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SISC ANNUAL CONFERENCE

CLIMATE CHALLENGES AND SOLUTIONS UNDER THE 2°C TARGET

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BOOK OF ABSTRACTS

SISC Annual Conference

Climate challenges and solutions under the 2°C target

Cagliari (Italy), October 19-20, 2016

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The Annual Conference of the Italian Society for Climate Sciences (SISC) takes place on October 19-20, 2016 at Cagliari, Italy.

The conference, entitled "**Climate challenges and solutions under the 2°C target**", is organized by SISC in cooperation with other Italian Institutions. It aims to foster the scientific debate among scientists, policy and decision makers (Italians and foreigners), NGOs members and other stakeholders whose activities are focused on climate change and its relationships with the environment and socioeconomic systems, opportunities and solutions helping in respecting the recent Paris agreement.

The main objective of the Conference is to summarize the Italian experience on climate research, and policy action within the international setting, and specifically:

• To promote an interdisciplinary platform for sharing and discussing on climate risk for the environment and the society;

• To highlight the scientific advances made to address the different aspects of climate change;

• To explore possible solutions to cope with climate change by promoting a dialogue on policies and strategies regarding adaptation, mitigation, and sustainable growth.

The program of the 2016 SISC Annual Conference consists of:

• plenary lectures
• parallel sessions of high profile invited talks
• contributing posters sessions
• workshop sessions

The Conference is open to:
• scientists
• policy and decision makers
• entrepreneurs
• NGOs
• others stakeholders

The Scientific Committee is dedicated to ensuring that the content will be relevant to today's questions.

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CHALLENGES AND OPPORTUNITIES FOR MITIGATION AND ADAPTATION IN A POST-PARIS CONTEXT

Chair: Francesco Bosello - Fondazione Eni Enrico Mattei (FEEM), CMCC Foundation, Università di Milano

This session brings together the two pillars of climate change policies, mitigation and adaptation, framing them in the light of the outcomes from the recent Paris Conference. Mitigation and adaptation will be thus analyzed with a multidimensional perspective not only under the methodological viewpoint proposing top-down-global and bottom-up-local assessments, but also under the topics covered: cost, effectiveness, higher order implications and equity.

Cost effectiveness of adaptation reconsidered in the light of higher order effects: the case of irrigation

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ABSTRACT

Agricultural activities depend on specific climate conditions such as temperature, CO_2 concentration, precipitation, water availability, as well as frequency and intensity of extreme weather events. It is thus expected that they will be particularly sensitive to future climate change leading to changes in agricultural productivity, level and regional distribution of food production. Therefore, there is a need to implement specific adaptation measures to cope with the negative effects of climate change. In this context, irrigation activities could play a key role, especially in developing countries. However, given that irrigation activities require specific resources, it is also necessary to include several economic aspects in the analysis. Among these aspects it is important to consider irrigation costs, and the interaction of irrigation activities with the rest of the economy. Also important are the repercussions in domestic and international markets following expected productivity shocks, as well as the mitigation of impacts which could be provided by adaptation measures. Therefore, the objective of the paper is to analyse the implications of including irrigation as an adaptation measure within an economy-wide context. These elements offer the basis to pose the following research question: Which are the economic implications of irrigation as a measure of planned adaptation for the agricultural sector, considering indirect economy wide effects as well as international trade?

To address this question we use a multi-country and multi-sector recursive dynamic Computable General Equilibrium (CGE) model which takes into account international trade flows. In addition, we extend it with specific features to include irrigation as a planned adaptation measure. This comprises enhancing the model, and its database with information on rainfed, irrigated land, and irrigation services. These modifications allow us not only to assess impacts of climate change with an improved model, but also assess the contribution of irrigation as a specific adaptation action.

Assessing INDCs in China, India and developing Asia

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ABSTRACT

We assess the impacts of different future climate policy scenarios for developing countries in Asia, using an integrated energy-economy-climate model. We interpret the outcome of the Paris Agreement in terms of mitigation measures until 2030 and beyond, and compare and contrast the results with scenarios aimed at keeping global temperature increase below 2°C. Our results confirm the lack of effectiveness of INDC policies, which achieve only about half of the required abatement effort. The gap in ambition varies significantly across countries. We evaluate the transformation of energy and land use systems, highlighting regional patterns in terms of low carbon investments. We find that marginal abatement costs underlying the INDCs vary significantly across countries, opening up the opportunity of efficiency gains through international carbon trading systems, including within Developing Asia. The idealized case of global trading and a single carbon price shows a large potential market with trade volumes of several GtCO2 per year, which raises political feasibility and institutional issues. Differentiated carbon prices appear to be relatively equitable in terms of marginal abatement costs, but not total mitigation costs, and promote higher clean energy R&D investments with respect to a case of permit trading. INDCs policy costs in Asia range between 0.1-1.6% of GDP, and would significantly increase under 2°C policies, though compensatory measures can change the balance of regional costs. We conclude by discussing the potential co-benefits of INDCs in terms of air quality in Asia.

Towards a comprehensive risk assessment of climate induced and aggravated risk in Italy

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ABSTRACT

Italy is notoriously prone to natural hazards and disaster risk. Among the 28 EU Member States (MSs), Italy has experienced the largest economic damage from natural hazards over the period 1980-2013. The damage to tangible physical assets topped 112 billion Euro (in 2013 Euro value), on average ~ 3.3 billion Euro per year. This is about a quarter of the damage registered over the rest of the EU. With about 30% of the recorded damage, floods are second only to earthquakes in terms of damage. Since 2002, Italy received post-disaster financial assistance amounting to 1.32 billion (in 2014 prices) from the European Solidarity Fund (EUSF). This is equivalent to one third of the solidarity payments granted over the thirteen years of the Fund's existence (until March 2015). Notwithstanding the high exposure to natural hazards, property insurance coverage is low, except for explosion and fire, not necessary of natural origins, which is a mandatory requirement for obtaining mortgage loans.

By focusing on flood risk, this presentation will explore the knowledge basis and gaps for an comprehensive flood risk assessment under current and future climate. On example of Natural Hazard Partnerships and Climate Partnership in the UK the contribution will explain the benefits of an national public-public and public-private partnership for management of climate variability and change induced risks in Italy.

The co-benefits of the INDCs on local air pollution

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ABSTRACT

We assess the impacts of different future climate policy scenarios, using an integrated energy-economy-climate model: WITCH [emmerling_witch_2016]. We interpret the outcome of the Paris Agreement in terms of mitigation measures until 2030 and beyond, and compare and contrast the results with scenarios aimed at keeping global temperature increase below 2 ° C. Although INDCs arose in the context of climate change mitigation, the climate mitigation goals interact with other domains, such as energy security, energy efficiency, fuel prices, technological development or air pollution. Air pollution is one of the most directly tangible co-benefits of climate policies because many air pollutant share the same sources as the GHGs, and because of their direct impact on health and the economy. We evaluate the outcomes of the INDC pledges in the context of the global climate goals and the consequences in terms of local air pollution, therefore discussing the co-benefits of the Paris agreement. Using the FASSTR (R version of the FASST model [leitao2013]) we evaluate the short term impacts of the INDCs on air pollutant emissions, reduced mortality and crop loss due to air pollution, focusing on Particulate Matter (PM) and Ozone (O_3). We find that the Asian regions, especially China and India, are the regions where most co-benefits from the implementation of the INDCs are expected, especially if local air quality control policies fail. However if current foreseen legislation on air pollution controls will be correctly and further enforced, short term climate policies will bring lower relative co-benefits.

Keywords: INDC; air pollution; mortality; crop yield.

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The challenge of the climate and energy policies integration in Italy: the De-carbonization Technical Experts Group

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ABSTRACT

In February 2015, the EU Commission launched the Energy Union Framework Strategy to manage the transition to a low-carbon economy [1]. Integrated national energy and climate plans will be at the core of this new governance system. The plans should set out national contributions to the EU's 2030 energy and climate targets, as well as policies and measures planned to meet the Effort Sharing Decision. National plans should include quantitative projections for the energy system and GHG emissions relative to a reference scenario, based on current trends with existing measures, and at least one policy scenario, reflecting the implementation of the additional policies and measures to reach the 2030 Member State's objectives [2].

The purpose of this work is to present the activities of the "Technical Experts Group" established under the co-ordination of the Presidency of the Council of Ministers on the decarbonization of the Italian economy.

More than 70 experts coming from Public Administration, Research Centers, Universities, private stakeholders are committed in providing a shared analytical basis finalized: i) to inform the decision makers on the costs and benefits of the different de-carbonization scenarios and effectiveness of the climate and energy policies ii) to strengthen the coordination and cooperation among public administrations and the other public and private stakeholders.

Medium-term specific objectives of the task force are: i) set up an "open source" data base on environmental, economic and technologies information ii) define a coherent chain of modelling tools to prepare the national scenarios and analyze their impacts iii) elaborate an integrated support framework to be used in the preparation of future climate and energy policies and for the assessment of the implications of the EU binding targets.

The task force is organized in four parallel working groups: three directly involved in modelling activities and one dedicated to set up an Impact Assessment Dashboard with economic, environmental and social key indicators.

CONTRIBUTIONS BY NON-STATE ACTORS FOR MORE EFFECTIVE POLICIES AT SUB-NATIONAL LEVEL

Chair: Mita Lapi - Lombardy Foundation for the Environment

This session brings together the two pillars of climate change policies, mitigation and adaptation, framing them in the light of the outcomes from the recent Paris Conference. Mitigation and adaptation will be thus analyzed with a multidimensional perspective not only under the methodological viewpoint proposing top-down-global and bottom-up-local assessments, but also under the topics covered: cost, effectiveness, higher order implications and equity.

Mitigation and adaptation planning in Italy at the different administrative levels: synergies and contradictions

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ABSTRACT

Mitigation of greenhouse gases and adaptation to climate change are complementary strategies for dealing with climate change. Dealing with mitigation and adaptation as one can therefore bring co-benefits and win-win solutions, make the whole process more effective and cost-efficient, help harness political support and strengthen coordination among municipal departments.

The Paris Agreement placed adaptation issues on par with mitigation. For one, the Agreement includes a long-term adaptation goal alongside the goal for mitigation. Despite that, synergies between adaptation and mitigation synergies are rarely taken into account in the commitments of countries and of regional and local governments.

One of the few examples of a coordinated climate action is the new Joint Covenant of Mayors and Mayors Adapt, launched on 15 October 2015, which provides an opportunity for local and regional authorities to enhance their contribution for shifting to a low-carbon energy system and contributing to a more climate-resilient Europe.

Despite the issue has not yet been the subject of specific investigations, there are a number of approaches and policies which can support, at the same time, mitigation and adaptation goals. A preliminary identification of these options is presented, which considers adaptation planning initiatives at the national [1], regional [2] and local [3] level in Italy.

On the other hand, sometimes environmental policies addressing specific issues may be counterproductive with respect to other environmental goals. This is the case of the role of biomass burning, which is supported within climate policies, with respect to the attainment of air quality objectives [4].

On the basis of this analysis, a number of recommendations is presented, in order to use as much as possible in adaptation planning work already done for the preparation of sustainable energy plans, at the same time avoiding contradictions with other environmental policies.

Keywords: adaptation planning, synergies between adaptation and mitigation, local climate policies

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From international commitments to the climate action plan of Lombardy: mitigation and adaptation at regional level

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ABSTRACT

Lombardy Region is strongly committed to tackle climate change both at local level and in the international framework.

Lombardy Region signed and took part in several relevant initiatives and networks of institutions with the common aim to assume the best possible efforts for greenhouse gases mitigation and adaptation to climate change: The Compact of States and Regions [1], Under2MOU and RegionsAdapt. Moreover, Lombardy is one of the “Four Motors of Europe”, a long-lasting cooperation between regions with similar socio-economic features and environmental needs and responsibilities, thus sharing important commitments to tackle climate change.

The goals of all these initiatives are perfectly consistent with the expected results of the “Paris Agreement” for both mitigation and adaptation.

Lombardy’s activities about the Climate issue started in 2004 with the “Kyoto-Lombardia” project, aimed to integrate the objectives defined in the first international agreement on global warming in the local policies.

Regarding mitigation, the Lombardy government has been tackling emission control for several years through important planning instruments: the Regional Program for Environment and Energy (PEAR), the Air Quality Plan (PRIA), the Mobility and Transportation Program (PRMT), not to forget the measures developed within the Rural development Program (PSR), in particular relevant for CO2 mitigation.

About adaptation to climate change, Lombardy - first among the Italian regions - has developed and approved a Strategy for Adaptation [2] [3] [4] and is now working for the implementation of a specific Plan, by means of a structured participated process that involves all the different sectors of the regional governance: from the water management to territorial planning, from agriculture to tourism. Finally, the regional Plan for Climate aims to integrate properly the complementary (yet sometimes conflicting) aspects of adaptation and mitigation.

Keywords: Mitigation policies; Adaptation action plans; Regional governance.

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Regional Climate Change Mitigation Strategy of the Sardinia Region: implementation and future evolution. Pilot actions and governance model

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ABSTRACT

Over the last ten years the Sardinia Region has been implementing concrete policies aiming at mitigating the effects of climate change, at investing energies and resources to reduce environmental impacts (CO2 reduction, the reduction of dangerous substances, waste reduction etc.), at rationalizing public expenditure and limiting public administration consumption, and finally at spreading green public procurement policy (GPP) within its organization as well as in other organization throughout the region. Clear rules and objectives were set out by means of a specific plan for green public procurement (named “PAPERS”), which provides a range of technical support activities for public administrations and caters for the allocation of significant resources in several sectoral programs (for example public lighting and energy efficiency in public buildings); hence, green procurement is being used as leverage to produce a significant impact on the regional economy. Furthermore, the environmental expertise of both public administration and entrepreneurs has been strengthened through dissemination of good practices and an integrated communication and training campaign. This has also led to the establishment of an extensive and branched network comprising public administrators, professionals and workers in different fields, whose increased awareness of environmental sustainability issues spurs them to play an active role in pursuing new ideas and actions. In light of the significant results achieved so far, and because of a new role as national co-ordinator on environmental issues, the Sardinia Region intends to replicate this model of governance as a strategy for adaptation to climate change. Through technical assistance, extensive networking and relevant investments on programs and innovative actions having high visibility, we aim at mainstreaming adaptation to climate change and at raising awareness of local administrators and civil officers so that tangible actions can be implemented quickly at the local scale.

From local to global fight for limiting warming at 1.5°C: the role of NAZCA pledges

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ABSTRACT

The carbon budget for a 66% chance of limiting warming at 1.5°C (the aspirational target of art. 2 of the Paris Agreement) is about 205 Gton CO2 left from 2016 onwards (McSweeney and Pearce, May 2016). To delay or definitely avoid its exhaustion, accelerated implementation and over-achievement of current targets is necessary, together with a significant increase in ambition of further waves of NDCs (Nationally Determined Contributions), with strong effectiveness of the implied sectoral transformations (in principle identified through NAMAs - Nationally appropriate mitigation actions), and with the full activation of cooperative synergies (art. 5, 6 - 13). As highlighted by Höhne et al. (2016), pledges by international coalitions of public and private bodies, including regions and cities, as collected at the Non-State Actor Zone for Climate Action (NAZCA), can deliver several gigatonnes of reduction. A description of the current state of NAZCA is provided. The perspective of a wider use of this tool is suggested, since high-frequency mitigation actions, including those arising from sub-national levels and coordinated internationally, are essential to break unsustainable pathways. The recent experience of a sub-national government in India, who organised the planting of 50 million trees in one day, offers lessons for further implementations of an innovative economic policies included in Piana et al., 2009. In this context, the possible accelerated implementation, funded by an international emission of green bonds, of pre-2020 commitments included in the Covenants of Mayor (recently transformed into the new Global Covenant of Mayors for Climate & Energy) is explored.

Keywords: 1.5°C; IPCC Special Report on 1.5°C impacts and emission pathways; Strengthened global response; UNFCCC; local government.

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CLIMATE SMART SOLUTIONS FOR AGRICULTURE AND FORESTRY: A WAY TO COPE WITH CLIMATE CHANGE

Chairs: Valentina Mereu, Costantico Sirca, Antonio Bombelli - CMCC Foundation

Agriculture and forestry can contribute to mitigate climate change, both reducing emissions and increasing sequestration of carbon. They also offer major opportunities in adapting to climate change, including increasing resilience of livelihoods, improving nutrition and providing vital ecosystem services.

In this context, climate-smart solutions for agriculture and forestry sectors aim to guide actions to support the sustainable development of agricultural and forestry strategies under modifications of climate and its variability, through the achievement of three main objectives: sustainably increasing agricultural and forestry productivity and incomes; adapting and increasing resilience to climate change; and reducing and removing greenhouse gas emissions.

As farms, pasturelands and forests are often interlinked in a complex mosaic of territories, it is more appropriate managing them in an integrated manner, known as “landscape approach”.

Such a comprehensive view can help multi-sectoral stakeholders from local to national and international levels (farmers, forestland owners, policy makers) to identify the agricultural and forestry strategies, also considering interrelated soil and water services, most suitable to each scale of analysis, and able to make agriculture and forestry sectors more productive and more sustainable, both in the short and long term future.

The aim of this session is to provide an opportunity to discuss innovative applications and methodologies focused on climate smart agriculture and forestry approaches as a response to climate change.

The role of precision agriculture tools to cope with climate change impacts

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ABSTRACT

Precision agriculture (PA) is a farming management concept aimed at optimizing crop production through the use of combined technologies (sensors, information systems, enhanced machinery, and informed management) (Gebbers and Adamchuk, 2010).

This type of farming management is becoming more and more needed to cope with the impacts of climate change. As a matter of fact, advances in precision agriculture can reduce the variability and uncertainties of crop production due to changes in climate conditions, also contributing to reduce the GHG emissions.

Several tools applied over a broad gradient of geographic and climatic conditions as well as a variety of crops and management practices, can be considered suitable for PA aims: i) crop models (e.g. CropSyst, SIRIUS, etc.) can be used to monitor crop growth and yield (Jamieson et al., 1998; Moriondo et al., 2007), thus allowing information on crop stress status and their needs; ii) ecosystem process-based models (DayCent, DNDC, etc.) can simulate biogeochemical processes such as organic matter decomposition, ammonia volatilization, nitrification, denitrification, etc., thus resulting effective tools in examining the magnitude and spatial-temporal patterns of C and N fluxes (Brilli et al., 2014); iii) remote and proximal sensing technologies are useful for obtaining images needed at reproducing crop yield (Maselli et al., 2012) and growth (Brilli et al., 2013) estimates under managed or natural systems; iv) GIS systems (i.e. ArcView, idrisi, etc.) are used for spatial database creation by integrating maps derived from remote sensing, soil sampling, yield monitoring, and various sensors, thus allowing assessment on environmental suitability and characterization of different geographical areas (Dibari et al., 2015, 2016).

All these tools, independently adopted either combined each other, can be applied to optimize the use of available resources in agriculture, increase crop yield and to reduce negative environmental impacts to cope with the expected change in climate conditions.

Keywords: Precision agriculture; Biogeochemical models; Remote sensing; GIS; Climate change.

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Innovative policy approaches; the key to unlocking global goals

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ABSTRACT

Climate change poses a significant challenge to the global community; it is well recognised that business-as-usual is not sufficient to mitigate and prevent the adverse effects of such a changing climate. The 2030 Agenda including Global Goal 13 to "take urgent action to combat climate change and its impacts" is an ambitious plan that invites an ambitious response of innovative actions. Policies are developed by countries as a response to a challenge, but to respond to these challenges even policies themselves must innovate. The Global Goals inherently require cross-cutting and integrated actions amongst sectors and actors.

