A CHANGING CLIMATE, AN ADAPTING WORLD

CIRCE Climate Change and Impact Research: the Mediterranean Environment

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INTEGRATED ASSESSMENT IN THE MEDITERRANEAN: THE CIRCE CASE STUDIES

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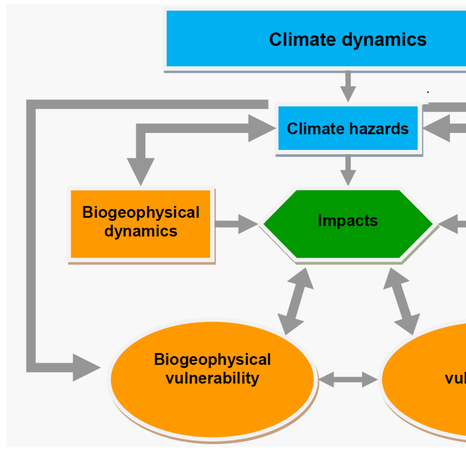
Within the framework of the CIRCE project, 11 case-study locations were selected to reflect three generic environments (urban, rural and coastal), to quantify current and future climate change and to assess the potential consequences to human communities and ecosystems at the regional to local scale.

A rigorous common framework, the CIRCE Case studies Integrating Framework (CCIF) was developed to facilitate a structured and systematic basis for identifying and selecting indicators.



Schematic representation of the CIRCE Case Studies Integrating Framework (CCIF). Climate dynamics is viewed as a key driver of changes in social and biogeophysical systems and is modulated by the inherent dynamics of these systems. The frequency and magnitude of climate hazards (sudden onset extreme events or longer-term changes) is altered by changes in the climate state and has measurable impacts on physical and social systems. Societal and environmental vulnerability to climate change is a function of the degree of exposure, the sensitivity of the system, and the capacity for adaptation.

Urban case studies
Athens, Greece
Beirut, Lebanon
Alexandria, Egypt

Rural case studies
Tuscany, Italy
Apulia, Italy
Judean Foothills, Israel
El Hadya, Syria

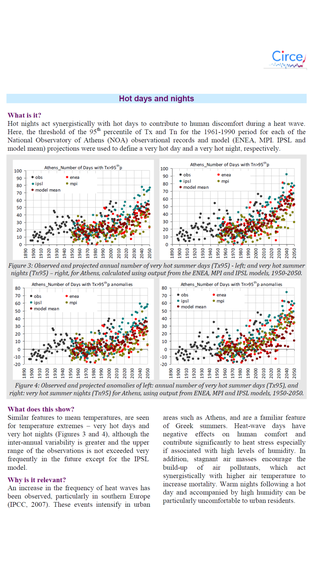
Coastal case studies
Gulf of Valencia – Catalan coast, Spain
Gulf of Oran, Algeria
Gulf of Gabès, Tunisia
West Nile Delta, Egypt

The case studies were chosen to reflect the east-west and north-south contrasts across the Mediterranean, using common selection criteria: vulnerability to climate change; availability of appropriate data; and, access to regional stakeholders including decision and policy makers.

The top-down indicator based approach was complemented by a bottom-up approach involving local and regional stakeholders. Stakeholder dialogue throughout the project culminated in a series of more formal regional stakeholder workshops. Stakeholders contributed to a number of areas of work including identification and assessment of adaptation strategies ('smart', 'green' and 'grey' options) and policy recommendations.

A detailed set of indicator selection criteria was defined and the process of selecting and refining indicators was iterative. A number of data and methodological challenges were encountered, e.g., data availability, combining qualitative and quantitative information, distinguishing between impact and vulnerability indicators. Indicators were classified as follows:
• climate and atmosphere (including indices of extremes)
• biogeophysical (marine and coastal, terrestrial ecosystems and biodiversity, freshwater systems, agriculture and forestry)
• social (human health, economic systems including tourism)

Briefing notes on the CIRCE urban case studies: Athens



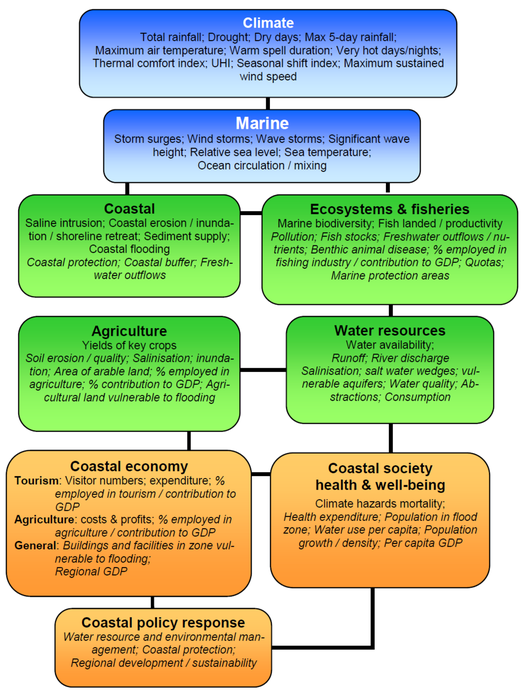
Hot days and nights

Information sheet on stakeholder engagement and adaptation options for the rural case studies: Apulia, Italy

