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Verification of precipitation forecasts of MM5 model over Epirus, NW Greece, for various convective parameterization schemes

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In this work, the role of the use of various convective parameterisation schemes on the precipitation forecast skill is examined. For that reason, the mesoscale meteorological model MM5 is applied for 22 selected days with intense precipitation in the region of Epirus, NW Greece. At first, a simulation is performed with a coarse grid over Europe (24x24km) and then the outputs of this simulation are used as initial and boundary conditions on a subsequent run with finer grid spacing (8x8km) over Greece. Finally, a third simulation is carried out using the outputs of the latter for a grid of 2x2Km, which covers the Epirus region.

For the model simulations, three different convective parameterization schemes (CPSs) are used: a) Kain-Fritsch2, b) Betts-Miller and c) Grell. Moreover, additional simulations have been performed by using the Kain-Fritsch2 CPS for the first two domains but without any scheme for the finest grid, in order to investigate whether the activation of the CPS is necessary or not in this high resolution grid.

The verification of the results is carried out separately for three sub-regions of Epirus: for the coastal areas (altitude up to 100 meters – 4 stations), the inland areas (from 100 to 500m – 5 stations) and the mountainous areas (above 500m – 5 stations). The model skill, as far as it concerns precipitation height, is examined for the two 12-hour intervals (00:00-12:00, 12:00-24:00) of the 22 rainy days. For the verification of the model, the following categorical and descriptive statistics are used: Bias Score, Threat Score, Proportion Correct Score (PC) and Probability of Detection Score (POD). According to the results, for the coastal areas, the optimum selection for precipitation forecast appears to be the convective parameterization scheme Grell. The Kain-Fritsch2 scheme yields also satisfactory scores, close to those of Grell, while the Betts-Miller appears to be the worst, especially for precipitation heights lower than 10mm/12-hour. Furthermore, the activation of a convective parameterization scheme at the high resolution grid is found to be necessary, as, without it, precipitation up to 10mm/12hour, is under-predicted. For the inland areas, the forecast is optimum for both, Kain-Fritsch2 and Grell schemes. Betts-Miller scheme presents better scores than for the coastal areas but it still appears poorer than the others. Without any CPS, the resultant scores appear also better than the ones for the coastal areas, but they are still not as good as the ones with Kain-Fritsch2. These findings appear more robust for precipitation heights lower than 10mm/12-hour. For the mountainous areas, the scores resulting by applying Betts-Miller scheme are further improved, being comparable, and in some cases better, than those of the other schemes. Thus, the best option for predicting high altitude rainfall is the application of the Betts-Miller or the Grell scheme.