

Ocean-waves-atmosphere interactions in the South West Indian Ocean around the tropical cyclone Bejisa (La Réunion, 2014)

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Tropical cyclones (TC) are a major source of uncertainty in weather forecast. In particular, the strong Ocean-Waves-Atmosphere (OWA) exchanges are not well represented which may have dramatic consequences on forecasting the intensities and trajectories of the TC. To explore and understand these OWA interactions, we developed a coupled system : Meso-NH for the atmospheric model, CROCO for the oceanic model and WW3 for the waves model. Both of these models are coupled by OASIS3-MCT. This coupled system is based on the work presented in Voldoire et al. (2017). In this study, we will focus on simulations around the tropical cyclone Bejisa (2014) that developed in the South West Indian Ocean, close to La Réunion. Several simulations are performed : coupled and forced simulations, and atmosphere, ocean-atmosphere and ocean-wave-atmosphere simulations. After a description of the forcing and coupling effects on the surface fields, the impact on the vertical structure of the atmosphere and the ocean is explored. Some comparisons with observations (buoys and satellites) are also presented to evaluate our simulations. The main results show that the coupled (Ocean-Atmosphere or Ocean-Waves-Atmosphere) simulations tend to decrease the intensity of the cyclone compared to the forced simulations. However the track is roughly unchanged. Coupling the atmospheric model with a wave model increases the roughness length that strongly modifies the wind stress. In addition, the sea surface temperature is lower in the oceanic coupled simulations which, in return, decreases the atmospheric heat fluxes. Both effects have important impacts on the vertical structure of the ocean and atmosphere. For example, a more important tilting of the cyclone and a deeper ocean mixed layer are present in the OWA coupled simulations. To conclude, the OWA coupling is shown to be a reliable tool to improve our understanding on the OWA processes in tropical cyclones.

Keywords :

ocean-waves-atmosphere interactions, modeling, tropical cyclone, South West Indian Ocean

Reference :

Voldoire et al. (2017, in prep. to GMD). The seamless and multi-model coupling between atmosphere, land, hydrology, ocean, waves and sea-ice models based on SURFEX surface scheme using OASIS3-MCT.