Cross-sectoral policy will not suffice without an authentic cross-sectoral process in both the development and implementation of policy. Therefore there is an urgent need to review the approach to policies, necessitated by both the 2030 Agenda and climate action in order for countries to meet their Nationally Determined Contributions for the Paris Agreement.

For the forest sector, updated policy frameworks that promote a diversified vision, in particular in regards to sustainable use of forest resources, both wood and non-wood, are a first step. Sustainable forest management (SFM) is a holistic approach to management of one of the key natural resources in the fight against climate change. SFM provides a framework that already requires and advocates for a certain extent of cross-sectoral coordination.

Broadening the scope of policies in a way that enriches the livelihoods of forest communities is possible through policies that favour and facilitate utilization of non-wood products and services. The inclusion of non-wood forest products (NWFPs) in policy frameworks can ensure economic, social and ecological benefits for rural communities. However current work under the pan-European StarTree project has demonstrated the complexity in institutional arrangements of NWFP regulation which requires a comprehensive and coordinated vision. It is not forest policies alone that impact on if and how NWFPs can be utilised; agriculture, rural development and food policies namely can have multiple influences. The promotion of innovative policy approaches will deliver sustainable forest management, simultaneously providing incentive for the retainment of forests, leading to increased carbon sequestration, biodiversity conservation poverty reduction and food security.

Keywords: policy; cross-sectoral coordination; non-wood forest products (NWFPs); SDGs.

Application of wildfire spread modeling to support fuel management programs and wildfire risk mitigation in Mediterranean ecosystems

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ABSTRACT

There is a keen interest in the effects of fuel management strategies and programs on fire risk mitigation in Mediterranean ecosystems, due to their fire proneness and their relevance in terms of biodiversity, touristic and socio-economic value. Overall, active fuel management programs have the goal to protect people and values, to minimize the adverse effects of high-intensity wildfires, and to ensure ecologically viable patterns and composition of the burned landscapes. Wildland ecosystems also require treatments to buffer the likely effects of future climate change on fires, which will likely result in an exacerbation of future fire regime and losses. However, several studies emphasized that there are still misconceptions, worries and knowledge gaps about fuel treatments and their effective implementation, effectiveness and role in fire-prone landscapes across the Mediterranean Basin. In addition, while there is uncertainty about the potential of fuel management programs to limit fire occurrence or enhance suppression capability, smart fuel treatment strategies can play a key-role in mitigating the negative effects of wildfires, in making wildfires more acceptable, and in promoting forest resilience.

This talk will present an overview of the strengths and limitations of fuel treatment strategies, with the aim to evaluate their potential to achieve given objectives, to develop sensible fire management policies, and to integrate fire management and land management programs. In addition, as part of recent efforts to improve wildfire risk estimation and mitigation efforts in Mediterranean areas, the advances in the use of wildfire simulation models to evaluate fuel treatments and risk mitigation strategies will be presented.

Keywords: fire risk mitigation; fuel treatments; fire management; Mediterranean Basin; fire spread modeling.

Tree inclusion over agricultural landscape, an uncounted potential for climate change mitigation

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ABSTRACT

Agroforestry, the inclusion of woody perennials within agricultural landscape, has been both a traditional landuse approach developed by subsistence farmers and a livelihood option promoted by managers and international development efforts. Agroforestry systems range from subsistence livestock and pastoral systems to home gardens, alley intercropping, and biomass plantations with a wide diversity of biophysical conditions and socio-ecological characteristics. The extent of its practice has never been quantified leading to widely varied estimates about its importance. Agroforestry systems and tree cover on agricultural land make an important contribution to climate change mitigation, but are not systematically accounted for in either global carbon budgets or national carbon accounting.

Remote sensing data show that in 2010, 43% of all agricultural land globally had at least 10% tree cover and that this has increased by 2% over the previous ten years. About 46% of agricultural land globally has a tree canopy cover of more 10%, with 558 million people inhabiting these landscapes. Agroforestry is a significant feature of agriculture in all regions, but its extent varies significantly across different regions (e.g. more significant in Central America and less in East Asia). The average tree canopy cover in agricultural land increases strongly with increasing humidity and it is partially influenced by population density with patterns varying across regions.

Combining geographically and bioclimatically differentiated IPCC Tier 1 estimates of carbon storage with this tree cover analysis, we estimated 45.3 PgC on agricultural land globally, where trees contribute >75%. Between 2000 and 2010 tree cover increased by 3.7%, resulting in an increase of >2 PgC (or 4.6%) of biomass carbon. On average, globally, over this period biomass carbon stored on agricultural land increased from 20.4 to 21.4 tC ha−1. Brazil, Indonesia, China and India show the largest increases, while Argentina, Myanmar, and Sierra Leone the largest decreases.

Keywords: biomass; mitigation; trees; agroforestry.

The biochar option: a carbon negative technology for climate change mitigation

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ABSTRACT

Biochar is a carbon-rich material produced from pyrolysis or gasification of biomass under low oxygen conditions [1]. Because of its aromatic structure, biochar is considered to be particularly stable in soil and recalcitrant to decomposition. For this reason, biochar application to agricultural soils is considered a promising strategy to increase carbon storage, decreasing its return to the atmosphere as carbon dioxide (CO2). By removing CO2 from the atmosphere through uptake by plants, biochar production and burial in soil could allow us, in principle, to reduce atmospheric carbon dioxide levels, representing a “carbon negative” technology [2]. Furthermore, biochar application to soil has shown to provide several agronomic benefits, such as improving plant productivity and soil water availability, promoting soil biological activity and reducing nutrient leaching [3–6]. This can lead to a significant reduction of external inputs such as fertilizers and water to agricultural systems, with important positive economic and environmental effects. The effect of biochar application can be highly variable, depending on the specific biochar and soil characteristics, other than the crop, so further research is needed to determine the conditions under which biochar can provide agronomic benefits and to elucidate the fundamental mechanisms [7]. However, considering the crop residue production in Italy, which could potentially be used as feedstock for pyrolysis, biochar production and application may represent an interesting opportunity for agriculture and forestry sectors in Italy, to increase sustainability helping at the same time to mitigate climate change.

Keywords: char; carbon sequestration; residues; soil.

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CLIMATE OF THE PAST, FROM ARCHIVES TO DATA INTERPRETATION

Chair: Carlo Barbante - DPA CNR, Università Ca' Foscari

Paleoclimatic and plaeoenvironmental archives are essential tools for the reconstruction of past global changes. With increasing awareness of human impact on global climate change, people pay more attention to the changes in spatial pattern, magnitude, and periodicity of climatic changes, as well as intensity and frequency of extreme weather. Having robust knowledge on amplitudes, frequencies, distributions, and mechanisms of past climatic changes is a prerequisite to understand present and future climatic changes and to put in the right perspective future regional-scale climatic changes and natural disasters. This session deals with all these aspects in a broad view, looking at climatic and environmental archives at different temporal scales; it will be concentrated on the use of different climatic and environmental proxies and on the interpretation of experimental data.

Paleoclimatology, geochronology and tephra layers

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ABSTRACT

The reconstruction of the climate variability during the geological history of our planet is of vital importance to understand the current situation and to make predictions for the future. Paleoclimatic data are inferred indirectly by studying the sedimentary deposits and their fossil organic remains, and, for the period closest to us, the Quaternary, also on ice cores from the polar areas. Inferences on past climate variation would be of little use, however, without a precise chronology seeking to determine when a given climatic regime was established, how quickly and in response to which boundary conditions. This is the task of geochronology that provides a time framework to past climatic variations, through the use of various radioisotopic dating methods. When key deposits cannot be directly dated, alternative and indirect chronological methods are used.

Italy has been characterized over the past 800 ka by an intense volcanic activity, predominantly explosive, which caused the dispersion of volcanic ashes all over its territory and in the Mediterranean basin. These ash levels, called tephra, on average do not contain climatic proxies, but represent isochronous surfaces of variable areas, starting from their source volcanoes. The geochemical characterization and dating of tephra, typically with ^{40}Ar-^{39}Ar method (when applicable also with ^{14}C method) turns them into chronological marker at local or regional scale, allowing to put time constraints on levels devoid of suitable material for dating methods and to synchronize stratigraphic series far apart. Some examples on the use of tephra will be shown.

A proposal to construct a database of Quaternary tephra in Italy is currently under discussion in the CNR-DTA community [1].

Keywords: paleoclimatology; geochronology; tephra layers; Quaternary; Italy.

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An ensemble of interglacials: insights from marine sediments

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ABSTRACT

On time scales of decades to millions of years, the oceans play a central role in shaping the Earth's climate and its variability through their high heat capacity, fluid motions, ecosystems and the solubility of carbon dioxide and other gases. We thus need a mechanistic understanding of the ocean's behavior in order to make predictions about the response of the Earth to perturbations, either natural or anthropogenic. The instrumental record of climate, while invaluable because of its resolution and precision, covers less than 0.1 millionth of Earth's history and clearly does not represent a steady background against which future variations can be gauged. Establishing a baseline of natural climate variability is essential in order to gain a better assessment on the rates and amplitudes of changes, and requires a perspective that can be obtained only from looking further back in the past, and unraveling the information encrypted in the geological archives. In this sense, marine sediments may provide a nearly continuous record often spanning tens of millions of years; they document and probe the way the ocean and climate systems have behaved much beyond the instrumental record, representing a potential treasure trove of unique past climate information. Here we will focus on some of the examples and questions posed by the study of Quaternary climate change, and review how long ocean-sediment cores have provided evidence for multiple glacial-interglacial cycles via indirect measures of global ice volume such as oxygen isotope ratios (d18O) in benthic foraminifera and, more recently, d18O in seawater derived from paired stable isotopes and Mg/Ca rations on foraminifera. Considering we are living in an interglacial period, the Holocene, special emphasis will be placed on how marine records are contributing to document interglacial climate variability, to reveal a large diversity among interglacials in terms of their intensity, duration and internal variability, to identify a variety of temporal trends within interglacials (e.g. peak warmth in the main records observed either early or late in different interglacials). Other geological archives, such as ice cores and additional terrestrial records (e.g. lake sediments, loess sections, etc.) preserve their own expressions of these cycles and only by assembling a variety of individual datasets past climate fluctuations can be determined with any degree of confidence.

Reconstructing terrestrial climates using quantitative palaeoecology. Case studies from the high-altitude alpine holocene and the last glacial and interglacial extremes in n-Italy and Slovenia

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ABSTRACT

Microscopic remains (pollen, spores, algae, insect remains, etc.) stored and preserved in sedimentary sequences over geological time periods provide a wide spectra of "response variables" (Birks et al., 2010) of past terrestrial and aquatic habitats. But, while the suitability of paleoecological records for qualitative environmental reconstructions is widely accepted, their potential as quantitative climate predictors is still poorly explored.

Within the CNR-DTA "Nextdata Project" we tested the feasibility of reconstructing past temperature and precipitation series using terrestrial fossil pollen records from lake and mires located in Northern Italy and nearby areas. Climate parameters are estimated through updated numerical procedures comparing fossil pollen spectra with modern datasets. We applied several modern calibration subsets, obtained from a recently issued version of the European Modern Pollen Database (EMPD, Davis et al., 2013) New altitudinal training sets, recording ecological and climate gradients in the Alpine region, are being sampled and integrated within the EMPD to obtain transfer function for paleoclimate reconstructions. Techniques of regression and calibration (Locally-Weighted Weighted-Averaging - LWWA, Weighted Averaging - WA; ter Braak & Barendregt, 1986; Juggins & Birks, 2012) and the assemblage approach (Modern Analogue Technique - MAT; Juggins & Birks, 2012) are applied to pollen assemblages and used to constrain model uncertainties and to validate the models.

Pollen-inferred quantitative climate estimations of past climate variables (temperatures and precipitation) will be presented from:

(i) a high-elevation site in the western Alps (Rutor Glacier foreland; Badino, 2016) bearing paleobotanical evidence of an Holocene climate optimum and the thermal decline at around 4000 yrs cal BP;

(ii) the Last Interglacial at Lake Fimon (Pini et al., 2010) where the development of forest vegetation after the treeless-steppe phase of the penultimate glaciation is documented. Here, mixed deciduous woodlands of warm-temperate and dry climate are replaced by mixed *Abies-Fagus-Carpinus betulus*

forests of oceanic-temperate signature chronologically constrained during a phase of insolation minima. This climatic pattern is captured in the pollen-based reconstructions so far obtained;
(iii) pollen and macroremains from a continuous sediment record spanning most of the Last Glacial Maximum at the slovenian fringe of the Alps. Here, the pollen and charcoal record of open forests with boreal signature provides several predictors of cold-temperate continental ecosystems, extinct in the Alps but finding appropriate analogues along ecological gradients in Fennoscandia and Siberian ranges.

Keywords: pollen; climate; MAT; regression and calibration techniques.

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Reconstructing early human activity and fire history from biomarker profiles in lake sediment cores: three case study

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ABSTRACT

Human activity associated with the development of agriculture and biomass burning for slush-and-burn practises could have had an impact on the environment and the climate system since the beginning of the Holocene. However, the timing of the development of human settlements had been asynchronous around the world and had covered areas with different extents, making it difficult to disentangling the anthropogenic contribution from natural forcing the climate system from local to global scale. The use of specific molecular markers in sediment cores is a promising approach for reconstructing human presence and fire activity. Indeed, several faecal sterols can be associated with humans, while levoglucosan and polycyclic aromatic hydrocarbons (PAHs) can be used for obtaining information on past fire history. Biomarker records, successfully integrate archaeological evidence, environmental and climatic reconstructions.

Three different sites were analyzed and herein considered. First, the early impact of Polynesian arrival in New Zealand since ~1260 A.D. that triggered an initial burning period that, in turn, led to the forest biomes conversion to open shrub-lands. This study was performed analyzing sediments from Lake Kirkpatrick (NZ) and showed that a small population is able to instigate a widespread and permanent environmental change.

Different dynamics were observed during the Iron Age (1100-2400 A.D.) in East Africa. In this case, form the analysis of Lake Victoria sediment cores, the seasonal migration of the InterTropical Convergence Zone (ITCZ) appeared as the predominant drivers of environmental changes that in turn impacted the development of human settlement.

Whereas human settlement didn't developed abruptly (as happened in NZ), nor climate forcing was not so massive (as ITCZ migrations in East Africa), a more complex human-fire-climate relation was observed. This is the case of Central Italy (Lake Trasimeno) that experienced Etruscan-Roman domination, Viking Invasions and Umbrian Renaissance, spanning from Roman Warm Period to Little Ice Age.

Millenial to centennial-scale climatic variability during the last 10 ka over the central mediterranean: chasing for analogues?

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ABSTRACT

During the Holocene, the Mediterranean region was the cradle for some of the world's oldest civilizations. During the same period, there were important climatic changes, which represented a challenge for cereal cultivation [1,2]. However, a direct link between rises and collapses of ancient societies and climate is probably not so straightforward also for the difficulties to put the archeological and historical evidences in a coherent climatic frame [3]. For central Mediterranean high-resolution paleoclimatic studies from continental archives (in particular lakes and caves) suggest the presence of several important (millennial to centennial-scale) climatic events, characterized by changes in hydrological conditions overprinted onto a general trends driven by changes in orbital parameters. Specifically some events occurred during the second half of the Holocene, when greenhouses gasses progressively increased, which may represent interesting analogues for present global warming. However, a clear pictures of the climate during the Holocene is by far to be complete [4] and evidences suggest a complex hydrological variability from N-S and E-W transects [5].

Keywords: Paleoclimate; Central Mediterranean; Holocene; Continental archives.

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FEASIBILITY AND IMPLICATIONS OF LOW-CARBON SCENARIOS

Chair: Stefano Caserini - Politecnico di Milano

To avoid the most dangerous effects of climate change, the Paris Accord requires large cut in greenhouse gas emissions and thus a deep transformation of the energy system worldwide. Emissions reduction should be very fast, much faster than what imposed by previous commitments, and the feasibility and the timing of these reductions are under discussion.
In this session the feasibility and techno-economic implications of ambitious mitigation scenarios will be discussed, both at the global level than for Italy. Evaluating the role of the portfolio of different technology options, negative emissions, R&D investments, land use, and the related uncertainties, allow to understand the tremendous scale of the challenge that has to be faced in the next years and decades.

Introduction: looking for ambitious low-carbon scenarios

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ABSTRACT

Even if scientific uncertainties haven't all been solved and human activities are not the only responsible of all climate changes, the knowledge of the climatic system and the large amount of fossil reserves available imply a strict carbon budget for the next decades. Although the Paris Accord is widely recognized as a success, many decision makers at different administrative levels fail to acknowledge the consequences of the Accord, the striking tim ing of the change that it requires. The timing implied by the carbon budget is that the transition to net zero carbon emissions worldwide has to be achieved between 2045 and 2060.

Pursuing the objective of the Paris Accord, to limit global temperature increase "well below 2°C" and to and to "pursue efforts to limit the temperature increase to 1.5 °C" requires thus a significant deviation from the policy trend of the last decades, characterized by lack of ambition, limits of scope and shameful delays. Immediate actions and profound transformations in every individual sector of the economy are needed. Emissions reduction should be very fast, much faster than what imposed by previous commitments. Only in a few decades it will be necessary to change the present energy system, to deliver a profound near-term de-carbonization of energy supply and simultaneously to satisfy the growing energy demand. Furthermore, negative emission will play a crucial role.

The next decades are a brief window of opportunity to minimize large-scale and potentially catastrophic climate change that will extend longer than the entire history of human civilization. If the pathways of the international effort to limit the increase in global temperature will stop, there will not be another option, it will not be possible to try again later with the same objectives.

Keywords: COP21; Paris agreement; 1.5C; decarbonization.

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Going further than the INDC, a global view on the short and long term implications of the Paris agreement

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ABSTRACT

The Paris agreement achieved two main outcomes: bending the emissions curve up to 2030 and the establishment of a more ambitious climate target, the so-called 'well below 2oC', 1.5oC temperature increase by the end of the century with respect to pre-industrial levels. Up to last year's COP in Paris, the integrated assessment modelers focused on the 2°C target, this new goal pushes the integrated assessment models to their limits and to the need to consider more emission reduction options. What does it really means in terms of technological development and availability, R&D investments, land use and socio-economic scenarios to aim at such a temperature target? We set out to answer this question, using the currently available model outcome databases, such as SSP [Bauer et al, 2016], AR5 [Clarke et al, 2014], and the IAM WITCH [Emmerling et al., 2016]. We design two types of scenarios, one where the INDCs emission goals are attained, and another set where the world becomes more ambitious and attempts a deep decarbonization pathway in the short term.

We analyze the results focusing on the technological deployment required, on the use of on negative emissions, and on the demographic and economic growth potential assumptions. Additionally, we discuss on the possible risks of such stringent scenarios given the limits of current knowledge of integrated assessment models.

We conclude that the models are very sensitive to the more stringent climate target, as the carbon prices ramp up very quickly, and the share of negative emissions become more and more important.

Keywords: COP21, Paris agreement, 1.5C, decarbonization

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Deep decarbonisation of the Italian energy system based on renewable energies: a technical analysis

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ABSTRACT

The Italy's National Energy Strategy approved in 2013 sets some explicit targets for the year 2020. Later, it becomes vague and simply recalls the need to be in line with the European Roadmap 2050, therefore reducing emissions by 80% (relative to 1990 levels) [1].

