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Impact of ocean-atmosphere coupling and high resolution on the simulation of medicanes over the Mediterranean Sea: multi-model analysis with Med-CORDEX and EURO-CORDEX runs

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Medicanes are cyclones over the Mediterranean Sea having a tropical structure and a rather small size, for which the sea-atmosphere interaction plays a fundamental role. High resolution and ocean-atmosphere coupled RCM simulations performed in MedCORDEX and EURO-CORDEX projects are used to analyze the ability of RCMs to represent the observed characteristics of medicanes, and the impact of increasing resolution and using air-sea coupling on its simulation. An observational database based on satellite images combined with very high resolution simulations (Miglietta et al. 2013) is used as the reference for evaluating the simulations. The simulated medicanes do not coincide in general with the observed cases, so that the evaluation should be done in a statistical sense. The spatial distribution of medicanes is generally well simulated, while the monthly distribution reveals the difficulty of simulating the first medicanes appearing in September after the summer minimum. Large differences are found among models, supporting the use of multi-model ensembles. Interesting trade-offs are found for some models, as better values for intensity are associated to worse frequency values in one model, or relatively good values of frequency and intensity are obtained at the expense of a damped air-sea interaction in a model with spectral nudging. High resolution has a strong and positive impact on the frequency of simulated medicanes, while the effect on its intensity is less clear. Air-sea coupling reduces the medicane frequency, as could be expected due to a negative intensity feedback that is known for tropical cyclones. A preliminary analysis indicates that this feedback could depend on the oceanic mixed layer depth, increasing the interest of applying ocean-atmosphere coupled RCMs