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Assessing climate change over the Marche Region (central Italy) from 1951 to 2050: toward an integrated strategy for climate impacts reduction

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This study investigates consequences and future impacts of climate change on the social and natural systems of the Marche Region (one of the 20 administrative divisions of Italy). This Region, is located in central part of the peninsula and borders the Adriatic Sea on the East and the Apennine mountains on the West. The Region extends for about 60 km E-W, and has a NW-SE coastline of about 170 km, covering a total area of 9366 km2. Multimodel projections over the Marche Regions, on daily, monthly and seasonal temperature and precipitation parameters, have been extracted from the outputs of a set of Regional Climate Models (RCMs) over Europe run by several research institutes participating to the EU ENSEMBLE project. These climate simulations refer to the boundary conditions of the IPCC A1B emission scenario, and have a horizontal resolution of 25km $\times$ 25km covering a time period from 1951 to 2050. Results detail a significant increase of daily, monthly and seasonal mean temperatures, especially in summer, with anomaly values reaching +3°C after the year 2025, referring to the model CliNo 1981-2010. Mountain areas show higher values of temperature anomalies than coastal ones of approximately 0.5 °C. Concurrently, a widespread decrease of seasonal precipitation appears to affect all seasons, except for autumn. Rainfall decrease and temperature increase could reduce the Region's aquifer recharge and overall availability of hydro resources. These alterations could affect human health, agricultural productivity, forest fires, coastal erosion, algal blooms and water quality. Ongoing analysis of extreme climatological indices (e.g. frequency of maximum daily temperature exceeding comfort thresholds) are expected to quantify such impacts. A first analysis, linking climate change to the hydrologic cycle, studied through the computation of the hydro-climatic intensity index (as defined by Giorgi et al., 2012), suggests for the Marche Region an increase of the intensity of both wet and dry extremes. Such changes could alter the Region's hydro-geologic processes leading to increased intensity and frequency of landslide and flood hazards. These trends, considering the geomorphologic, social and economic characteristics of the Marche Region, suggest severe physical impacts scenario over the mountains band with subsequent socio-economic effects on hilly and coastal areas. Greater dry conditions are expected all over the Region, causing soil degradation and reducing river solid transport. In turn, this will impact agriculture productivity and natural beach nourishment likely causing a decline in beach tourism. On the other hand increased flood frequency would impact the several urban and economic settlements located on floodplains. Once these scenarios will be better defined, the next step could be mapping the vulnerability conditions within the Marche Region, thus highlighting exposure and resilience of infrastructures and population. Better knowledge of climate hazards and risks would support decision makers and legislators to implement, in the short terms, policies for the long term reduction of climate impacts in the Marche Region.