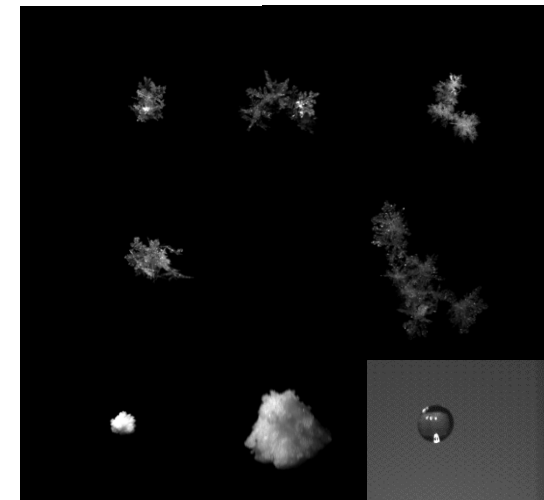
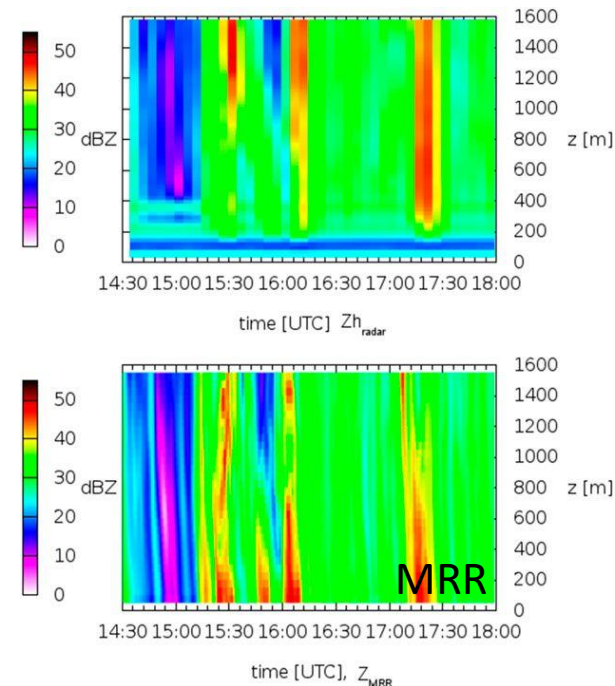
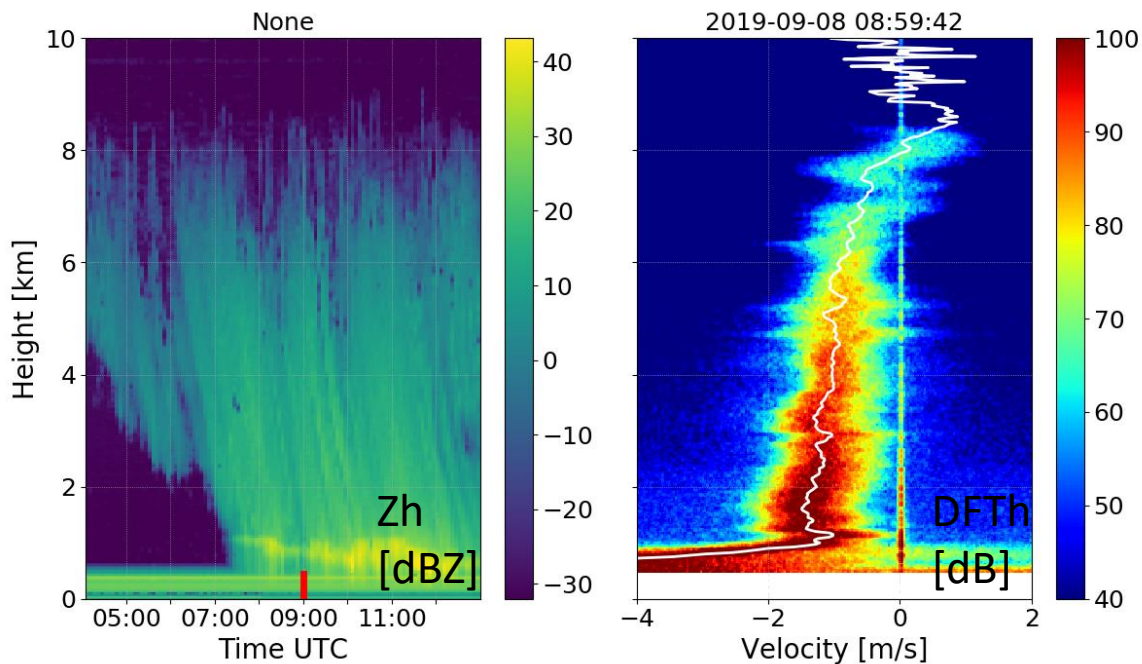


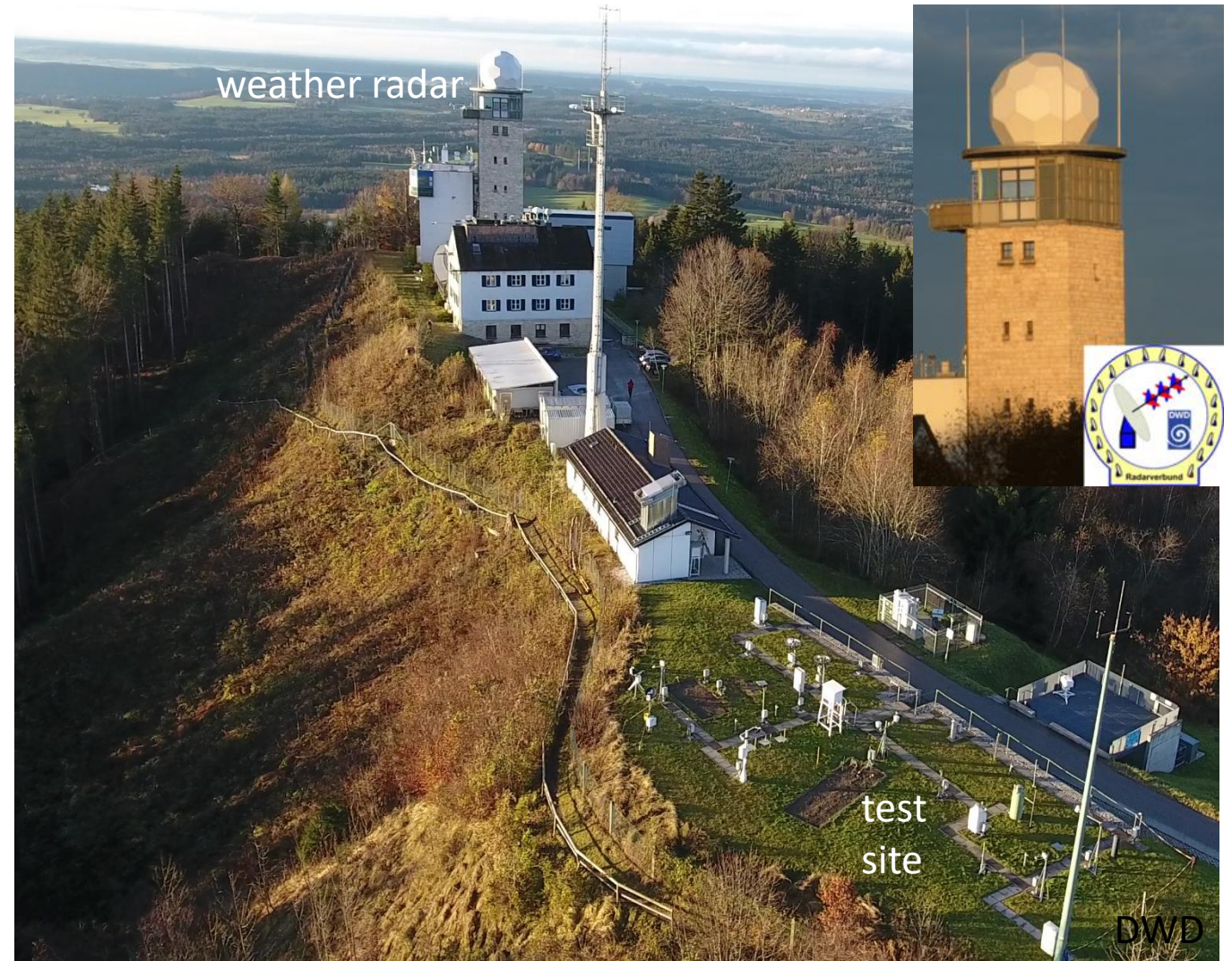
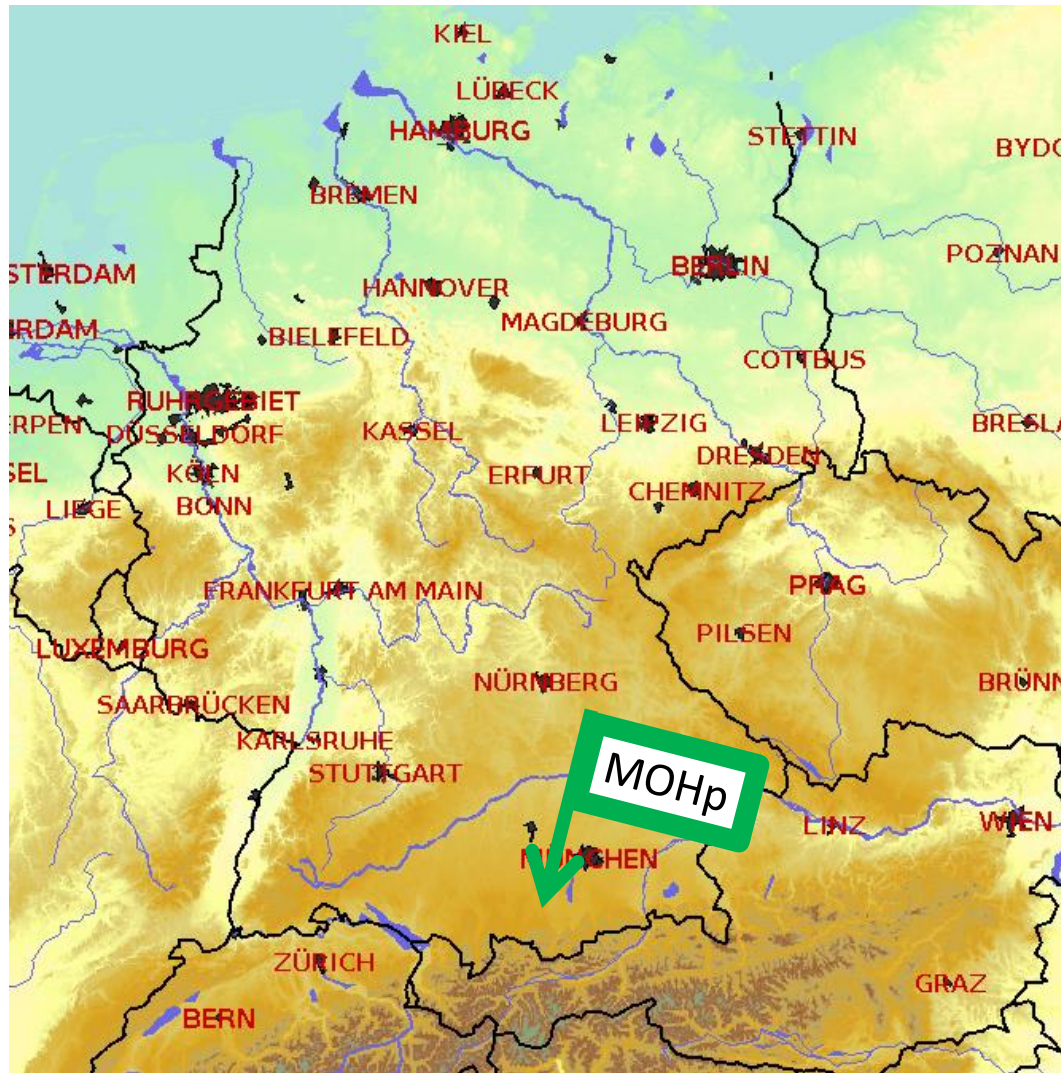
# A seamless profile of the precipitation process of mixed-phase clouds employing data from a polarimetric C-band radar, a Micro Rain Radar and disdrometers

Mathias Gergely, Deutscher Wetterdienst (DWD)



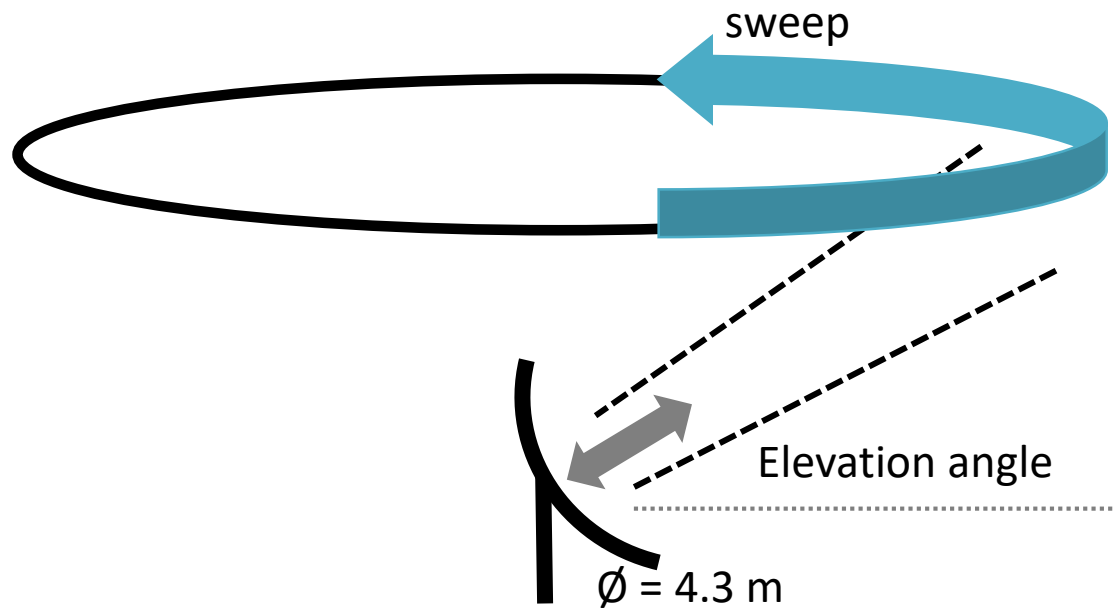
# Setup: weather radar + MRR + in situ sensors

