CLIMATE CHANGE

Resources and natural environment

CLIMATE RISK MANAGEMENT IN THE MEDITERRANEAN

Climate services: a decision support tool for adaptation

The Mediterranean region is already particularly vulnerable to climate variability and extreme events. This region is also expected to be one of the most prominent climate change "hot spot". In order to promote climate risk management and adaptation to climate variability and change, decision-makers need to rely on tailored and directly usable climate information and tools. Addressing the climate information needs of users is one of the aim of the several climate services initiatives that have recently been established. The development of climate services in the Mediterranean basin is of major importance for the promotion of sustainable development in this region.

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Adaptation to climate variability and change at the heart of sustainable development in the Mediterranean

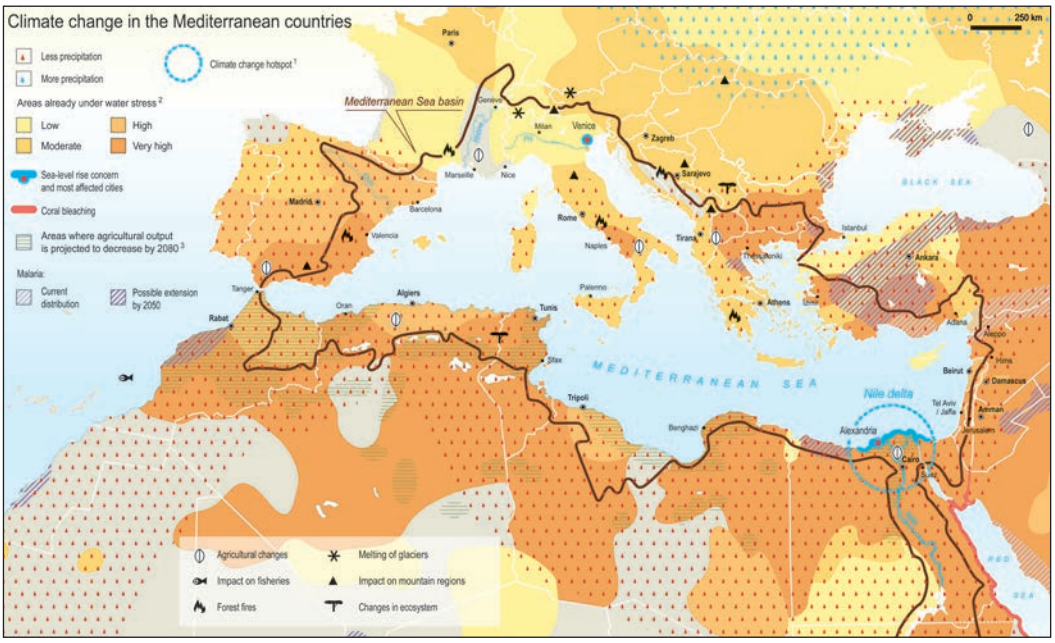
The Mediterranean area is highly vulnerable to climate variability and climate extremes events. For this region the effects of global warming on human activities and natural ecosystems is of major concern as it threatens to create new hazards and exacerbating existing ones such as droughts, floods, heat waves and wild fires. Already afflicted by increasing issues of water stress and faced with major problems of desertification, erosion and decline in land and marine biodiversity, the Mediterranean region is expected to be one of the most prominent and vulnerable climate change "hot spots" (Fig. 1).

Several generations of climate change projections have consistently indicated for the future much warmer and drier conditions in the Mediterranean. The region is expected to warm at a greater rate than the global average and undergo a possibly severe (up to 30-40%) decrease in precipitation, particularly in the southern rim of Mediterranean basin and in spring and summer seasons [IPCC, 2013]. Water stress and drought will thus increase throughout most of the region leading to more arid conditions and a decrease agricultural productivity. Mediterranean summers are expected to be much warmer and drier which translates into an increase of both the intensity and the duration of heat waves and which may increase the risk of extended wild fires. The higher temperatures could also increase the area of influence of vector-borne diseases such as malaria. Finally, sea-level-rise might have huge impacts on vulnerable regions such as the Nile Delta.

