Contribution ID: **45** Type: **Talk**

Low-level radiative cooling peaks in regimes of shallow convective organization

Thursday, 19 May 2022 10:00 (15 minutes)

In models, a local maximum of clear-sky radiative cooling in the lower troposphere often appears as a necessary condition for the development and persistence of convective organization. However, no robust understanding has been provided for the emergence and disappearance of lower-tropospheric cooling in the atmosphere. Here we propose a theoretical characterization of clear-sky radiative cooling peaks, recently calculated from over 2,000 soundings launched during the EUREC4A field campaign in various patterns of shallow organization. A suite of scaling approximations are developed from simplified spectral theory to connect the longwave cooling peak to the vertical humidity structure set by convection. Its height is controlled by local maxima in the vertical gradients of water vapor path, and its magnitude is mainly controlled by the ratio between column relative humidity above and below the peak. In contrast, the value of the Planck function and the spectral width of emission at the peak only weakly vary across soundings. However, water vapor spectroscopy implies that upper-level intrusions of moist air detrained from lower latitudes can substantially dim low-level cooling, possibly by reducing the range of the spectrum that effectively cools to space at the level of the peak. This work motivates future modeling work, formulating the hypothesis that "Fish" patterns, which embed the widest persisting dry areas, may be the most favorable conditions for radiative processes to act on the circulation. If at play, these radiative feedback mechanisms would maintain these patterns that are efficient at cooling the tropics, a type of "dry radiator fins" which could mitigate the risk of runaway climate states.

Primary authors: FILDIER, Benjamin (Laboratoire de Météorologie Dynamique, ENS, Paris); Mrs MULLER, Caroline (Institute for Science and Technologie, Vienna, Austria); Mr PINCUS, Robert (Cooperative Institute for Research in Environmental Sciences, University of Colorado Boulder, Boulder, Colorado, USA; NOAA Physical Sciences Laboratory, Boulder, Colorado, USA); Mr FUEGLISTALER, Stephan (Geosciences Department, Princeton University, Princeton, New Jersey, USA)

Presenter: FILDIER, Benjamin (Laboratoire de Météorologie Dynamique, ENS, Paris)

Session Classification: Wind, radiation and organisation