This work has two objectives: i) to investigate the technical feasibility of this 2050 target excluding nuclear energy, power plants with CCS, and Enhanced Geothermal Systems; ii) to identify key unavoidable measures by comparing different future scenarios.

Our analysis is based on the software "REMod" (Renewable Energy Model), an optimization tool developed by the Fraunhofer Institute for Solar Energy Systems [2]. REMod examines all energy sectors with an hourly time step for a whole year, and identifies the least-cost system configuration.

Results show that energy efficiency and electrification of final consumptions in buildings and transportation are mandatory to reach the target, together with a strong growth of all renewables, particularly photovoltaic plants. New elements of flexibility are essential to integrate over 70% of non-programmable electricity in the energy system: hydro pumping, batteries, combined heat and power plants, heat pumps, power to syngas and power to heat solutions.

This study helps to imagine an alternative future based on a defined portfolio of technological solutions. It highlights the tremendous scale of the challenge that has to be faced. Light duty vehicles should be all electric. Electricity production from wind and PV needs an unprecedented level of deployment for its rapidity and long lasting increase: the resulting growth rate is higher than that observed for electricity from fossil fuels during the Italian economic miracle after the end of the Second World War, and it is equal to the one observed for wind and PV in the period 2010-2013 during the generous Italy's renewable energy incentive scheme, but it needs to last without interruption for 35 years.

Keywords: decarbonisation; electrification; energy system modelling; renewables; smart energy systems.

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Deep Carbonisation in the Paris Agreement and the role of negative emission

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ABSTRACT

The Paris Agreement aims at “holding the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels(…)”. This focus on deep carbonization creates numerous scientific, technological, economic, and political issues. We study the techno-economic implications of such ambitious stabilization targets based on climate-energy-economic models used within the IPCC process. Our results confirm the lack of effectiveness of existing INDCs. Moreover, the possibility of negative emissions is pivotal for the feasibility of such targets. Notably, the role of bioenergy with CCS, but also other climate engineering have been put forward as complementary mitigation strategies. Yet, at present, substantial abatement of GHG emissions seems the dominant near to medium term mitigation option, even at high and regionally varying abatement costs.

Keywords: RCP; 1.5 degree target; Paris Agreement; Climate scenarios; CCS.

IMPACTS AND MITIGATION STRATEGIES IN COASTAL AREAS

Chair: Renzo Mosetti - OGS

Coastal areas are the most vulnerable from the point of view of impacts resulting from ongoing climate change. In particular, it is predictable that the coasts of Italian seas will be increasingly subject to sea level rise, to coastal storms and generally to considerable change in their coastlines. All this has significant socio-economic implications (tourism, port facilities, industrial plants and land use planning). The ecological implications are similarly important, be it from the point of view of environmental sustainability or exploitation of resources like fishing and aquaculture. The aim of this session is to discuss such themes with a multidisciplinary view, thus trying to provide some answers in terms of risk reduction and mitigation, while taking into consideration the overall picture that emerges from climate scenarios.

Impacts of climate-driven changes on coastal marine ecosystem and related good and services

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ABSTRACT

This paper presents a downscaling experiment linking a regional atmospheric model to local hydrodynamical, biogeochemical, ecosystem and target specie population dynamic models to evaluate the effects of IPCC climate change scenarios on a temperate coastal lagoon ecosystem, the lagoon of Venice, along with goods and services provided by this ecosystem. Results in terms of spatio-temporal dynamics of biogeochemical properties provide evidence of significant impacts of climate change. Under both the A2 and B2 scenarios we observe an amplification of the seasonal precipitation patterns which affect the timing of nutrient inputs to the lagoon and causes a reduction in plankton productivity.

Results highlighted that these changes propagate through the food web up to the higher trophic level with a cascading multi-path process which takes an year or more, and that significantly different outcome can emerge, also depending on the dynamics of the extremes (yearly maximum) values.

Changes in intensity of nutrient load maximum discharege (scenario A2) favors primary producers that have higher maximum values (peaks) that propagate up in the food web to groups more related to grazing food chain. Conversely, small modifications of the timing of the nutrient peaks (as in B2 scenario) implies less exploitation of nutrients by primary producers due to temperature limitations and the enhancement of the groups in the food web that are more related to detritus-based food chain.

Assuming constant exploitation rates for target and non-target (discarded) species over the 30 years of simulations, lead to divergent changes on fisheries landings in future scenarios. Ecological indicators highlighted changes in food web biodiversity and complexity .

Simulations also show that clam aquaculture activity will suffer and point to the need and space for management policies to mitigate the adverse effects of climate change.

Current status of development of ocean energy in Italy

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ABSTRACT

Within the dynamic evolution of renewable energy, marine energy is emerging as an alternative source which may contribute to the EU 2020 strategic goals and, from 2020 onwards, to the EU objectives for 2050. On June 2012 the European Commission Communication "Renewable energy: a major player in the European energy market" (COM/2012/271) advocates higher priority for research in ocean energy. It is one of the five sectors of the blue economy highlighted in the Communication on "Blue Growth" (COM/2012/494). Ocean energy is still at an earlier stage of development than offshore wind. At present, it only represents a tiny percentage of the overall energy supply, and is available only in a some EU Member States. However, marine energy is currently recognised as a renewable energy resource that could benefit European citizens by increasing energy security, enhancing economic growth, creating jobs, and mitigating the negative impacts of climate change.

The marine resource in the ocean comes from six sources, each with different origins and requiring different technologies for conversion: ocean thermal energy conversion (OTEC), salinity gradients (osmotic power), surface waves, tidal range, tidal currents, and ocean currents. The distribution of these sources in the oceans is not uniform. In particular in the Mediterranean offshore areas, energy can be exploited mainly from waves.

Currently a number of different Wave Energy Converters (WECs) have been proposed and tested in EU, but large scale commercial installations are not yet in operation. Research on wave energy production is particularly advanced in countries bordering large oceans where the greatest wave energy potential is found. In Europe most of the pilot plants either planned or in operation are located along the Atlantic coast in countries such as Ireland, Portugal, Spain, Norway and the UK. Energy availability is certainly a major factor affecting wave energy production but high energy potential usually implies exceptional wave conditions during extreme events. Such conditions pose serious engineering challenges to the design and deployment of WECs increasing the costs of development, production, installation, maintenance and insurance of these devices. On the other hand, in calmer and semi-enclosed seas such as the Mediterranean, where lower amounts of wave energy are available, many technical issues related to extreme sea climate could be more easily solved, possibly making wave energy production still economically viable. From this point of view, wave energy production in the Mediterranean is especially appealing for countries like Italy having relatively long coastlines. Currently in Italy there is an increasing interest in the exploitation of wave and tidal technology to produce clean and renewable energy. Moreover, our

Government, according to the National Renewable Energy Action Plan (NREAP), expects to meet by 2020 the target of 3 MW of installed capacity. At the current stage, marine renewable energy is a real opportunity for Italy to generate economic growth and jobs, enhance the security of its energy supply and, most importantly, boost competitiveness through technological innovation. The present talk will focus on the ongoing marine energy research in Italy and especially those conducted by ENEA in collaboration with some Italian Universities in the context of the National Program called "Ricerca di sistema elettrico" (Research for Electric System).

Hydraulic civilizations and climate change

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ABSTRACT

Water and architecture go hand in hand and that this relationship has to be managed with care and attention. In the age of necessary sustainability, architecture is the collective discipline of assuming responsibility for the physical Care.

The problem of the relationship between architecture, resources, the water system and climate change, becomes essential. The examples of Venice, Angkor and the water civilizations show that care must be exible and must adapt, they must be enlarged to scale and mentally embrace a planet which must, and continue to be, inhabitable.

Multi-model and multi-scenario projections for waves and storm surges along the Italian coast

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ABSTRACT

Recent initiatives (MedCORDEX) and European projects (RISES-AM, CIRCE) have provided new material for a consolidated assessment of the future evolution of marine storminess. Nowadays, by driving a storm surge and a wave model using regional high resolution atmospheric forcings, ensemble projections of waves and storm surge levels along the Italian coastline can be produced and impacts of climate change (with associated uncertainties) have become available. Here the results of a set of seamless wave and sea level simulations covering the period 1950-2100 under multiple emission scenarios (A1B, RCP4.5, RCP8.5) and based on a set of different regional climate models are described. Results show a progressive future reduction of intensity of marine storms with the only exception of the Sicilian coast. However, a tentative superposition of changes of storm intensity and expected sea level rise suggests increasing risks for the future in spite of the reduction of storminess.

Assessing economically coastal zone protection in a general equilibrium framework

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ABSTRACT

This paper conducts a global analysis on the economic implications of combining a mitigation policy and adaptation in the form of coastal protection.

The economic assessment is conducted by means of the ICES-XPS Computable General Equilibrium (CGE) model featuring a realistic representation of the public sector and an adaptation module representing investments and recurrent expenditures related to coastal protection. Different policy scenarios are analyzed considering the combination of adaptation to sea level rise, mitigation policies and a Climate Fund that supports also adaptation and mitigation measures in developing countries.

Two are the key messages from this analysis. The first relates to the way adaptation is financed. When adaptation expenditures are financed through taxes rather than through public debt the distortionary crowding out effect of adaptation and the consequent penalization of growth is lower. Taxes have a recessive effect on private consumption, but public debt crowds out private investment with a more harmful effect for economic growth and capital accumulation. Secondly, developed countries can benefit from supporting developing countries in their climate change policies. The lower contraction of developing countries' economic activity can benefit developed countries either directly through lower international demand contraction, or through lower/higher relative competitive losses/gains following the implementation of mitigation objectives.

INTEGRATED APPROACH FOR THE MANAGEMENT OF THE COASTAL AREAS IN A CLIMATE-CHANGING ENVIRONMENT

Chair: Giovanni Coppini - Fondazione CMCC

The session will discuss some of the possible elements for an effective integrated approach for the management of the coastal areas in a climate-changing environment. Speakers will present scientific and technological achievements in the field of the study of the interaction of coastal zone and open sea, for the development of applications for the management of coastal zone and marine resources with a particular attention to the problems of adaptation to climate change.

Marine spatial planning in a changing world

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ABSTRACT

Marine/maritime spatial planning (MSP) is a process of mapping, analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives that have usually been specified through a political process. MSP represents an unprecedented opportunity to include conservation planning in the broader planning of marine uses with the ultimate aim of reconciling conservation and socio-economic goals. Nevertheless, it also poses immense challenges to all countries. While general lessons and models can be derived from previous MSP experiences in northern Europe and around the world, comprehensive spatial planning in the Mediterranean has not been completed to date and faces additional challenges, such as the possibility to include the consideration of future changes driven by climate changes. Here, I will present the scientific and management challenges faced in a complex basin largely exposed to future changes starting from a review to understand how future environmental changes have been included in spatial planning around the world. The idea is to provide a framework for guiding the implementation of conservation planning in the Mediterranean countries stressing the need of incorporating future changes in MSP strategies.

Deep-sea ecosystems responses to climate anomalies along the European continental margins

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ABSTRACT

Continental margins are sites of intense exchange of energy and material between the continental shelves and the deep basins, and, as such, play key roles in global biogeochemical cycles. Information on temporal changes of the biodiversity and functioning of deep continental margins are still scarce, and the consequences of climate change and anomalies on these ecosystems are even scarcer. We have analyzed comparatively the trajectories and timing of ecosystem change in the Cretan, Catalan and Arctic margins, after episodes of dense shelf water cascading (Cretan and Catalan margins) or current anomalies over the continental shelf (Arctic margin). In all areas under scrutiny, irrespectively of the type of anomaly at the sea surface, we observed significant changes in the quantity, biochemical composition and bioavailability of sedimentary organic matter, whereas the effects of episodic events on the benthic (meiofauna) biodiversity varied among areas depending also on the oceanographic mechanism involved and the strength and duration of resulting deep-sea environmental conditions. As current climate change is increasingly influencing the strength and intensity of anomalies at the oceans' surface we can anticipate that these will most likely have large consequences on the deep ocean interior, the largest biome on Earth.

Keywords: deep sea; climate anomalies; continental margins; biodiversity; ecosystem functioning.

Coastal areas and harbours operational scientific based information system in support of safety and resilience: the case of Apulia region in Italy

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ABSTRACT

The START project aims at designing and implementing of a system for rapid mapping and monitoring the marine and coastal environment of Apulia region (in Southern Eastern of Italy).

The project is driven by the synergy between different research fields (e.g. oceanography, coastal and harbour engineering, marine geology, information technology).

The project framework is the Coastal Situational Awareness (CSA) addressed to the improvement of awareness and knowledge of the coastal environment by means of integration between observing systems, also in real time, with operational numerical modeling.

Products and services will be developed to provide (i) early warning and rapid mapping of extreme events in Apulia coastal areas, (ii) coastal erosion and flooding indicators, and (iii) support an integrated management of harbor areas.

CMCC has developed a new configuration of short-term forecasting system SANIFS (Federico et al., 2016) in order to reach higher spatial resolution in specific an complex sites (harbors and coastal areas) nested in the Copernicus Marine Environment Monitoring Service (CMEMS) products for the Mediterranean Sea (MED-MFC). A prototypal and user-oriented web-platform displaying the project products (observational data, forecasting fields, etc.) has been implemented and is constantly under development.

Keywords: Coastal applications; operational oceanography; integrated information system.

Climate change adaptation and coastal management

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ABSTRACT

Scientists have confirmed that, at all beaches, erosion and accretion are naturally occurring coastal processes. However, these processes may be accelerated due to anthropogenic activities such as unsustainable coastal management practices that can place human population at greater risk to climate change threats.

Definitions of adaptation to climate change are many and varied in the literature. The focus of the present paper is on that portion of the climate change adaptation hierarchy involving the consideration and selection of physical intervention measures to address existing coastal hazards and future increased risk posed by these hazards as climate changes.

This study goes beyond previous research in that it seeks (1) to determine the impact of beach dynamics caused by natural and anthropogenic factor and (2) to contribute/help in making appropriate decisions in managing coastal development problems subject to climate variability.

Furthermore, in the full paper, the experience gained within the currently-in progress START research project aimed to provide a rapid mapping and monitoring system of marine and coastal environment in Apulia coastal areas will be presented.

Keywords: Beach erosion; vulnerability; risk assessment; coastal management.

Risk assessment and decision support tools for the evaluation of multiple climate change impacts in coastal and marine areas

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ABSTRACT

Global climate change is expected to pose increasing environmental problems across different regions and sectors worldwide. The expected impacts at the land-sea interface have grown in complexity due to the interaction of multiple sources of hazards (sea level rise inundation, increased storm surges, saltwater intrusion, sea water quality deterioration, land use changes), with potential cumulative effects on population, ecosystems and economic activities. Moreover, the large amount of climate, environmental and socio-economic data and information that needs to be handled requires innovative methodologies and tools to produce comprehensive and multi-hazard risk scenarios.

A combination of vulnerability indicators, Geographical Information Systems (GIS), Decision Support Systems (DSS) and Bayesian Belief Network (BN) methods have been applied in the Adriatic region (Italy) in order to integrate and spatially represent the effect of multiple climate change impacts in coastal and marine areas.

After a brief overview of the capability of the decision support tools to mainstream the definition of adaptation strategies in the terrestrial coastal environment (e.g. shoreline planning, land use and water resource management, flood risk reduction), a cumulative impact assessment approach developed to cope with multiple sources of natural and anthropogenic pressures (e.g. temperature variation, shipping traffic, aquaculture, ports activities, nutrients input) is presented and discussed.

Keywords: risk assessment; decision support systems; Bayesian Belief Network; climate change adaptation; Adriatic sea.

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NEW DATA ANALYSES AND DATA-DRIVEN MODELLING FOR CLIMATIC INVESTIGATIONS

Chairs: Antonello Pasini - Institute of Atmospheric Pollution Research, CNR Roma

Observations and modelling represent the basis for understanding climate change and planning future actions. Up to now, the general attention has been devoted to time series of standard variables, such as temperature and precipitation, for historical climatology, and to the results of GCMs and RCMs for modelling activity.

More recently, also new data and data analyses have been considered. This allows us to investigate the characteristic features of the complex climate system in greater detail (e.g., considering multi-sensors systems in the analysis of extremes), eventually supplying us with new climatologies for non-standard variables.

From the modelling point of view, the recent big amount of data available and some unavoidable uncertainties in dynamical modelling led to consider even some data-driven models (e.g., neural networks and autoregressive models) as useful tools for investigating climate characteristic features and impacts. These models showed their ability to handle with climate variability, especially on time horizons and spatial scales in which it is crucial for understanding the climate behaviour.

In this framework, the aim of this session is to provide an opportunity to discuss innovative data analyses and modelling techniques which could help us to better identify climate characteristic features and their impacts in present and future situations.

Sunshine duration and surface solar radiation variability and trends in Italy and underlying causes

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ABSTRACT

A dataset of 104 daily Italian sunshine duration (SD) [1] and 54 surface solar radiation (SSR) [2] records have been set up collecting data for the 1936-2013 and 1959-2013 periods, respectively. The datasets were subjected to a daily quality control and homogenization in order to eliminate non-climatic signals in the raw series. In addition, SSR series under clear-sky conditions were obtained considering only the cloudless days by comparison with ground-based total cloud cover (TCC) series. Then, the records were interpolated onto a regular grid and clustered into two regions (north and south). Finally, the records were averaged in order to get regional all-sky SSR/SD and clear-sky SSR series. Both SSR and SD regional records, in agreement with that reported in literature, show a decreasing tendency (i.e. global dimming) from the 1950s to the 1980s and a subsequent increasing tendency (i.e. brightening period) since the 1980s. Moreover, considering the length of the available series, SD records show also some evidence of an increasing tendency (i.e., early brightening) between the 1930s and 1950s. A comparison of SD with TCC records shows a positive correlation during the dimming period suggesting that there is an important fraction of SD evolution that cannot be explained by TCC, but it should depend on other factors, such as, changes in atmospheric aerosol concentration. This is also confirmed by SSR records that show stronger tendencies under clear-sky than under all-sky conditions during the dimming period in all seasons and during the brightening period in winter and autumn. In addition, the clear-sky SSR dimming is stronger in the south than in the north, suggesting a significant contribution of mineral dust and so of natural aerosols to the SSR variability.

Keywords: Sunshine duration; surface solar radiation; Italy; homogenization; dimming/brightening.

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Temperature and precipitation climatologies for Italy and downscaling of the italian secular records onto a high-resolution grid

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ABSTRACT

Italy has an exceptional availability of secular temperature and precipitation data. In this presentation, we discuss a methodology, based on the anomaly method, to project these records onto a high-resolution grid. The key issue of this methodology is the construction of thirty-arc-second resolution monthly temperature and precipitation climatologies [1][2]. These climatologies are obtained by means of a procedure which consists in considering each cell of a high-resolution grid and in using the neighboring stations with geographical characteristics as much similar as possible to those of the cell itself in order to perform a local weighted linear regression (LWLR) of temperature or precipitation versus elevation. The weights are given by the distances of the stations from the grid point and by the level of similarity between the stations cells and the considered grid cell in terms of elevation, slope steepness, slope orientation and distance from the sea. The model performances are compared with the results provided by other widely used interpolation methods, highlighting the best agreement of LWLR method with the observed station normals and a lower leave-one-out-estimated mean absolute error. The better performances of LWLR are even clearer when specific clusters of stations are considered, e.g. high elevation sites.

The temporal component to be superimposed to climatologies can be obtained, for each grid point, by means of a distance-weighted average of the temperature and precipitation anomaly records of the neighboring stations.