- MOHp (DWD) Hohenpeißenberg, ~ 1000 m a.s.l., 50 km SW of Munich



# Idea: weather radar + MRR + in situ sensors

- MOHp (DWD) Hohenpeißenberg, ~ 1000 m a.s.l., 50 km SW of Munich

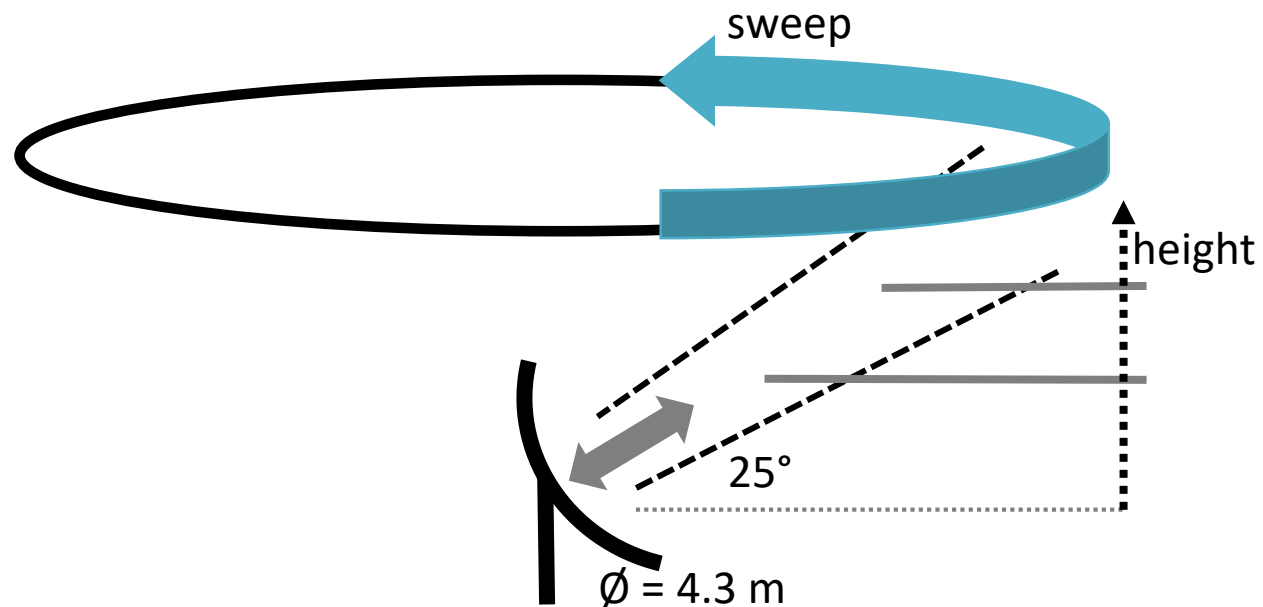


C-band polarimetric  
Doppler radar:

- Polarimetric moments  $Z_h$ ,  $Z_{DR}$ , ...
- Doppler spectrum

# Idea: weather radar + MRR + in situ sensors

- MOHp (DWD) Hohenpeißenberg, ~ 1000 m a.s.l., 50 km SW of Munich



C-band polarimetric  
Doppler radar:

- Polarimetric moments  $Z_h$ ,  $Z_{DR}$ , ...
- Doppler spectrum

Quasi-Vertical Profile (QVP)  
for  $25^\circ$  elevation

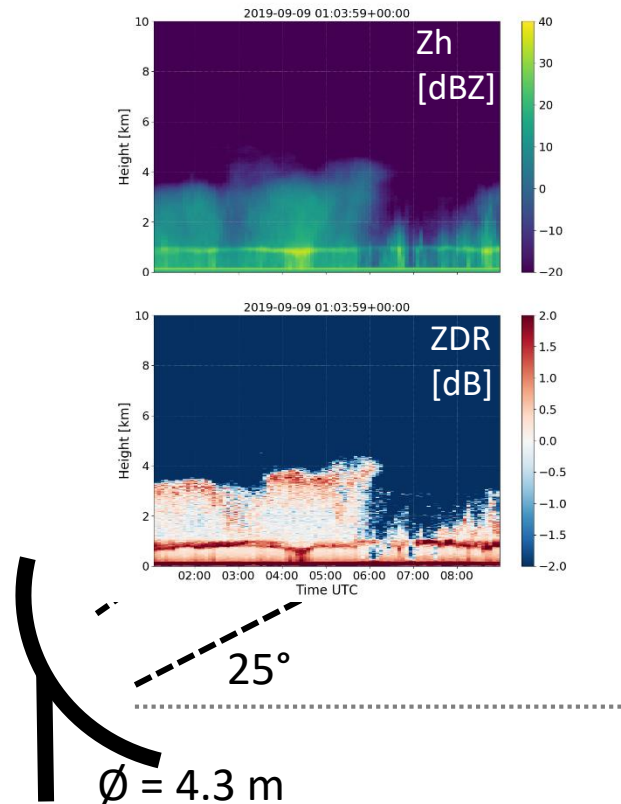
$$\rightarrow \Delta_{\text{hor}} / \Delta_{\text{ver}} \approx 2.1$$

OR

- for limited azimuth ranges
- from multiple elevations

# Idea: weather radar + MRR + in situ sensors

- MOHp (DWD) Hohenpeißenberg, ~ 1000 m a.s.l., 50 km SW of Munich



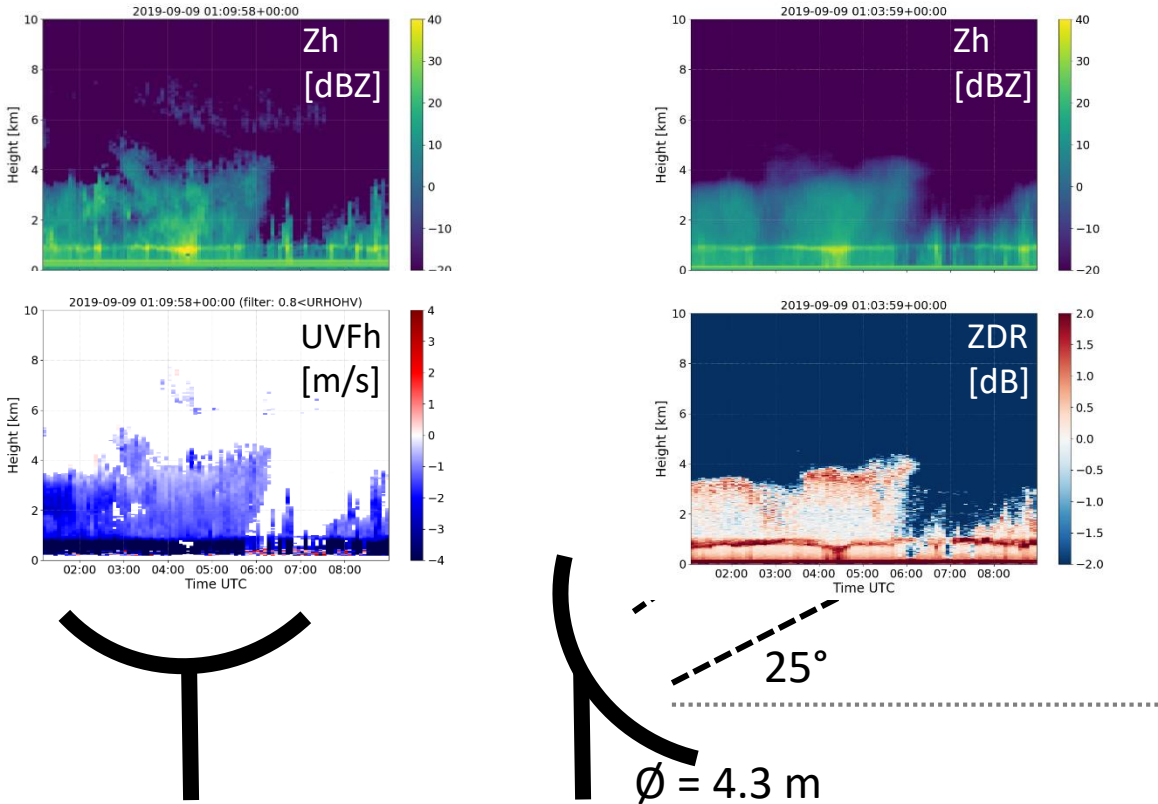
C-band polarimetric

Doppler radar:

- Polarimetric moments Zh, ZDR, ...
- Doppler spectrum

# Idea: weather radar + MRR + in situ sensors

- MOHp (DWD) Hohenpeißenberg, ~ 1000 m a.s.l., 50 km SW of Munich



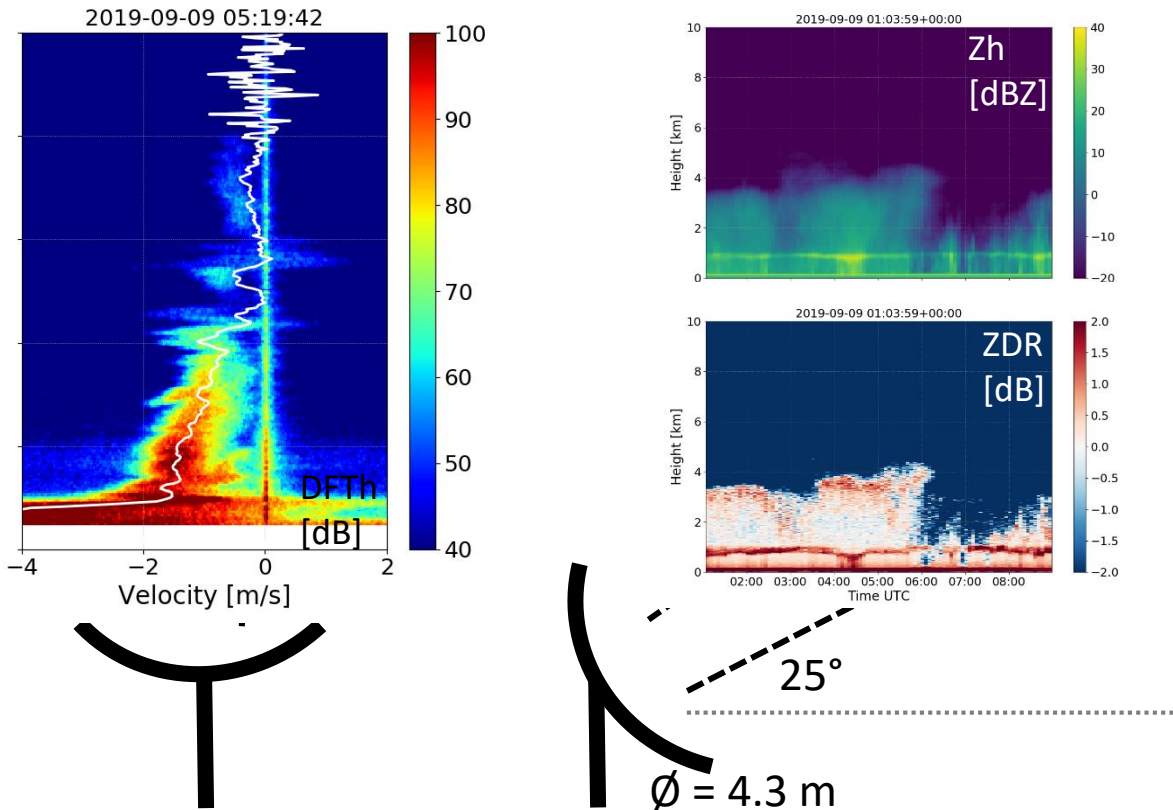
C-band polarimetric

Doppler radar:

- Polarimetric moments  $Z_h$ ,  $ZDR$ , ...
- Doppler spectrum

# Idea: weather radar + MRR + in situ sensors

- MOHp (DWD) Hohenpeißenberg, ~ 1000 m a.s.l., 50 km SW of Munich

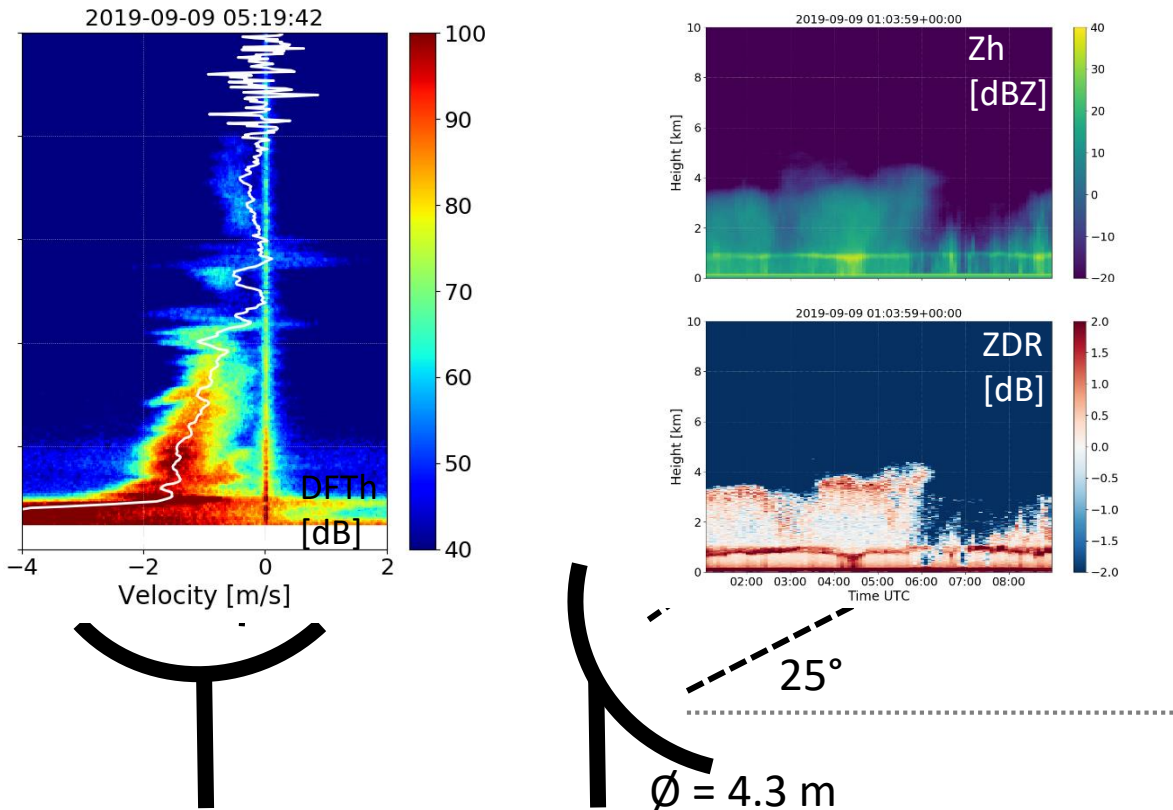


C-band polarimetric  
Doppler radar:

