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Effect of sea-surface roughness on the surface deepening of an explosive cyclone in the Taurus Sea

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Sea-surface fluxes play important role in the genesis and deepening of explosive cyclones in the eastern Mediterranean. In this study, the regional atmospheric model COSMO.GR, used for operational forecast in the Hellenic National Meteorological Service, is employed to evaluate the effect of the sea-surface roughness parameter of the model on the deepening of an explosive cyclone that occurred in the Taurus Sea between Turkey and Cyprus from December 10/06UTC to December 11/06UTC, 2010 with central pressure of about 989hPa according to the ECMWF ERA-Interim analysis and the University of Melbourne cyclone tracking algorithm.

Sea-surface roughness parameter determines the latent and sensible heat fluxes resulting from the sea in winter and it is considered one of the most sensitive model parameters for the model performance over maritime regions. Model runs were performed for six different values of the parameter, including the operationally default value. It was found that smaller values of sea-surface roughness result in significant enhancement of the sea-surface fluxes and are able to simulate more realistic surface deepening rates and minimum sea-level pressures during the explosive period following the cyclonic track.

The model validation was performed with the aid of observations from adjacent stations in Greece and Turkey. However, it was found that the more appropriate value of the parameter differs among the different phases of the cyclone evolution. These results signify the necessity to test the default parameters of the operational models in order to improve the forecasting efficiency of intense cyclones in the Mediterranean.