Some case studies of the potentiality of this approach will be presented.

Keywords: high-resolution climatology; precipitation; temperature; Italy; interpolation methods.

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Climatology of surface and subsurface layer parameters on Piemonte (Italy) vineyards

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ABSTRACT

The rationale of the project is to perform long term simulations using third generation land surface model UTOPIA (University of TOrino model of land Process Interaction with Atmosphere) [1], in order to evaluate all components of hydrological and energy budget, as well as soil and canopy parameters, on a specific subset of land use, the vineyards. The reason is that vineyards have a specific importance in the economy of Italy, and in particular of some regions, like Piemonte [2].

A preliminary step of this work has been to compare the datasets resulted from the calculations made by the UTOPIA and some experimental datasets acquired within vineyards by our team in the past experiments [3]. The reason for such control is to ensure that UTOPIA outputs could be considered as sufficiently representative of the climatology of vineyards. Thus, three different Piedmontese vineyards (Fubine, Castiglione Falletto, Cocconato) were selected, each one characterized by same climatic but different microclimatic conditions, in which measurements of a wide number of variables were performed in the vegetative seasons 2008-2010 by us (experiment MASGRAPE) [4]. Subsequently, in this study, the results of additional simulations performed using the freely available global database GLDAS (Global Land Data Assimilation System) were compared with those of the simulations driven by observations, in order to check if the model was still able to reproduce the microclimatic characteristics of the vineyards.

This preliminary part of the study gave satisfactory results; thus, we could pass to the phase two of the project. In this phase, using GLDAS database, long term simulations will be carried out with the UTOPIA in order to have output data available on a period of climatic interest (30 years or more). This database could be used in order to perform climatic statistics and assess possible trends in some parameters, eventually to be correlated with grape production. In the talk, the preliminary aspects of this work will be illustrated.

Keywords: Piemonte; vineyards; energy and hydrological budget; microclimate; UTOPIA.

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Role and capabilities of GPM mission in the characterization and monitoring of extreme precipitation events in the Mediterranean region

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ABSTRACT

The Mediterranean area is a particular meteorological environment and a weather forecasting challenge, because severe weather events of different nature often originate over the relatively warm sea and develop to hit coastal regions, causing major damages and casualties. A number of studies have recently been devoted to the analysis of these events, both from the observational and numerical modeling points of view. The need to monitor these severe events during their offshore development, make the use of conventional ground-based rain measuring systems (i.e., raingauges and weather radars) inadequate to fully provide the observational details which are necessary to improve the monitoring and forecasting of precipitation in terms of time, location, and amounts. The increasing global Earth Observation (EO) observational capacity provides today an unprecedented potential to observe, describe and predict precipitation, and key processes governing the water cycle from local to global scales. Satellite precipitation products made available by space agencies and through international programs, can be used for floods and droughts monitoring, hydrological applications, and for climate studies.

The goal of this presentation is to show the potentials of the constellation of passive microwave (PMW) radiometers orbiting around the Earth to monitor precipitation associated to extreme events, also in particularly challenging regions, with complex orography and extremely variable surface conditions, such as the Mediterranean area [1]. Such constellation has recently reached an optimal configuration thanks to the advent of the NASA/JAXA Global Precipitation Measurement (GPM) mission [2]. By combining the overpasses from different radiometers it is possible to obtain precipitation estimates at different temporal scales (i.e., daily, monthly) in agreement with reference ground-based radar and raingauge measurements. Moreover, the GPM Core Observatory is equipped with the most advanced microwave radiometer (GPM Microwave Imager, GMI) and with the first spaceborne dual-frequency precipitation radar (DPR), allowing the analysis of the 3-D structure of precipitation. Extreme precipitation events that hit the coast of Italy in the last years will

be presented and analyzed.

Keywords: GPM; precipitation retrieval; extreme events; Mediterranean; Passive Microwave.

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Assessment of climatic influences on the abundance of vectors of leishmaniosis in Italy using a neural-network model

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ABSTRACT

Leishmaniosis is a severe vector-borne zoonotic disease affecting dogs and humans caused, in the Mediterranean basin, by the protozoan parasites of the genus *Leishmania* and spread through the bite of the phlebotomine sand fly [1,2].

In recent years, likely due to climate change (global warming in particular), these vectors expanded their distribution colonizing higher altitudes. In this context, it is necessary to develop a model that is able to quantify the impact of meteo-climatic drivers on vector densities [3,4].

In this study, after the use of simple linear techniques, we apply a fully non-linear neural network model (specifically developed for analyses of small data sets [5,6]) to vector trapping data. Sand flies were collected from different sites of the Latium region during two summers (2014-2015) characterized by markedly different climatic situations.

The results allow us to identify the major meteo-climatic drivers affecting sand fly density and also highlight the capacity of the model to explain the majority of the variance found in the data. In particular, the consideration as predictors of the values of averaged minimum temperature and relative humidity in the previous 45 days with respect to the trapping day leads to the best results (R^2 = 0.53).

Considering the strong influence of other specific non-climatic drivers on vector abundance, these findings are very promising.

Keywords: Leishmaniosis; sand fly density; neural network forecasting model.

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REGIONAL AND ENVIRONMENTAL IMPACTS IN A CHANGING CLIMATE I

Chair: Cristina Sabbioni, Istituto di Scienze dell'Atmosfera e del Clima (ISAC), Consiglio Nazionale delle Ricerche (CNR), Bologna

Research has been able to link observed changes in global and regional climate to changes in external forcing of the climate system and to climate variability. Key aspects of regional climate variability and trends are, among others, the amplification of surface warming trends with elevation, the modulation of temperature trends by tropical sea surface temperature, the impact of aerosol particles on atmospheric circulation in the monsoon-dominated regions or in the glacier dynamics. On the other hand, climate variations affect every aspect of our society through, for example, changes in the various components of the hydrological cycle from evaporation to precipitation to runoff and subsurface processes, leading to impacts on water accessibility and storage, energy and food production, agriculture, air quality and human health and others. Climate projections from the state-of-the-art global and regional climate models suggest that these variations may become more prominent in the future leading to non-negligible impacts on ecosystems and their services and, ultimately, on the society as a whole.

This session aims at gathering studies on the environmental impacts of climate change and climate variability.

The contributions will be focus on various aspects of the multifaceted interactions between climate change and their impacts, including basic research studies, data measurements, modeling studies, past, present, and future climate conditions, downscaling methods, impact models.

Elevation-dependent warming and changes in the hydrological cycle in the mountains

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ABSTRACT

One of the most remarkable expressions of global warming at the regional level is the amplification of positive temperature trends with elevation, the so-called elevation-dependent warming (EDW, [1]): in recent decades, mountains have warmed faster and more intensely than adjacent regions or compared to the global mean. EDW can have serious impacts on mountain ecosystems leading to changes in glacier dynamics, hydrological regimes, water availability and distribution and thus to negative consequences for downstream societies that benefit from the services provided by mountains.

Here we present an EDW study in the Tibetan Plateau-Himalayas, using an ensemble of global climate models (GCMs) from the CMIP5 project. The models, on average, reproduce EDW in the 20th century and project an amplification of this phenomenon by the end of the 21st century under a high-emission scenario (RCP 8.5). The relationship between warming rates and elevation is not linear: regions with temperatures below the freezing level of water show more warming than the ones with temperatures above. Using a multiple regression model we find that the negative change in surface albedo is the leading driver of EDW in the Tibetan Plateau-Himalayas, followed by the positive change in atmospheric humidity and downward longwave radiation [2]. In a previous study we showed that this region will undergo a significant reduction of snow depth over the Karakoram and an even stronger one (up to the 50% of the historical value) in the Himalayas [3].

In addition, we present preliminary results on the analysis of EDW and of the extent of the areas that will experience a significant reduction of snow cover in three mountain ranges - the Alpine Region, the Rocky Mountains, and the Tibetan Plateau-Himalayas. This study exploits the availability of global simulations with the EC-Earth GCM at five spatial resolutions (up to 16 km) [4].

Keywords: Mountain Climate, Elevation-dependent warming, Water resources, CMIP5 models, Model Resolution, Model uncertainty

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Extreme precipitation events and climate change in the Mediterranean region

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ABSTRACT

Heavy precipitation is a major hazard over the Euro-Mediterranean region. In this work we provide an assessment of Mediterranean extreme precipitation as represented in different observational, reanalysis and modelling datasets, exploiting the added value of the ensemble of high-resolution model simulations provided by the Med-CORDEX coordinated initiative. A spatio-temporal characterisation of the long-term statistics of extreme precipitation is performed, using a number of different diagnostic indices. Employing a novel approach based on the timing of extreme precipitation, a number of physically consistent sub-regions are defined. Extreme precipitation diagnostics over the Mediterranean domain and physically homogeneous sub-domains are discussed, focussing on the impact of different model configurations (resolution, coupling and physical parameterisations) on the performance in reproducing observed precipitation. It is found that the agreement between the observed and modelled long-term statistics of extreme precipitation is more sensitive to the model convective parameterisation than to resolution or coupling [Cavicchia et al. 2016].

Furthermore, possible changes in the intensity of heavy precipitation events at the end of the twenty-first century over the Euro-Mediterranean region are investigated, using a subset of the CMIP5 numerical climate simulations. As a measure of the intensity associated with heavy precipitation events, we use the difference between the 99th and the 90th percentiles. Despite a slight tendency to underestimate the observed heavy precipitation intensity during summer and to overestimate it during winter, the considered CMIP5 models well represent the observed patterns of the defined 99th–90th percentile metric during both seasons for the 1997–2005 period over the Euro- Mediterranean region. Over the investigated domain, an increase of the width of the right tail of the precipitation distribution is projected in a warmer climate, even over regions where nearly the entire precipitation distribution becomes dryer [Scoccimarro et al. 2016]. This is the case of the European domain within the 45N–55N belt.

Keywords: Climate Change; Euro-Mediterranean region; Heavy precipitation; MedCORDEX simulations CMIP5 climate change projections.

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Reconstructed and projected heat waves over the main Italian cities from the new high resolution Med-Cordex climate simulations

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ABSTRACT

Recently, an increasing interest in the climate variability and changes at local level can be easily pointed out, in particular regarding the occurrence of intense events that could have high impacts on the society and high prices for the community. However, the climatic projections do not always agree in the foreseen changes of intense warming events.

The uncertainty of these outcomes should be conveniently communicated to end-users. At the same time, strong efforts in modelling activities are needed to improve the skills of the numerical models in reproducing the main characteristics of the observed climate with the ultimate goal of producing trustable and physically consistent climate projections.

The SSPT-MET-CLIM lab in ENEA, that has recently coordinated the FP7 EU CLIM-RUN project on the production of climate information at Mediterranean level, is realising several climate products on the intense warm events, and related uncertainty, as reproduced in the high resolution regional climate simulations.

Here we analyse the capability of the most recent high resolution climate simulations produced in the framework of Med-CORDEX international initiative over the Mediterranean basin in reproducing the observed intense warm events over the main Italian urban areas and the expected changes in their occurrence and magnitude in the future climate projections.

The Mediterranean region hotspot: links to global climate change and likely impacts

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ABSTRACT

CMIP5 projections show that future increase of temperature in the Mediterranean region has a strong seasonal connotation, with summer warming at a pace 40% larger than the global mean. This future trend is consistent with the global reduction of the meridional temperature gradient that is produced by climate change. However spatial distribution of changes shows a strong a sub-regional modulation depending of the land-sea contrast, the role of soil moisture feedback and changes of large scale atmospheric circulation leading to increased subsidence conditions. Projections show that precipitation decrease will affect most of the region, but with a strong difference between southern and northern areas, where CMIP5 projections suggest a 7% and 3% decrease of annual precipitation for each degree of global warming, respectively. For both Mediterranean temperature and precipitation the dependence is substantially linear in the range up to 4^{0}C of global warming. Interannual variability and intermodel differences are a substantial source of uncertainty for precipitation (while there is a robust consensus for temperature changes). Therefore future precipitation changes are still a controversial issue, in terms of intensity and precise location of the transition belt that separates the decrease of precipitation over the MR from areas in central and northern Europe, where precipitation is expected to increase. On this respect, though the overall drying trend appears consolidated in the scientific literature, its precise evaluation remains to some extent controversial.

REGIONAL AND ENVIRONMENTAL IMPACTS IN A CHANGING CLIMATE II

Chair: Cristina Sabbioni, Istituto di Scienze dell'Atmosfera e del Clima (ISAC), Consiglio Nazionale delle Ricerche (CNR), Bologna

Research has been able to link observed changes in global and regional climate to changes in external forcing of the climate system and to climate variability. Key aspects of regional climate variability and trends are, among others, the amplification of surface warming trends with elevation, the modulation of temperature trends by tropical sea surface temperature, the impact of aerosol particles on atmospheric circulation in the monsoon-dominated regions or in the glacier dynamics. On the other hand, climate variations affect every aspect of our society through, for example, changes in the various components of the hydrological cycle from evaporation to precipitation to runoff and subsurface processes, leading to impacts on water accessibility and storage, energy and food production, agriculture, air quality and human health and others. Climate projections from the state-of-the-art global and regional climate models suggest that these variations may become more prominent in the future leading to non-negligible impacts on ecosystems and their services and, ultimately, on the society as a whole.

This session aims at gathering studies on the environmental impacts of climate change and climate variability.

The contributions will be focus on various aspects of the multifaceted interactions between climate change and their impacts, including basic research studies, data measurements, modeling studies, past, present, and future climate conditions, downscaling methods, impact models.

Integrated climate monitoring and operational applications

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ABSTRACT

Following GCOS, monitoring of climate system covers a long, reference list of atmospheric, oceanic and terrestrial variables, the well-known Essential Climate Variables (ECV). Most ECV are monitored by both in-situ and satellite/remote-sensing platforms. In a broad sense, climate monitoring includes not only the observation of ECV but also, as far as possible, the prediction and projection of ECV under the changing climate. ISPRA has been involved for more than 25 years in national-scale in-situ monitoring programs of oceanic ECVs, as sea surface temperature and sea level (by means of the Italian tide gauge network (RMN) and the tide gauge network in the Venice Lagoon) and sea state (Italian wind –wave buoy network (RON)).

Climate monitoring programs have been and are progressively more oriented to operational applications, i.e. to climate services. This is also a consequence of the constantly growing need to define climate change adaptation strategies and implement adaptation plans at all scales: global, continental, national and local.

A strong impulse to the development of climate services driven by users needs comes from the European Earth observation programme Copernicus. In particular, one pillar of the Copernicus Climate Change Service, the Sectoral Information System, explicitly aims to apply climate information to improve decision-making and planning in different socio-economical, institutional, public and private sectors.

Along with WMO and EU-Copernicus guidance, at national level there are many examples of operational applications of climate monitoring. Several public entities, that all together constitute a national network of climate services, express a portfolio of existing operational climate products and capabilities, with requirements and characteristics already adopted (or to be adopted) by territorial management entities.

Among the others:

quality-controlled time series of climate data, statistics and indicators, derived from a number of national and regional meteorological networks (SCIA system), have been and are used in the framework of the Department of Civil Protection duties for preventing and mitigate draught risks;

the same, are used within the Working Group on Decarbonisation under the Presidency of the Council, in order to derive a methodologically agreed and consistent set of heating and cooling degree days at national and county scales;

combined information on land use from high resolution satellite data, observed meteorological data from ground network, probabilistic seasonal predictions and a water balance model, provide

every year a probabilistic assessment of potential irrigation demand of crops for the plain area of the Emilia-Romagna region;
the statistical analysis of sea-state climate, based on more than 20 years of marine observations in several Italian key-locations, provides a support for the long-term planning of marine operations at sea, as shown in the case of the displacement of the Costa Concordia.

Climate change scenario at regional scales for risk valuations and production of climate services for local stakeholder

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ABSTRACT

Local adaptation actions to mitigate climate change effects are based on risk evaluation. The availability of Regional Climate projections is a pre-requisite to evaluate impacts of climate change and better support politics and stakeholders to propose adaptation actions, managing properly all the uncertainties. Climate services add value and define specific products for local users, including the capacity building for public administrations and communities. International project can get value from local best practices, adapt techniques for local purposes and enhance knowledge and awareness. EU funded partnerships can boost even local cooperation to look for new solution and to share effective measures for managing common risks. Impact model chains, applied to regional climate projections, are the core of local climate services for reducing risks, for example, of flood injuries, heath waves effects and wildfires damages.

Arpae-SIMC gives its contribution in the production of local climate scenario and climate services, through the: a) developing statistical downscaling methods of Global Climate Models (GCM) to individuate future scenario of temperature and precipitation at regional and local scale [1, 2, 3]; b) evaluation of runoff future scenario in the Po river (change of drought and flood occurrence) [4]; evaluation of potential future water needs for irrigation ([5], ICOLT system, developed by Arpae in the last ten years in the framework of several EU (Demeter, Ensembles) and national (Agroscenari) projects), [6].

Othes climate services are in preparation, regarding Solar Energy Assessment and Planning, to provide spatial operational managing of solar energy systems (SES) based on the knowledge of scenario of climate variables.

Keywords: Climate downscaling; Hydraulic Risk evaluation; Drought occurrence; Heat waves future scenario; Water needs.

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Role of the mixing bottom layers in the ocean circulation (Ionian Mediterranean sub-basin)

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ABSTRACT

The Mediterranean Sea is a marginal sea with a peculiar thermohaline circulation that is strongly affected by climatic changes. More specifically, the Strait of Sicily separates the Mediterranean basin in two main sub-basins eastern and western respectively with intrinsic different oceanographic and climate characteristics. This paper will discuss, from a broad perspective, some recent climate changes of the Mediterranean Sea from in situ observations and numerical results, which highlighted the different mechanisms that drive the main circulation of the eastern and western ocean circulation. From the analysis of about 30 years of T, S profiles of the Ionian abyssal plane and, in particular, below 2000 meters, we found the following main results: i) a large and lopsided variability of the hydrological characteristics; ii) an active deep mixing involving the layer between 3000-4000 meters and, more likely, iii) a change in the regional vertical dynamics deduced indirectly from the analysis of the vertical normal modes and vorticity. These complex behaviors of the Ionian abyssal oceanographic characteristics allow us to make some similarity with recent numerical results, which show that the meridional overturning circulation of the Eastern Mediterranean Sea experiences decadal variability with multiple equilibria states, and hysteresis behavior of deep-water formation. All this resembles the deep decoupling oscillations of Winton and Sarachik (1993), in which EMT-like event may occur spontaneously without a major change in atmospheric or other forcing.

Keywords: Mediterranean circulation; mixing; dynamical system.

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Urban climate projections with UrbClim

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ABSTRACT

While global and regional climate projections have become fairly common, the situation is different when it comes to urban climate projections. One of the principal causes for it is that regional climate models, when pushed to the spatial resolutions required for resolving urban areas, become exceedingly slow hence computationally expensive. As a result, urban climate projections covering periods spanning several decades are difficult to achieve.

In order to overcome this, the Flemish Institute for Technological Research (VITO, Belgium) developed a new urban climate model, UrbClim (De Ridder et al., Urban Climate, 12, pp.21-48, 2015), which couples a simple slab model of the urban surface to a 3-D atmospheric boundary layer model. Initial and boundary profiles are taken from regional- or global-scale models, either in re-analysis mode such as is the case for ERA-Interim fields, or else in climate mode, typically using output fields from climate projection archives such as that of CMIP5. Terrain characteristics are specified from generic (European-wide) data sources, including CORINE land cover, and satellite vegetation index maps. While UrbClim is based on a series of simplifications, validation experiments have shown that it is as accurate as more detailed and sophisticated models.