- Polarimetric moments Zh, ZDR, ...
- Doppler spectrum

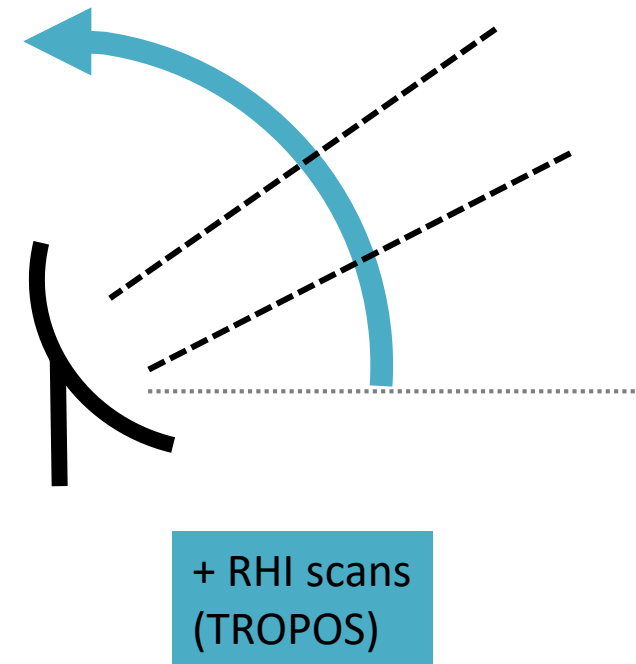
# Idea: weather radar + MRR + in situ sensors

- MOHp (DWD) Hohenpeißenberg, ~ 1000 m a.s.l., 50 km SW of Munich



C-band polarimetric  
Doppler radar:

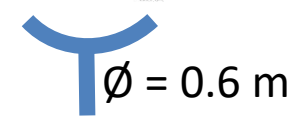
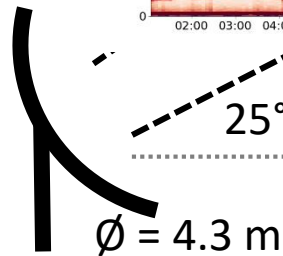
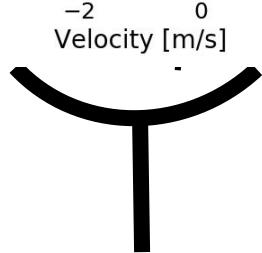
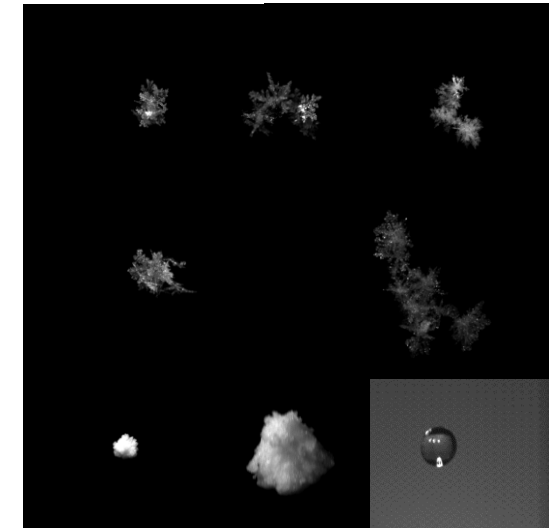
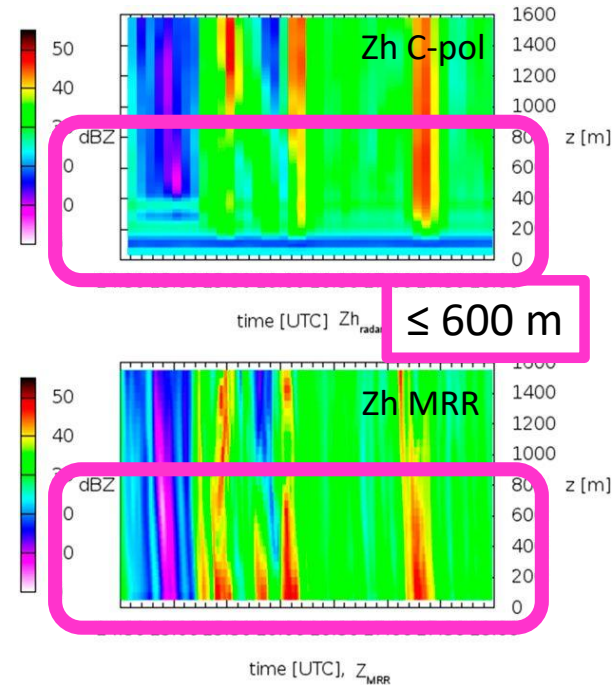
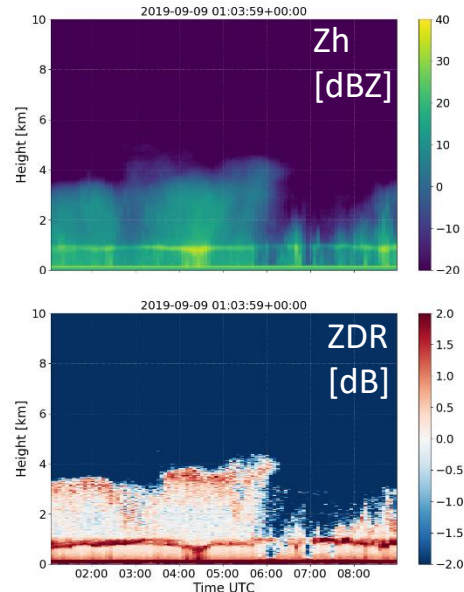
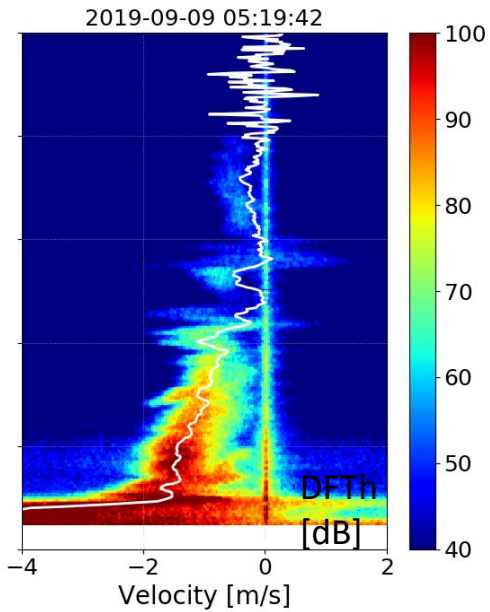
- Polarimetric moments Z<sub>h</sub>, ZDR, ...
- Doppler spectrum





# Idea: weather radar + MRR + in situ sensors

- MOHp (DWD) Hohenpeißenberg, ~ 1000 m a.s.l., 50 km SW of Munich



C-band polarimetric  
Doppler radar:

- Polarimetric moments Zh, ZDR, ...
- Doppler spectrum



K-band FMCW  
radar:

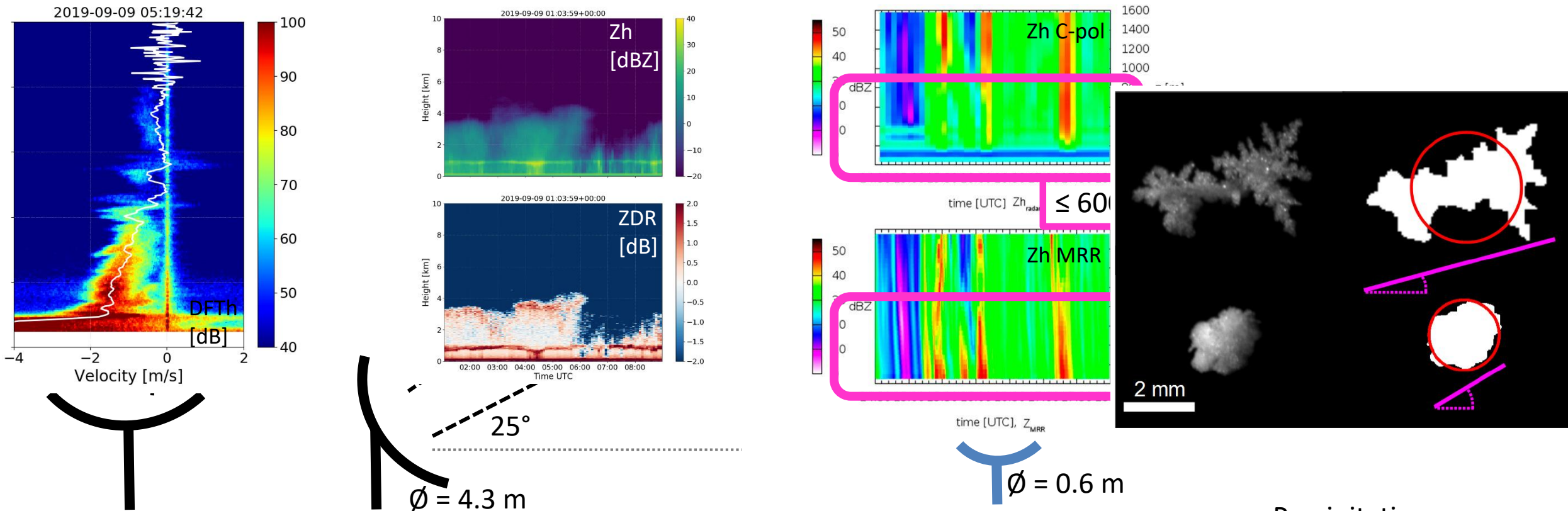
- Reflectivity Z
- Doppler spectrum

Precipitation gauges,  
disdrometers:

- Precipitation rate
- Particle size distribution
- Particle shape (Thies 3D)

# Idea: weather radar + MRR + in situ sensors

- MOHp (DWD) Hohenpeißenberg, ~ 1000 m a.s.l., 50 km SW of Munich



C-band polarimetric  
Doppler radar:

- Polarimetric moments Zh, ZDR, ...
- Doppler spectrum



K-band FMCW  
radar:

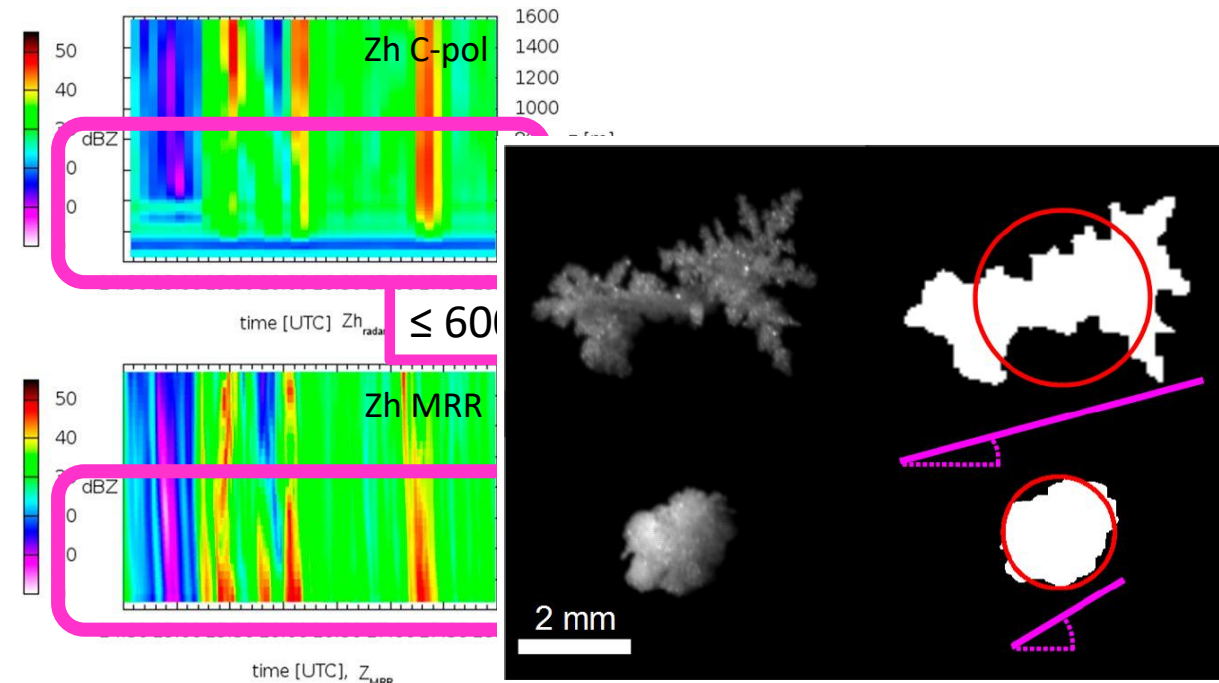
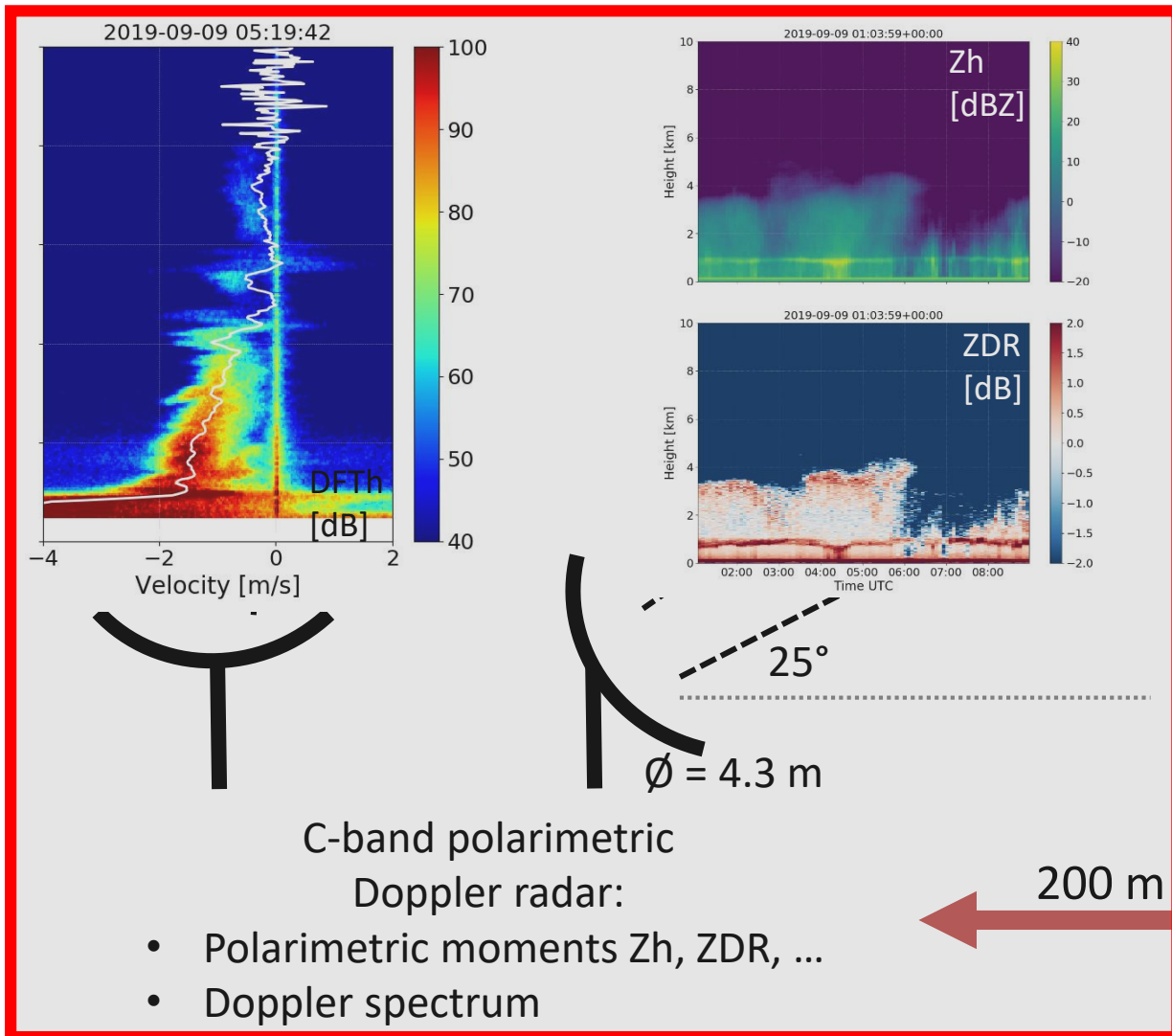
- Reflectivity Z
- Doppler spectrum

