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Deutscher Wetterdienst
Wetter und Klima aus einer Hand

Observations of a mesoscale convective system

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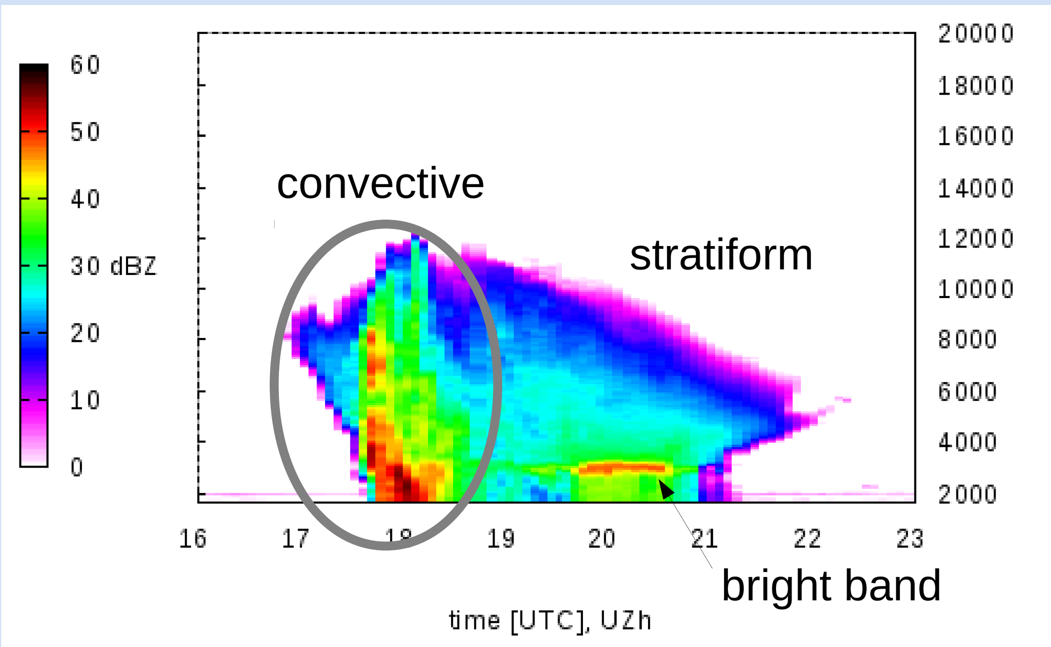
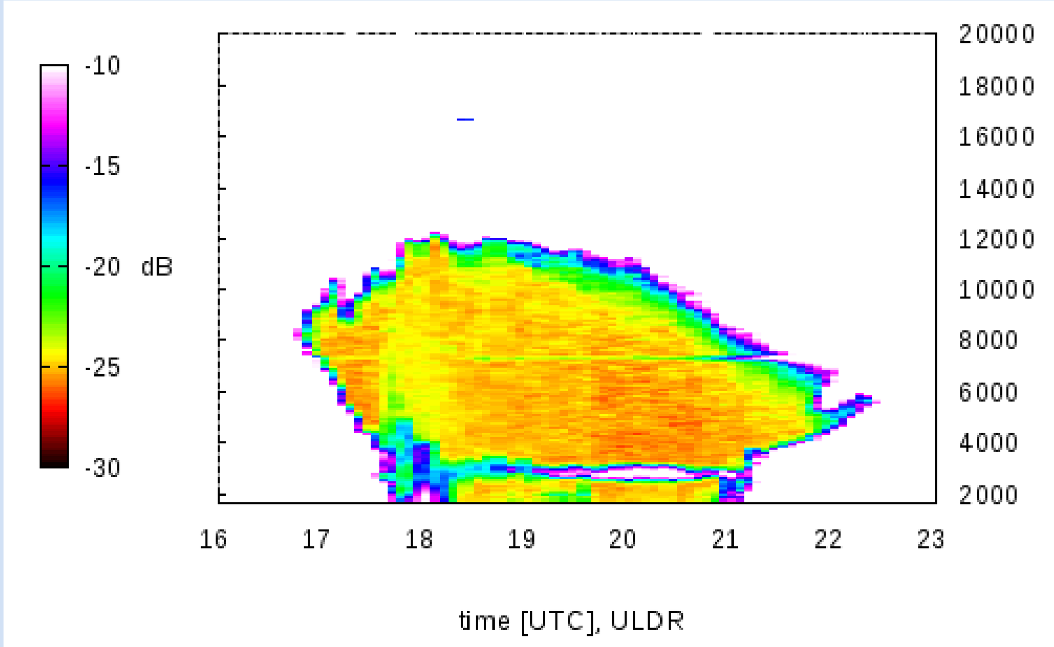
A mesoscale convective system developed over the Alps 10th September 2012. It propagated from the Alps north/north-east towards Munich. Based on observations at the Observatory Hohenpeißenberg, this system produced 47.7 mm rain within about 4 hrs. Hail with a maximum diameter of 8 mm was reported by the weather observer. The polarimetric C-Band research radar was operating in DWD's operational scan mode. The birdbath scan (5 min resolution) provides a high resolution view of this MCS in time and space as it passes over the observatory. The typical stages of a MCS are revealed - the convective part - transition from convective to stratiform - stratiform phase. We find a hail spike feature in the data during the most intense part of the convective phase.