The climate risk management and an efficient adaptation to climate change issues lie at the heart of sustainable development in the Mediterranean and therefore in the revised Mediterranean Strategy for Sustainable Development. These risks have been taken into account in the Regional Framework for Adaptation to Climate Change elaborated by the Mediterranean

Plan of the United Nations Environment Program (UNEP/MAP) and a regional project on the integration of Climate Variability and Change (CVC) in national strategies of Integrated Coastal Zone Management (ICZM) has been initiated for supporting the implementation of its ICZM protocol.

Figure I: Climate change risks in the Mediterranean countries



I. At a global scale, the overall Mediterranean basin is considered a hotspot. - 2. Ratio between withdrawal and availability (2003) - 3. Africa only

Sources: IPCC , 2007; Water stress: Revenga &Döll, 2000 updated by Alcamo & al., 2003; World Resources Institute, 2007; Rogers & Randolph in: Science, 2000; Agricultural output: Fischer & al., 2005; Plan Bleu, 2009.

The need of reliable and directly usable climate information to support adaptation to CVC

Whilst decision-makers in key climate-dependent sectors are increasingly interested in managing their climate risk portfolio, there is a structural lack of information regarding what doing in practice. Delivering actionable information derived from improved climate observations, predictions and projections is essential for the promotion of a climate resilience/smart society, and for preventing socioeconomic damages which can derive from CVC. However, increasing societal resilience and adaptive capacity to CVC is not just about the improvement of the climate knowledge itself but it also requires the co-generation of relevant climate services and products that can be used directly to help decisions and policies.

Developing Climate Services to promote climate risk management in the Mediterranean area

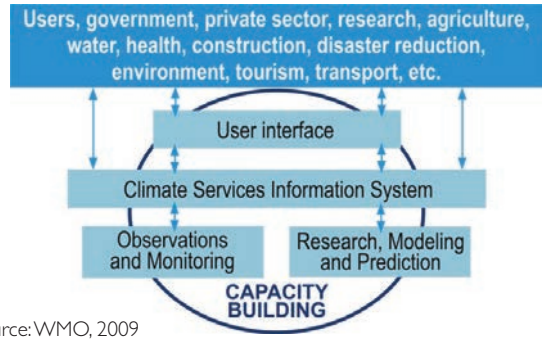
Defining the content and objectives of a Climate Service

There is a high and steadily growing demand for trustworthy, reliable and actionable climate information at a regional level. The Global Framework for Climate Services (GFCS), launched by the World Meteorological Organization (WMO) at the World Climate Conference-3 in 2009 (Fig. 2), has been set up to address some of these requests.

Climate Services is defined as the "timely production and delivery of useful climate data, information and knowledge to decision-makers" [NAS, 2001]. The services and products generated and delivered by a Climate Service can be viewed as a progressive and increasing integration of climate information, from "raw" climate data (observations, model outputs), elaborated data (e.g. index), elaborated products (e.g. diagrams, static and/or interactive maps, probabilistic products), to documentation and tools (illustrative adaptation measures, decision-support tools as business assessment tool or local climate impacts profile) [Lémond, 2010].

Thus, a climate service aims at making available a range of relevant resources directly to those who have to take decisions partially influenced by climate. It plays the role of an interface and coordination tool between needs (user area) and available information and resource (research area). In that sense, climate services are designed as a way for meeting users' needs and should be developed as an iterative process between researchers and users. This issue is reflected in the structure of the GFCS as one of its five pillars, the user interface platform, is essentially designed to bridge the gap between climate information providers and users (Fig. 2).

Figure 2: The Global Framework for Climate Services of the World Meteorological Organization



Source: WMO, 2009

The CLIM-RUN Research Project on Climate Services in the Mediterranean

The growing importance of climate change in the public debate and the growing interest surrounding the development of climate services have led the European Commission (EC) to support a number of projects designed to promote climate services

development and its underpinning research. CLIM-RUN (Climate Local Information in the Mediterranean region - Responding to User Needs) aimed at developing a protocol for the provision of climate services that are relevant and usable by different sectors and actors at the regional and local scales. Differently previous current approaches, CLIM-RUN developed a bottom-up protocol directly involving stakeholders throughout all the process of provision of climate services, with the aim of identifying well-defined needs at regional and local scales. Improved modeling and downscaling tools have then been used to optimally respond to sector-specific climate information needs (tourism, renewable energy, forest fires, and coastal zones).
Building upon the experience of CLIM-RUN, the EC funded a few other research projects focusing on shorter time scales such as EUPORIAS (EUropean Provision Of Regional Impact Assessment on a Seasonal and decadal timescale).