Precipitation gauges,  
disdrometers:

- Precipitation rate
- Particle size distribution
- Particle shape (Thies 3D)

# Idea: weather radar + MRR + in situ sensors

- MOHp (DWD) Hohenpeißenberg, ~ 1000 m a.s.l., 50 km SW of Munich



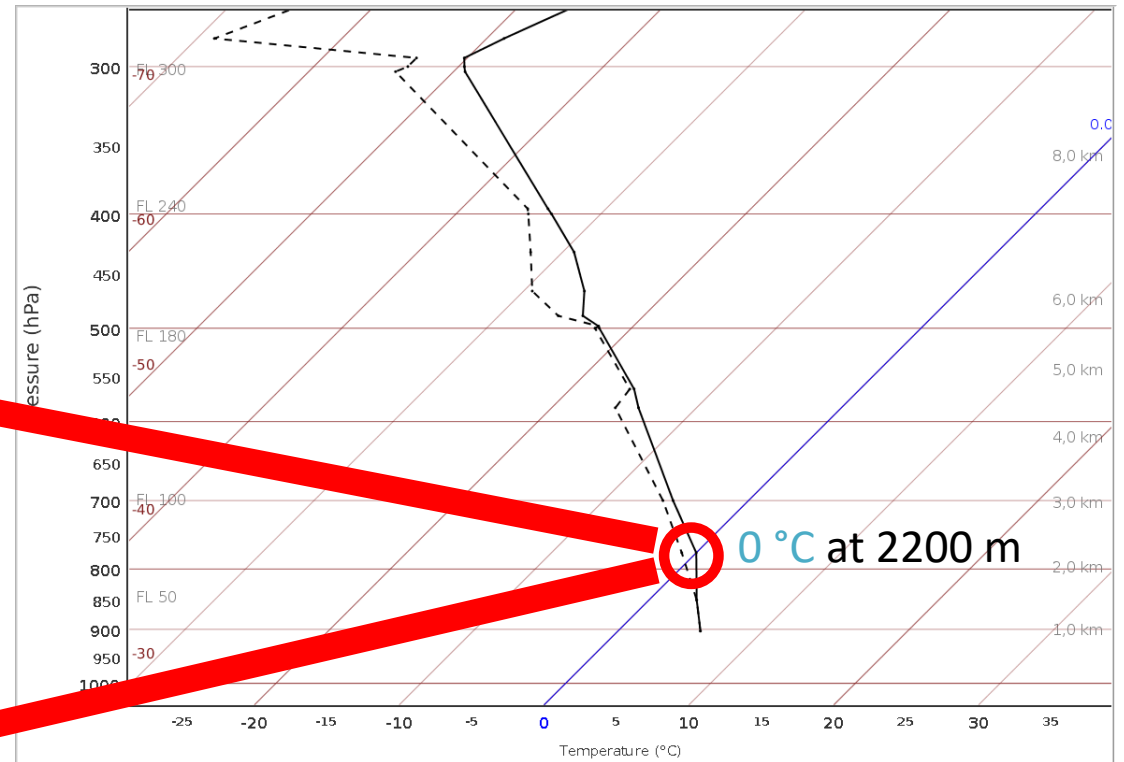
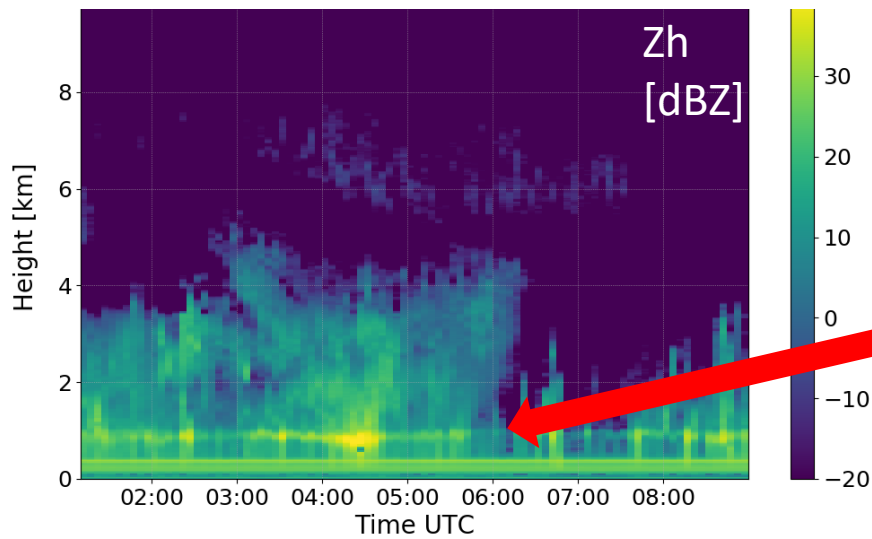
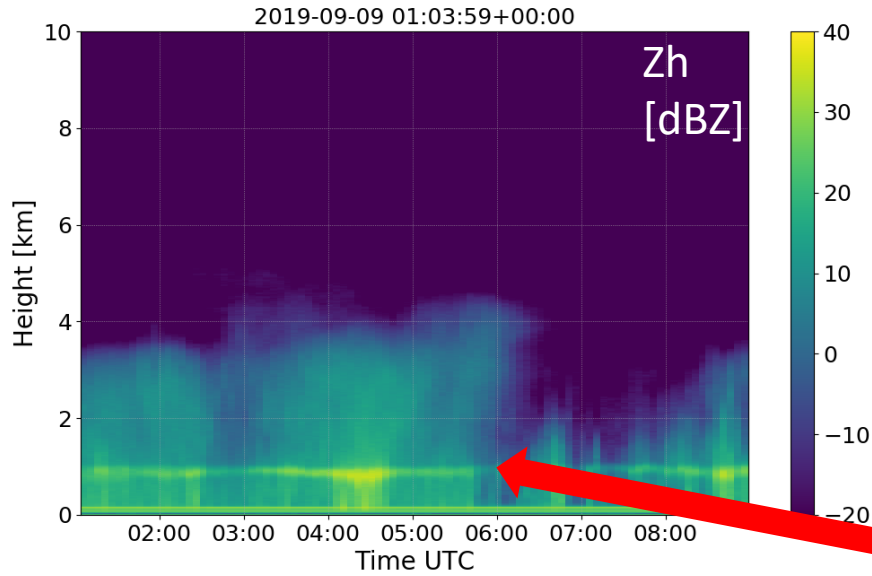
K-band FMCW radar:

- Reflectivity Z
- Doppler spectrum

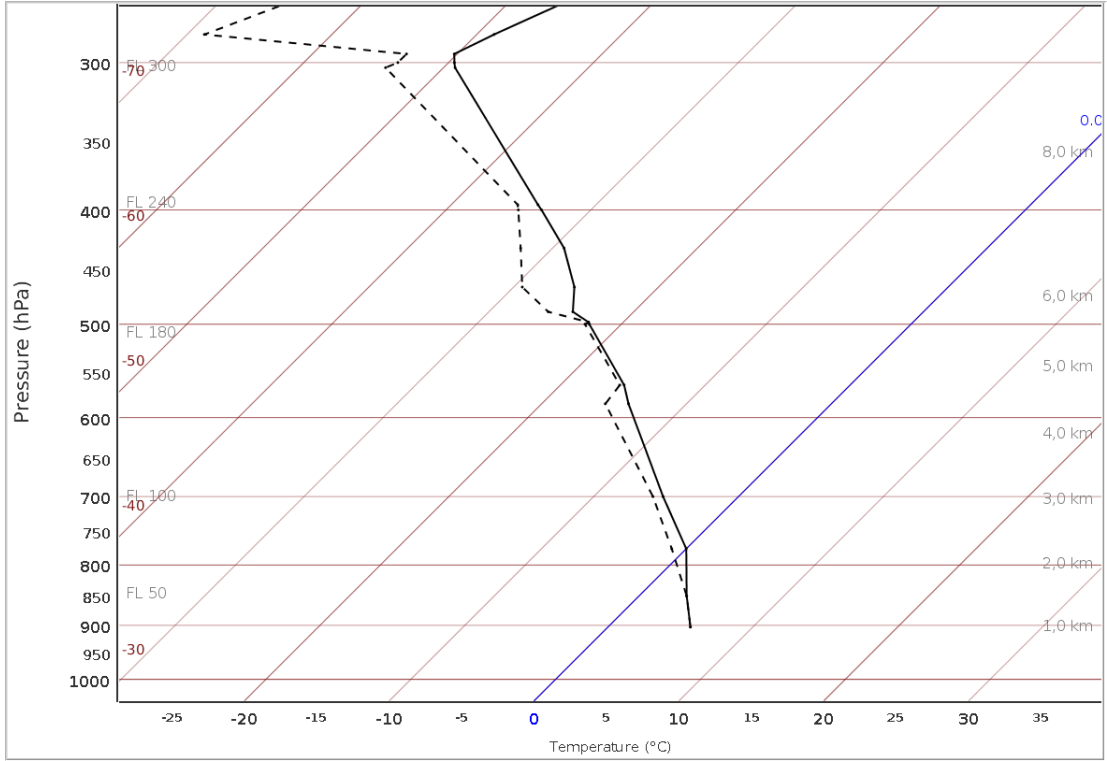
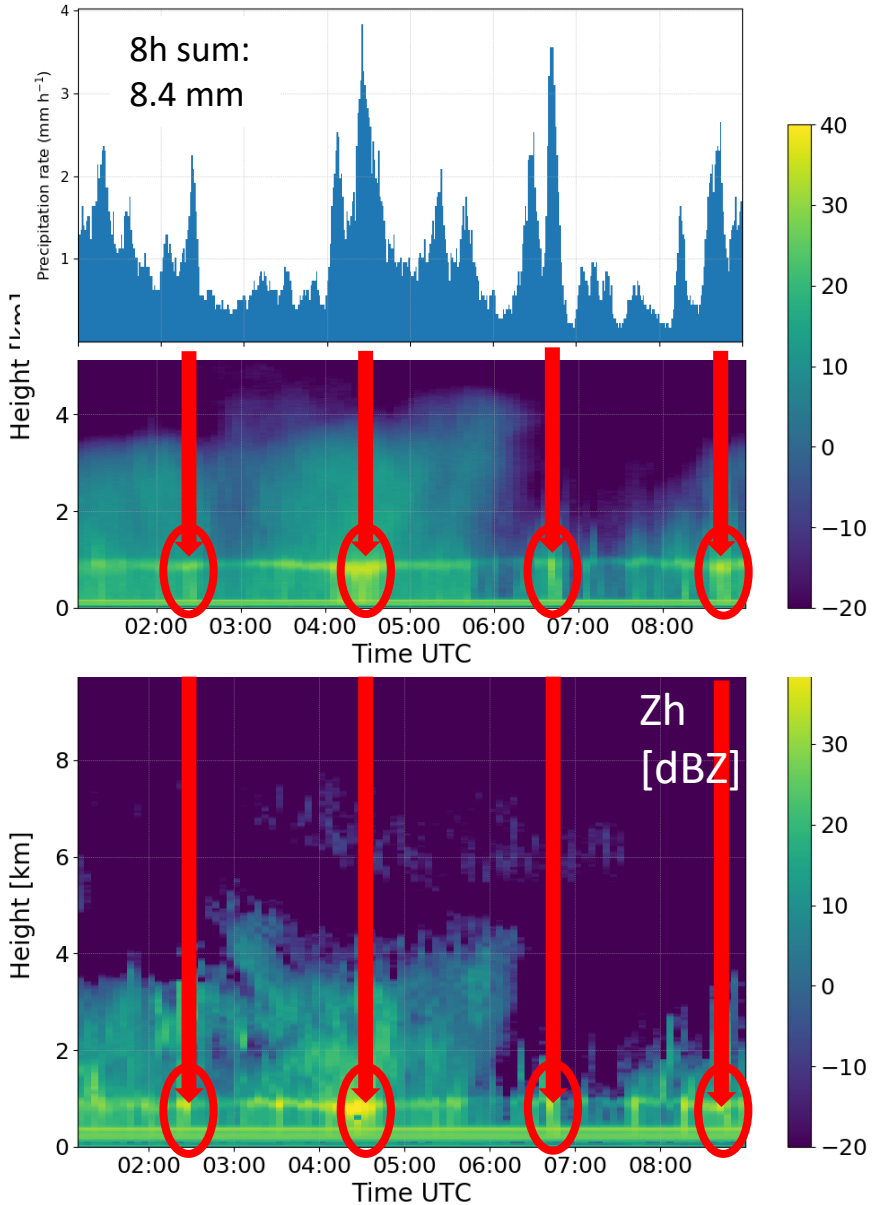
Precipitation gauges, disdrometers:

