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Interaction of tropical cyclone Ivan (South-West Indian Ocean, 2007) with the ocean

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Tropical cyclones are major natural hazards, that regularly wreak havoc in many places of the world. They grow over the tropical oceans, where upper-layer warm waters constitute a main source of energy for their development. A necessary criterion for tropical cyclogenesis is that the sea surface temperature (SST) is higher than 26°C, with warm waters extending down at least 30 to 50m. However, the SST under a cyclone is affected by the strong winds that are responsible for upper-ocean mixing and SST cooling. The interactions of a tropical cyclone with the ocean are therefore critical to understand its dynamics.

The purpose of this study is to investigate the role of the ocean, and more particulary, of a horizontal SST gradient on the rapid intensification and structure change of tropical cyclone Ivan (South-West Indian Ocean, 2007). The cyclone is simulated with the high-resolution (4-km) non-hydrostatic numerical model Meso-NH. Two simulations are computed: the first one uses a realistic SST field which is kept constant during the simulation, while the second one uses a SST which evolves during the simulation through a coupling with a 1D ocean model. This last simulation allows to simulate the SST cooling due to the cyclone winds. The results of these simulations show the impact of the SST gradient and cooling on the surface sensible and latent heat turbulent fluxes, and on the thermodynamical and dynamical structure of the cyclone Ivan. They help to understand the contribution of the ocean to the rapid intensification of this cyclone as it passed over the SST gradient.