EGU2020-12643
https://doi.org/10.5194/egusphere-egu2020-12643
EGU General Assembly 2020

Hydration of the tropical tropopause layer (TTL) by convective updraft during tropical cyclone ENAWO(2017) and generalization to tropical storms in the southwestern Indian Ocean in summer 2016-2017.

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Stratospheric water vapor variations play an important role on the climate. Predictions of changes in stratospheric humidity are uncertain because of gaps in our understanding of physical processes occurring in the TTL, between 14 and 20 km altitude. In particular, climate models have great difficulties in modelling water vapor variations in the TTL due to a poor representation of tropical convection, which largely controls the vertical transport of water vapor to UTLS, among other things.

One of the scientific objectives of the CONCIRTO[5] program is to better understand the role of marine deep convective systems, and tropical cyclones in particular, on the hydration of TTL in the Southwestern Indian Ocean. In March 2017, a rapid deepening of the tropical cyclone Enawo occured north-west of Reunion island before to strike and cross Madagascar from north to south. The progressive intensification of the cyclone to the intense tropical cyclone stage makes it an ideal case study to analyze the transport of water vapor and hydrometeors in the TTL according to the intensity phase of the cyclone.

We will present modelling results on water vapor transport into the TTL in March 4 during ENAWO's intensification. On March 4, the mesoscale model Meso-NH simulated a large water vapour transport through the TTL, associated with the injection of ice through the tropopause and the observation of cirrus clouds. The model validation is done by comparison with satellite data (CALIPSO, Meteosat-8). We generalize the intrusion modelling during ENAWO intensification by comparing the brightness temperature observed above the tropical cyclones and the tropical tropopause temperature extracted from ECMWF-Analysis during the 2016-2017 cyclonic season. From these studies, we can estimate the number of intrusions during a cyclonic season and the cyclonic intensity associated with the intrusions.

[5]Effects of convection and cirrus clouds on the Tropical Tropopause Layer over the Indian Ocean