- Precipitation rate
- Particle size distribution
- Particle shape (Thies 3D)

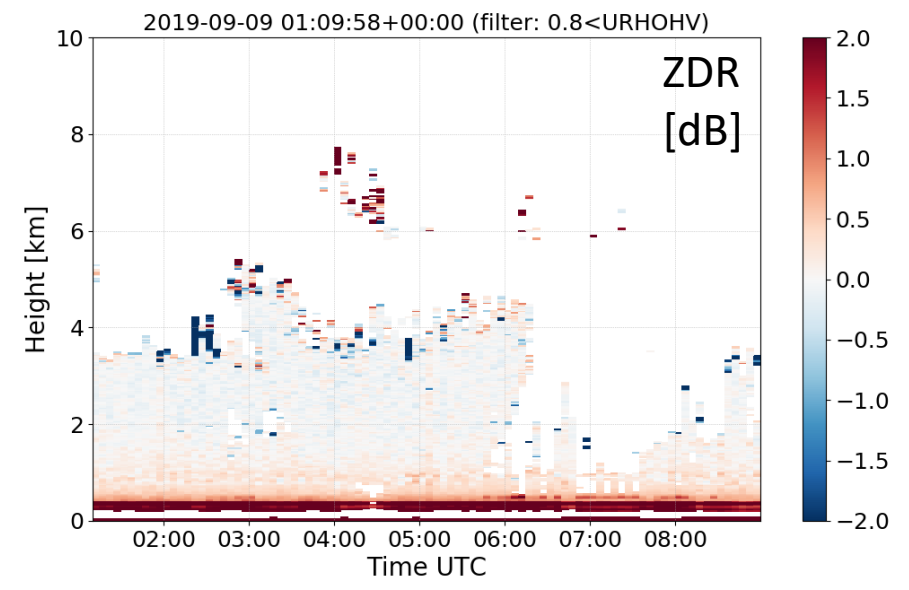
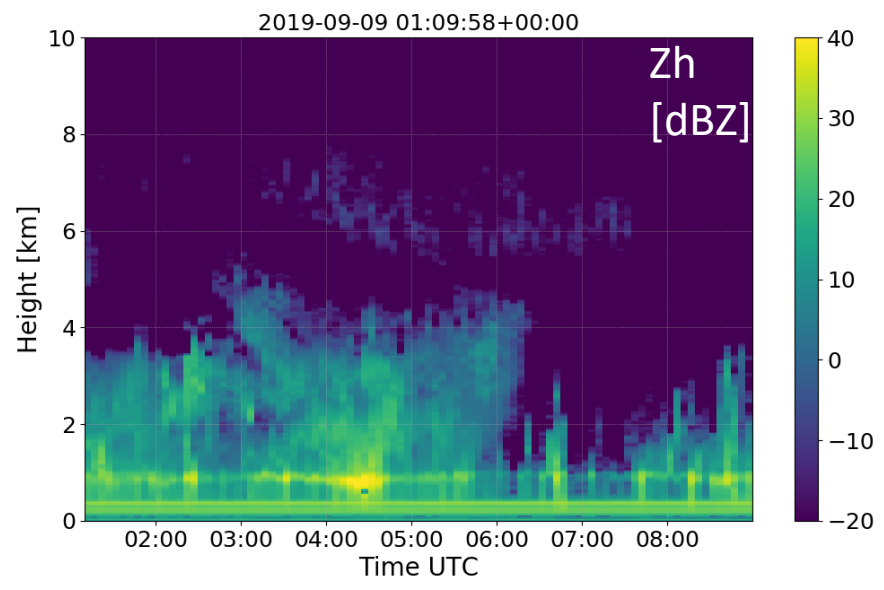
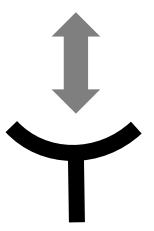
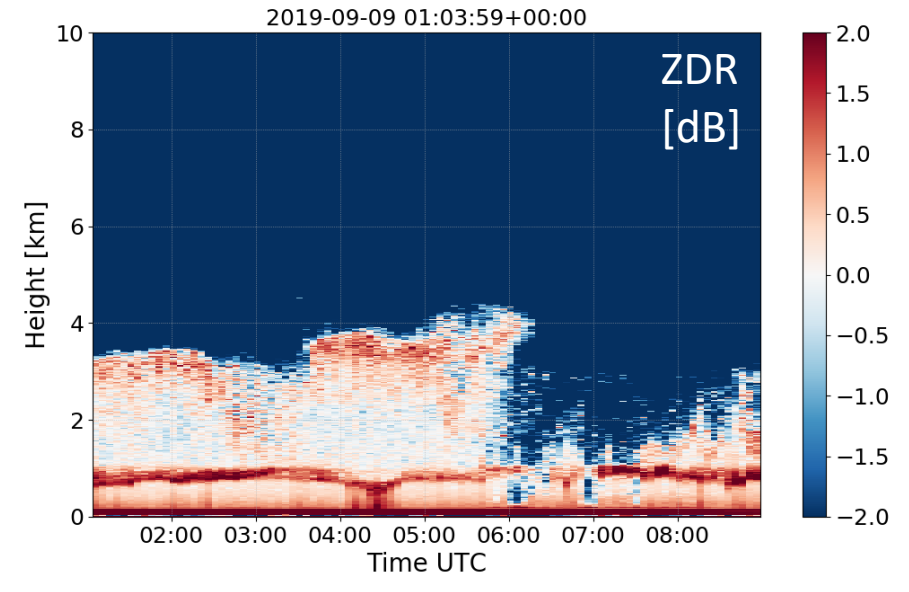
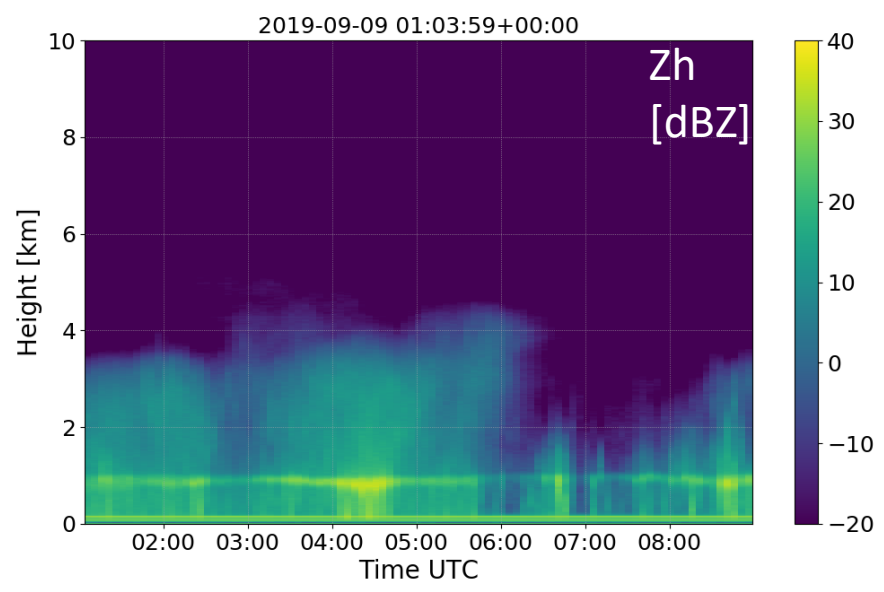
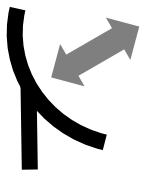
# Example: 09 Sep 2019



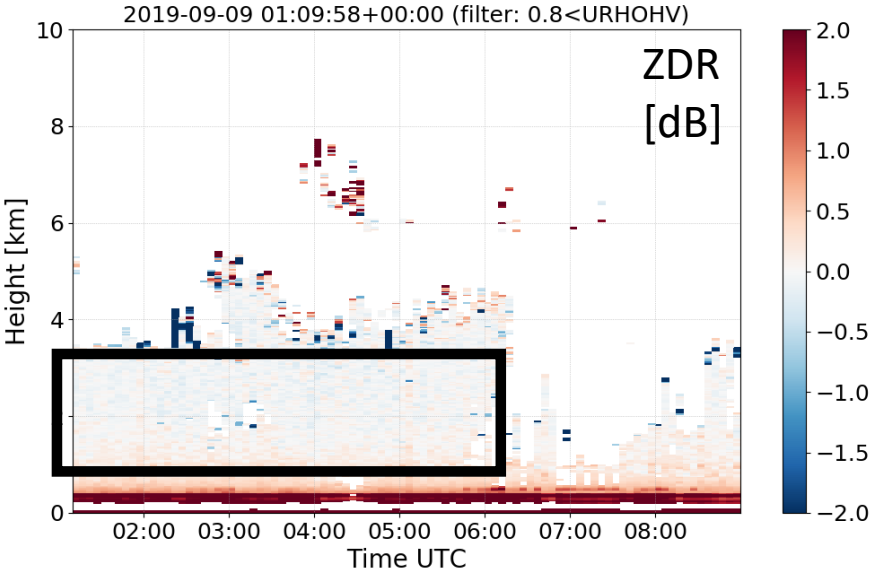
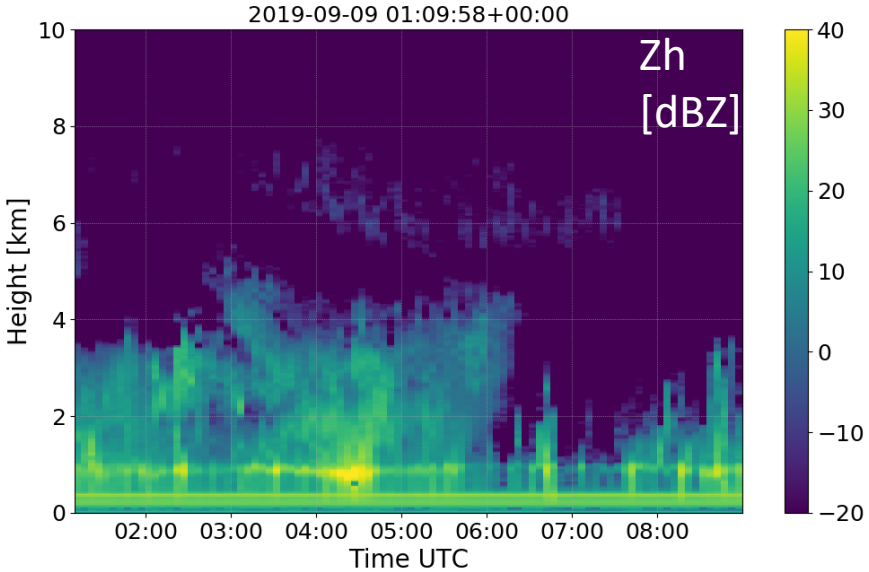
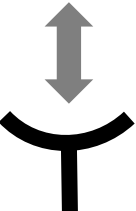
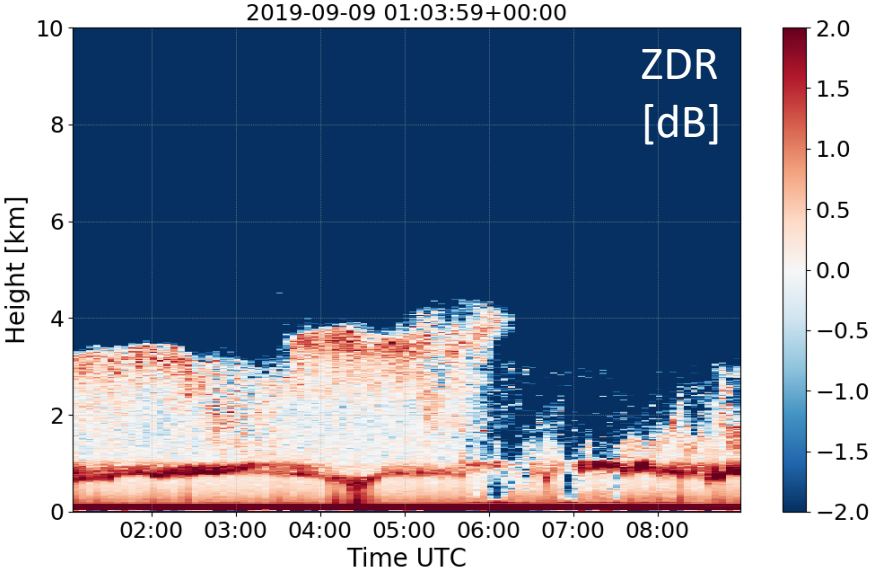
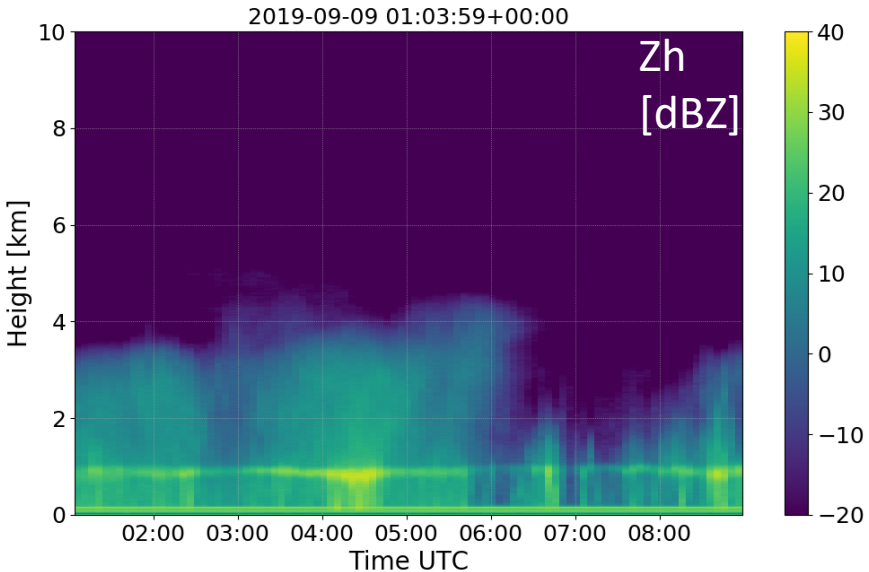
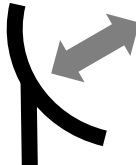
# Example: 09 Sep 2019



