Identifying the autoconversion process in continental stratus and strato-cumulus clouds using novel ground-based remote sensing techniques

C. Acquistapace[1] , U. Löhnert[1], M. Maahn[1], S. Crewell[1], A. Hirsikko[2], P. Kollias[3]

[1]Institute for Geophysics and Meteorology, University of Cologne, [2]Forschungszentrum Jülich GmbH , [3]McGill University, Montreal

Hands on autoconversion

- **What is autoconversion?** Collision/coalescence between cloud droplets (initial phase of warm rain, subgrid microphysical process)
- **Why is it difficult to describe?** Parametrizations mostly rely on thresholds in liquid water mass mixing ratios (big uncertainty on the onset of the process)
- **When and where in the cloud does onset of precipitation occur?**

  2 Approaches:
  - Statistical analysis of Cloudnet target categorization
  - Analysis of Doppler spectra skewness for case studies

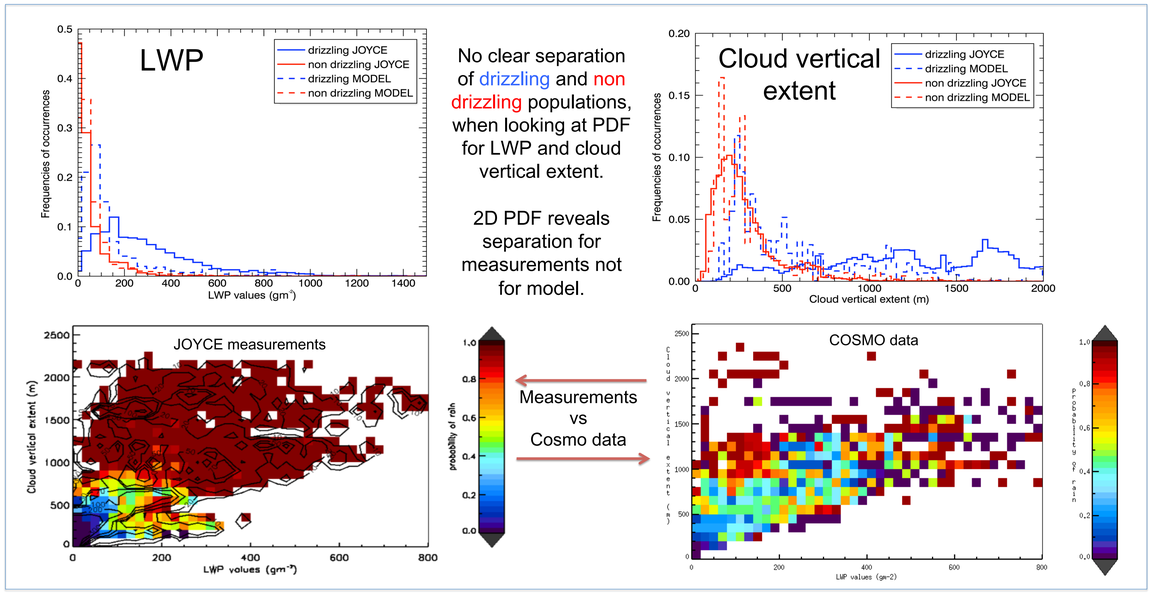
Data settings

Statistical analysis of a one year dataset of real and model data

	MODEL	JOYCE
Which clouds	Single layer liquid clouds	Single layer liquid clouds
period	mar 12 - mar 13	mar 12- mar 13
rainy columns	3590	18690
non rainy columns	11505	15708
Categorization tool used	Categorization built on thresholds on mixing ratios	Cloudnet target categorization
location	7X7 grid points over Juelich	JOYCE supersite measurements
dataset/instruments	COSMO.DE Forecasts at 3 hours	Cloud radar, ceilometer, microwave radiometer measurements constrained by temperature profiles from NWP models + derived variables

- Differentiation of rainy and non rainy clouds in terms of thresholds in LWP and vertical extent
- Exact pinpointing of onset of precipitation not possible by use of Cloudnet target categorization only

Comparing measurements and model



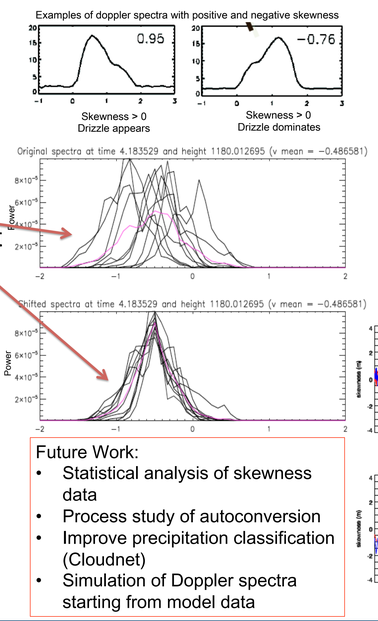
No clear separation of drizzling and non drizzling populations, when looking at PDF for LWP and cloud vertical extent.

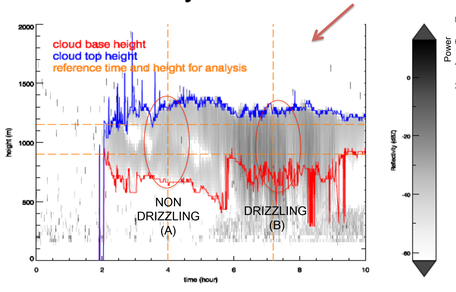
2D PDF reveals separation for measurements not for model.

Measurements vs Cosmo data

Cloud radar: skewness

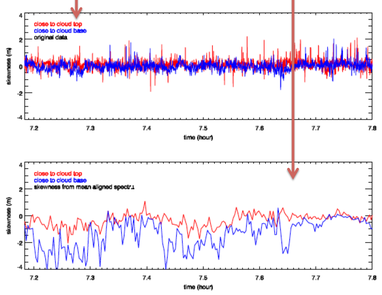
- **Why skewness**? Increases probability of detecting precipitation at a much earlier stage
- **Technique**: aligning maximum peak of 10 consecutive spectra (int. time 1 sec), averaging and calculation of moments (Luke et al. 2012)
- **Case study**: 17/03/14 overview





Why the technique? Without applying the technique the skewness time series is fluctuating around zero.

Applying the alignment technique reveals a negative skewness close to cloud base.



Future Work:
- Statistical analysis of skewness data
- Process study of autoconversion
- Improve precipitation classification (Cloudnet)
- Simulation of Doppler spectra starting from model data

First skewness analysis: a case study (17/03/14, JOYCE)