In our presentation, we will briefly describe the processes included in UrbClim and outcomes of validation exercises, after which we will give an overview of the results achieved with the model so far, focusing on long-term urban climate projections, and on the simulation of aggregated parameters such as the annual number of heat wave days occurring in cities.

TRANSFORMING CONSUMPTION AND PRODUCTION PARADIGMS TO SUPPORT SUSTAINABLE SOCIETIES – SUSTAINABLE FUTURES IN PRACTICE

Chair: Pierpaolo Duce, CNR IBIMET

Sustainable Consumption and Production (SCP) has become an important topic of policy and research agendas over the last ten years. Although early policy ideas can be traced back to the mid-1990s, policy attention accelerated after the 2002 World Summit on Sustainable Development in Johannesburg, where a 10-year framework programme on SCP was promoted, and then developed (multi-stakeholder Marrakech Process - 2003–2011), together with national SCP initiatives, before being adopted at the UN Conference on Sustainable Development (Rio + 20) in 2012.

In parallel, SCP has been increasingly debated by academics, resulting in various special issues in scientific journals, overviews, and analyses of policy debates.

The appeal and importance of the SCP agenda is that it moves beyond the dominant focus on pollution control and green products, widening attention to the patterns of consumption that sustain the resource-intensity of everyday lives and design sustainable futures in practice.

The strength of SCP-research is its proposal to jointly consider production and consumption activities. In the context of climate change, environmental degradation, resource problems and declining bio-diversity, research on these two fundamental areas of human activity has intensified because of the recognition that both domains need to change to achieve large gains in environmental sustainability.

The aim of this session is to provide an opportunity to discuss innovative applications and methodologies focused on how current consumption and production paradigms can be modified or replaced to support transitions to sustainable and equitable societies.

Opportunities for a multifunctional agriculture

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LCA in the agro-food sector: complex but necessary

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ABSTRACT

LCA is a method for the quantification of the environmental footprint of products and systems that is more and more used in public policies, enterprise management and communication to consumers. Its main advantages are:

- Avoid problem shifting
- Can catch the complexity behind products even those apparently simple;
- Can help in identifying and assess eco-innovation opportunities;
- Help in managing data
- Help in supply chain management

However, its application in the agro-food sector is particularly challenging due to:

- Technical definition of the system boundaries
- Definition of the functional unit (unit of analysis)
- High variability of soil characteristics
- Diverse agricultural /management/crop rotation practices
- Complex relations among input (nutrients, soil, weather, etc) and output (crops and emissions
- Relation between agricultural practices and long term soil quality

European pilots of product environmental footprint (PEF) tackled most of those key issues, proposing harmonisation and guidance to solve them. The experience will be precious for the newborn Italian labelling scheme Made Green in Italy, that adopts PEF as background methodology.

Transition to a circular economy and climate change

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ABSTRACT

The circular economy aims at maintaining the value of products, materials and resources in the economy for as long as possible [1]. Public and private strategies aimed at promoting the circularity of the economy are also likely to contribute substantially to reducing greenhouse gas emissions from production and consumption activities. The objective of the paper is to illustrate the links between increased circularity and climate change mitigation objectives in both production and consumption activities.

We first evaluate from an economic point of view how interactions between production (producers) and consumption (consumers) that are put in place for 'circularity' reasons also influence the generation of greenhouse gases in production and consumption, as well as changes in the relative distribution of emissions between production and consumption activities.

We then look at two specific case studies that show how both complementarities and trade-offs could emerge. The first one refer to the implementation of the 'waste hierarchy' for municipal solid waste. The movement from landfill to recovery (through incineration and, more importantly, recycling), reuse and waste prevention also implies a substantial reduction in the generation of greenhouse gases in the various steps of the production and consumption chains. The second case study refers to the private transportation sector (i.e. cars), where a rapid renewal of the car fleet aimed at improving the fuel efficiency and reduce greenhouse emissions from driving cars may result in an acceleration of material use and waste generation (end of life vehicles).

Keywords: circular economy; climate change mitigation; complementarity.

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Re-use residues: food wastes and circular economy

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ABSTRACT

Reuse of agroindustry residues plays a pivotal role in the transition to Bioeconomy and in reaching the target of the COP21 agreement. Thus, not only these residues can be valorized to produce new bioproducts and biomaterials of different added value according with the rules of circular economy, but their reuse will avoid greenhouse gas emissions due to some agricultural practice, such as the tilling back of rice straw into the paddy producing 6 tonnes of CH_4 per hectare. Several examples of reuse will be presented, in particular linked with the main Italian agro-industries: rice, wine, tomato and cheese

Keywords: Food Supply Chain Waste; Biomaterials; Bioeconomy; Circular economy.

Poster Session

Adapting to climate change in a multiple stressors context: a case study from two rural districts in the "*Ceja de Selva*" of Perù

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ABSTRACT

UNFCC Parties at COP 21 committed to enhance adaptive capacity, strengthening resilience and reducing vulnerability with special attention to developing countries, which are considered the most vulnerable to the impacts of climate change [1]. Indeed, developing countries have to face with an already stressed marginal production environment, heightened exposure to extreme events and scarcity of capital for development and dissemination of adaptation measures [2].

This research investigates the adaptation responses to climate variability and change of two rural agricultural Districts in the "Ceja de Selva" of the Amazonas Region (Peru) in the context of other socio economic stresses.

A qualitative case study approach [3] was employed in the research, utilizing semi-structured interviews (n. 23). Moreover, two participatory workshops based on participatory rural appraisal techniques (climate calendar, activities calendar, hazard map) were organized in each District, involving a total of 33 participants [4].

Findings show that climate change effects are evident in the study area. The changes observed by farmers are considered responsible for the diffusion and increase of pest diseases in coffee and fruit plantations as well as for the reduction of crop productivity and other economic losses. However, climate factors are interacting with multiple stressors in the wider socio economic context [5], such as economic liberalization, the consequent price volatility and low food crop prices, challenging local small scale agriculture system and affecting adaptation responses.

Most of the strategies adopted by farmers are «autonomous» without any public intervention [6]. Among these the research highlights: i) diversification of crops (i.e. more resistant coffee varieties and new profitable crops); ii) increased use of pesticides and fertilizers; iii) income diversification into no-farm sector; iv) use of family nets for loans during crisis periods and v) collective actions of internal community users associations, especially in emergency situations related to climate extreme events.

Keywords: climate change, adaptive capacity, multiple stressors, small scale farmers, Peru.

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Heat waves in the changing climate of Northern Italy

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ABSTRACT

In the recent decades Northern Italy has undergone a rapid warming that was more pronounced in the summer season [1]. Future climate simulations [2] predict this warming to continue in the following decades. Yet, substantial multi-decadal variability is superimposed to this non-linear warming trend [3]. In this framework, here the frequency and the characteristics of summertime heat waves at Northern Italy are analyzed for the period 1960–2015, and aspects of their dynamics are examined using reanalysis data. A very significant, yet not monotonic, increase in the frequency of heat waves is found, which on one hand is explained by the overall warming (distribution shift) and on the other hand contributes to it.

Back trajectories are also computed and analyzed. The typical synoptic setting associated with these extreme events indicates adiabatic warming following the air motion (lagrangian subsidence) and horizontal, warm temperature advection driven by a southerly anticyclonic excursion resembling wave breaking. The role of radiative effects is also considered. Different epochs are identified during the examined historical period exhibiting considerable differences in the mean large-scale circulation pointing to the role of multi-decadal variability. Still in progress, this study tries to shed some light on the nature and the origin of the increasing number of Northern Italy heat wave events and on the physical processes (such as changes in circulation patterns) via which global warming manifests itself in this region, effectively by changes in the local energy balance. Understanding the dynamics related to local climate change is paramount for increasing our confidence in the model simulations of future climate.

Keywords: Extremes; heat waves; climate change; dynamics; warming.

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Integrating fire modelling systems to estimate fire emission under climate change: a novel approach

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ABSTRACT

Future wildfires are projected to increase in Southern Europe due to climate change (CC) [1] and concurrent exacerbation of extreme weather conditions could also lead to a significant rise in greenhouse gas (GHG) emissions due to biomass burning [2,3,4]. Fire emissions (FE) include a wide range of gaseous compounds and particles significantly contributing to the atmospheric budgets at local, regional and even global scale [5]. FE estimation is affected by a number of uncertainties, mainly related to vegetation moisture, fuel characteristics and fire behavior and probability. Further, also CC data could have additional source of bias and uncertainties that need to be added to those previously mentioned.

The current work aims to present the development of an integrated methodology to assess the forest fire risk in relation to CC and to estimate the greenhouse gas emissions due to vegetation burning. The main objective was achieved throughout the coupling off-line of fire danger and fire simulation models (FWI - Fire Weather Index and RANDIG [6]) together with a fire emission and combustion model (FOFEM [7]). The regional climate model CMCC-CLM [8] (under A1B emission scenario) was used to calculate the variation of weather variables for the period 1981-2070. FWI and RANDIG were used to investigate and simulate the relationships between fire danger and burned area and fuel moisture proxies; further, hundred thousand wildfires were simulated burning the whole study area [Italy and main islands] for three different periods: 1981-2010, 2011-2040 and 2041-2070.

The methodology allowed the assessment of the interaction among climate change, fire behavior and fire emission trough a probabilistic approach. Furthermore, the results highlighted also the vegetation type that, in different Italian sub-areas, could distinctively contribute to fire emissions. This information constitutes a key guideline for the definition of the most appropriate forest and land management strategies in order to mitigate fire risk and emissions, also in a context of climate change.

Keywords: fire emission; fire danger; fire behavior and spread; climate change.

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Heat waves in Italian urban areas and their relationship with weather patterns

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ABSTRACT

In the last few decades the number of heat waves (HW) over Europe has been increasing [1], [2] with important impacts on human health, increasing the number of deaths, hospitalization, accesses to emergency room [3], [4]. This study focuses on HW occurring in urban areas in Italy in relation to the persistency of weather types, and in relation to large scale atmospheric indices relevant for the Mediterranean Region.

A climatological analysis of air temperature observations over the last decades, a series of summer HW that had an adverse impact on human health, i.e. with a large number of hospitalizations and accesses to emergency rooms, has been performed, and the recurrence of events has been analysed in relation to the persistency of the weather types and to large scale dynamical configurations. The weather types considered in this study have been elaborated in the framework of the COST 733 action [5] which permitted to identify weather types and build their daily occurrence over the central Mediterranean region.

Keywords: Heat waves; Weather patterns; Climate extremes.

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Future pathways towards SDGs

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ABSTRACT

The adoption of the Sustainable Development Goals (SDG) on September 2015 sets broader and more ambitious targets for both developed and developing countries encompassing all sustainability dimensions (economic, social, and environmental) and designing the pathway towards an inclusive green growth.

This paper aims at giving an ex-ante assessment of future trajectories of some representative SDG indicators, assessing in 2030 their distance from meeting the targets and envisioning the most suitable policies to reduce their the gap from Sustainable Development.

Our analysis relies on a recursive-dynamic Computable General Equilibrium (CGE) model developed and enriched with indicators representative of each SDGs. CGE models have a flexible structure, and can capture trade□offs and higher-order implications across sectors and countries that follows a shock or a policy. These models are well suited to assess the performance of economic indicators such as sectoral value added, GDP per capita, and public debt evolution; moreover, the CGE modelling literature of the past decades has highlighted that this is also a powerful tool to assess the evolution of some key environmental indicators, such as GHG and energy intensity [1]. Enhancing the model with social and environmental indicators is demanding but also allows assessing in an internally consistent framework their future evolution and how changes in one sustainability sphere may affect the achievement of SDGs all around the world.

Our framework considers 37 indicators covering 16 SDGs and classified into the three sustainability pillars. The analysis has world coverage, but for modelling reasons we aggregate the result in 40 countries/macro-regions. The baseline reproduces a Shared Socio-economic Pathways 2 (SSP2), consistent with a RCP4.5, and it is used as a benchmark to assess the effects of different Sustainable Development policies in meeting SDGs.

Keywords: Sustainable Development Goalsì; Computable General Equilibrium; indicators.

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Analysis of temperature time series collected in a high elevation site in Southern Apennines (Montevergine, AV – Italy): variability, trends and extreme events (1884-2015)

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ABSTRACT

In recent years climate change issues have taken high resonance, motivating the scientific community to carry out multiple research activities in order to understand the complex mechanisms that regulate atmospheric variability. The central Mediterranean area is characterized by a climatic context of great interest, being affected both by atmospheric dynamics typical of Western Europe and by dynamics typical of sub-tropical areas. In this work, we present the results obtained from the analysis of the homogenized historical temperature time series collected between 1884 and 2015 in Montevergine observatory (40° 56°N, 14° 43'E). The latter, being located at 1280 m a.s.l. on the western side of Campania Apennines (southern Italy), provides a valuable opportunity to study the climatic changes observed in the past century at high-elevation sites in Central Mediterranean regions.

The analysis of time series, performed on both a yearly and a seasonal basis, has been carried out through Wavelet Analysis, in order to investigate about series behavior in time-frequency spectrum. Moreover, we performed a linear trend analysis for the following subperiods: 1884-1913; 1914-1943; 1944-1973 and 1974-2015; the significance of the trends at 95% confidence level has been evaluated through the Mann-Kendall test.

We estimated also mean trends in the extreme events such as "heat waves" and "cold waves". Following the guidelines provided by CLIVAR project (Climate and Ocean: Variability, Predicatibility and Change), we adopted indicators based on percentiles and duration to define a heat wave and cold wave event.

In addition, the relationships between Montevergine temperature time series and large-scale atmospheric patterns were analyzed.

Keywords: climate change; air temperature; high altitude climate; extreme events.

Can circulating metabolic N derivates point to the estimation of livestock impact on climate changes?

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ABSTRACT

Farm animal emissions are accounted to contribute to environmental load, above all in the fraction represented by outputs as results of dietary energy and nutrients necessary to cover nutritional requirements for productions. Globally, water and carbon footprints were estimated according to breeding systems and animal species reared and the role exerted by N and derivates were most of times interpreted as to be responsible for the impact on ecosystems, gathering the interest of the scientific community. Investigations on the gaseous forms of N derivates from metabolic utilization of dietary N are increasing worldwide. However, a different perspective might be the key to achieve additional insight about the intermediate metabolism leading to emissions[1, 2]. It was hypothesized that the screening of the different levels of blood circulating N metabolic forms could help in the correct interpretation of outputs, though a comparative analysis of such metabolites in different farmed animal species. Thus, this investigation was undertaken with the purpose to develop a model on the metabolic utilization of dietary proteins in comparative terms of circulating N forms in the animal body, to draw a potential orientation on how the breeding system actually affects the different routes taken by N metabolic derivates. Three animals species entered the statistical model: dairy cattle, sportive horse and dairy goat. Blood circulating concentrations of total protein, urea and creatinine were comparatively analyzed. Data show differences in circulating metabolic N and results are discussed within climate change scenario.

Keywords: Farm animals; Monogastrics; Protein turn over; Ruminants; Urea.

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Intercomparison of climate model data on Piemonte (Italy) single meteorological stations

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ABSTRACT

The analysis aimed to verify the climatology deduced from recent climate model outputs, compared with the ones carried out on time series of meteorological data. Variables analyzed were: minimum and maximum temperatures, and daily precipitation. The reference period considered in the analysis was from 1971 to 2000. This choice allowed to have: i) recent data, to highlight climate change; and ii) available homogenised time series of observations to use as comparison. A statistical analysis of both model outputs and observations was performed, with tests allowing to establish whether any differences found were statistically significant or not. The secondary objective of this analysis was to try assigning an uncertainty to the climate reconstructions. Three were the locations chosen in this analysis (choice also dictated by the availability of measures): Vercelli, Rosone, and Vannino (all located in Piemonte region); each of them was selected as representative of the type of area in which it is located. Regional models selected were: RCA4 (driven by four different global models: MPI-ESM, HadGEM2, IPSL-CM5 e CNRM-CM5.1) and CanESM2 (driven by CGCM4). Global models selected were: MPI-ESM, HadGEM2, and CGCM4. The analysis, conducted only on three stations of different types, highlighted the weaknesses in the direct use of the values simulated by a climate model. We did not found significative differences among global and regional models. The variety of results and the fact that, very often, the models were unable to capture the distribution of data makes very difficult to perform a post-processing of data, in order to remove the highlighted trends, because of the heterogeneity of the results, highly variable from site to site. It is thus difficult to talk about climate change, because it is difficult to generally assign a statistical uncertainty to the model outputs.

Keywords: climate model; climatology; temperature; precipitation; uncertainty.

Towards resilient climateproof towns: urban and territorial projects and strategies

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ABSTRACT

In the lasts years the effects of the climate change have led reduction of safety and livability, especially in coastal and delta river towns, consequently subject to the dynamics of the latter.

In 2013 Bernardo Secchi proposed a “new urban question” (Secchi, 2013) to describe the set of environmental, economic and social changes affecting the European cities: among which the effects of climate change that push national and local governments to develop new strategies able to respond to the increasing level of risks due to climate change. These pressures are more detectable in some “sensible” territories, such as water urban landscapes, that rely project and plan the task to put at the end “the permanent emergency approach, the irresistible weight of the previous questions, the autonomy seemingly irreconcilable interests” (Palermo, 1998). In these conditions, the urban project takes a strategic role, linking the determinism of the usual rules about what you can do with the rules on how and which principle must be taken the decision (Portas, 1998).

In this contest, the development of climatic and risk scenarios in the urban built area, can produce initiatives to limit risks, as well as could include urban strategic projects, in order to identify evolutionary scenarios that focus the relationship between environmental structure and urban project, identifying design alternatives and sequences that can develop a new *forma Urbis*, adaptive and more resilient, able to limit risks, keeping the economic activities, integrating in the landscape and in search of an order.

The abstract proposes an adaptation process to the effects of climate change in waterfronts areas (Lisbon), through strategies, urban scenario projects and economic assessment models.

Keywords: adaptation; climate change; urban planning; sensible urban areas.

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Barriers for increasing resilience – municipal adaptation to extreme rainfall in Poland

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ABSTRACT

Extreme weather events, especially heavy rainfall are a threat which can bring large financial losses or even risk for human health and life. Due to climate change it is predicted by different studies that the intensity and frequency of extreme weather events will increase in the future [1]. Although urban areas densely inhabited are at higher risk because of the fact of accumulation of infrastructure and people they ability of coping with different type of extremes is higher than smaller and less inhabited towns. Therefore municipalities which are in possession of smaller resources are seen as more vulnerable to extreme weather events consequences. On the other hand researches indicate that governance of extreme situations in smaller towns is more effective due to a larger role of local authorities and their consciousness of local conditions and familiarity of communities' needs [2].

Author is focusing on small municipalities as the area where innovation and active attitude of local authorities and other participants of the governance process could lead to an increased resilience towards extreme weather events. Nevertheless, it is pointed out that municipal resilience remains low. The actors dimension [3] is seen as the key to understand the problem of omitting available solutions (resources). Some studies are showing that lack of knowledge might be the problem [4], at the same time other indicate the issue of understanding and reacting to available knowledge [5, 6].

The study presents results of an ongoing research project, funded by National Science Centre of Poland, that aims at researching the barriers for increasing extreme weather events resilience in Polish municipalities. The analysis bases on statistical data from National Fire Departments from Wielkopolska province and in-depth interviews with key-actors in selected municipalities in the region. The policy arrangement approach is used as the analytical frame.