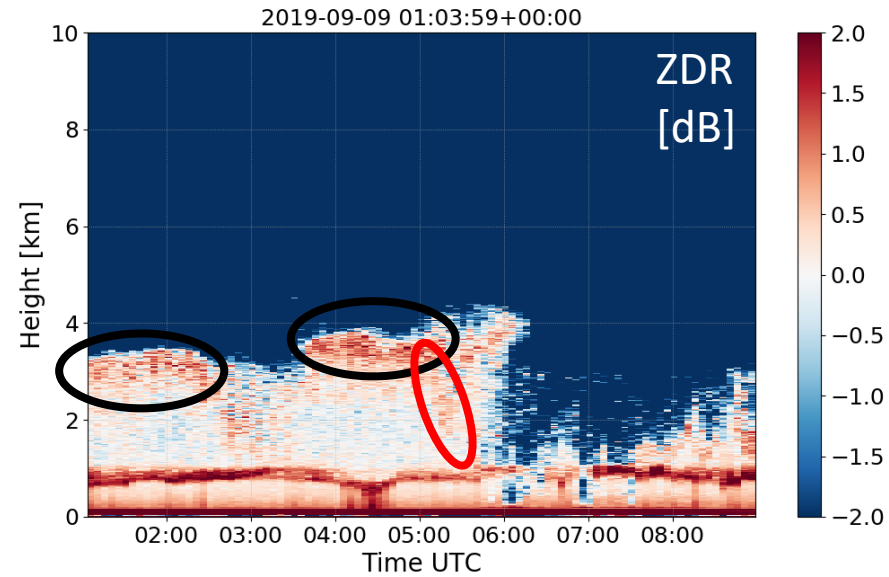
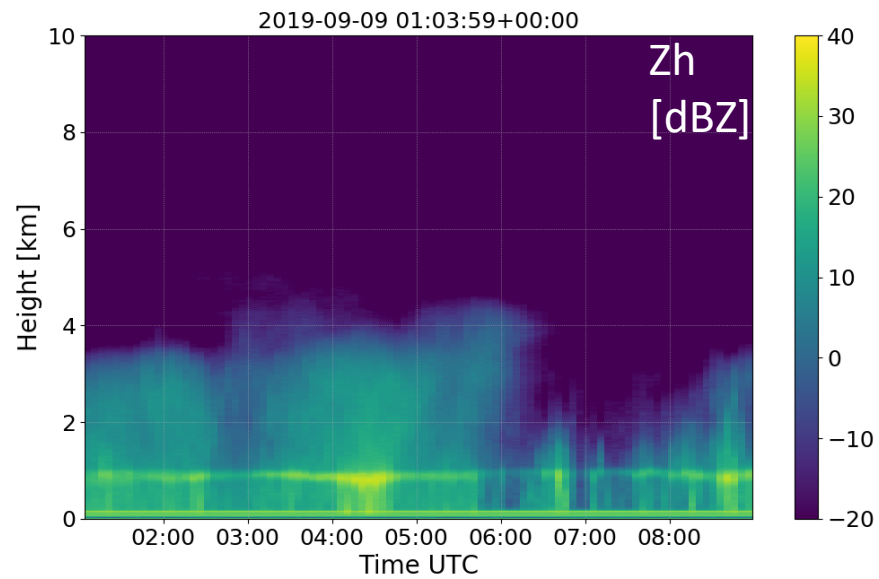
# Example: 09 Sep 2019



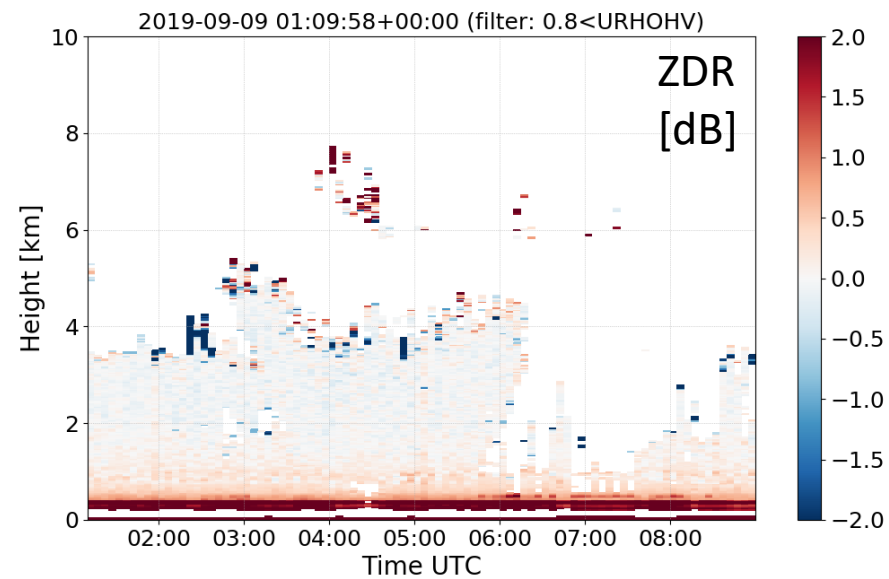
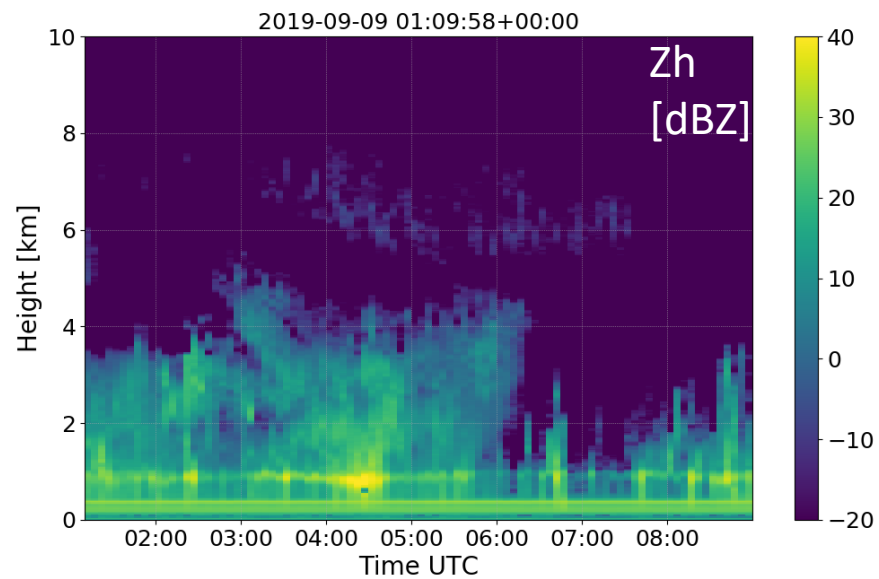
# Example: 09 Sep 2019



# Example: 09 Sep 2019

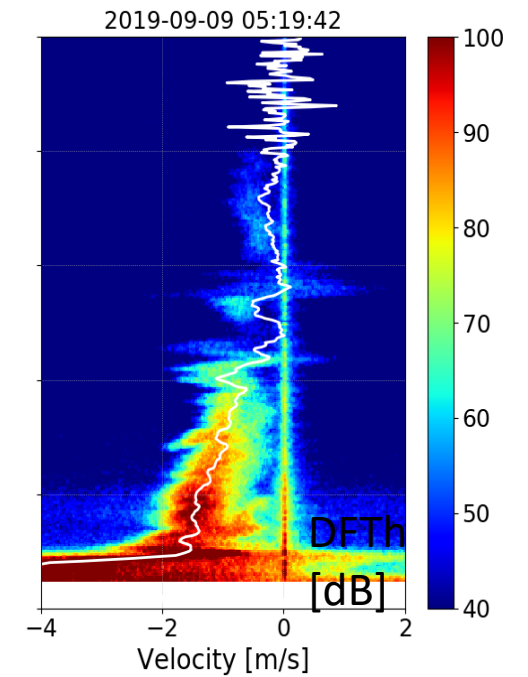
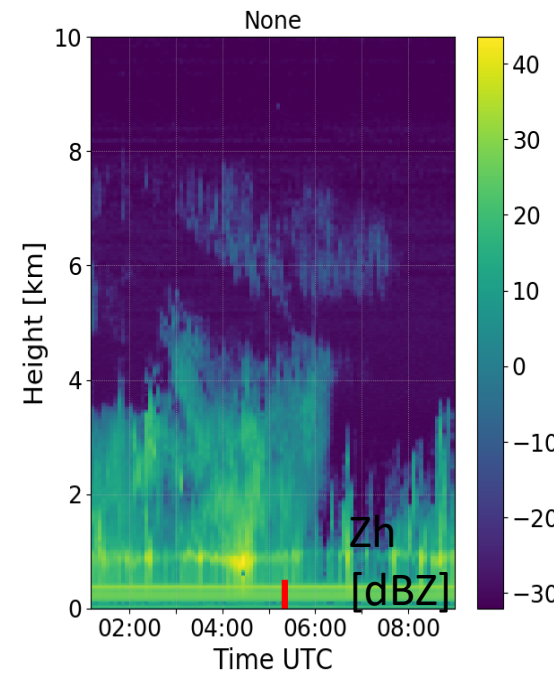
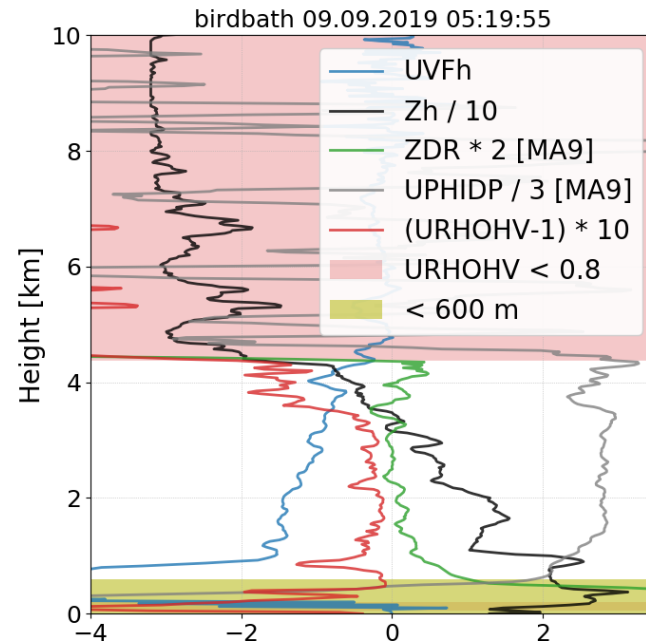
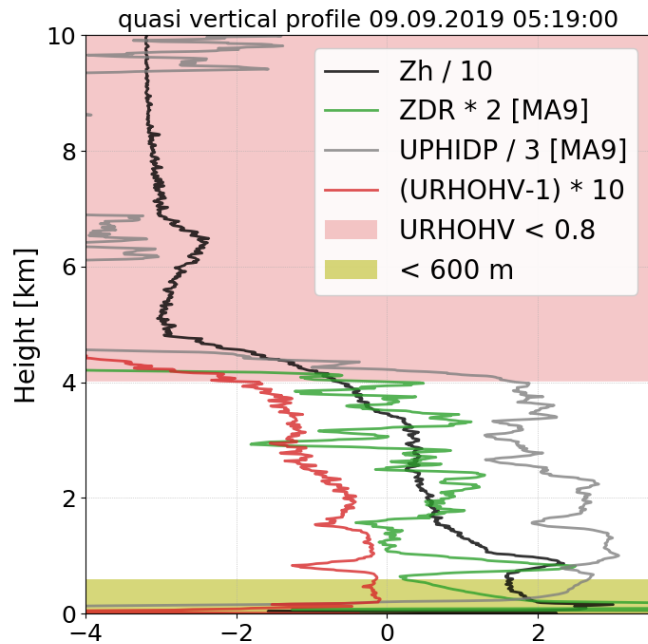
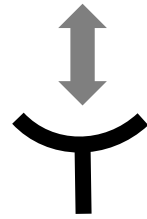
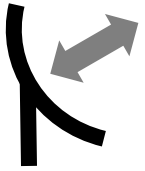


