Project title: Small scale atmospheric modeling

Principal Investigator: Prof. Dr. Juan Pedro Mellado

We use high-resolution simulations to perform exploratory studies of multiscale process interaction in planetary boundary layers. One line of work is atmospheric turbulence, in particular, buoyancy and wind shear effects on boundary-layer properties. This work allows us to better parametrize mean and fluctuation properties of temperature, moisture and wind in terms of environmental conditions like surface fluxes, lapse rates in the free troposphere and initial conditions. Another topic is surface effects. In particular, we are want to understand better how roughness and heterogeneity influences boundary-layer structure and dynamics, for instance, by influencing the large coherent motions in which turbulence organizes. Can we find general trends, or do we need to study each specific surface separately? The third topic is boundary-layer clouds and shallow convection, in particular, stratocumulus and their transition to shallow cumulus. Here we study the importance of microphysical processes such as sedimentation and condensation/evaporation, and how to model them at different levels of detail, from storm resolving models to bulk models to meter and submeter scale models.