Keywords: extreme weather events; resilience; municipalities.

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Levels of alarm matrix in rapid flow

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ABSTRACT

Authorities responsible for land management are interested in simple tools that can be easily applied in both technical and administrative terms in order to: 1) identify areas at real and/or potential risk; 2) determine technical standards for the assessment and design of structural and non-structural interventions for risk mitigation; 3) set up alarm systems to integrate into civil protection plans.

The paper analyzes particular experimental on-site measurements that facilitate an evaluation of the levels of risk and alarm in increasingly frequent and dangerous phenomena of rapid flow [1,2]. This increased frequency and hazard is related to climate changeand to environmental modifications caused by human interventions. A number of predictive methods aiming to support such an action have been proposed in recent years, the most innovative and propitious of which appear to be those which combine soil stability models with water infiltration and transport models [3,4].

It can also be noted that displacement processes are triggered when rainfall causes the slope's surface layer to become heavier and seepage determines neutral pressures that cancel out the cohesion and friction forces.

It therefore appears to be initially useful to determine a matrix for the assessment of a warning threshold A (further subdivided into four fields, from moderate to very high) linked to a weather event severity parameter I, a function of the rainfall intensity, and a soil state and property parameter F, a function of the h/z ratio (z is the height of the soil layer; h is the groundwater level, with reference to z).Use of this matrix is complementary to the installation, in the single RTU, of monitoring instruments (rain gauges and piezometers) which are needed (in addition to the characterization of the soil's geometry and hydrological properties) in order to calibrate the parameters I and F and to define warning thresholds in the civil protection plan.

Keywords: rapid flow; alarm matrixes; alarm threshold; slope monitoring.

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Changes in precipitation extremes over italian peninsula and its impacts on the electric system

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ABSTRACT

Extreme weather events represent serious risks for human activities and infrastructures. In particular hazards such as floods and droughts are one of the main challenges of the 21st century with significant societal and economic implications.

The intensification of extreme weather events (strong winds, thunderstorms and snowstorms) put a strain on the continuity of service of the Italian electrical grid.

The aim of this work is to assess potential changes in precipitation extremes that would have serious impacts over Mediterranean basin with focus over Italian peninsula.

Two future scenarios have been elaborated (one at medium-term 2021-2050 and the other at long-term 2071-2100) by analysing Med-CORDEX simulations in two emission scenarios RCP 4.5 and RCP 8.5 at the horizontal resolution of 0.44° (about 50 km).

Model values have been bias-corrected on the basis of data provided by EOBS [1], a reference dataset of gridded daily observations with 25 km spatial resolution, by using a nonparametric transformation based on quantile-quantile mapping [2].

To investigate the change of climatic signal, a subset of standard indices defined by the World Meteorological Organization Expert Team on Climate Change Detection and Indices (ETCCDI) [3] was considered.

In spite of a certain degree of uncertainty in the characterization of the regions, more likely affected by extreme events and found especially in short term period (2021-2050), the results highlight that an increase in the intensity and frequency of extreme events is likely. Therefore an increase of the risk for electric failures is expected. In particular the likely reduction of precipitations and the increase of the length of dry spells lead to a decrease of hydroelectric power generation and to a scarcity of water for the cooling of thermoelectric power plants.

Keywords: extreme events; Med-Cordex simulations; future scenarios.

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Estimating degree days

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ABSTRACT

An important aspect dealing with the impacts of climate change on the urban environment may be assessed by considering the modification in the energy demand for heating and cooling of buildings. As the energy request depends closely on surface temperature variability (with maximum energy requirements correlated to temperature extreme values), the effect of temperature impacts on heating/cooling energy use have been analyzed by considering heating (HDD) and cooling (CDD) degree-days.

Two methodologies to compute such indexes (JRC/MARS-EUROSTAT [1,2] and Giannakopoulus [3]), which substantially differentiate one from each other for the reference temperature considered for quantify the deviation (in degree Celsius) of the daily temperature from it, have been considered to assess the sensitivity of the two procedures applied over Italy.

The daily temperature input have been provided by the gridded data E-OBS and a sub-set of seven ENSEMBLES models at 25 km spatial resolution. The first data-set allowed to investigate the annual degree-days from 1961 to 2014 against the national data provided by JRC/EUROSTAT, as well as their spatial distribution; the model simulations let to estimate the changes expected in the next decades, after a bias correction has been applied and a validation of their performances has been checked.

Moreover, as the energy demand is strongly correlated to the building dimensions to be heated/cooled, the population distribution has been considered as proxy data to improve HDD and CDD national average estimates. As the urban areas are not distributed homogeneously over Italy, significant differences has been found in the new values: HDD decrease substantially and CDD increase lightly as most of population live in low altitudes area.

On the basis of models results and in accordance with previous studies climate change will result in reduction in demand for heating and increases everywhere in demand for cooling.

Keywords: degree-days, climate models, energy demand

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Relations between natural phenomena and solar activity in the oceanographic and forest fields

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ABSTRACT

A number of studies on the relationship between solar activity and various terrestrial phenomena, especially in the climatic, oceanographic and biological fields, have been carried out over several decades. In this work we analyse the shorter oscillations of solar activity as well as those recognized in the evolution of some natural fluctuating phenomena such as mean sea level evolution and the space/time succession of coastal pine stands. In particular, we analyse the sunspot series (Wolf relative number series) which is considered an index of solar activity and has been observed since 1700, together with the series of the mean sea level variation from four oceanographic stations in Poland (Swinoujsce), France (Brest) and Italy (Venezia and Cagliari) and the series of the space/time succession of coastal pine stands of southern Sardinia. Because the sea level evolution and the space/time succession of the investigated coastal pine stand fluctuate in intensity, an analysis of these fluctuations and their possible correlation with solar activity was considered of great interest in contributing to explain the various interactions between natural fluctuating phenomena and other problems relating to the forecast of the climatic evolution.

Keywords: solar activity**;** natural fluctuating phenomena; sea level; coastal pine.

The anthropogenic climate change hazard: role of precedents and the increasing science-policy gap

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ABSTRACT

There are some parallelisms and similarities since the 1960s in the identification, attribution, scientific communication, and the subsequent initial policy setting processes of the acidification, ozone layer depletion, and climate change hazards.

The anthropogenic factors behind the latter one were hypothesized well before the discovery of the cause-effect relations of the two other problems; nevertheless, later on the policy approaches to address the “acid rain” and “ozone shield” issues served to some extent as precedents for building up the international climate policy mechanisms. The analysis of these knowledge and policy development cases is of particular interest in light of the widening climate change science-policy gap, whilst efficient international policy and legal regimes have been built up for tackling the acidification and ozone depleting phenomena. Concerning the global climate policy regime, the consideration of its progress covers the time period since the early 1970s by 2015 when its most recent building block was adopted.

Keywords: acidification; ozone layer depletion; climate change; environmental precedence; science-policy gap.

The LIFE programme & adaptation to climate change

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ABSTRACT

The LIFE programme was established in 1992 and is the EU's funding instrument for the environment. The general objective of LIFE is to contribute to the implementation, updating and development of EU environmental policy and legislation by co-financing pilot or demonstration projects with added value.

Since its start, LIFE has been continuously co-funding innovative projects that help address the EU's transition to a low-carbon and climate-resilient economy, strategically underpinning the implementation of the EU strategy on climate change.

Below you can find some indicative examples of LIFE projects on specific themes:

WIZ developed and demonstrated an innovative online platform that includes two informative services (WIZ4All & WIZ4Planners), able to incorporate the protection and sustainable management of water in urban planning processes and local policy areas. An analysis of long-term management of drinking water integrated into land use planning was conducted, enabling water authorities to prepare investment plans and harmonize data characterising the water demands of an area. Information on water resources availability based on the effects of climate change or active reporting on the quality of drinking water are amongst the activities making an optimum 'participatory management approach' possible.

HydroClimateStrategyRiga aimed to create a flood risk management plan for the city of Riga in order to create the means necessary to ensure that hydrological processes intensified by climate change phenomena are adequately investigated and incorporated into the city's planning system. Methodological guidelines were developed, based on existing and future flooding trends in Riga and reinforced by best practices in the identification, planning and management of flood risk zones as adopted in Rotterdam, Antwerp and Hamburg.

Drought monitoring in Sardinia. A case study

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ABSTRACT

Drought monitoring is crucial to provide timely information to subjets directly and indirectly involved (farmers, river basin authorities, water resource managers, etc.) about the beginning, duration and intensity of the events and to prepare appropriate plans risk management.

The Meteoclimatic Department of ARPAS produces constantly updated decadal and monthly bulletins containing specific indicators based primarily on precipitation, in order to identify the onset of drought conditions and to assess the intensity in different areas of Sardinia. The data coming from the network of meteorological stations are processed on different length time periods in order to highlight different types of drought (meteorological, agricultural, hydrological, etc.), and shown both in form of graphs and maps. The used indicators are the ratio with normal climate, the percentiles, the hydro-climatic budget (BIC) and the standardized precipitation index (SPI), regarded the 30 year period 1971-2000. Precipitations were compared against three different climatologies 1951-80, 1961-90, 1971-2000. That enabled to compare drought data against mean precipitation of recent years and those of the years when all major Sardinia dams had been projected and built.

The spatial processing are implemented through geostatistical techniques in a GIS environment. The goal of this service is to provide users and institutions with timely and detailed information both through the Department's website (ww.sar.sardegna.it) and specific requests.

During the fall 2015, ARPAS was requested to carry a more detailed analysis of drought conditions that affected Sardinia, particularly its northern part, where some small and medium-sized reservoirs experienced severe water shortages. The large precipitation deficit in December, together with the one of November, aggravated the situation in most of central and northern areas, where cumulate precipitation values in the short term period (3-6 months) hardly reached 50-60% of climatology. The SPI index in December was moderately drought or severe drought, even on the medium-long periods. Particularly low were SPI values calculated for some stations located in the area of Sos Canales reservoir (Alà dei Sardi e Osidda).

Keywords: Drought; climate; precipitation; SPI.

Comparison of two approaches to optimize the genetic coefficients of CSM-CERES wheat crop model

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ABSTRACT

Accurate predictions in agriculture depend on a correct estimate of the genetic parameters of the crop models. These can be hand-estimated or optimized through an automatic approach, using different methods.

The objective of this study is to compare two methods (hand estimation and GLUE method) for the optimization of the cultivar-specific parameters for a durum wheat variety cultivated in Italy (Iride) using the CSM-CERES-Wheat model, implemented in the Decision Support System for Agrotechnology Transfer-Cropping System Model (DSSAT-CSM) [1; 2].

The hand procedure [3] method was applied by minimizing the differences between the average values of simulated and measured data, through a trial and error approach. The automatic estimation was made using the Generalized Likelihood Uncertainty Estimation (GLUE) method [4]. This is a Bayesian Monte Carlo method that allows to combine information from different types of observations with the aim to estimate the probability distributions of parameter values for model predictions [5]. Observed data from different experimental sites located in Italy were considered in this study.

The results show that the manual optimization of cultivar-specific coefficients allows to better simulating the characteristics of the wheat cultivar at national level, in particular for phenology. The set of phenological parameters estimated using GLUE indicate an increased need for vernalization, an increased grain filling phase duration and a lower photoperiod response. As regards the yield, similar values of genetic coefficients were obtained with the two approaches with the exception of the kernel size under optimum conditions standard (greater with the hand calibration). However, the difference between simulated and observed mean values of phenology and yield is smaller with the genetic coefficients obtained with the hand approach.

Keywords: GLUE; DSSAT-CSM; crop modeling; wheat; parameter estimation.

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ClimaSouth: Support for Climate Change Mitigation and Adaptation in the Southern and Eastern Mediterranean Regions

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ABSTRACT

The EU-Funded ClimaSouth project was initiated in 2013 for a period of 48 months, with the aim to support climate change mitigation and adaptation in nine South Mediterranean Countries: Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, Palestine and Tunisia. The overall objective is to assist partner countries' transition towards low carbon economies, build climate resilience and exploit opportunities for economic development and employment in the region.

This is pursued by strengthening the capacity of policy makers in the region to effectively engage in the global change framework, and by enhancing the institutional capacity for strategic planning in the areas of climate change mitigation, adaptation and financing.

CMCC, scientific partner of ClimaSouth, promotes the south-south cooperation and information sharing on climate change issues within the region with the aim of "Strengthening institutional adaptation capacity".

The poster illustrates and underlines how well planned regional activities and focused national initiatives could lead to significant results both on climate research, policy action and institutional strengthening in the Mediterranean region. It highlights results achieved from the following activities:

i) "*Regional Workshop on Improving access to Climate Change Information*" (Lecce, Italy);

ii) "*Regional Climate Downscaling Modelling Programme*", structured in two Regional Workshops on "*Downscaling Climate Modeling*" (Lecce, Italy), and "*Homework programme - Participant Case Studies of Using Downscaled Information for Impact Assessment*";

iii) "*Regional Workshop on Methods and Tools for Vulnerability Assessment*", (Milan, Italy), and the homework exercise on coastal vulnerability assessment by applying GIS-based DSS tools (i.e. DSS DESYCO), with a focus on selected coastal case studies (Palestine, Algeria);

iv) "*Algeria National Activity*", a focused training to provide technical support to the Direction Générale des Forêts (Ministère de l'Agriculture et du Développement Rural) and the Algerian Office National de la Météorologie on "*Downscaling and Climate Modelling with an Application to the Management of Algerian Forests*".

Keywords: climate change; adaptation; vulnerability; policy action; capacity building.

A participatory process to design climate change adaptation measures for the Carmen-Pajonal-Machona lagoon system in Mexico

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ABSTRACT

The participatory process described is part of a project for the design of climate change adaptation measures to be implemented in the Carmen-Pajonal-Machona coastal lagoon socio-ecosystem, situated in the Mexican state of Tabasco. Since these measures should be implemented and managed by the local communities impacted by climate change, they were designed based on the active engagement of the local communities, international, national and local institutions, academics, i.e. on knowledge provided by local stakeholders. The project was organized around a set of different activities, a multidisciplinary effort drafted to create synergies among researchers of the Consortium. Two workshops were designed and organized as part of this. The first workshop's (March 2015) aim was to elicit local knowledge on impacts and vulnerabilities, and ideas on what measures are needed to address them. Impacts and vulnerabilities identified in the first workshop and in the diagnostic were used to identify measures adequate to address climate and anthropogenic changes in the lagoon socio-ecosystem. The preliminary list of measures identified was refined through the second workshop (June 2015), in which participants provided qualitative information needed to identify the five most promising measures to address impacts using a multi-criteria decision support system: Mulino Decision Support System [1].

Keywords: climate change adaptation; community based adaptation; participatory process; Tabasco; Carmen-Pajonal-Machona Lagoon System.

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Impact of climate change on grapevine: bioclimatic-land suitability maps as forecast tools

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ABSTRACT

Many climatic indices have been proposed to study the spatial suitability of grapevine and to delimit areas with similar environmental factors so as to differentiate the specific viticultural zones. The aim of this study is to analyze and combine three different bioclimatic indices [Dryness Index (DI), Heliothermal Index (HI) and Cool night Index (CI)] with two soil variables (slope and depth) in order to provide a new method to analyze land suitability for grapevine in Mediterranean areas. In addition, the impact of climate change has been considered in order to analyze projected shift in suitable areas for grapevine cultivation, considering the new Representative Concentration Pathways climate scenarios (RCP 4.5 and RCP 8.5 for future climate projections from 2006 to 2095) and climate data at high resolution (spatial resolution of 14 Km dynamically downscaled from the Global Circulation Model CMCC-MED for the Mediterranean basin).

The bioclimatic maps and subsequently the grapevine suitability maps, have shown an evident northward transition of the areas designated for grapevine cultivation. Among others, the late varieties might have an interesting role in the European zoning of the future.

The results obtained confirm the outcomes of other studies conducted in the same areas. However, this study has additionally underlined the differences of thermal requirements of grape varieties, considering high resolution climate data and the latest GHG emissions scenarios (RCP 4.5 and RCP 8.5). The results of this study increase knowledge in terms of methodology of viticultural zoning studies and give information on the most suitable grapevine varieties under climate change conditions, giving phenological indications for adaptation strategies.

Keywords: Grapevine; bioclimatic index; climate change impact; suitability; Mediterranean area.

Over come global drought and water crisis

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ABSTRACT

With the Population Growth and Global Warming or Climate Change there is an increased consumption of water resulted in constant growing demand for clean drinking water with decrease in land aquifers and ground wells water level leading to water crisis and drought. In India Eighty percent of Population depends on Agriculture Further Farmers depend heavily on Monsoon for cultivation of Land. The Impact of Climate Change or Global Warming resulted in change in season pattern,extended summers, delayed monsoon, Abnormal Monsoon during the season cycle which is either below average rainfall or above average rainfall leading to floods. With Temperature rise conservation of rainwater does not meet the the growing demand for clean drinking water One reason is water pollution due to contaminates from domestic waste, industrial waste and agricultural waste constantly dumped into rivers,seas and oceans disturbing the ecological balance polluting the surface water, underground water and fresh water aquifers. Water Pollution is further lead to soil degradation of farm lands, the livelihood of Farmers resulted in decreased food production lead to food grains demand and prices in the market place. Even though Rain water Conservation, Water Recycling,Water Treatment is way to solve soil and water pollution for productivity in farm lands and to meet growing demand for clean drinking water which effectively does not solve the problem. To meet growing demands of water and to solve the water crisis or Drought Our Innovative method is Desalination and Reverse Pumping of Sea water or Ocean water using Solar Energy for domestic, industrial and agricultural needs. Our Research is focused to obtain Low cost desalination and reverse pumping mechanism to overcome Global Drought and Water Crisis.

Enabling forest policies for the achievement of the Sustainable Development Goals

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ABSTRACT

Achievement of the 2030 Agenda and the Sustainable Development Goals (SDGs) will be impossible without sustainable management of natural resources, and the means to achieve this will be primarily through policies. Forest policies in particular received attention from governments and international stakeholders, following the Rio Earth Summit, for their role in driving sustainable management of forest resources. Countries can use the seven thematic elements of Sustainable Forest Management (SFM) as the basis for defining policy objectives, and the principles of governance developed by various UN bodies to guide the policy making process. We assess the consistency of national forest policies to SFM objectives and governance principles via a text analysis of policies that identifies the presence and heterogeneity of elements and principles. We show that SFM is widely applied in forest policies; about 40% of countries have policies that are fully consistent with the seven thematic elements, increasing to over 80% when 6 or more of the seven elements are present. In contrast, reference to governance principles is less evident in policy documents, and when present they appear in a non-standardised form. There is a weak link between the consistency of a policy with SFM elements and the actual change in forest cover. Although countries experienced a reduction in forest cover during the analysed time frame from 2000-2010, it is estimated that the presence of SFM elements led to lower rates of forest loss. Presence of governance principles, on the other hand, showed no association to changes in forest cover.

At the national level, continued efforts must be made to increase consistency of forest policies to SFM elements and formulate policies guided by governance principles. More importantly, coordination with other sectors for policy definition and implementation is necessary. Only a holistic vision will allow countries to increase the potency of their forest policies and contribute to the achievement of recent agreements such as Agenda 2030 including the SDGs and the Paris Accord.

Keywords: Sustainable Development Goals; Sustainable Forest Management; Policy coordination;Policy analysis; Forest cover.

