1. Introduction: focus on autoconversion

- What is autoconversion? Collision/coalescence between cloud droplets.
- How to deal with it in models? Parametrized subgrid scale process.
- Where are the challenges? Parametrizations are based on thresholds in liquid water mass mixing ratios (q), and number concentration (N); however they differ very much from each other, showing big uncertainties over the process as a whole.
- What is the goal of this study? Understand when and where in the cloud onset of precipitation occurs and improve model parametrizations.
- How to get there? Two different approaches:
  - Statistical analysis of one year of measurements from JOYCE and comparison with corresponding COSMO.DE model data: drizzling and non drizzling populations are determined on the basis of Cloudnet target categorization. Analogous populations for model data are calculated and compared with real data.

2. Comparing JOYCE measurements and COSMO model

<table>
<thead>
<tr>
<th>SETTINGS</th>
<th>MODEL</th>
<th>JOYCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cloud type</td>
<td>Single layer liquid clouds</td>
<td>Single layer liquid clouds</td>
</tr>
<tr>
<td>Period</td>
<td>mar 12 - mar 13</td>
<td>mar 12 - mar 13</td>
</tr>
<tr>
<td>Rainy columns</td>
<td>3590</td>
<td>18690</td>
</tr>
<tr>
<td>Non rainy columns</td>
<td>11505</td>
<td>15708</td>
</tr>
<tr>
<td>Categorization tool used</td>
<td>Categorization built on thresholds of mixing ratio</td>
<td>Cloudnet target categorization</td>
</tr>
<tr>
<td>Location</td>
<td>7X7 grid points over JOYCE</td>
<td>JOYCE supersite measurements</td>
</tr>
<tr>
<td>Dataset/instruments</td>
<td>German operational NWP COSMO-DE</td>
<td>Cloud radar, ceilometer, microwave radiometer measurements constrained by temperature profiles from NWP models + derived variables</td>
</tr>
</tbody>
</table>

3. Improved precipitation detection

- Skewness of cloud radar Doppler spectrum: much more sensitive to precipitation onset
  - Technique:
    - Align maximum peak of 10 consecutive Doppler spectra (int. time 1 sec), average and calculate skewness (Luke et al. 2012)

4. Skewness analysis: a case study (17/03/14, JOYCE)

CASE A: NON DRIZZLING

- Drizzle appears, cloud droplets dominate spectra
- Without applying the technique the skewness time series is fluctuating around

CASE B: DRIZZLING

- Spectra aligned to mean Doppler velocity of main peak of the ensemble
- In case of drizzle skewness turns positive in the upper part of the cloud

Future work:

- Statistical analysis of skewness data, simulation of Doppler spectra starting from model data,
- Process study of autoconversion,
- Improve precipitation classification (Cloudnet)