

Integrated assessment in the Mediterranean: the CIRCE case studies

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The heterogeneous nature of the Mediterranean environment, combined with a wide diversity of economic, social and cultural identities, make this region particularly amenable to integrated research on climate change impacts, vulnerabilities, and adaptive response. Within the framework of the EU FP7 CIRCE project, eleven 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. The case studies (Athens, Beirut, Alexandria, Tuscany, Apulia, Tel Hadya, Judean Foothills, Gulf of Valencia, Gulf of Oran, Gulf of Gabes, West Nile Delta) were chosen to reflect the east-west and north-south contrasts across the Mediterranean, using common selection criteria. A rigorous common framework, referred to as the CIRCE Case studies Integrating Framework was developed to facilitate a structured and systematic basis for identifying and selecting indicators. Within this framework, 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 top-down, indicator-based approach was complemented by a bottom-up approach involving local and regional stakeholders. A participatory level of involvement was aimed for, with stakeholder dialogue on an informal basis throughout the project, culminating in a series of more formal regional stakeholder workshops. Identification and construction of physical and socio-economic indicators was the most challenging and time-consuming aspect of the case-study work. A detailed set of selection criteria was defined and the process of reviewing and refining indicators was iterative. Nonetheless, a number of data and methodological challenges were encountered. Availability of appropriate data of sufficient quality and length was an issue in many cases. Other challenges included combining and using indicators derived from both quantitative and qualitative data, and distinguishing between impact and vulnerability indicators. Despite these issues, indicator linkages diagrams provided a useful preparatory stage for structuring the integrated assessment for each case study. 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. This then provided the context for considering future changes. The latter work was based on climate projections derived from the CIRCE global and regional climate model simulations which have the main novel characteristic of incorporating coupling between the Mediterranean Sea and atmosphere. Natural and human systems in all eleven case studies were found to be vulnerable to current climate variability and change as well as to social dynamics or drivers. The climate projections of increases in mean and extreme high temperature and decreases in precipitation are considered to be robust, although there is uncertainty with regards to the magnitude of change. They indicate that all case studies will experience continuing and increasing vulnerability to climate change in the absence of mitigation or adaptation. Projections for other extreme weather events, such as heavy precipitation and flooding, are highly uncertain, but any increase in such events would further increase vulnerability. Very few examples have been identified of where climate change might be beneficial for the case studies or where there might be opposing or compensating changes. At the same time, social dynamics and drivers such as population growth (at least in the short term and in the southern Mediterranean) are likely to further increase vulnerability.