CNRM, UMR 3589

SEMINAIRE CNRM

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OBSERVING MESOSCALE SHALLOW CIRCULATIONS IN THE TRADES

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Lien visio : https://bluejeans.com/998976949/7492

Summary :

Evidence is emerging that mesoscale circulations pattern cloudiness on scales that are not represented in standard theories of climate, such as those represented by current climate models. Both large-eddy simulations (LES) and theory make the case for the role of such circulations, but even if they do exist it is not clear how important or prevalent they are, because such shallow circulations have never been observed, owing to a lack of measurements.
Recently, the first extensive measurements of mesoscale divergence were made thanks to the EUREC4A field campaign in the north-Atlantic trades in January-February, 2020. Using these measurements, I present observational evidence for shallow mesoscale overturning circulations (SMOCs). Large mesoscale variability in vertical velocity, five-fold the synoptic mean, is shown to be associated with the ubiquity of SMOCs. Furthermore, time-lag correlations suggest that SMOCs amplify mesoscale moisture variance at cloud-base and in the sub-cloud layer. Through their modulation of cloud-base moisture, SMOCs influence the drying efficiency of entrainment, thus yielding moist ascending branches and dry descending branches. The observed moisture variance differs from expectations from large-eddy simulations, which show largest variance near cloud top and negligible sub-cloud variance.
Meteorological reanalyses ERA5 reproduces the observed low-level divergence well and confirms SMOCs to be ubiquituous mesoscale features (ca. 200~km). The ubiquity of SMOCS and their coupling to moisture and cloud fields suggest that the strength and scale of mesoscale circulations are important in determining how clouds couple to climate, something which is not considered by present theories.

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