Geophysical Research Abstracts
Vol. 21, EGU2019-15882, 2019
EGU General Assembly 2019

How are Marine Atmospheric Boundary Layer processes influenced by oceanic Diurnal Warm Layers ?

Pierre-Etienne Brilouet (1,2), Jean-Luc Redelsperger (1), Marie-Noëlle Bouin (2), and Fleur Couvreux (2)
(1) LOPS, CNRS, Plouzané, France , (2) CNRM, Météo-France CNRS, Toulouse, France

In the current context of global change, numerical models are key tools to explore the characteristics of the Earth climate and anticipate its evolution. The appropriate representation of air-sea exchanges in climate models (CM) is still a major challenge, since they contribute to the global Earth's energy balance. The COmprehensive Coupling approach for the Ocean and the Atmosphere (COCOA) project aims at revisiting the overall representation of air-sea interactions in CMs by considering physical aspects among others.

The tropical regions, and in particular the Indian Ocean impacted by the Madden-Julian Oscillation (MJO) are preferential study areas where latent heat surface fluxes largely control the atmospheric water content and where strong model biases are observed. During periods of reduced convective activity (suppressed phase of MJO), the solar radiation combined with light near-surface wind conditions can result in thermally stable stratification and inhibit the oceanic vertical mixing, resulting in diurnal warm layer (DWL). According to recent studies, the lack of representation of those local processes in models can have an important impact of climate simulations. The response of the marine atmospheric boundary layer (MABL) to DWL is also thought to play an important role in the atmosphere preconditioning of deep convection leading to MJO initiation.

Atmospheric and oceanic data collected onboard the R/V Revelle during the Cindy-Dynamo (CD) field campaign (tropical Indian Ocean, october-november 2011) are used to build a reference case that is simulated with the MesoNH model in Large-Eddy Simulation (LES) configuration. The impact of the DWL on the MABL's mean thermodynamic structure, the vertical turbulent exchanges and the PBL turbulence and cloud structure organization has been investigated using three different numerical configurations: the prescription of the diurnal cycle of the SST, a DWL parameterization producing a time-evolving SST and a coupled model with a single column oceanic mixing layer attempting to reproduce the DWL. From the transfers at the surface up to the cloud organization, the whole MABL is impacted by the DWL. In particular, the presence of DWL leads to an intensification of the turbulent fields organization into coherent structures and in modulation of the vertical turbulent exchanges.