

## **To what extent does the radiative effect of low-level clouds depend on an accurate description of their vertical structure?**

Raphaël Lebrun<sup>1,2,3</sup>, Jean-Louis Dufresne<sup>1,2,3</sup>, Najda Villefranque<sup>1,2,3</sup>

In this work we quantify the impact on the radiative flux of two approximations used in atmospheric models to parameterize clouds : homogeneity of cloud properties in each cell and exponential random overlap of clouds.

For this, we perform plan-parallel Monte-Carlo radiative computations with classical low-level cloud LES cases.

To test the homogeneity hypothesis, we mapped the variables of the LES onto a coarser vertical grid (GCM/RCM), while preserving the total cloud cover. Radiative transfer computations show that this idealized coarsening leads to a relative difference in cloud albedo up to 20% (5-7% of albedo) for vertical layers of 100m thickness.

As we investigate the ERO approximation, we show it can be considered as a Markovian process and we compute the optimal overlap parameter for which the total cloud cover is conserved. We obtain that the ERO approximation introduces only small errors.

Finally, we use ERO to represent the LWC heterogeneity within a coarse cell.