Climate services for the assessment of climate change impacts and risks in coastal areas at the regional scale: the North Adriatic case study (Italy).

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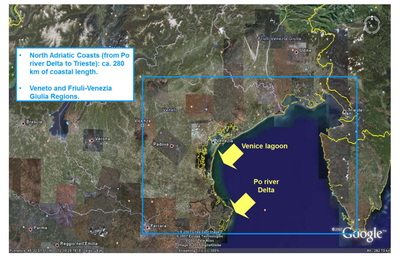
ABSTRACT

At the international level, the interest for climate services is rising due to the social and economic benefits that different stakeholders can achieve to manage climate risks and take advantage of the opportunities associated with climate change impacts. However, there is a significant gap of tools aimed at providing information about risks and impacts induced by climate change and allowing non-expert stakeholders to use both climate-model and climate-impact data. Within the CLIM-RUN project (FP7), the case study of the North Adriatic Sea is aimed at analysing the need of climate information and the effectiveness of climate services for the integrated assessment of climate change impacts in coastal zones of the North Adriatic Sea at the regional to local scale. A participative approach was developed and applied to identify relevant stakeholders which have a mandate for coastal zone management and to interact with them in order to elicit their climate information needs. The final results include climate products developed by climate experts through the analysis of climate observations and scenarios (e.g. standard indices of extreme precipitations and droughts, consecutive days of heavy rain, mean sea level pressure) and risk-based maps supplied by environmental risk experts to facilitate the definition of adaptation strategies (e.g. sea-level rise/storm surge risk maps with the surface of receptor lost; drought risk maps with the percentage of suffering agricultural areas).

INTEGRATED CASE STUDY FOR THE NORTH ADRIATIC COAST

Climate change and sea level rise is a prominent issue for the case study area both considering the vulnerability of fragile ecosystems such as coastal lagoons, and the concentration of cultural and socio-economic values. Accordingly, within the FP7 CLIM-RUN project, a participative approach was developed with the aim to:

- Understand stakeholder information needs concerning climate change for the implementation of the ICZM Protocol;
- Involve stakeholders in the application of risk-based approaches for the assessment of climate change impacts for each sector of interest (e.g. agriculture, coastal and marine environment and hydroclimatic regime);
- Produce climate services tailored to the end-user needs.



The case study area: the Northern Adriatic Sea and the coast of the Veneto and Friuli Venezia Giulia regions (Italy). (Adapted from maps.google.it).

PARTICIPATIVE PROCESS

1. Stakeholder identification;
2. Stakeholder analysis and selection;
3. Stakeholder involvement;
4. First workshop: collection of information needed;
5. Questionnaire to stakeholders;
6. Interaction with stakeholders;
7. Second workshop: delivering of climate services;
8. Feedback from stakeholders.

STAKEHOLDERS INVOLVED IN THE PARTICIPATIVE PROCESS

- Supranational authorities;
- Civil protection;
- Regions (Veneto and Friuli Venezia Giulia);
- Independent authorities (e.g. Port authority of Venice);
- Provinces;
- Municipalities;
- Parks.

FIRST WORKSHOP

Three thematic working groups were identified: group 1 related to extreme climate/weather events; group 2 related to shoreline and marine issues; group 3 focused on droughts and irrigation.

