EVALUATION OF BOUNDARY LAYER TYPE IN ICON USING A NEW BOUNDARY LAYER CLASSIFICATION DEVELOPED AT JOYCE

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The prediction of the way boundary layer clouds respond to climate change is affected by large uncertainties. This is largely due to the way low-level clouds are parameterized in climate models. These uncertainties give rise to large differences in radiative feedback processes and thus lead to a major source of spread among climate models.

Climate models parameterize turbulent motions in the PBL by applying so-called PBL-schemes, which can be situation dependent.

In order to better understand how low-level clouds are affected by the PBL scheme at a given time, a classification of different boundary layer types is used, associated with specific parametrizations of entrainment, mixing and shallow cumulus or non local schemes.

Since the choice of one PBL scheme can dramatically affect the model output, it is essential to evaluate the parametrized PBL schemes with observations.

In recent years ground based instruments (especially wind lidars) have been used to develop boundary layer classifications from observations. They can be used to better select which scheme to apply under specific dynamical and thermodynamical conditions. Moreover, choosing the proper PBL scheme can also improve the representation of low level clouds and of the moisture transport, which are essential for the description of the radiative budget and the water cycle.

In this work, we exploit a new PBL classification based on wind lidar, ceilometer and tower measurements applied to observations of the JOYCE supersite in Germany to statistically evaluate the PBL representation in the high-resolution (150 - 300 m) Icosahedral non-hydrostatic general circulation model (ICON). ICON is developed by the Max Planck Institute for Meteorology (MPI-M) and the German Weather Service (DWD).

A PBL classification analogous to the one used for the observations has been developed for the model output to properly compare PBL regimes identified in model and observations. Also, different cloudy regimes described on the basis of the PBL classification are compared, in order to understand if the model is able to capture the characteristic features of the different cloud types.

The PBL classification is applied to all the current (ICON) simulated days available (13) and to all the corresponding days of observations from JOYCE as well as from other supersites in order to statistically evaluate the PBL representation adopted in ICON. Also, statistical macroscopical properties of clouds identified under different regimes are evaluated, in order to guide future improvements in the low level clouds description.