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Analysis of Mediterranean cyclones using RegCM4 simulations and reanalysis fields

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The aim of this study is to analyse the performance of a regional climate model to reproduce cyclonic activity in the Mediterranean region. The used regional climate model is RegCM4. Mediterranean cyclones are complex systems, they are usually weaker and smaller than typical mid-latitude cyclones. These low pressure systems can be rather considered subsynoptic scale phenomena. The resolution of global climate models are not fine enough to represent subsynoptic features, hence one needs to use regional climate models to analyse them. These Mediterranean cyclones are highly influenced by the Mediterranean Sea, which is a moisture and energy source for the atmosphere. The Mediterranean Sea is a genesis and reinforcement area for cyclones, more generally it is an area where strong regional phenomena occur, so it is an adequate region for testing a regional climate model.
The cyclone identification is performed on the 50 km horizontal resolution RegCM4 simulation for the Mediterranean region (Med-CORDEX domain) using the 1981-2010 period. The lateral boundary conditions are provided by the ERA-Interim reanalysis dataset with 1.5°x1.5° horizontal resolution. The identification algorithm searches for cyclone centres as local pressure minima in the mean sea level pressure field, and vorticity maxima at the 850 hPa isobaric level. The mean sea level pressure field is an essential indicator for cyclones, as low pressure systems. Also, the low level vorticity field is considered as a feasible indicator of smaller scale systems, like Mediterranean cyclones.
The model results are compared with the full resolution (0.75°x0.75°) ERA-Interim reanalysis data, which is finer than the driving field of the model, it has almost the same resolution as the RegCM4 results. This way it contains more information than the driving field, and nearly as detailed as the model results, that is why it could be acceptable for validation purposes in the selected region. The E-OBS daily gridded observational precipitation data is also used to estimate the precipitation related to the cyclones identified in the reanalysis data.