Eutrophication in the context of climate change: a methodology to study the impacts of nutrients on aquatic ecosystems in the 21st century

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ABSTRACT

It has been recognized that the increase of atmospheric greenhouse gases (GHG) due to anthropogenic activities is causing changes in Earth's climate. In the last decade, the effects of climate change on the environmental distribution of nutrients and contaminants on the ecosystems attracted the attention of scientists [1, 2, 3]. In fact, through the modification of climate variables (e.g. temperature, precipitation) and environmental conditions (e.g. salinity, dissolved oxygen), climate change is affecting the exposure, uptake, toxicity and effects of nutrients and contaminants for the ecosystems.

Here we present the case study of the Zero river basin, one of the main contributors of freshwater and nutrients loadings to the Venice lagoon (Italy). In order to predict the effects of climate change on the nutrient loadings and their effects on the lagoon ecosystem, we applied a methodology integrating an ensemble of climate projections, the hydrological model SWAT [4] and the ecological model AQUATOX [5].

Climate scenarios for the study area, obtained from a set of climate models, show an increase of precipitations in the winter period and a decrease in the summer months, while temperature shows a significant increase over the whole year. SWAT demonstrates how such changes can affect the current water quality, with a general increase of nutrient loadings during the winter period, and a reduction during the summer months. Simulations with AQUATOX show changes in seasonal dynamics of primary producers (algae and macrophytes) and the related impacts on different trophic levels.

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Daily and seasonal fluxes in the city of Sassari (Sardinia)

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ABSTRACT

Cities present structural and morphological characteristics allowing to absorb and trap more solar and thermal radiation than natural ecosystems (soils or vegetation), thus reflecting an increase in the urban temperature. In addition, human activities such as the heating and the cooling of buildings, traffic, various industrial activities and human metabolism release energy in the form of heat, as well as greenhouse gases (GHG) (mainly carbon dioxide). All these processes have an impact on the urban climate by modifying the energy flux partitioning and the carbon budget.

One year of urban fluxes measurements was carried out in the city of Sassari, located in the north of Sardinia Island (Italy), to study the exchange of energy, water, and carbon over the city, evaluate their impact on human livability, and understand the main factors or activities affecting them.

The measured fluxes were sorted by wind direction to better investigate the role of the reduced vegetation area (< 20% in the measurement footprint) in decreasing anthropogenic fluxes, which could help the municipality to identify possible actions for mitigating human impact. Daily trend showed the traffic as one of the main sources of carbon emissions, with two distinguishable peaks clearly related to the rush hours during the working days (morning and evening peaks), but an additional peak was observed during lunch time, that makes this Mediterranean city different from other at higher latitudes. Also, seasonal trends and differences between working days, weekends and holidays are reported.

Keywords: urban carbon emissions; eddy covariance; energy fluxes; anthropogenic components; Mediterranean city.

Statistical framework for generating precipitation occurrence over complex terrain

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ABSTRACT

Orographic precipitation may be treated as the modification of hydrometeors resulting from a complex interaction among orographic moist flow dynamics, thermodynamics, cloud microphysical processes and the environment large-scale flow and moist stability. The produced rainfall patterns exhibit ample and abrupt changes and intermittences over relatively short scales in both space and time. This segmented nature requires an accordingly accurate assessment of rainfall spatial distribution, both allowing a deeper understanding of the phenomena and providing input data for subsequent studies. In the context of statistical downscaling of climate models we develop a framework for generating spatially correlated binary data for daily precipitation occurrence over mountainous terrain. The procedure is applied separately on each season, in which days are furthermore segmented in classes built on the basis of prevalent concurrent large-scale circulation features and weather types obtained from climate models. A method based on spatial generalized linear mixed model (GLMM) is used to simulate precipitation occurrence. Various set of explanatory variables are tested, combining simulations from climate models and features extracted from a digital elevation model. The spatial data are assumed independent conditional on an unobserved underlying Gaussian spatial process, reflecting the propagation of gravity waves triggered by the vertical flow passing through the moist layer and whose spatial covariance function is determined according to results from Boussinesq mountain wave theory. Preliminary results show that the model reproduces the known key mechanisms of orographic precipitation and the synthetic data show a good agreement with observations.

Keywords: downscaling; orographic precipitation; mountain waves; geostatistics.

Evaluation of climate change impact on crop water requirement at local and mediterranean scale

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ABSTRACT

The impact of climate change on Mediterranean water resources is expected to be exacerbated by the end of the 21st century due to the increasing temperature and the changes in frequency and intensity of precipitation events. The increasing population growth, the economic development, and the lifestyle changes will lead to a rise in water scarcity.

Irrigated agriculture is the sector with the largest share of water consumption in the Mediterranean, where it can account for up to 80% of total water withdrawal. Since agricultural production is essential to meet human needs, it is crucial to assess and optimally manage water use in agriculture in order to ensure a sustainable development.

In this work, a GIS spatial platform for the improved soil water balance model SIMETAW# (SIMETAW-GIS) was developed to provide local and regional simulations of the daily water consumption and irrigation demand of economically relevant crops in the Mediterranean. Data from the COSMO-CLM regional climate model downscaled at final spatial resolution of 14 km were used to estimate irrigation needs of specific crops for past climate (1976-2005) and future climate projections from 2006 to 2095, under two Representative Concentration Pathways (RCPs) scenarios 4.5 and 8.5.

Values of crop water consumptions measured by the Eddy Covariance technique and estimated through SIMETAW# were compared to evaluate the performance of the model at local scale for several European sites. In addition, model outputs at regional scale were mapped for the past and projected climate under both RCPs.

Results showed that future irrigation requirements will be affected by increasing crop evapotranspiration in most Mediterranean regions for both RCPs. The platform presented in this work could be a useful tool to improve the irrigation scheduling and consequently to optimize the water use efficiency in agriculture.

Keywords: RCPs; water scarcity; crop evapotranspiration; Mediterranean basin scale; spatial models.

ICCG observatories: research, policy and best practices on climate governance

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ABSTRACT

Moving towards the target of containing global temperatures "well below 2 °C" [1] entails important challenges in all sectors of our societies and requires the involvement of different actors, which must necessarily work together for building a more sustainable world. National and international climate policies are crucial elements to guide the change needed, and only a good climate governance can allow countries to reach the targets set by their Nationally Determined Contributions (NDCs). Nonetheless, a good governance must be supported by scientific research on the one side, and by citizens' approval, bottom-up ideas and practices on the other.

With the aim to help preparing society and policymakers address this urgent issue, the International Center for Climate Governance (ICCG) develops a wide range of activities focused on different aspects of climate policy and governance. ICCG's mission is to disseminate science-based and socio-economic research in the field of climate change mitigation and adaptation to policymakers and the general public. It seeks to achieve this at the local, national and international level through interdisciplinary activities as well as producing climate and energy policy analyses and defining optimal governance models to manage climate change.

The proposed poster, which is not based on a scientific paper, aims at presenting ICCG's activities to the SISC community in order to reinforce synergies between science and society. In particular, it focuses on the ICCG's observatories: three on-line tools to provide information and news on specific aspects of climate governance:

- Best Climate Practices [2], an interactive platform collecting and awarding the best practices to control climate change;
- Think Tank Map [3], a platform that provides a complete overview and a yearly public ranking of the best think tanks active in the field of climate change economics and policy;
- Climate Policy Observer [4], an all-in-one tool for keeping up with the latest developments in climate and energy policies.

Keywords: climate governance; climate policy; dissemination; interdisciplinarity; science-in-society.

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Fostering Climate Change Mitigation through local forest biomass for energy production in Sardinia

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ABSTRACT

With particular attention to Climate Change, policies focus on green technologies and low-Carbon economy [1]. Thus, many studies were developed in this field (e.g. [2]; [3], [4], [5]). Technological progress in green economy is crucial to accelerate the transition to a post fossil-Carbon society to mitigate the Global Warming and its effects on ecosystems and human life.

The present work focuses on using forest biomass to supply the local energy demand, by guaranteeing efficiency and sustainability of the conversion plant.

The two main aims were: 1. To assess the effects of physical and chemical characteristics of Sardinian forest biomass on impacts on Climate Change in the life cycle of a wood chip boiler; 2. To assess the kg of CO_2-eq avoided by using the above-mentioned boiler instead of an oil-fired one.

For the former, laboratory determinations were performed on two groups of Sardinian biomass: 58 samples of the Ogliastra District, and 12 of the Monte Olia forest (Olbia-Tempio District).The Life Cycle Assessment methodology was applied to the boiler, by considering 1 kWh of thermal energy as functional unit, and by evaluating the ReCipe2008 [6] midpoint category “Climate Change”. For the latter, a comparison was made between impacts on Climate Change of the Monte Olia wood chip boiler and of a fossil fuel-dependent one.

Results show that:

- Ogliastra biomass revealed less humidity, less ash content, higher values of LHV, C, H, N, S, O on a wet basis, than those of the Monte Olia biomass, and it is less impactful on Climate Change. Thus, the characteristics of biomass fuelling a plant are relevant for GHG emissions.
- the kg of CO_2-eq avoided using the wood-chip boiler instead of an oil-fired boiler account for 17.96 per functional unit.

Keywords: Climate Change Mitigation; Forest Biomass; Renewable Energy; Sustainable Development.

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Water-Food-Energy nexus and climate change for multipurpose reservoirs in the island of Sardinia

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ABSTRACT

Land, food, energy, water and climate are interconnected into a Nexus, dominated by complexity and feedback. The integrated management of the Nexus is critical to secure efficient and sustainable use of resources, especially under climate change. Climate change is affecting water resources in the Mediterranean by worsening drought, and thus water scarcity and social vulnerability. Barriers to resource efficient systems are policy inconsistencies and incoherence, knowledge gaps, and lack of methodologies and tools to integrate multiple sectors. The SIM4NEXUS project (HORIZON2020, Grant Number 689150) develops innovative methodologies to address these barriers, by building on scientifically established models, developing complexity science to simulate and integrate different thematic components of the Nexus.

The SIM4NEXUS perspective is applied to the Sardinian region to assess relevant policy initiatives and improvements to better integrate the Nexus. Specific priorities are sustainable water management, renewable/low-carbon energy use and climate change mitigation; sustainable tourism development; water efficient planning in irrigated agriculture; conservation of ecosystem services and biodiversity through guaranteeing environmental flows. To integrate impact of climate change, resilience and vulnerability of Sardinian reservoirs will be assessed under several climate projections (sensitivity analysis) by articulated water reservoir balances accounting for the demands and potential conflicts among key economic sectors (agriculture, hydro-power, tourism). Irrigation requirements of relevant crops are estimated using SIMETAW-GIS platform, while changes in irrigated areas are defined from the CAPRI model.

An integrated management of reservoir systems and optimal allocation among different water using sectors will support sustainable strategies focusing on the water-food-energy nexus. A challenge for the implementation of nexus compliant practices is to improve policy and development plans that efficiently limit conflicts between water use, while increasing hydropower production for the transition to a low-carbon and climate resilient economy.

Sustainable agriculture in Sardinia: first results of conservation tillage in vineyards

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ABSTRACT

Conservation tillage is a soil management technique, poorly widespread in Sardinia, allowing cover cropping between vineyard rows. It usually involves direct benefits to farmers such as increasing soil fertility as well as reduction of tillage costs, soil erosion and carbon dioxide (CO_2) emissions in the atmosphere.

A long term experimental trial has been conducted with the aim to assess the conservation tillage impact on chemical-physical soil characteristics in comparison with traditional tillage by evaluating the change of organic matter and nitrogen level as well as its impact on soil compaction, soil erosion and soil biological quality.

To evaluate medium term impacts on soil characteristics a split/plot design with four replications was set up, with the comparison between conservation and traditional tillage apart as main plots. The field trial are located in a 35% slope condition vineyard, showing mainly massive erosion problem and organic matter low content. At the beginning of the trial (2011) a pedological survey was made. Three soil profiles were described and sampled along the field slope and soil sampling in each plot were made both to characterize the soil and to find the zero point. The soil chemical and physical characteristics were monitored through a soil sampling made at the end of 2013 and 2015.

The preliminary results, considering the high slope (35%) of the vineyard chosen as research area, show up the intense reduction of the erosive phenomena in the experimental plots managed according to the conservative tillage techniques and the persistence of intense erosion with conventional tillage. The organic matter and nitrogen values monitored during the years show an appreciable increase in the first soil centimeters contributing to store CO_2 e NH_3 in the soil. The biological soil quality monitored with the QBS-ar index shows a greater environmental sustainability of the conservative tillage in the vineyard towards that conventional.

Keywords: soil chemistry; sustainable agriculture; vineyards; conservation tillage.

An ecosystemic approach for the problems of our times: How to deal with public policies, research and teaching programmes

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ABSTRACT

Contemporary problems stem from the prevailing power-driven ethos, anomic individualism, which diverts human concern into technological invention, scientific advancement, and unlimited material consumption and production. Beyond the creation of choices, development of capacities and motivations, quality of life depend on incentive structures of cultural, social, political and economical institutions, more critical than individual motives and morals.

Contemporary problems cannot be understood and solved within the present context of weakening social bonds and cultural, political and economical clashes; instead of trying to adapt to droughts, floods, air pollution, land degradation, deforestation and rising sea levels, that inevitably will lead to overall catastrophe, we should deal with the present development paradigms embedded into the cultural, social, political and economical institutions.

To develop insight to put forth normative forecasts to reach more sustainable states to solve some of the problematic trends, new paradigms of growth, power, wealth, work and freedom should be linked to new forms of being-in-the-world: individuals, groups, society, natural and man-made environments should be dealt with simultaneously, in view of the need of a conceptual space within which praiseworthy morals and essential capacities are developed.

The transition to an ecosystem model of culture encompasses heterogeneous attributes, behaviours and interactions of individuals and the dynamics of the systems in which they live (institutions, populations, political, economic, cultural and ecological background) in terms of an ecosystemic approach, intertwining, as donors and recipients, the four dimensions of being-in-the-world. (intimate, interactive, social and biophysical).

Instead of taking current trends for granted and project them into the future (exploratory forecast), the definition of the desired goals and the exploration of new paths to reach them (normative forecast) is posited in view of the planning and evaluation of public policies, research and teaching programmes, encompassing norms and policies for natural and built environments, cultural, aesthetic and ethical values.

Climate Change and heat waves: the impact on citizenry

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ABSTRACT

During the last years, the European Continent has been affected by severe heat - waves. These occurrencies have had health consequences. The resulting medical necessity requires appropriate research, e.g. suitable statistical population of data with harmonized instructions and adequate ICD classification.

Effects of Municipal Solid Waste Compost on Forage Barley Crop productivity and soil chemical characteristics

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ABSTRACT

Municipal solid waste (MSW) compost is a soil improver (amendment) mainly deriving from organic fraction of urban and agro-industry waste. The agronomic use of MSW compost is an important recycling tool and a possible solution to the increasing waste production [Hargreaves et al., 2007; Abarca Guerrero et al., 2012]. In the experimental farm of AGRIS (Bonassai, NW Sardinia), was tested the effect of MSW compost (COM, 24t ha^{-1}) on forage barley crop productivity and soil fertility compared to mineral fertilization: i) MIN100=100 kg ha^{-1} of N + 92 kg ha^{-1} of P_2O_5; ii) MIN 50= 50 kg ha^{-1} of N+ 46 kg ha^{-1} of P_2O_5 and to not fertilized treatments (MIN 0 and COM 0). MSW compost increased forage herbage mass, both in autumn (0.47 vs 0.23 t ha^{-1} DM in COM and COM 0, respectively, $P<0.01$) and winter (1.42 vs 0.96 t ha^{-1}DM, $P<0.05$). The highest level of mineral fertilization increased barley herbage mass in autumn and winter too, when reached value similar to that achieved with compost (1.54 vs 0.70 t ha^{-1} DM in MIN 100 and MIN 0, respectively, $P<0.05$). MSW compost gained soil content of K_2O (617 vs 466 ppm in COM and COM 0, respectively, $P<0.05$) and Ca (4663 vs 4341 ppm, $P<0.03$), whereas total N and organic carbon content showed an increasing trend in soil fertilized with organic fertilization ($P=0.08$). No change was detected in soil chemical characteristics treated with mineral fertilizer. These results point out a significant positive effect of MSW compost on barley crop productivity and soil fertility. MSW compost led to a higher macronutrients (K and Ca) availability and to an increasing trend of soil organic carbon (SOC) content, that overall improved soil-plant system conditions. The results suggest a possible complementary use of MSW compost and mineral traditional fertilizers in extensive crop systems.

Keywords: MSW compost; mineral fertilizer; barley; soil.

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Changes in atmospheric chemistry and pollutants deposition in the Asinara island: a tool for investigating global change

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ABSTRACT

The atmosphere is a fluid shell whose dynamic reflects the biogeochemical processes of the biosphere and especially perturbations induced by human activities. Its mixing is so efficient to connect ecosystems at global scale, leading an important role in global change. In fact, local emissions may be carried in the distant regions of the planet, transmitting the impacts of activities and actions at the global or regional scale and vice versa.

Hence the interest to know the potential negative impact on climate of some pollutants in natural ecosystems and the transport of the same, especially in areas of significant natural value at the edge of highly industrialized zones such as Asinara, a small island of approximately 50 km^2 in the northwestern coast of Sardinia (Italy). This island is located a few kilometers from a factory which manufactures organic chemical products with direct discharge of emissions to air.

Asinara has a multitude of biotic and abiotic environments in a small area and it has been recognized at Community level as a special protection zone for the conservation of biodiversity that makes the impacts of human activity more visible and more easily observable.

By its nature, an Environmental Observatory has been settled on the island and equipped with a continuous monitoring system of air quality that measures the concentration of the main recognized atmospheric contaminants, such as particulate matter (PM_{10}), sulfur dioxide (SO_2), ozone (O_3) and nitrogen oxides (NO_x). At the same time meteorological and carbon flux data are also recorded.

In this work the results of the study carried out for the period 2006-2015 are presented with the ambitious project that aims to differentiate between natural factors and other situations due to the action of global change that induce changes in atmospheric chemistry and pollutants deposition.

Keywords: air quality; atmospheric contaminants; Environmental Observatory; GHG emissions; human impacts.

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Building an internet based science–policy interface for climate change adaptation in Sardinia

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ABSTRACT

How to ensure that citizens feel involved in the fight against climate change? This is the recurring question that scientists and policymakers ask themselves. Climate change remains for many a vague and abstract notion, whose consequences are difficult to visualize. Melting ice? Rising sea levels? Higher frequency of extreme weather events? These effects are the order of the theory for many of us as we are not directly concerned. This distance, both in space and time, that separates us from climate change also partly explains our inaction: we do not think (or do not want to admit it) that our personal existence can have a real impact on something so global. People must be informed about the impact of climate change on their communities and how this change can bring a profit [Happer and Philo, 2013]. A science–policy interface in climate change is needed to facilitate political and professional relationship, promote formal and informal dialogues [Iyalomhe et al., 2014], and is particularly needed to implement effective and long term adaptation programs.

Bridging the gap between science and policy is one of the major issues today world has to face in adapting to climate change efforts. In order to develop a science-policy interface in Sardinia the web portal www.sardegnaresiliente.it was created and implemented. The main objectives of sardegnaresiliente.it can be summarized as follow:

- understanding the Sardinian political context to optimize research information and communication
- providing high quality evidence and key findings through credible and easy to understand messages
- fostering engagement between researchers and policy-makers to fill existing gaps and to make informed decision

The results achieved, in the first three months of implementation, are about 500 subscribers with 1,300 concrete interactions and more than 33,000 people reached.

Keywords: Climate Change; Science-Policy Interface; Resilience, Adaptation.

