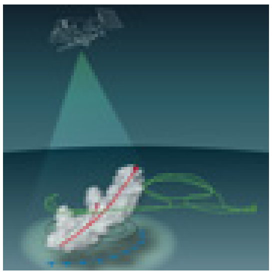

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Diabatic processes in the Warm Conveyor Belt of the Stalactite Cyclone: sensitivity to two convective parametrization schemes of the global Météo-France model ARPEGE

Wednesday, 11 March 2020 13:55 (20 minutes)

The main goal of this study is to analyze the representation of the Stalactite Cyclone warm conveyor belt (WCB) in the global Météo-France model ARPEGE. Two simulations, each using one of the two different deep convection parametrization schemes developed in ARPEGE are compared. The first one is the Bougeault's scheme, developed in 1985 and the second one is based on grid-scale budget equations separating microphysics and transport terms (PCMT, Piriou et al., 2007).

The Stalactite Cyclone is an extratropical cyclone (29 Sept-2 Oct 2016) that has been intensively observed during the international field campaign NAWDEX. As its later stage of development was closely associated with the onset of a low-predictable European blocking event, it is particularly interesting to study the model skills in representing the associated WCB dynamics. Two flights of the SAFIRE Falcon equipped with the RALI platform have been performed in the ascending and outflow regions of this WCB. The RALI platform is composed of a Doppler radar RASTA and a three-wavelength backscatter lidar LNG. Observations and model outputs are compared in terms of the horizontal wind speed derived from the Doppler radar RASTA and of the ice water content retrieved from the RALI observations. All of these observations provide indirect informations about diabatic heating rates along the WCB and their impacts on the dynamics through potential vorticity modification.

Lagrangian trajectories are computed for each simulation and those satisfying the WCB criteria are selected. The heating associated to the transition toward the liquid phase is higher with PCMT convection scheme while the transition toward the ice phase is more important in Bougeault's one. Futhermore, more WCB trajectories with anticyclonic curvature are found using Bougeault scheme
and they reach, in average, higher isentropic levels. This explains the lower values of potential vorticity found in the upper isentropes with this deep convection scheme. Potential vorticity modification along WCB trajectories differs between the two simulations due to sensible and latent heat differences during their ascents. Finally, both parametrizations strongly underestimate the ice water content retrieved from the remote sensing observations. Bougeault's deep convection scheme has slightly more ice water content in the upper troposphere than the Piriou's one, and in that sense, is slightly closer to the observations. This is in agreement with the slightly stronger upper-level heating rate due to ice phase transition detected in the Bougeault's WCB trajectories.

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