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Impact of Diurnal Warm Layers and Rain-Induced Cool Freshwater Lenses on Atmospheric boundary layer and convection : The CINDY/DYNAMO Case.

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Due to the lack of vertical mixing, shallow thermo-haline stable stratifications, corresponding to changes up to few degrees and several psu within the ocean first tens of centimeters, form when the wind is weak. These changes in skin temperature and salinity are induced by the absorption of solar radiation in the case of Diurnal Warm Layers (DWL) and by the addition of cool and fresh rainwater in the case of Cool Freshwater Lenses (CFL). By changing the ocean skin temperature, these phenomena can perturb the heat exchanges at the ocean interface and thus have an impact on the atmospheric boundary layer structure and on convection. In particular, DWL of 1 to 3°C are frequently observed in the deep tropics where they can destabilize the atmosphere and trigger convection in the afternoon. Less is known however about CFL characteristics and on their impact on atmosphere processes.

The international CINDY/DYNAMO field campaign took place in the equatorial Indian Ocean in winter 2011-2012 to observe the complete lifecycle of Madden-Julian Oscillation (MJO) in the region where it usually originate. Three MJO events were documented. During this campaign, several large DWL and some CFL were observed from the R/V Revelle situated on the equator at 80°E. ECMWF analysis constrained by R/V Revelle precipitation radar measurements are used to derived large-scale forcing terms necessary to force single column models and limited area models. A single column version of the LMDZ atmospheric general circulation model coupled to a simple model for DWL and CFL is then used to study the impact of representing DWL and CFL. In particular, we will focus on their impact on the simulated atmospheric tendencies in temperature and moisture associated with different atmospheric processes: boundary layer turbulence, boundary layer thermals (shallow convection) and deep convection.