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Gravity waves from thunderstorms: impact on the general circulation

Philippe HEINRICH and Lorenzo Costantino
CEA, DAM, DIF, France (philippe.heinrich@cea.fr)

Small scale atmospheric waves, usually referred as internal Gravity Waves (GW), represent an efficient transport mechanism of energy and momentum through the atmosphere. They propagate upward from their sources in the lower atmosphere to the middle and upper atmosphere. Depending on the horizontal wind shear, they can dissipate at different altitudes and force the atmospheric circulation of the stratosphere and mesosphere. The deposition of momentum associated with the dissipation, or wave breaking, exerts acceleration to the mean flow, which can significantly alter the thermal and dynamical structure of the atmosphere. In the framework of the ARISE project, the mesoscale meteorological model WRF (Weather Research and Forecasting) has been used to generate and propagate GW forced by convection and orography, without any GW parameterization. Results from model simulations are compared with in-situ observations of potential energy vertical profiles in the stratosphere, measured by a LIDAR located at the "Observatoire de Haute Provence" (OHP) in Southern France. Such comparisons allow, to a certain extent, to validate numerical results and quantify some of those wave parameters (e.g., GW drag force, intrinsic frequency, breaking level altitude, etc..) that are fundamental for a deeper understanding of GW role in atmospheric dynamics, but that are not easily measurable by ground- or space-based systems (limited to specific region or certain latitude band).