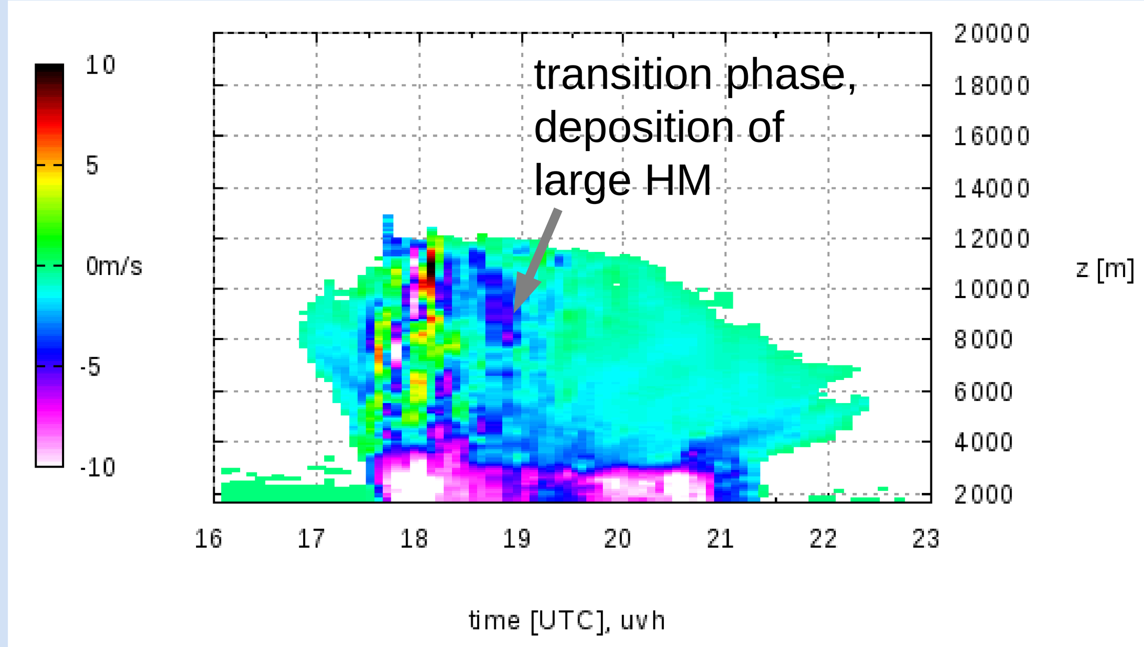
Radar Hohenpeißenberg



Time-height plot of UZh, based on the 90°-scan every 5 min. The initial convective stage and then the stratiform phase is indicated. Displayed data starts from 1680 m ASL (first range bin in the far-field, about 650 m above the radar)



Time-height plot of the linear depolarization ratio ULDR. It reveals nicely the bright band.



Time-height plot of fall velocity, uvh: Doppler velocity, no clutter filter applied, thresholded with SQI < 0.2. Regions with strong updrafts (convective regime, areas with u > 10 m/s) are found. Transition phase with large hydrometeor (HM) fall velocities. Those are HMs injected in the upper troposphere during the convective phase .

