Geophysical Research Abstracts
Vol. 19, EGU2017-13152, 2017
EGU General Assembly 2017

On the role of Sea Surface Temperature forcing in the numerical simulation of a Tropical-Like Cyclone event in the Mediterranean Sea

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Between 19-22 January 2014 a baroclinic wave from the Atlantic region goes in cutoff over the Strait of Gibraltar. The resulting depression remains active for approximately 80 hours, passing off shore of the north African coast, crossing the Tyrrhenian Sea and the Adriatic Sea, before turning south. During the first phase (close to the Balearic islands) and when passing over the Adriatic, the depression assumes the characteristics of a TLC (Tropical Like Cyclones). Sea Surface Temperature (SST) is a very important factor for a proper numerical simulation of these events hence we chose to model this TLC event using the COAWST suite (Coupled Ocean Atmosphere Wave Sediment Transport Modelling System). In the first phase of our work we identified the best model configuration to reproduce the phenomenon, extensively testing different microphysics and PBL (Planetary Boundary Layer) schemes available in the numerical model WRF (Weather Research for Forecasting). In the second phase, in order to evaluate the impact of SST, we used the best physical set-up that reproduces the phenomenon in terms of intensity, trajectory and timing, using four different methods of implementation of the SST in the model: i)from a spectrum-radiometer at 8.3 km resolution and updated every six hours; ii) from a dataset provided by "MyOcean" at 1 km resolution and updated every 6 hours; iii) from COAWST suite run in coupled atmosphere-ocean configuration; iv) from COAWST suite in fully coupled atmosphere-ocean- wave configuration). Results show the importance of the selected microphysics scheme in order to correctly reproduce the TLC trajectory, and of the use of high-resolution and high-frequency SST fields, updated every hour in order to reproduce the diurnal cycles.

Coupled numerical runs produce less intense heat fluxes which on turn result in better TLC trajectories, more realistic timing and intensity when compared with standalone simulations, even if the latter use a high resolution SST. Last, a temporary increase of the mixed layer depth along the trajectory of the TLC was exhibited by the fully coupled run during the two phases of maximum intensity of the phenomenon, when the wave field is more developed and acts more intensely on the vertical mixing. We will discuss how these results can be improved or further validated in proximity of land by using satellite information that will be available within the framework of H2020 CEASELESS project.