Horizontal orientation

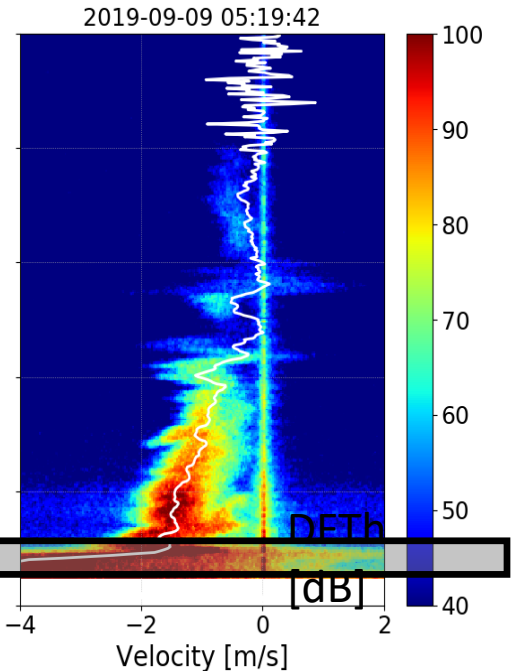
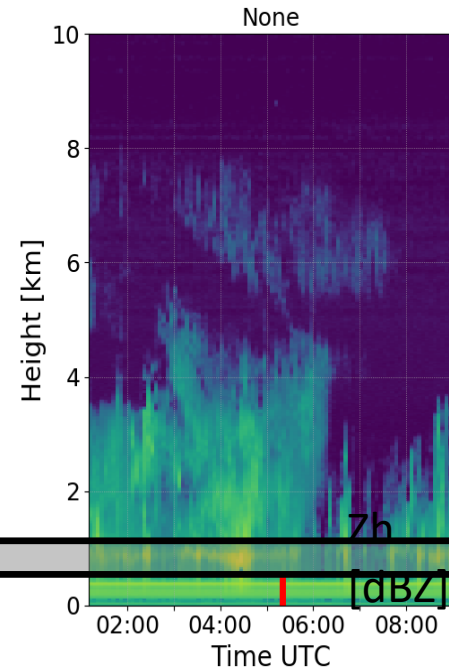
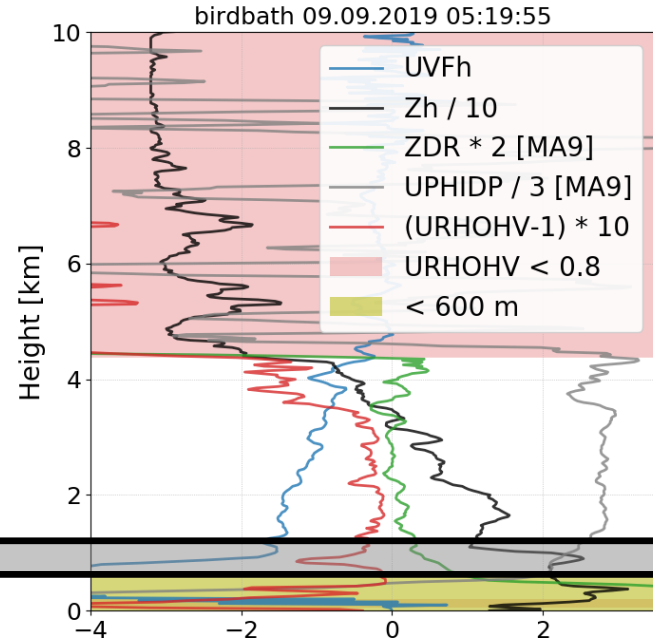
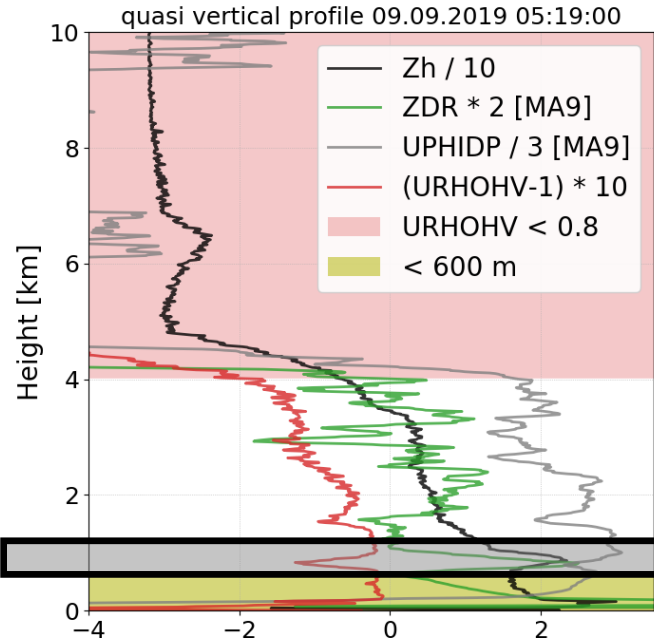
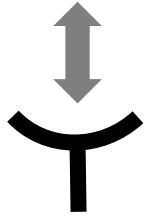
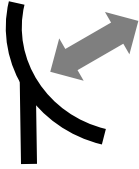




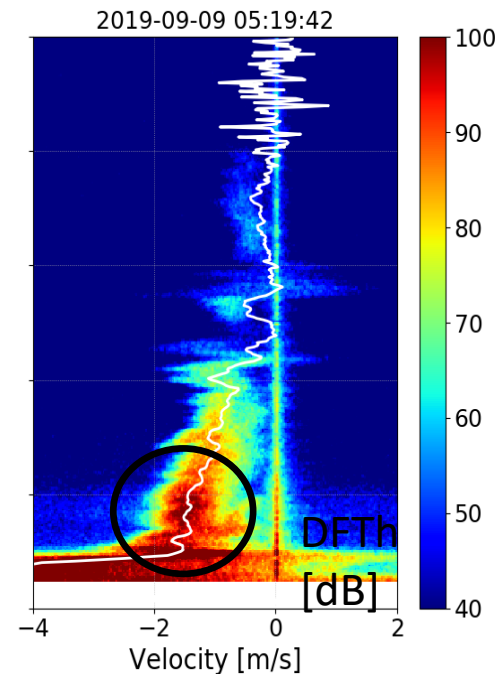
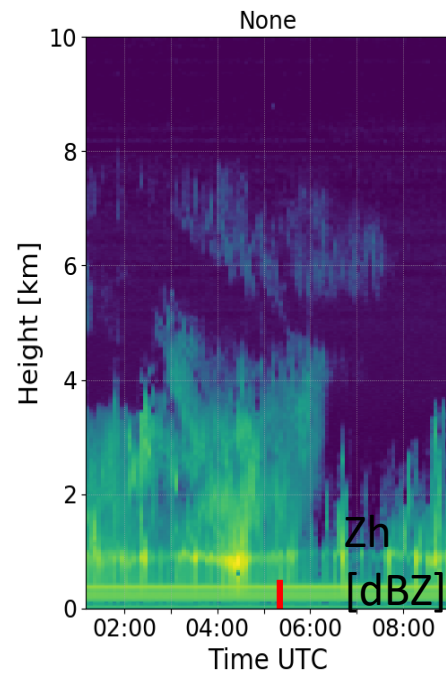
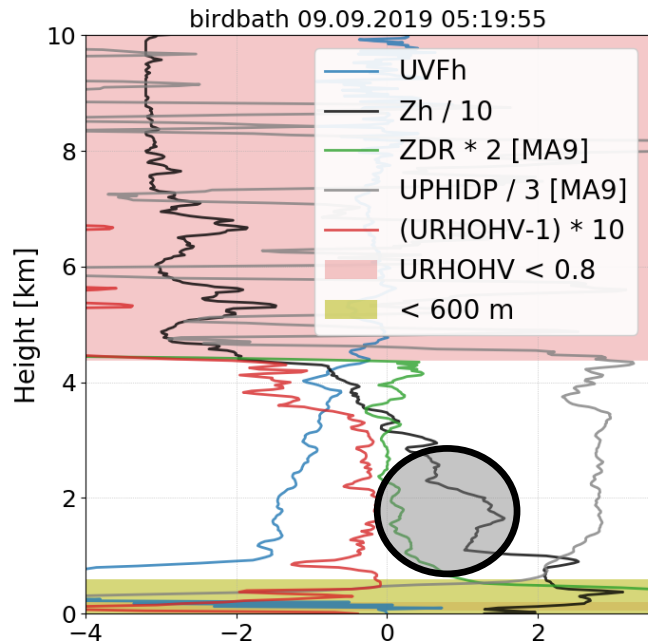
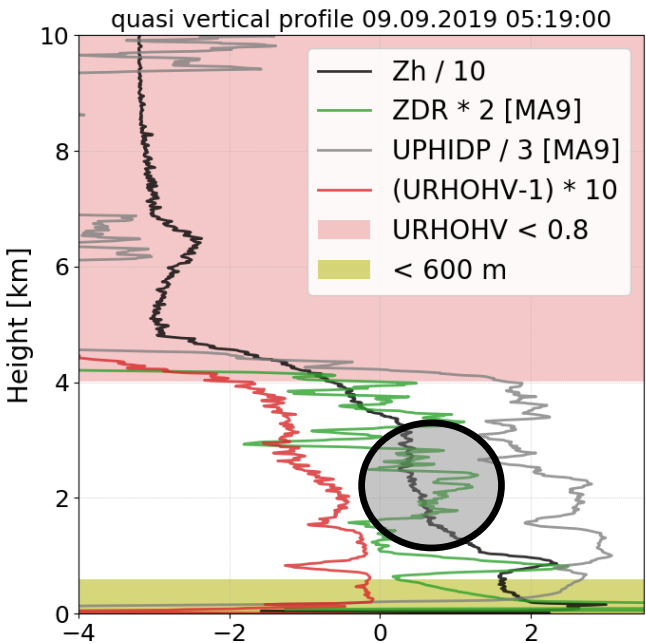
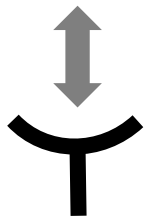
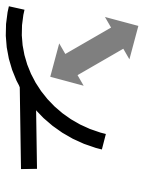
# Example: 09 Sep 2019, 05:20 h



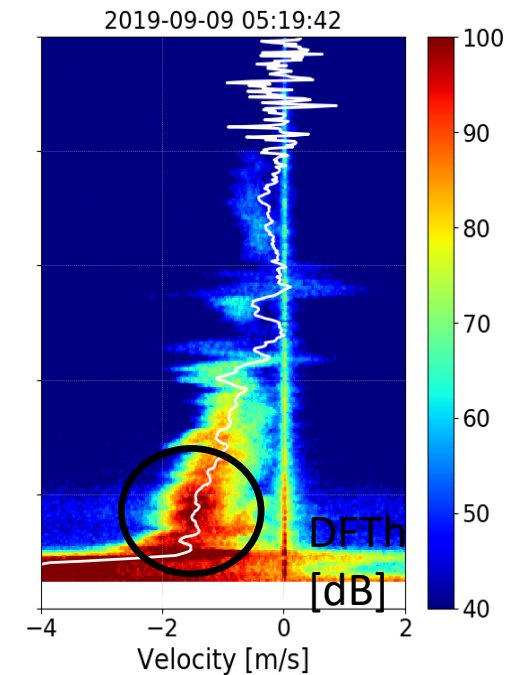
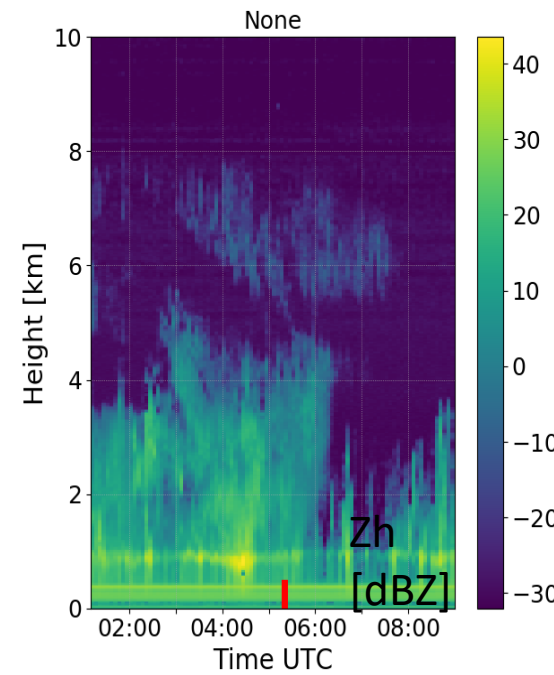
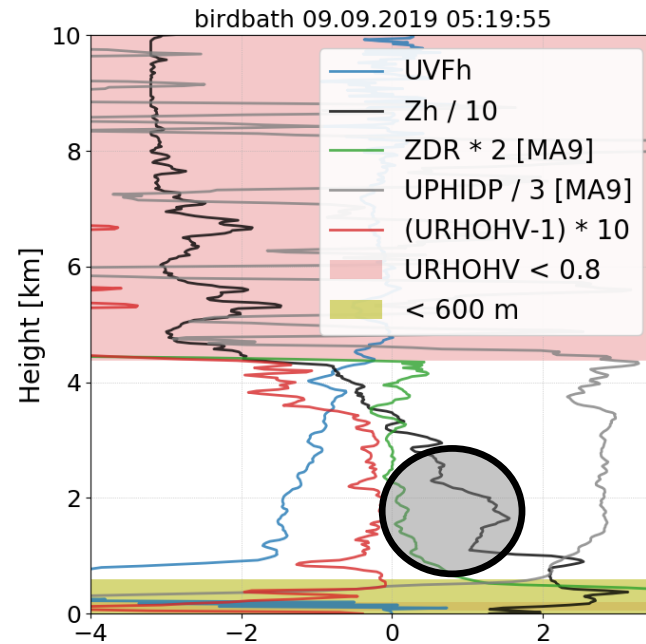
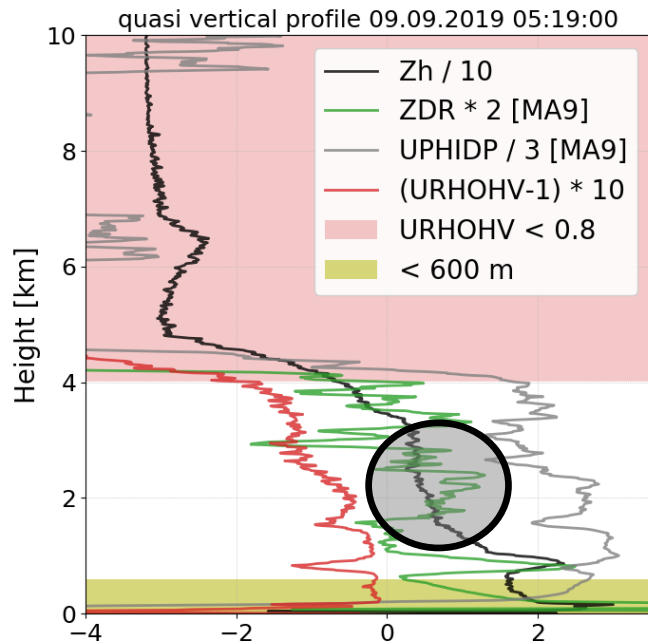
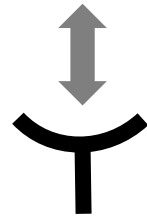
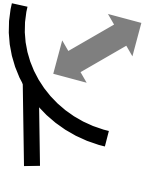
# Example: 09 Sep 2019, 05:20 h