Prototypes of climate products for the Tunisian tourism sector

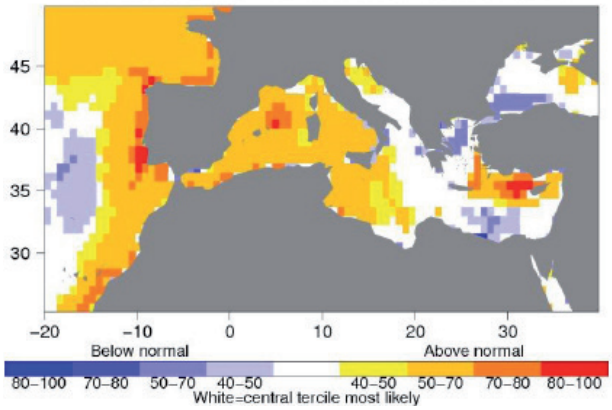
The Tunisian tourism in the context of climate change

The tourism sector is of primarily importance for the Tunisian economy by representing 7% of GDP, almost 20% of yearly foreign exchange earnings and 12% of job creation. Largely dominated by seaside tourism, the Tunisian tourism is primarily based on meteorological and natural determinants: the sun and the sea. This sector is vulnerable to climate change as it would be affected by air and sea temperature changes, but also by its indirect effects on sea-level-rise, water resources, ecosystems and beaches.
In the context of the CLIM-RUN project, the research team identified and interacted with various and representative stakeholders from the Tunisian tourism sector through interviews and workshops. This participatory process was intended to identify and develop well-defined climate products to support stakeholders in their efforts of adaptation to CVC. Two main products are described here: the provision of seasonal forecasts of sea-surface temperature and an analysis of the present and future climate-tourist environment.

Seasonal forecast of sea surface temperature and bathing conditions

The delivering of indicators of changes in sea-surface temperature (SST) under climate change but also of seasonal forecast of the bathing season has raised the interest of Tunisian tourism stakeholders, as the intra-annual variability of SST largely determines the length of the summer bathing season.
In this way, IC3 research centre has produced probabilistic future SST information as an operational tool that shows the distribution of the forecast for the 3 months of the next season over three categories: above normal, below normal and normal SST, and the probability of the event to happen. As shown in Fig. 3, the exercise was able to inform tourism actors that for the next summer season (June, July, August, here in 2011), above normal SST were predicted around Tunisian coast, with a probability of 50-70%. Operational predictions that provide probabilistic future SST information at the regional and at site-specific scale allowed to conclude that a longer bathing season comparatively to the normal ones. The delivery of such a climate products on a regular basis would be useful for tourism institutions, seaside tour operator and hotels as it would support them in their efforts to adapt to CVC by exploiting the opportunity of a longer bathing season, or managing the risk of a shorter one.

Figure 3: Summer 2011 forecasts for a sea surface temperature



Source: CLIM-RUN project, EC3

Analysis of the present and future climate-tourist environment

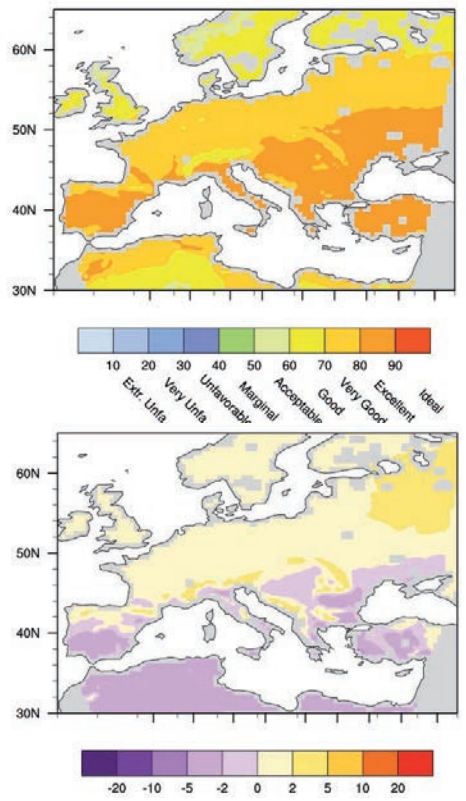
In order to support adaptation to CVC of Tunisian tourism actors, the provision of indicators on the relationships between climate parameters and tourist comfort and expectations in a longer term perspective could be useful. Climate Tourist Comfort Indexes (TCI) are commonly used to describe conditions suitable for tourism activities in a planning and investing perspective.