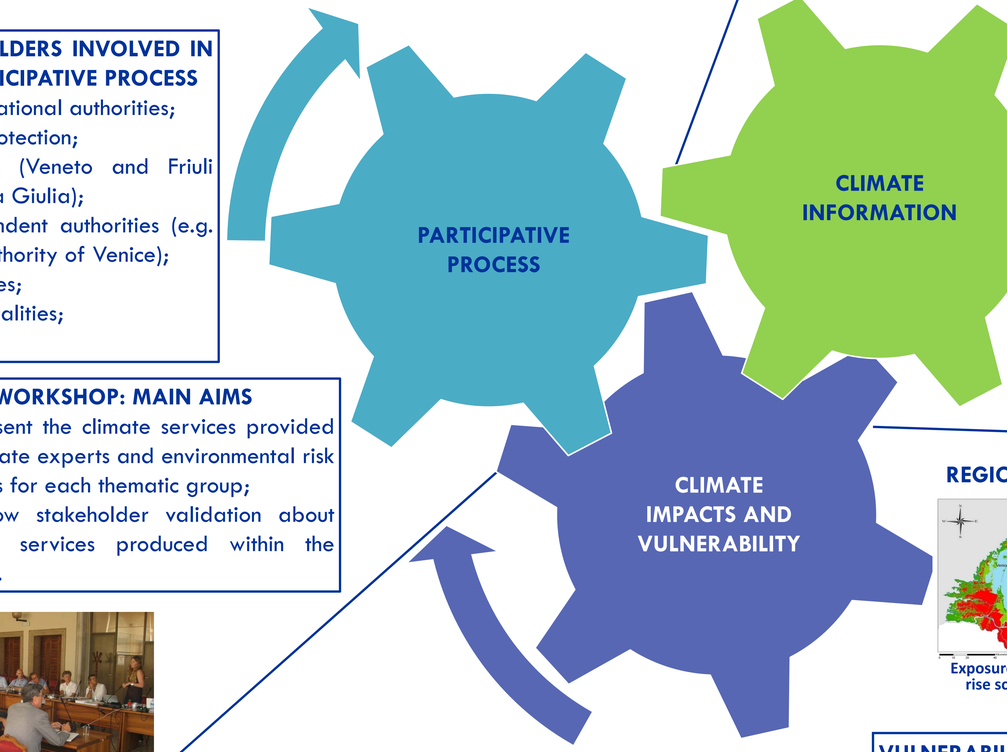
MAIN ISSUES

1. Extreme events forecasts;
2. Climatic projections (e.g. precipitations, temperature);
3. Climatic information for urban planning;
4. Risk assessment of coastal impacts (e.g. sea level rise, erosion);
5. Effects of drought in agriculture;
6. Consequences of the extreme events in water systems.

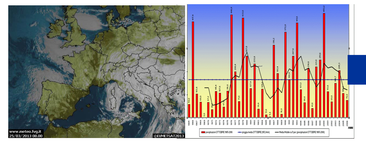
SECOND WORKSHOP: MAIN AIMS

1. To present the climate services provided by climate experts and environmental risk experts for each thematic group;
2. To allow stakeholder validation about climate services produced within the project.

First workshop presentation.

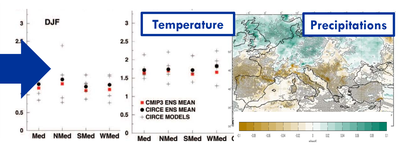


CLIMATE OBSERVATIONS



Climate observations are sourced from the meteorological and observational networks of Veneto and Friuli Venezia Giulia regions. They provide the basis for statistical downscaling and climate forecasts.

CLIMATE PROJECTIONS



Climate projections are provided by climate models which allow the analysis of long-term climate change scenarios (Gualdi et al., 2012; ENSEMBLES regional climate models).

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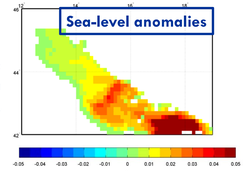
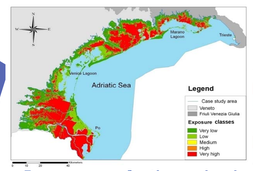
A.Carillo, G. Sannino, V. Artale, P. M. Ruti, S. Calmanti, A. Dell'Aquila, 2012. Steric sea level rise over the Mediterranean Sea: present climate and scenario simulations. Clim Dyn DOI 10.1007/s00382-012-1369-1
S. Gualdi, S. Somot, L. Li, V. Artale, M. Adani, A. Bellucci, A. Braun, S. Calmanti, A. Carillo, A. Dell'Aquila, M. Déqué, C. Dubois, A. Elizalde, A. Harzallah, D. Jacob, B. L'Hévéder, W. May, P. Oddo, P. Ruti, A. Sanna, G. Sannino, E. Scoccimarro, F. Sevault, and A. Navarra, 2012. THE CIRCE SIMULATIONS Regional Climate Change Projections with Realistic Representation of the Mediterranean Sea. AMERICAN METEOROLOGICAL SOCIETY