Synoptic situation 10.9.2012
Southern Germany was under a south-westerly airflow, the warm air mass was stratified indifferently, weak vertical shear was present. The Munich sounding at 12 UTC had a CAPE value of 950 J/kg. Thunderstorms were triggered over the Alps (orographic forcing). Multiple cells formed and merged into a cluster (horizontal scale ~ 100 km) which moved from the Alps to the North/North-East.

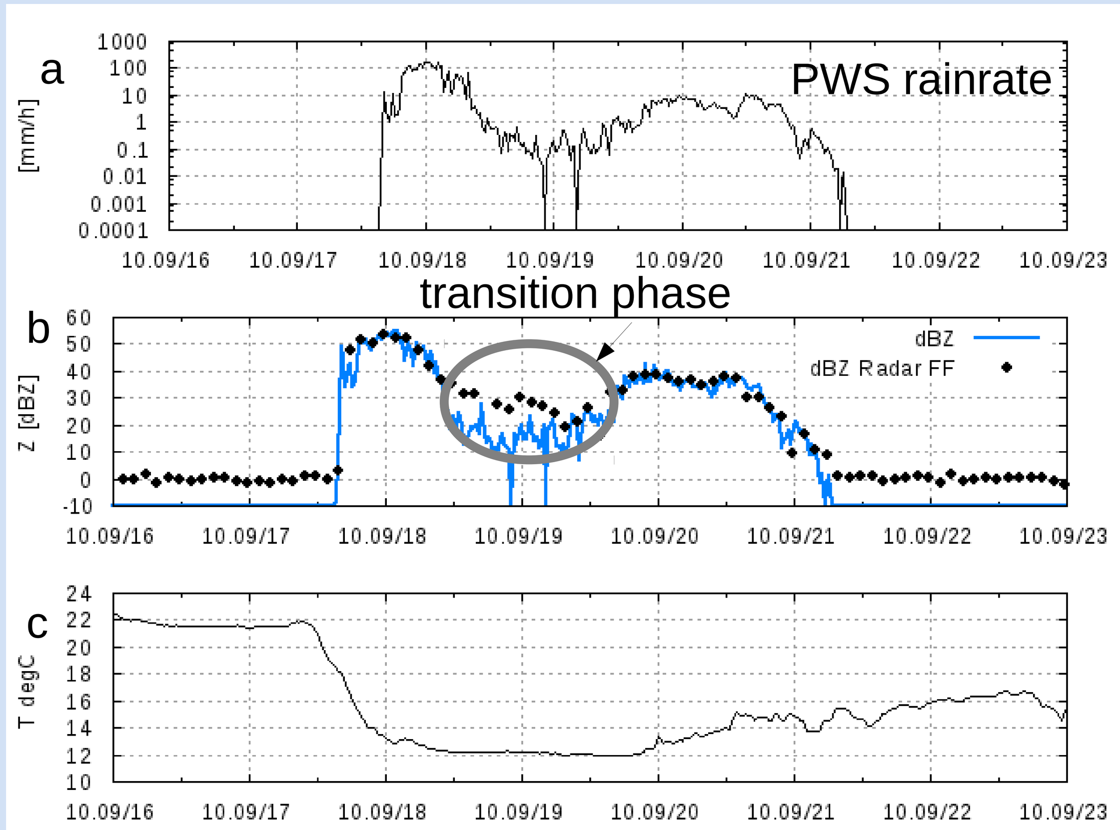
Radar
Data from the research dual-polarisation radar are used to analyse this weather situation (EEC's DWSR5001C/SDP/CE). The DWD radar network consists of 17 operational C-Band systems and one research radar.

Birdbath scan configuration
Every 5 Minute after the volume scan
Sweep 1:
LDR Mode, PW 0.8 µs, PRF 1500 Hz
Sweep 2:
STAR Mode, PW 0.4 µs PRF 2400 Hz
Sweep 3:
STAR Mode, PW 0.8 µs PRF 1500 Hz

