MSc thesis topics in the Cloud physics group (March 2018)

1. Enhancement of cloud property dataset from tracking algorithm with active measurements and reanalysis databases

Advisors: Dr. Quentin Coopman, Prof. Dr. Corinna Hoose

We have recently developed methods to automatically track a large number of convective clouds and to analyse their transition from liquid to ice cloud tops in a dataset based on the geostationary satellite instrument SEVIRI. In the proposed thesis, it is planned to select some of these cases for a more in-depth analysis using active satellite and ground-based sensors as well as reanalysis data in order to study the liquid-to-ice transition in these clouds.

Keywords: ERA-Interim, MACC, SEVIRI, Cloud tracking, LIDAR, CALIOP, CLOUDSAT, Ground-based measurements, A-train, Aerosol-cloud interactions, Cloud radiative properties, Cloud optical properties

2. Cloud properties from active measurements from space-based instruments and use of forward simulations of Doppler Radar

Advisors: Dr. Coopman, Prof. Dr. Corinna Hoose

With the upcoming launch of EarthCARE (a space-based doppler radar), we expect to gain unprecedented insights into the development of clouds. This thesis will look at case studies of different clouds, which will be simulated with high-resolution models, and apply a forward simulator to find out what additional information exactly can be expected from EarthCARE in comparison already existing measurements (e.g. CloudSat).

Keywords: A-train, MODIS, CALIOP, POLDER, CLOUDSAT, CERES, EarthCARE, Cloud optical properties, Cloud radiative properties, PAMTRA

3. Idealized squall line setup in ICON

Advisors: Dr. Hassan Beydoun, Prof. Dr. Corinna Hoose

In this thesis, we plan to use a new idealized squall line setup in ICON to test a newly developed ice nucleation parameterization and its sensitivity to key dynamic variables (CAPE, wind shear).

4. Secondary ice formation

Advisors: Dr. Hassan Beydoun, Prof. Dr. Corinna Hoose

The role of secondary ice formation in different clouds is still unclear, but is suspected to often dominate over primary ice formation. In this thesis, sensitivity experiments with ICON-LEM-P3 will be conducted regarding the role of secondary ice formation for cloud glaciation and precipitation formation.

The P3 (predicted particle properties) microphysics scheme applies a new approach for a unified treatment of unrimed and rimed ice particles over the entire size range from small ice crystals to hail. It has recently been implemented into ICON-LEM. Here we propose to exploit new advances in secondary ice formation representation in cloud models, particularly ones developed for the default microphysics scheme in ICON.