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Assessment of Mediterranean cyclones in the multi-ensemble EC-Earth

Victoria Gil (1), Margarida L. R. Liberato (1,2), Isabel F. Trigo (3), and Ricardo M. Trigo (1)

(1) Instituto Dom Luiz (IDL), Faculdade de Ciências, Universidade de Lisboa, 1749-016 Lisboa, Portugal (mlr@utad.pt), (2) Universidade de Trás-os-Montes e Alto Douro, UTAD, 5000-801 Vila Real, Portugal, (3) Instituto Português do Mar e da Atmosfera (IPMA), 1749-077 Lisboa, Portugal

The geographical location and characteristics of the Mediterranean basin make this a particularly active region in terms of cyclone forming and re-development (Trigo et al., 2002). The area is affected by moving depressions, most originated over the North Atlantic, which may later be forced by the orography surrounding the Mediterranean Sea and enhanced by the local source of moisture and heat fluxes over the Sea itself.
The present work analyses the response of Mediterranean cyclones to climate change by means of 7 ensemble members of EC-EARTH model from CMIP5 (Fifth Coupled Model Intercomparison Project). We restrict the analysis to a relatively small subset (7 members) of the total number of ensemble members available in order to take into account only the members present in the three selected experiments for robust detection of extra-tropical cyclones in the Mediterranean (Trigo, 2006). We have applied the standard procedure by comparing a common 25-year period of the historical (1980-2004), present day simulations, and the future climate simulations (2074-2098) forced by RCP4.5 and RCP8.5 scenarios. The study area corresponds to the window between 10ºW-42ºE and 27ºN-48ºN.
The analysis is performed with a focus in spatial distribution density and main characteristics of the overall cyclones for winter (DJF) and summer (JJA) seasons. Despite the discrepancies in cyclone numbers when compared with the ERA Interim common period (reducing to only 72% in DJF and 78% in JJA), the ensemble average matches relatively well the main spatial patterns of areas. Results indicate that the ensemble average is characterized by a small decrease in winter (-3%) and a notable increase in summer (+10%) in total number of cyclones and that the individual ensemble members reveal small spread. Such tendency is particularly pronounced under the high RCP8.5 emission scenario being more moderated under the RCP4.5 scenario. Additionally, an assessment of changes in the annual cycle suggests a slight decrease of the spring maximum and a pronounced increase in the summer maximum. The cyclone characteristics obtained from the ensemble members of EC-Earth indicate that summer cyclones will tend to be slower, less intense but will have a faster deepening phase. Part of the summer enhanced activity is in areas dominated by thermal lows.

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