Regarding the current climate, the Tunisian specific TCI has been developed by Grevachot research centre, on the basis of a questionnaire survey among tourists. This index is the sum of five climatic indices on climate-tourist atmosphere (temperature, humidity, sunshine duration, wind speed, sand wind duration, and precipitation). It shows that Tunisia presents a dominance of favorable and very favorable days during the year for outdoor activities. For example, in average 85% of the days are at least favorable in terms of tourist climate comfort in Jerba each year.
As temperature and humidity are major components of climate related comfort of tourists in Tunisia, their expected evolution under climate change is of importance for the future potential of the tourism sector.

A regional simulation of the evolution of suitable climate conditions for tourism activities has been carried out at the regional level by Meteo-France. The evolutions of TCI of Tunisia, and of the Mediterranean region, are of interest for the Tunisian tourism sector stakeholders as the TCI of the destination and of emitters' country are important for the destination choice of tourists but also because the Tunisian destination is in concurrence with other ones across the Mediterranean region.

Nine regional climate models simulations of the EU FP6 ENSEMBLES have been used to calculate the TCI for the Mediterranean region at a 25km horizontal resolution for the summer period according to present and future climate (Fig. 4). The change in summer TCI over the period 2021-2050 compared with 1971-2000 indicates a decrease of the TCI around the Mediterranean basin, which will be accentuated in the southern countries. Moreover simulations show that the number of summer days with a TCI greater than 70 (i.e. good and above) will decrease by 4 to 10 days, with the strongest decrease in the south.

Figure 4: Summer TCI in 1971-2000 (top) and changes over 2021-2050 (bottom) simulated by the ensemble mean models under the A1B emission scenario



Source: CLIM-RUN Project, CNRM. EU FP6 Ensemble data base

In summary, the Tunisian tourism sector would be probably negatively affected by climate change in the summer season as it will become more and more uncomfortable. But it would be probably positively impacted in intermediary season as favorable temperature conditions and the average length of the bathing season will increase.

These indicators are intended to allow developers, investors and policy-makers to have a better understanding of tourist comfort relationship to climate, and its expected evolution under climate change, but also to make a better use of the climate potential of the country and a diversification of tourism products.

MedCOF as an example of climate services for the Mediterranean region

Launched following the Scoping Meeting in June 2013 at the State Meteorological Agency of Spain (AEMET), the Mediterranean Climate Outlook Forum (MedCOF) generates consensus forecasts for the Mediterranean region and reflects the WMO desire to increase the availability of user-friendly climate services. Its purposes is to improve climate scientists' understanding of the information needs and thus able to produce more usable and salient climate information.

The aim of MedCOF is to strengthen the collaboration between all Mediterranean countries in developing capacities for the climate services information system within the GFCS. The forum stands for an opportunity to member countries to exchange information on the recent knowledge of climate conditions. Besides, it promotes training and operational activities on seasonal timescales.

The forum produces information concerning the state of ocean and other climate drivers for the region, probabilistic forecast of temperature, precipitation and hydrological relevant variables, information on climate monitoring since the previous season and verification of the last forecasted period. Water and energy sectors, both from the production and demand sides, were initially indicated as a major stake for a number of Mediterranean countries. Efforts are currently conducted in conjunction with some research projects, like EUPORIAS, to demonstrate the benefits of seasonal forecast in both targeted sectors.

An initiative to be consolidated

The development of Mediterranean climate services is of major importance for the sustainable development in the Mediterranean region and also regarding the climate risk management and regional forecasts. In that way, scientists and decision makers are working together to provide tools such as regional climate outlook forums and platforms.

As suggested by the Global Framework for Climate Services, the MedICIP (Mediterranean Integrated Climate Information Platform) is a multiple country platform to share information (GIS layers, documents and metadata) on climate change and variability in the Mediterranean basin allowing to bridge between climate sciences and the operational needs of the main socio-economic sectors.

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