SEA-LEVEL RISE SCENARIOS

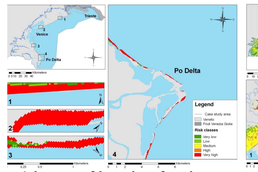
Sea-level rise scenarios obtained from the regional climate models for mid and long term time horizons (e.g. 2041-2050) (Carillo et al., 2012).



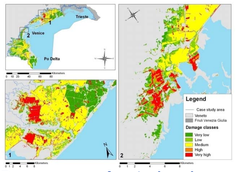
REGIONAL RISK MAPS AND STATISTICS FOR THE NORTH ADRIATIC COAST



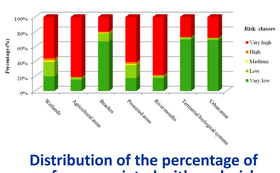
Exposure map for the sea level rise scenario for the North Adriatic coast.



Risk map of beaches for the sea level rise scenario for the North Adriatic coast.



Damage map of agricultural areas for the sea level rise scenario for the North Adriatic coast.



Distribution of the percentage of surface associated with each risk class for the receptors located in the North Adriatic coast .

Regional Risk Assessment objectives:

- To integrate climate information with site-specific vulnerability factors in order to visualize areas and targets at risk by climate change impacts;
- To provide a relative estimate of areas/targets where the potential social, economic and environmental losses would be greater than others.

RECEPTORS: Beaches; River mouths; Wetlands; Marine Biological systems; Protected areas; Aquaculture; Urban areas; Agricultural areas.

VULNERABILITY FACTORS

Pathway factors: Elevation, Distance from coastline.

Susceptibility factors: Vegetation cover, Slope, Geomorphology, Dunes, Wetland extension, Sediment budget, Mouth typology (estuary, delta), Bio-diversity index.

Value factors: Protection level, Urban typology (commercial buildings), Agricultural typology, Population density.

Attenuation factors: Artificial protections.

RRA is implemented in the Decision Support sYstem for COastal climate change impact assessment **(DESYCO)** in order to provide GIS-based maps that can be customized according to end-user needs:

Hazard metrics
Pathway factors
Attenuation factors
→ Exposure maps
Susceptibility factors → Susceptibility maps
→ Risk maps
Value factors → Value maps
→ Damage maps

DESYCO outputs

REFERENCES.
Torresan, S., Critto, A., Dalla Valle, M., Harvey, N. and Marcomini, A., A regional risk assessment framework for climate change impacts evaluation in a coastal zone management perspective. In Özhan, E. (Editor), *Proceedings of the Eighth International Conference on the Mediterranean Coastal Environment*, 13-17 November 2007, Alexandria, Egypt, MEDCOAST, Middle East Technical University, Ankara, Turkey, 2, 741-752, 2007.
Giannini V., Torresan S., Gallina V., Critto A., Giupponi C., Marcomini A., 2012. Deliverable 8.1 - Workshop report: context and objectives, comparison of data supply and demand, simulation results, feedback and discussion. Integrated case study: Veneto and Friuli Venezia Giulia, Northern Adriatic Sea, Italy. CLIM-RUN - Project No. 265192.
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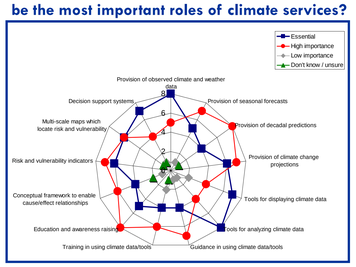
Questionnaire results. What do you consider to be the most important roles of climate services?



Questionnaire results. Variables required.