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Changes in climate, extreme climate events and associated sectoral impacts for the Eastern Mediterranean and the Middle East: An integrated assessment of relevance to stakeholders

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Mounting evidence on changes in climate conditions in the eastern Mediterranean has increased interest in whether or not the intensity and frequency of extreme climate events are expected to change in the future, as well. As a result, a large number of studies are undertaken focusing on climate extremes and their societal, ecological and economic impacts. The daily projections used in the present study, are derived from the latest Hadley Centre PRECIS regional climate model (RCM) runs carried out at the Cyprus Institute within the framework of the study on "Climate Change and Impacts in the Eastern Mediterranean and Middle East" (CIMME, http://www.cyi.ac.cy/climatechangemetastudy). The study area is characterized by enhanced vulnerabilities to global warming and future extreme climate events. This is mainly related to the semi-arid nature of regional climate and the increasing trends seen in temperature records. The vulnerability of this region's climate to extremes is reflected in large moisture deficits and desertification processes which have been triggered, especially in the southernmost parts of the region. The PRECIS RCM uses boundary and initial conditions from the HadCM3Q0 global climate model, employing the IPCC SRES A1B emission scenario. The control run represents the base period 1961-1990 and is used here as reference for comparison with future projections. Three future time slices are studied: 2010-2039, 2040-2069 and 2070-2099. Using daily PRECIS output, we examine climatic changes in both mean (temperature, precipitation) and extremes (heatwaves, cold extremes, drought, heavy precipitation) with the aim to identify regions in the study area that are likely to undergo a significant amount of climate change with associated impacts in sectors such as energy requirements and forest fire risk. More specifically, vulnerable regions per sector of interest are identified, using different indices for the evaluation of climate change impacts in agriculture, forestry or energy. Results from these runs yield vulnerability maps in each sector for each region. Since climate change projections are associated with large uncertainty, we estimate confidence ranges for each of the projected changes in extremes or in sectors using bootstrapping. For completeness, decadal trend rates are also calculated and spatially portrayed on maps to show important changes and determine those areas identified as risk hotspots by this study.