Project: **838**

Project title: **High Definition Clouds and Precipitation for Climate Prediction - PDF cloud schemes**

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The goal of the project is to assess the basis of the cloud parameterisations in the ICON model, the underlying probability density function that describes the subgrid-scale variability of the total-water specific humidity (q_t) to predict cloud fraction and condensed water content. To this end, various sensitivity studies are conducted with different cloud schemes and the results are intercompared and evaluated using observational data.

In the reporting period, we have published results (Nam et al., 2014) on the evaluation of three different cloud schemes with help of the satellite simulator tool COSP (Cloud Feedback Model Intercomparison Project Observational Simulator Package) that, among other satellites, emulates the radar reflectivity and lidar backscatter ratio from the Cloudsat and CALIPSO satellites, respectively. It was found that the Neggers (2012) cloud scheme compares best to the satellite data with respect in particular to low-level clouds (Fig. 1).

In a second axis of research, the simpler cloud scheme by Sundqvist et al. (1989) is compared in its fundamental assumptions to similar cloud schemes. Using large-eddy simulations for various cases, in Rosch et al. (2015) we were able to propose improvements to the Sunqvist scheme.

Finally, ongoing work explores the subgrid-scale variability of q_t and also of temperature in the more comprehensive parameterisations (dissertation work of Matthias Brück). Preliminary results indicate that the neglect of temperature variability in all current cloud schemes in ICON might imply deficiencies in correctly simulating subgrid-scale variability.

References

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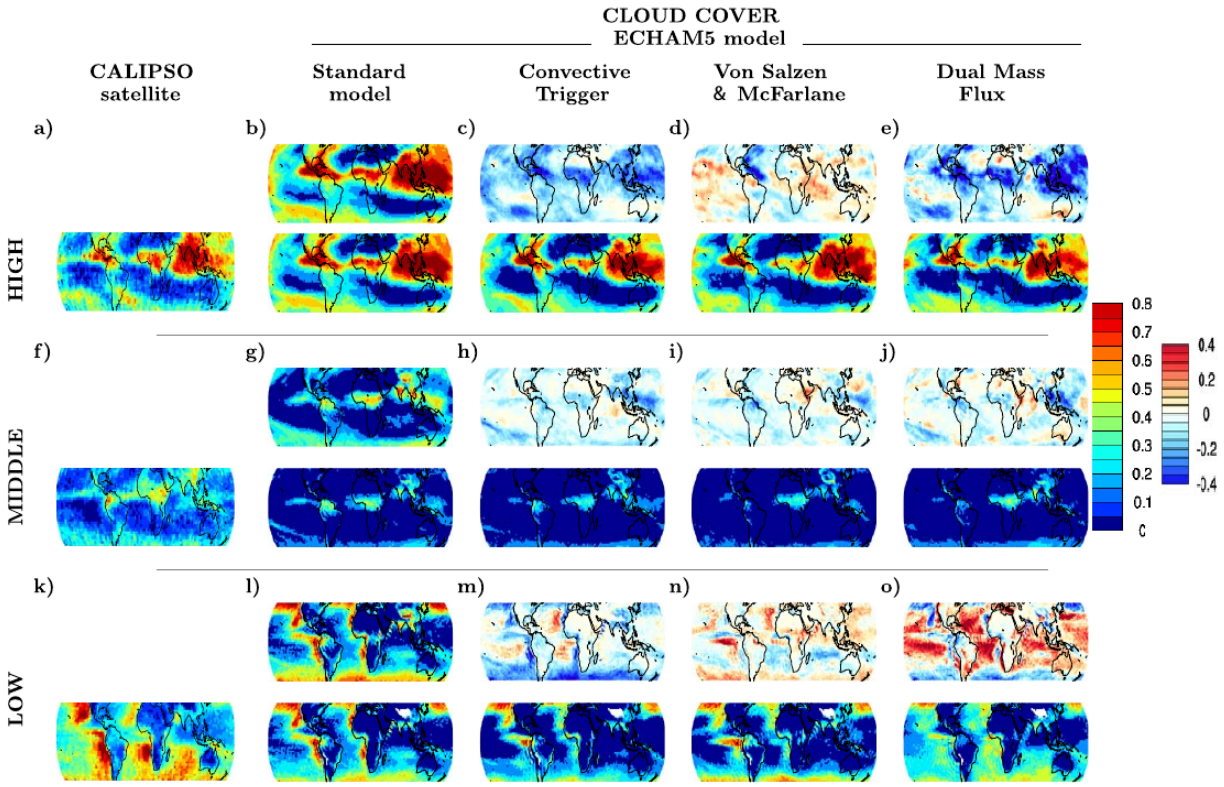

Fig. 1: High-level clouds: (top row) high-level cloud cover for JJA 2007 from 45 N to 45 S in ECHAM5_Std as well as the differences of the three new boundary layer schemes to thestandard model (e.g., Experiment-ECHAM5_Std). (bottom row) CALIPSO retrievals and all models with the lidar simulator. The midlevel and low-level cloud cover is similarly presented. (From Nam et al., 2014).