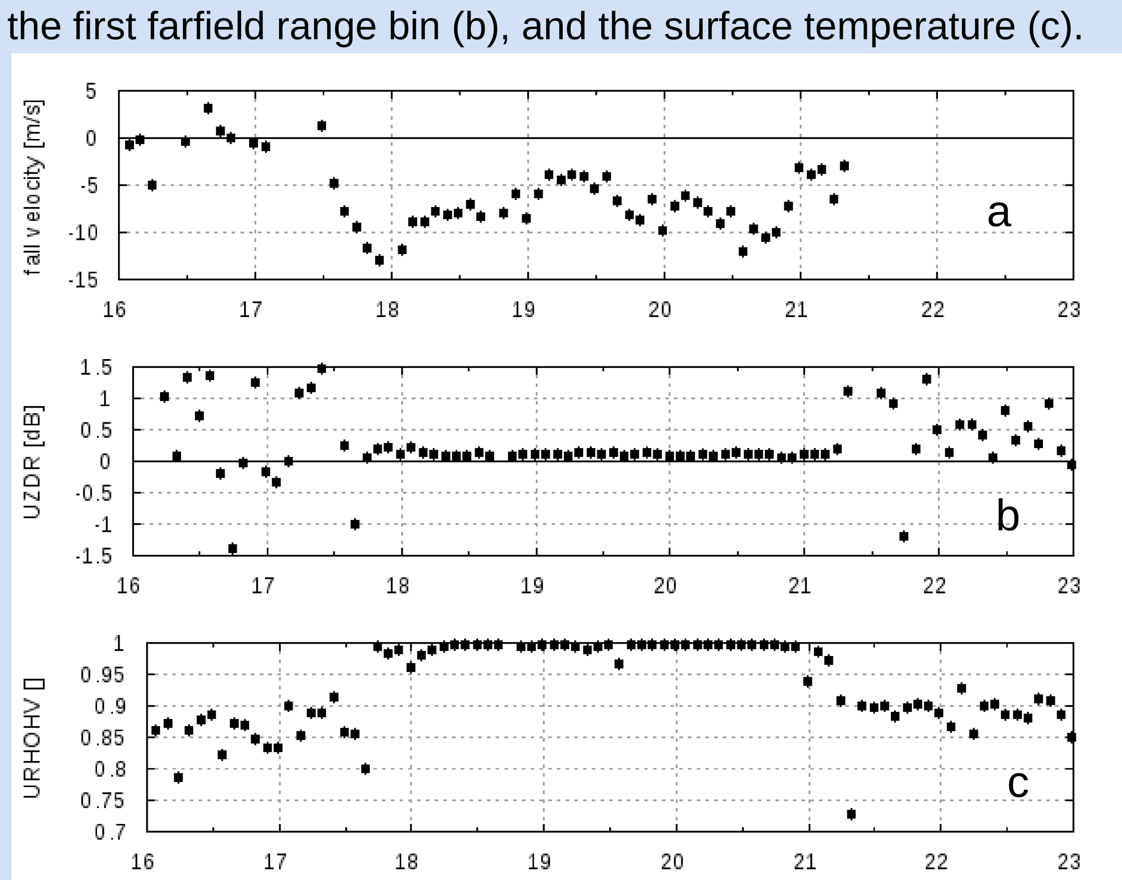
AZ rate 48 °/s, dynamic angle syncing 5°
Corrected (fitered and thresholded) and uncorrected moments are stored.
Main purpose of this scan: to monitor and quantify the ZDR and Phidp offset.

Summary
MCS example from a birdbath scan point of view, which produces high resolution look into the life stages of this system. We show a hail spike feature caused by *small* hail (d_{max} = 8 mm), visible in the Doppler data.
The SQI in the hail spike is small.

