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Mediterranean Winter Cyclones as Projected by Climate Models

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The output of simulations of 9 models that participated in the CMIP-3 Project is compared to the NCEP-NCAR reanalyzed data for 1961-1990. The aim is to evaluate their performance in reconstructing the temporal and spatial characteristics of the winter Mediterranean cyclones. The properties examined are the spatial distribution of cyclone occurrence, long-term trend in their occurrence and the location of the Mediterranean upper-level trough.
The models reconstructed realistically the maxima of cyclone density within the Mediterranean and the inter-annual variability in their occurrence. However, they underestimated the level of cyclone occurrences, especially in the western part, where the simulated winter average cyclone counts was 60% of that observed. Accordingly, the models underestimate the intensity of the 500 hPa Mediterranean trough and shift it eastward.
A possible reason for that is the models' tendency to overestimate both the subtropical high-pressure belt and the low pressure over the higher latitudes. This is expressed in the doubling of the south to north pressure gradient between western North Africa and the eastern North Atlantic. This gradient was found correlated, with marginal significance, with the density of the Mediterranean cyclones. The models skill in reproducing the cyclone density distribution was found also to be correlated also with their spatial resolution, 0.8 for the number of vertical levels and 0.56 for the horizontal grid spacing. The improvement expected in the models' spatial resolution suggests that their ability to reproduce the Mediterranean cyclones would be improved as well.