Characterization of the microphysics of ice in tropical convection for rain retrieval algorithms

A. Martini, N. Villard, M. Gosset, P. Caremagne, L. A. Toledo Machado

1. Dynamo

Dynamo is a nippo-american initiative whose objective is to study the conditions for the development of active convection in episodes of the Madden-Julian oscillation in the Indian Ocean (http://www.esd.ucar.edu/projects/dynamo/). The instrumental deployment set up an emphasized area composed of the islands of Gan (0.7°N, 73.2°E) and Diego Garcia (7.3°S, 72.5°E), and two research vessels station, one at (0.7°N, 79°E) and the other at (7.3°S, 79°E). The campaign is classically divided into several phases: an Extensive Observation Period (EOP) from the 1st October 2011 to the 31 March 2012, an Intensive Observation Period (IOP) from the 1st October 2011 to the 15 January 2012 and a Special Observation Period (SOP) from 1 October 2011 to 15 November 2011. The Mega-Tropiques Algorithm Validation (phase II) component consisted of the deployment of the Falcon 20 from 17 November to 15 December at Gan airport with a flight zone of about 300 km around the airport. The ground based SMART-R C-band radar (P. Houze) was used to guide the plane through rain systems while the SPolKa (P. R. Houze) is used for particles identification.

2. RASTA and In-situ Microphysics

The Falcon 20, operated by SAFIRE, was equipped for this campaign with a set of microphysics probes (PPI, CIP, FSSP, 2DS) and with the W-Band Doppler radar RASTA. The combination of the two sets of measurements allows to retrieve the main characteristics of the ice particles above and below the plane, and in particular a mass-diameter law which impacts directly the simulated brightness temperatures. These data are currently being processed at LaMP (E. Fontaine, Clermont Ferrand, France) and LATMOS (J. Delanoë, Gagnacourt, France).

3. Particles Identification with SPOLKA

If the instrumented Falcon allows us to characterize precisely the particles properties, the limited number of flights does not provide a robust statistic. On the other hand, the PID computed from the polarimetric radars is quite through over the 4 month of the campaign but is very qualitative. The algorithm is based on a combination of the two sets of measurements allows to retrieve the main characteristics of the ice particles above and below the plane, and in particular a mass-diameter law which impacts directly the simulated brightness temperatures.

4. Colocalisation PID Satellite

The piezdiagram represents the proportion of the various species as identified by SPolKa PID piezdiagram algorithms co-located in the TMI 85 GHz Pixel. One can see that there is indeed some correlation between the 85 GHz horizontal TB and the presence of graupels in the PID on the 23rd. On the 27th, this correlation remains mostly true but not for the main Tb depression east of Gan. This might be explained by either some instrumental artifacts or related to the life cycle of the system. These results are preliminary.

5. Discussion

These preliminary results are meant to show that it is possible to somewhat fill the gap between in-situ and satellite measurements through the use of ground based polarimetric radar data. Although the correlation between TBs and PID is not always straightforward in those two examples, it appears that there is some signal either through wet snow and/or graupel presence.

The next step will be to compare the PIDs with the in-situ measurements when a flight of the Falcon is available. Then the same kind of effort will be pursued using the Naimey and Ouagadougou data set over Africa and the CHUNA data set over Brasil in various situations: oceanic, continental, coastal.

References