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A holistic view of precipitation systems from macro- and microscopic perspective

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1. Introduction

- The German initiative High Definition Clouds and Precipitation for advancing Climate Prediction (HD(CP)^2) focuses on improving the accuracy of climate models in relation to cloud and precipitation processes.
- Polarimetric radars widely used in the observations of precipitating systems
- X-band polarimetric radar with auxiliary instruments to obtain a holistic view of precipitation systems

→ To better understand microphysical/macrophysical processes

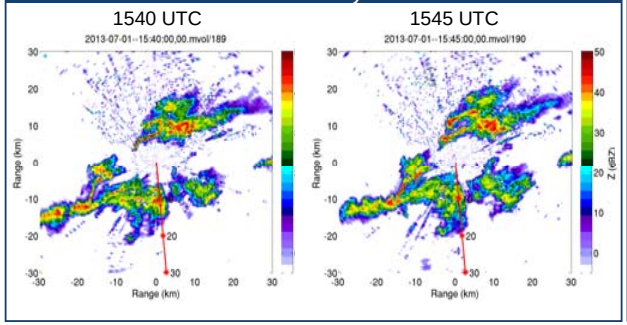
→ To evaluate cloud parameterization schemes

2. University of Bonn X-band radar

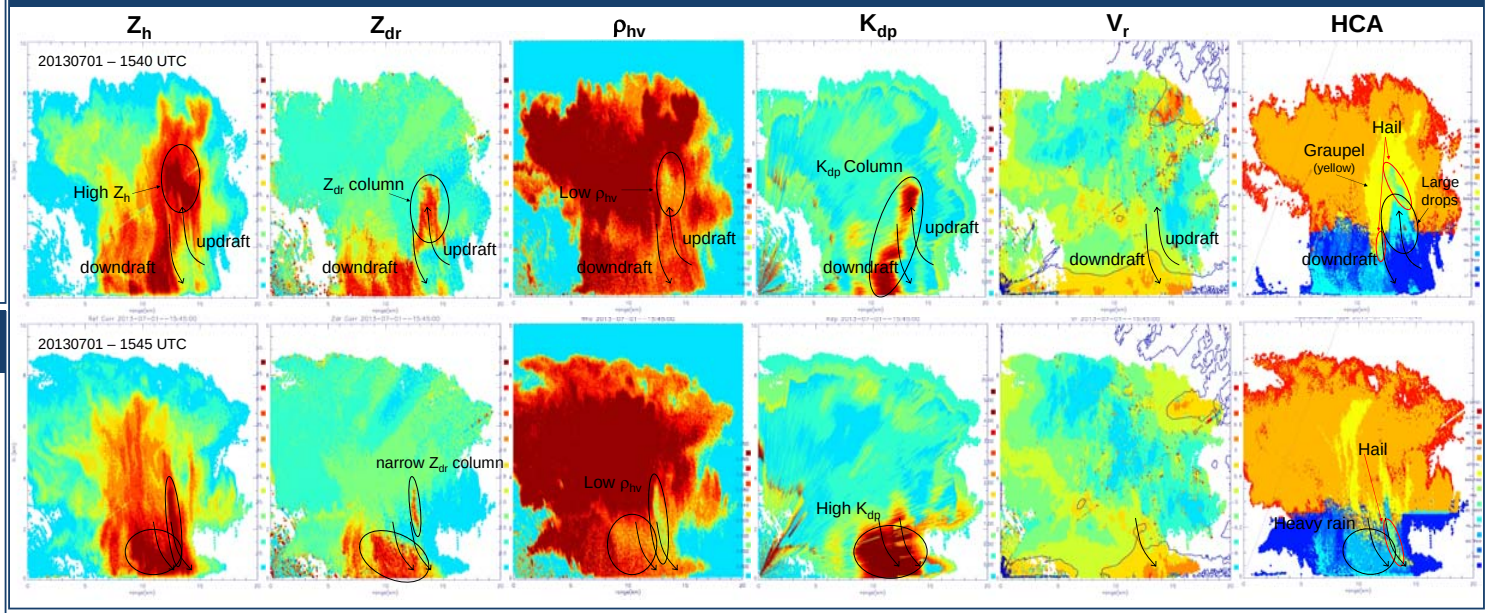
Parameter	Specification
Frequency (GHz)	9.375
Wavelength (cm)	3.2
HPBW (degree)	1.03
Range resolution (m)	75
RHI range (km)	50

- Exclusively dedicated to research
- Volume scans every 5 min
- RHI scans every 5 min, direction depends on particular situation
- RHI's from 0 to 90º elevation, range resolution 75m, 0.2º elevation step.

3. Radar Observations: Reflectivity PPI

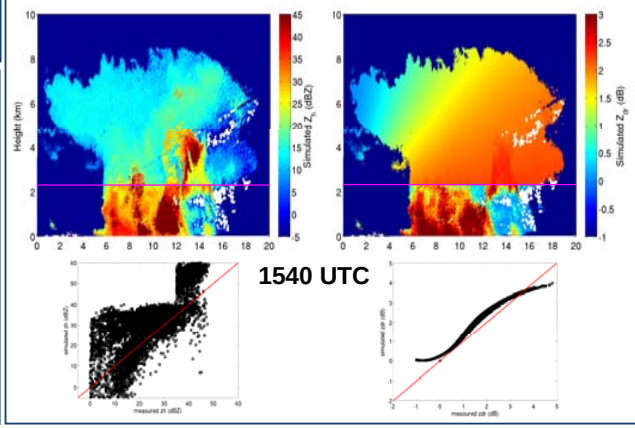


3. Radar Observations: Polarimetric Variables and Hydrometeor classification



4. Radar forward operator

- DSD is a normalized gamma distribution
- Parameters D_0, N_w (or W) retrieved from radar measurements
- Method valid only in rain (no ice phase)
- Tried 3 different methods, the one shown is from Kim et al., JTech, 2010.



- Good agreement in general
- General features captured
- Overestimation of Zh, particularly at higher reflectivity values

5. Discussion

- The frequent RHI's with high resolution in elevation allow for a very detailed look into precipitating systems.
- A convective cell in the mature stage of its life cycle is shown, with all the features well delineated in the polarimetric variables:
  - updraft and downdraft
  - hail shaft
  - Z_{dr} and K_{dp} columns
- The classification algorithm identifies a great amount of graupel mainly above the 0ºC isotherm, a hail shaft, large drops in the updraft region, and heavy rain in the downdraft.
- Radar forward operator used to retrieve Z_h and Z_{dr} assuming a normalized gamma distribution.
- Results show fairly good agreement with observations in general.