Biogeophysical and social vulnerability indicators rural case studies information sheet: Tuscany, Italy

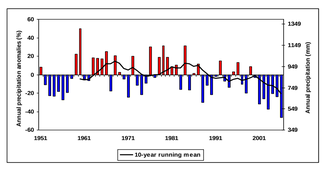
http://www.cru.uea.ac.uk/projects/circe/

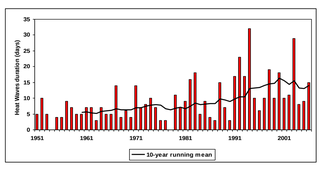
Project results are summarised in a series of briefing notes and information sheets (which were designed to facilitate stakeholder interaction). These are available from the case studies web site (www.cru.uea.ac.uk/projects/circe), together with additional information and data.
See also Volume III, Part 5 of A. Navarra and L. Tubiana (eds.), 2011: *Regional Assessment of Climate Change in the Mediterranean*, Springer, Dordrecht, The Netherlands, in press.

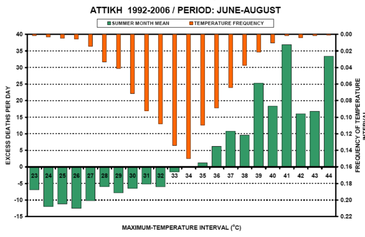


Indicator linkage diagrams, such as this one for the Gulf of Gabès, were very useful for structuring the integrated assessment for each case study. The extent to which the selected indicators could be quantified, especially for future periods, varied considerably.

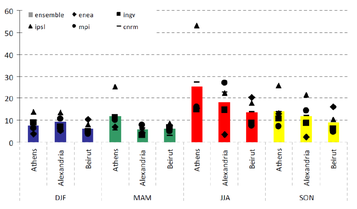
In the first and major assessment stage, impacts and vulnerability due to exposure to hazards associated with current and recent climate variability and change were explored using observed data. The left-hand examples below show mean annual precipitation and heat wave duration for NE Tuscany (1951-2006 from 1971-2000 baseline, data from E-OBS). The right-hand example shows daily excess summer deaths in Athens by maximum temperature interval (green bars) for 1992-2006. The frequency of occurrence of each temperature interval is shown using orange bars. From this information, a system threshold of 34°C was identified, above which heat-related deaths in Athens increase exponentially.

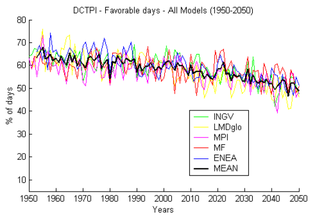


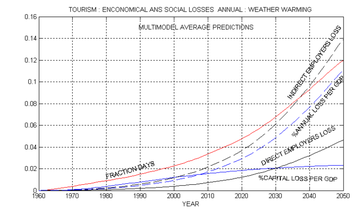




Assessments of future changes were based on output from the CIRCE climate model simulations (global and regional models with a coupled Mediterranean Sea, A1B, 1961-2050). The left-hand figure below shows projected seasonal changes (2021-2050 minus 1961-1990) in the number of very hot nights (Tn95n) for the urban case studies. The middle panel shows projected changes in the number of favorable days defined by the Daily Climate Tourism Potential Index for the Gulf of Gabès, while the right-hand-panel shows the associated simulated socio-economic impacts.







KEY MESSAGES FROM THE CASE STUDIES

1. Natural and human systems in all 11 CIRCE case studies are vulnerable to current climate variability and change as well as to social dynamics or drivers.

2. Climate projections of increases in mean and extreme high temperature and decreases in mean precipitation are robust, but there is uncertainty in the magnitude of change.

3. Projections indicate that all case studies will experience continuing and increasing vulnerability to climate change in the absence of mitigation or adaptation.

4. At the same time, social dynamics and drivers such as population growth (at least in the short term and in the S Mediterranean) are likely to further increase vulnerability.

5. A number of research needs and gaps have been identified e.g., relating to data and monitoring, and adaptation.

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