Disdrometer measurements (PWS) vs. farfield radar data

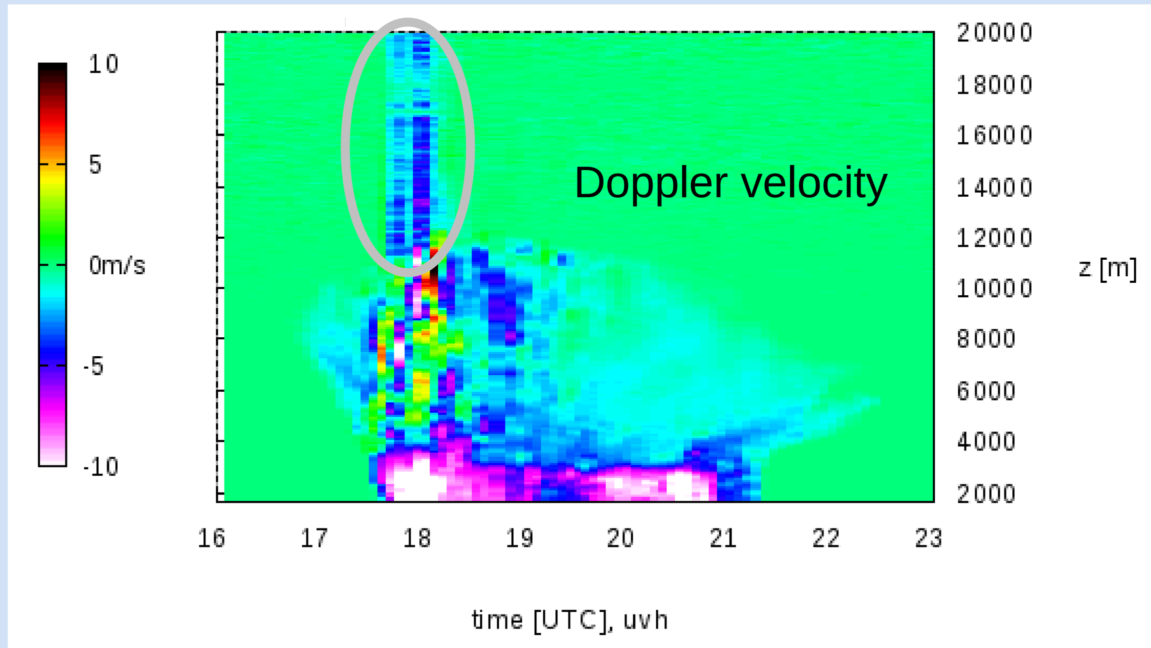


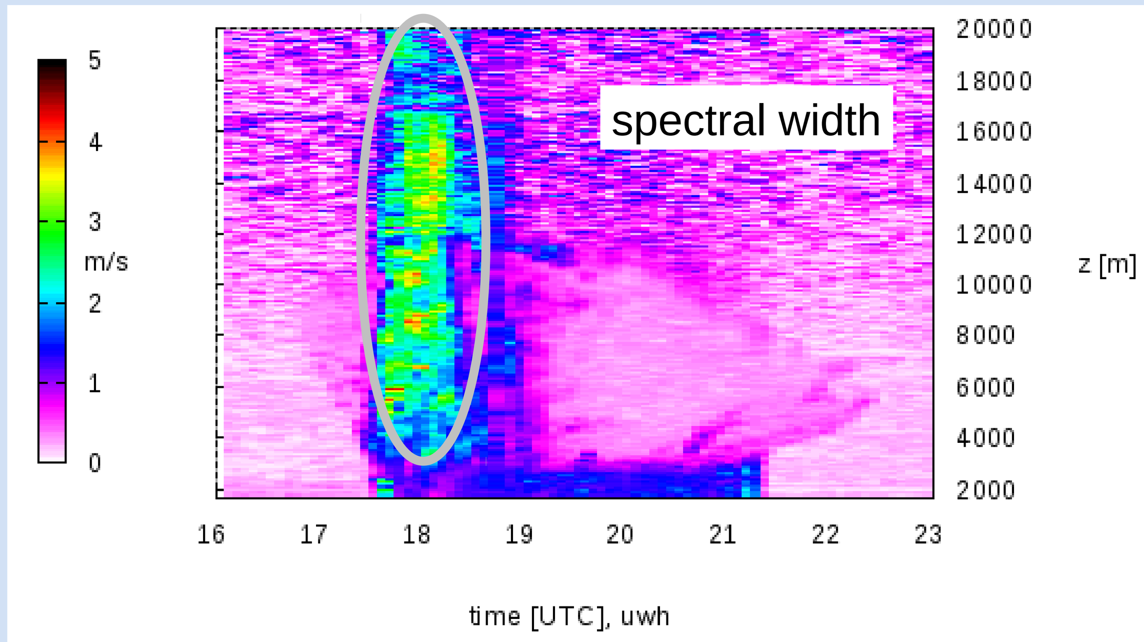
Disdrometer rainrate (a), comparison of radar reflectivity factor Z computed from the disdrometer dsd compared to the radar Z at the first farfield range bin (b), and the surface temperature (c).