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Assessment of agricultural biomass for realizing climate and modern energy goals in sub-Saharan Africa

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ABSTRACT

Within the context of Intended Nationally Determined Contributions (INDCs), developing countries can contextualize their national development to satisfy both the climate agenda and the Sustainable Development Goals (SDGs) [1]. This paper explores the role that biomass is expected to play in sub-Saharan countries as per defined in actions to address climate change and SDGs. Historically, the sub-Saharan African (SSA) countries have been largely dependent on traditional biomass for energy services. However, with increasing focus on agricultural development and climate mitigation, agricultural residues could play an increasing role in modern energy provision. What is the role given to agricultural biomass in the INDCs of SSA countries? The agricultural biomass residue potential of four major crops, by production volume, of each of the 16 countries is assessed using BEFS RA, a modeling tool given by Food and Agricultural Organization [2]. The residue to product ratio is taken from literature [3–5]. The analysis in this study indicates that most SSA countries do not explore the use of biomass for electricity, even though substantial agricultural biomass is available and is likely to increase with the expansion of agriculture. In 2014, the energetic potential of the agricultural biomass residue available in 16 SSA countries was 64.8 Mtoe. Despite this, there is no systematic plan to include biomass in electricity generation and no institutional structure to develop those initiatives and integrate them with other energy policy strategies in most of the countries. This finding makes us reflect on how effective the INDCs are for SSA when it comes to utilizing climate appropriate resources and technologies, such as biomass. The scientific community and policy-makers will have to take a serious look at how to use the timely, relevant and bottom-up opportunity accorded by the INDCs and the climate initiative more effectively to explore the multiple benefits of bioenergy for climate mitigation and poverty alleviation.

Keywords: INDCs; agricultural residues; biomass; electricity access.

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Towards optimal 2°C and 1.5°C emission pathways for individual countries: an Italian case study

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ABSTRACT

IAMs (Integrated Assessment Models) play a key role in assessing long-term mitigation pathways under the IPCC Working Group III. However, a key limitation of IAMs is their limited regional resolution, which usually focuses on 10-20 main regional aggregates.

The goal of this paper is to downscale the results of IAMs at the country level by using a simplified model: SIAMESE (Simplified Integrated Assessment Model with Energy System Emulator). SIAMESE compares well with IAMs on the regional level and its simplicity allows for a reasonable downscaling to individual countries within a specific region. Because Siamese is essentially a reduced-complexity IAM its application to downscale regional results is more sophisticated than simple downscaling according to socio-economic indicators, such as GDP, and preserves more of the key indicators of national energy-system structure. Like other IAMs, SIAMESE employs a welfare-maximisation approach to determine optimal emission pathways.

With SIAMESE we analyse the implications of the Paris Agreement for Italy, with the goal of providing useful insights for policy makers to consider cost-effective mitigation options. Results show that both 2°C and 1.5°C scenarios require a fast decline in CO2 emissions from the energy sector and we estimate the time when individual primary energy carriers would need to be phased out. This paper argues that the current level of ambition of Italy's emission reduction target would need to be enhanced, if it were to be aligned with least-cost mitigation strategies consistent with the long-term goal of the Paris Agreement.

Keywords: Mitigation; Paris Agreement; Pathways; Integrated Assessment Models; Italy.

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Differences in carbon flux patterns between an urban and a natural Mediterranean ecosystem

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ABSTRACT

Terrestrial ecosystems play a fundamental role in the context of the global carbon budget acting as net sinks of CO_2 through their photosynthesis processes. Urban environments are CO_2 source hot spots resulting from the sum of biogenic and human contributions, with fossil fuel combustion being the main responsible of anthropogenic emissions. Moreover, cities center typically records higher temperatures than rural surroundings (urban heat island effect) due to a presence of buildings and complex surfaces with respect to trees and lawns. In this work, eddy covariance measurements of carbon dioxide exchange from two different nearby sites (a natural Mediterranean maquis ecosystem and an urban site in central Sassari, Italy) have been analysed and compared over the same multi-seasonal period aiming to characterize the daily and seasonal trend of carbon fluxes. Due to their proximity, the two sites are expected to experience similar weather conditions but differences in air temperature, humidity, and precipitation have been further investigated. CO_2 exchanges are significantly different between the two sites: in the natural site, carbon fluxes show a seasonal and diurnal pattern linked to the physiological activity of the vegetation and soil microrganism (with peaks of fluxes occurring in spring and autumn) whereas during the summer months carbon uptake decrease due to water stress conditions. At the urban site, carbon fluxes are characterized by a different trend, especially at daily scale, where peaks emissions are clearly related to traffic. Similarities are observed during the summer weekends, due to urban vegetation uptake and a decrease in vehicular traffic (holiday period). Other emissions sources in the urban site have been analyzed, such as domestic heating during winter months, as well as the mitigation potential of increased vegetated areas.

Keywords: carbon balance; anthropogenic sources; Eddy Covariance; net ecosystem exchange; urban emissions.

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Sensitivity of modelling results to technological and regional details: The case of Italy's carbon mitigation policy

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ABSTRACT

It is the aim of this work to carry out a systematic assessment on the sensitivity of Computable General Equilibrium (CGE) models to technological and geographical scales used to evaluate the mitigation costs of a climate policy. Taking Italy as a case for study, we investigate the economic impacts of the country's carbon mitigation policies. We start with a basic version of a global CGE model and database [1] [2], with Italy as one single economic unit and one technology in the electricity sector. We then disaggregate the electricity sector into a bundle of various generation technologies, and split Italy into 20 sub-national regions to create more sophisticated versions of the model. The comparison across different model specifications enables us to detect the causal link that drives the differences of results.

Overall, we find that it is important to have regional and technological details when using CGE models to investigate the policy impacts of a carbon price or emission target. Having a coarse model that does not account for the regional and technological differences will lead to higher estimate of abatement cost and carbon price (up to about 70%). The Italian pattern of mitigation costs is monotonously decreasing following the increased resolution in the model specification. The spatial dimension appears to be dominant but the interaction between the spatial and technological component is also substantial.

Overlooking sub-national differences means that sub-national regions cannot specialize and trade between them after the introduction of the carbon tax. The average national technology and the lack of this intra-national trade result in reduced market opportunities, bigger welfare losses and higher market distortion (higher carbon price). We think special attention should be paid on the biggest countries such as USA, China, Russia, India, Brazil where much heterogeneity can be observed within the borders.

Keywords: Computable General Equilibrium; Carbon Mitigation Policy; Sensitivity, Technology; Sub-national regions.

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Constrained climate models in the Integrated Assessment Emission pathways matter for the economy

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ABSTRACT

This work explores the consequences of constrained climate models in the integrated assessment of climate change. Instead of limiting global mean warming to 2°C as stated by the UNFCCC, many integrated assessment models (IAMs) [1,2] use seemingly equivalent climate targets expressed in atmospheric greenhouse gas (GHG) concentration (e.g. the 450ppmv target [1]) or cumulative emission budget (e.g. total anthropogenic emissions < 1000GtC [3]). The emission pathway might be unimportant [3] for global mean warming but is it also for the global economy?

We apply a cost-effectiveness analysis using the Model of Investment and Technological Development (MIND) [4] at the stage of [5] to quantify shortcomings of simplified formulations of climate targets in the integrated assessment. Using an equilibrium climate sensitivity of 2.8K, we compare the scenarios in terms of maximum global mean warming and welfare losses. As a cost metric, we deploy relative differences of balanced growth equivalent $\Delta\gamma$ [6] against a business as usual scenario (BAU) without any climate policy. $\Delta\gamma$ expresses a constant change in relative consumption between two scenarios. Exemplarily, the loss of keeping warming below 2°C then amounts to $\Delta\gamma = 0.77\%$.

We find that the commonly used 450ppmv concentration target and the 1000GtC cumulative emission target lead to higher warming (2.32°C and 2.27°C) and lower economic losses (0.62% and 0.52%) than the 2°C target.

In order to meet and not to overshoot the 2°C target in our model, GHG concentrations are bound to stay below 413ppmv and cumulative emissions below 815GtC. These scenarios are then equivalent in maximum warming but lead to higher welfare losses (1.15% and 0.92%) than the 2°C target.

The differences in welfare result from different emission pathways and show that replacing a temperature target by an emission or concentration target can lead to different economic outcomes under the same warming.

Keywords: climate models; integrated assessment; climate targets; cumulative emissions; atm. GHG concentration.

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Climate change scenarios over areas of PRIMES-Life+ project

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ABSTRACT

PRIMES -Preventing flooding risk by making resilient communities- is a *Life + project* focused on the issue of adaptation to climate change, and aims to build resilient communities through their participation in the operations of early warning and flood risk prevention. The project is coordinated by *"Agenzia Regionale di Protezione Civile Emilia-Romagna",* with the associated beneficiaries: *Arpae Emilia-Romagna, Regione Emilia Romagna, Regione Abruzzo, Regione Marche, Univ. Politecnica delle Marche*. The selected pilot areas are: Emilia-Romagna, Marche and Abruzzo. Knowledge of territorial vulnerability is linked to the study of present and future climate changes. To this aim, a set of climatic indices focused on extreme precipitation and temperature has been selected and changes during 1961-2015 (present) and 2021-2050 (future) are evaluated. One important index selected in the project is the frequency of Areal Intense Precipitation. The index is computed over the warning areas (macro-areas) of each regions, and is defined as the number of days in which the areal average precipitation exceeds 50 mm in 24 hours.

The daily E-OBS data set (http://www.ecad.eu/E-OBS/) has been used for temperature analysis, while, for precipitation a gridded data set at 5km resolution over 1961-2015 has been produced and analysed. The future scenarios have been obtained through statistical downscaling technique based on canonical Correlation Analysis (CCAReg scheme) applied to CMCC-CM global climate simulations. The local scenarios are constructed in the framework of RCP4.5 and RCP8.5-Representative Concentration Pathways, and are referred to 2021-2050 with respect to 1971-2000. The results reveals positive and significant trends in minimum and maximum temperature during all seasons, more intense in maximum temperature, over 1961-2015. Negative trends in summer precipitation and a non homogeneous signal of trends in intense precipitation have been detected over observed period. As regards the areal intense precipitation index, the analysis reveals that great part of cases are concentrated during autumn. Future scenarios project an increase in seasonal temperature over all case studies, between 1-2.5°C. A decrease in spring and summer precipitation is expected to occur over the case studies, while an increase is projected in autumn ,during 2021-2050 with respect to 1971-2000.

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A gis-based Bayesian belief network for the assessment of cumulative environmental and climate change impacts in the Adriatic sea

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ABSTRACT

Efforts to achieve the Good Environmental Status in the European marine regions [1] require appropriate planning options and decisions which cannot be designed without the comprehensive knowledge of the impacts induced by different natural and anthropogenic drivers [2]. Improving our capacity to model the cumulative effects induced by multiple and interactive stressors, in decisional contexts where data are limited and uncertain, is therefore essential to address the future planning and management of our seas [3].

The combination of Geographical Information Systems (GIS) and Bayesian Belief Network (BN) methods is finding increasing application in marine spatial planning since they allow together to spatially represent and evaluate multiple model-based management scenarios [4].

A BN–GIS framework was developed and applied in the Adriatic sea in order to assess the relationships between interactive climate and anthropogenic pressures (e.g. temperature variation, shipping traffic, aquaculture, ports activities, nutrients input), the environmental vulnerability of marine targets (e.g. seagrasses, maërl and coral beds, marine protected areas) and the resulting cumulative impact. The main aim was to test the potential of a BN–GIS framework to support adaptive marine management by evaluating multiple what/if scenarios for different climate projections and management measures envisioned for the Adriatic sea.

A first testing of the designed approach in the case study, allowed to develop future impact scenarios for the timeframe 2035-2050, to be compared with the baseline scenario 2000-2015. The results, including the evaluation of cumulative risks related to acute and chronic chemical hazard, abrasion and sealing of the seabed, introduction of non-indigenous species and physical disturbance by underwater noise, represent a valuable decision support tool to set priorities and targets in adaptive planning and management of marine areas.

Keywords: cumulative impacts, Geographical Information Systems, Bayesian Belief Network, adaptive marine management, Adriatic sea.

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A Bayesian networks approach for the multi-risk assessment of climate change impacts on water resources

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ABSTRACT

The assessment and management of climate change impacts represent a multi-risk and complex systems' problem, due to the multiple relationships between social and environmental systems and the potential cascades of natural and anthropic impacts involved [1]-[2]. Bayesian networks (BNs) have been increasingly applied to support risk assessment and management problems in changing environmental conditions. In fact, they allow to overcome some of the main limitations of traditional risk assessment approaches (e.g. single hazard assessment focus, representation and communication of uncertainty), enabling to model multiple interacting stressors and their effect on a set of assessment endpoints [3]-[4]. A comprehensive multi-risk model, implementing Bayesian Networks analysis, is proposed to combine existing qualitative and quantitative data (i.e. experts knowledge, modeling simulations, climate change projections, historical records) allowing a stochastic analysis of potential cascading impacts induced by climatic (i.e. drought, sea-level rise) and non-climatic stressors (i.e. water abstraction, land use changes, pollution) on water resources in vulnerable transitional systems. The result is a decision support tool simulating the potential alterations of ecosystem services provided by transitional systems (i.e. water availability, recreation, fisheries productivity, biodiversity) as a consequence of different climate and land use scenarios, adaptation and management options.

The approach was applied to the Dese-Zero river estuary (Venice Lagoon Watershed, Italy) to evaluate the conjoined effects of climate change on water quantity and quality and the related consequences on different water uses (irrigation, aquaculture, mussel farming) and on the overall environmental status of water resources, according to the requirements of the Water Framework Directive.

Keywords: climate change impacts; water quality; land use; Bayesian Networks.

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Bioaerosol identification and air quality analysis in hyderabad city

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ABSTRACT

Access to good quality air for healthy Living is a fundamental right of citizens of every country. India with a population of 1.27 billion people (2013) must ensure good quality air for healthy living of citizens. In a recently published editorial article of THE NEWYORK TIMES (02/13/2014). Outdoor air pollution is the 5th leading cause of death in India. Environmental Pollution[1] Control Authority of India believes that the air pollution has reached such severe levels that it is cause of 3000 child deaths a year in Delhi alone.

A bioaerosol[2] by definition is a suspension of airborne particles that contains living organisms or was released from living organisms. These particles are very small less than1 micrometre to 100 micrometre.

The bioaerosol may consist of bacteria, fungi, algae, viruses, microbialtoxins[3], insects, pollen, insect wings & scales etc. Hyderabad, the capital of newly formed Telangana State is all set to cross 10 million (1 crore) population.With the continuous increase in the population and migration[4] of people from rural from urban settlement's, puts tremendous pressure on the quality of living of the people living in urban environment (cities).pressure will be in terms of space, availability of water both for drinking and other uses, housing ,employment and various other related necessities. So far central and state pollution control boards have come up with technologies required for measuring the pollution levels in the cities. Therefore, present topic is selected to estimate the bio aerosol concentration at various major junctions in the greater Hyderabad area.

The results of experiments would be of immense value in making Hyderabad a clean and green city for healthy living. Various air sampling[5] methods employed in the proposed investigations.

Keywords: Pollution[1] bioaerosol[2] microbialtoxins[3] migration[4] sampling[5]

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Public and private law issues related to climate change

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ABSTRACT

The main theme of this poster is the examination of the current International and EU legal framework to avoid global warming and climate change which have resulted in *momentum* for green and white economy. An increased use of energy from renewable sources, measures taken to reduce energy consumption in the Union allow the Union to comply with the Kyoto Protocol to the UNFCCC. The European Union's 2020 Climate and Energy Package set three crucial objectives for 2020: a 20% reduction in EU greenhouse gas emissions from 1990 levels, raising the share of EU energy consumption produced from renewable resources to 20%, and improve of 20% the EU's energy efficiency.

The aim of the Paris 2015 United Nations Climate Change Conference COP21 was to achieve a binding and universal agreement on climate from all the countries of the world. International Treaties cannot be under force without ratification consequently soft law, lobbies and political pressure have paramount importance in order to implement them.

The second part of this poster illustrates one of the challenges that we face in order to tackle with climate change.

The disclosure of information of both private and public sectors, for instance, plays a rather crucial role in monitoring the compliance with legal instruments. For instance, in Japan, those, who deal with CO2 emissions, are obliged to disclose the information containing the amount of CO2 emissions, and reported to the regulatory authority. There are a number of challenges surrounding the disclosure of this type of information, and this poster forces on one of those. That is to say, the information in question might be confidential, and be categorised as trade secrets, and therefore law has a limitation in imposing cannot impose the disclosure requirement. The poster attempts to provide a possible solution to this acute problem.

Keywords: International Law; EU Law; Disclosure; Climate Change; Paris Agreement.

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The role of indigenous communities in the CDM decision-making process: Conditions to improve participation

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ABSTRACT

The creation of carbon credits mechanisms to limit the effect of global warming has opened a technical, economic and political discussion regarding the effects of the commodification of natural resources. Through the CDM, proposed by the Kyoto Protocol, developing countries receive investments to promote clean energy, which also aims to achieve sustainable development goals. However, there is not a clear criterion to include involved stakeholders in the decision-making process, allowing that authorities in each country can maintains a broad margin of arbitrariness. The lack of requirements for national procedures causes inequality in the conditions for the approval and implementation of projects. This situation is compounded in hydroelectric projects, which are causing impacts in the quality of life besides the infringement of human and indigenous rights.

This research explores the conditions that drive stakeholder's participation in the management of CDM projects in Latin America. Similar hydro projects are analyzed in Ecuador, Guatemala, Panamá and Perú, where the presence of indigenous population is significant. In order to study the cases, the national and international institutional frameworks regarding participation are considered, as well as the effectiveness of the accountability mechanisms. This research highlights that the variance on the level of satisfactory participation in the CDM management is conditioned by the national mechanisms to ensure accountability and enforce compliance.

Keywords: Clean Development Mechanism; sustainability; Mitigation; participation; human rights.

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Health and Climate, a strict relationship in an ecosystemic vision: proposals of a framework

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ABSTRACT

Concern for human health is one of the compelling reasons to study the effects of global climate change.

Health focus will reflect the combined impacts of climate change on the physical environment, economic environment and society ecosystems.

Climate change in facts, affects social and environmental determinants of health.

This assumption offer an ecosystemic vision of the problem of human health through which the relationship with climate change can be better understood.

According to the WHO impacts on health systems may be attributable to 4 large phenomena: heat waves, that contribute directly to deaths from cardiovascular and respiratory diseases; pollution comes from greenhouse gases. deaths from air pollution reach 12.6 million annually, natural disasters and variable rainfall, each year, these disasters result in over 60 000 deaths, mainly in developing countries and when these phenomena affecting facilities and other essential services generate serious damage to the health system that is not capable of providing health; alteration on vector diseases dynamics, climate change greatly affect the water-borne pathogens and the geographic distribution of vectors diseases like malaria and dengue.

The severity of the health risks will depend on the ability of public health and safety systems to address or prepare for these changing threats, as well as factors such as an individual's behavior, age, gender, and economic status.

However, the majority of adverse health impacts of climate change can be avoided by implementing suitable adaptation policies that will comprise also health risks.

The main challenges in developing adaptation strategies for human health are to account for the diversity of health impairments, regional conditions and adaptation actors, and for the large uncertainty about future changes in most climate-sensitive health risks.

The work will propose a framework to understand the relationships between climate change and health, useful to find adaptation strategies.

Keywords: climate change; health; ecosystem; framework.

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