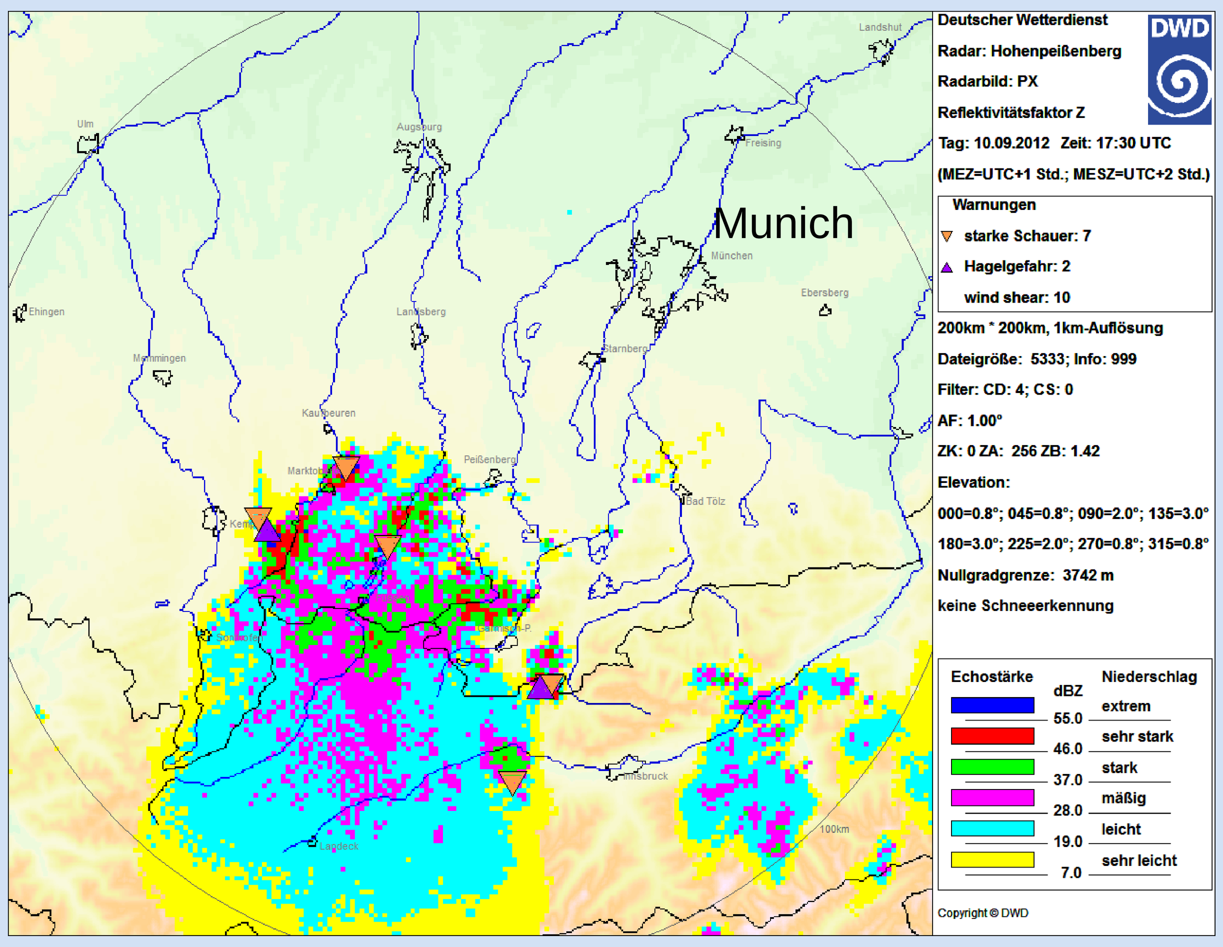
Time series of radar data of the first far-field rangebin. HM fall velocities (a), differential reflectivity UZDR (b, should be zero when looking vertically upward), cross correlation coefficient ρ_{hv}(c).

Hail spike features





Multipath scattering in the presence of small hail.
The back scattered signal is reflected back into the atmosphere by the radar dish. Spectral width is biased.
SQI < 0.2 thresolding is sufficient to filter the hails spike here.



Max. reflectivity Z, 17:30 UTC, 10.9.2012, Hohenpeißenberg radar.

Very good agreement between disdrometer based reflectivity factor Z and the radar based Z at the first farfield rangebin during the convective and stratiform stage. During the transition phase drop size sorting occurs, presumably associated with large vertical dsd gradients and subsequent differences in disdrometer and radar measurements.

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