# Example: 09 Sep 2019, 05:20 h

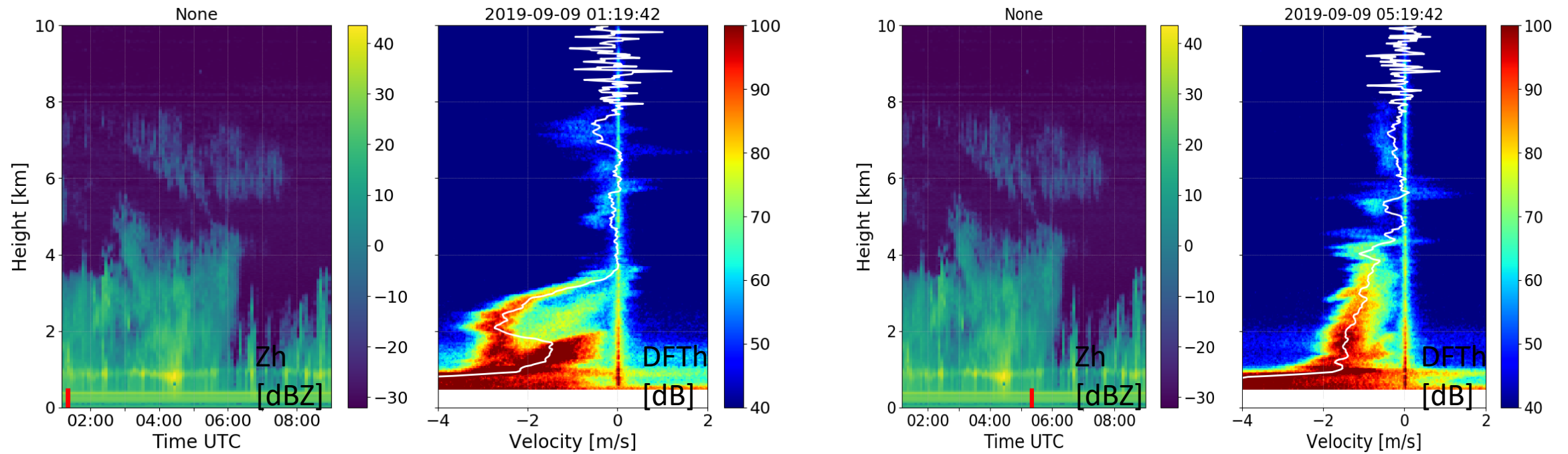


# Example: 09 Sep 2019, 05:20 h

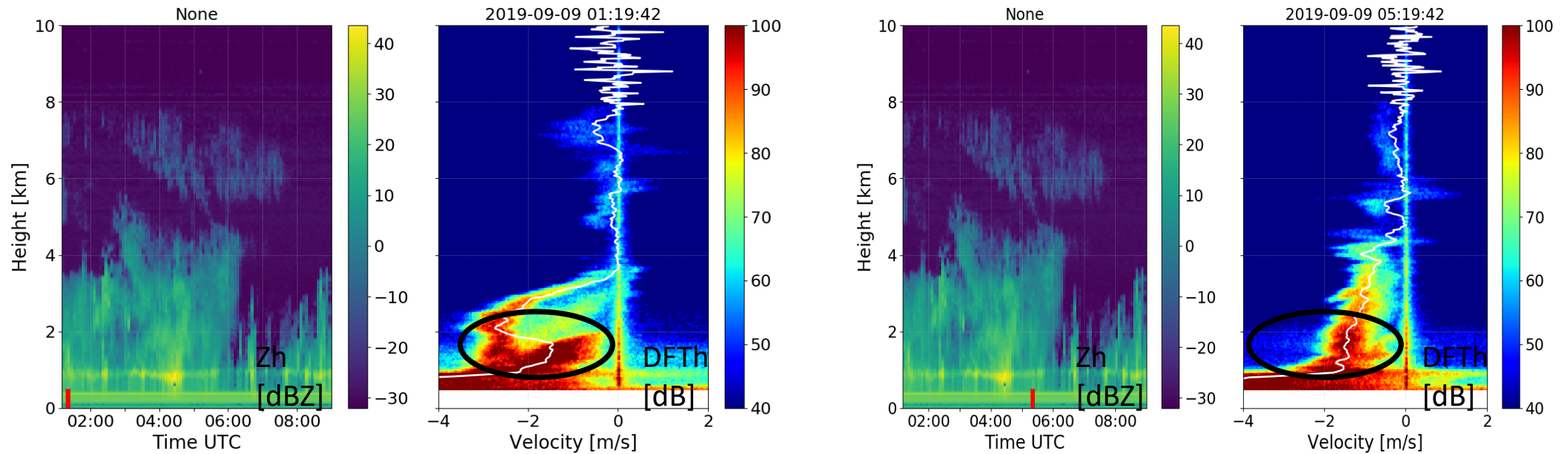


Challenges: variability, temporal averaging, sedimentation speed

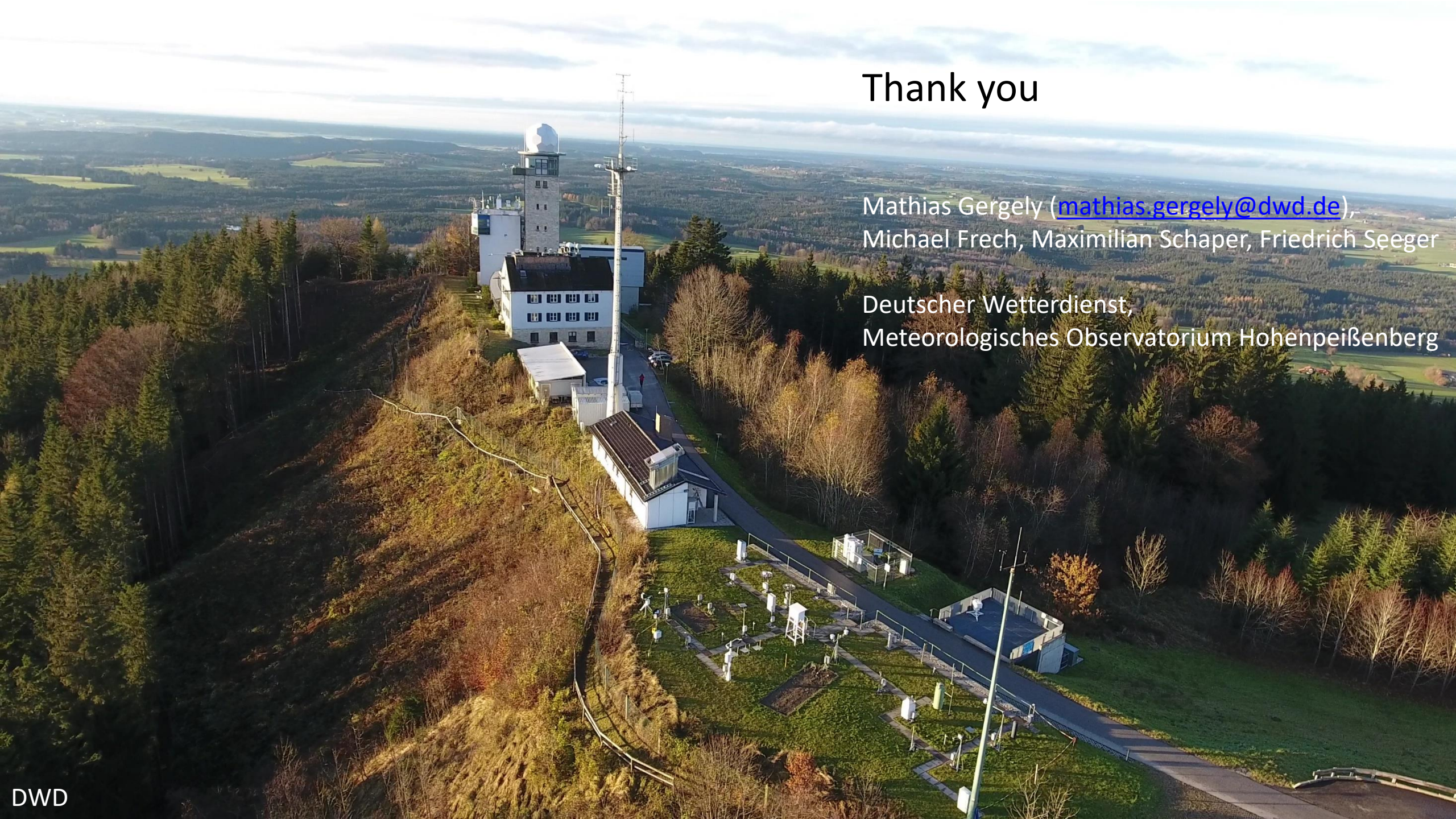
# Example: 09 Sep 2019, 01:20 h and 05:20 h



# Example: 09 Sep 2019, 01:20 h and 05:20 h



Characterize dominant microphysical processes by moments , e.g., mean, spectrum width, skewness, ..., and multiple maxima(?)

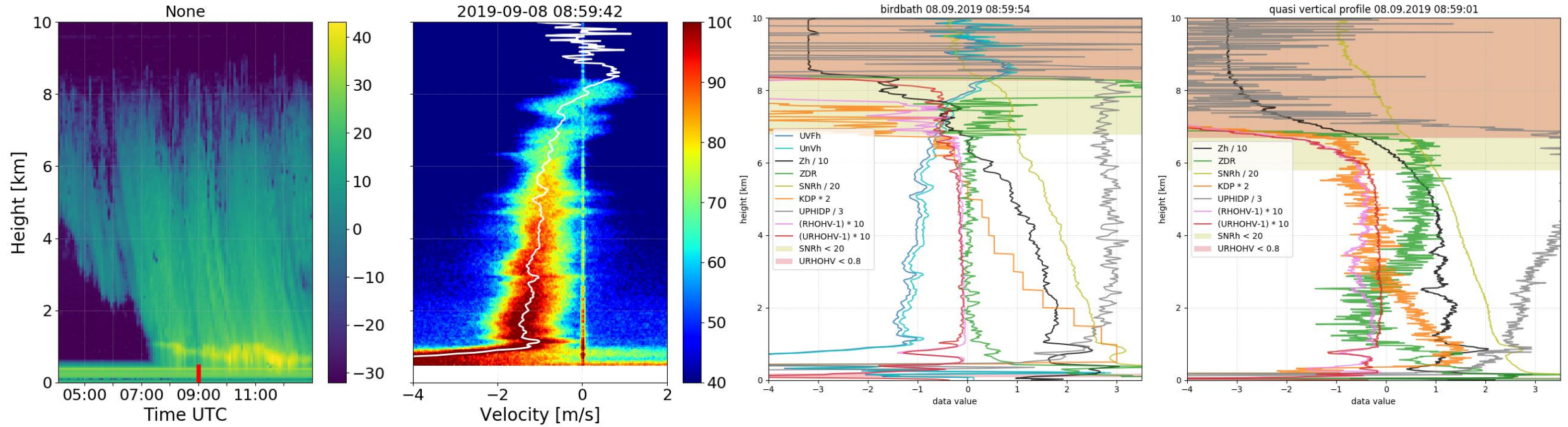


Thank you

Mathias Gergely ([mathias.gergely@dwd.de](mailto:mathias.gergely@dwd.de)),  
Michael Frech, Maximilian Schaper, Friedrich Seeger

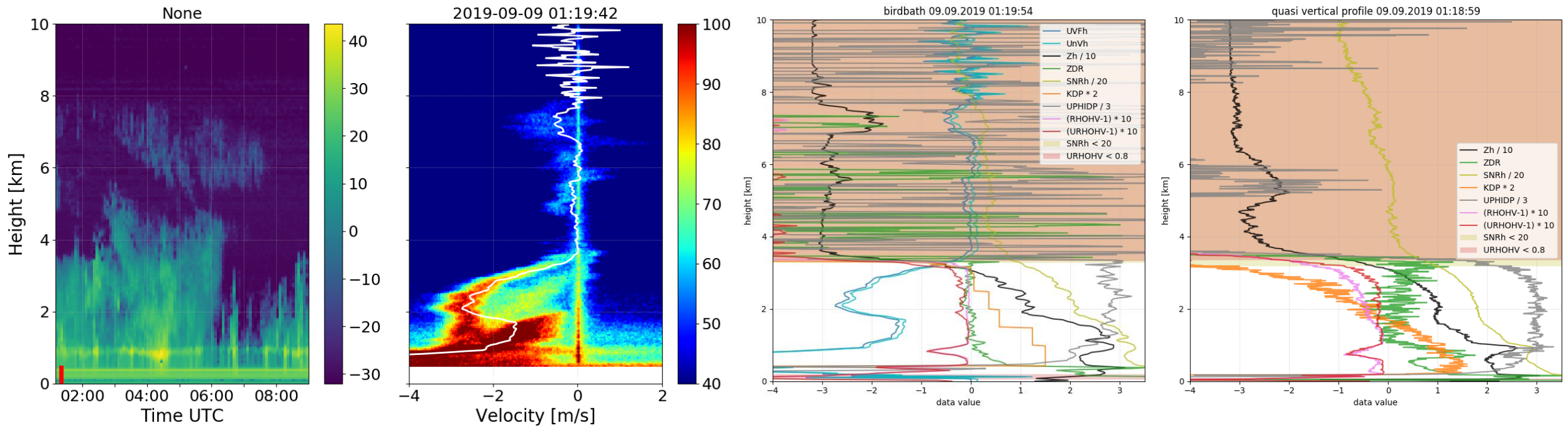
Deutscher Wetterdienst,  
Meteorologisches Observatorium Hohenpeißenberg

# Extra

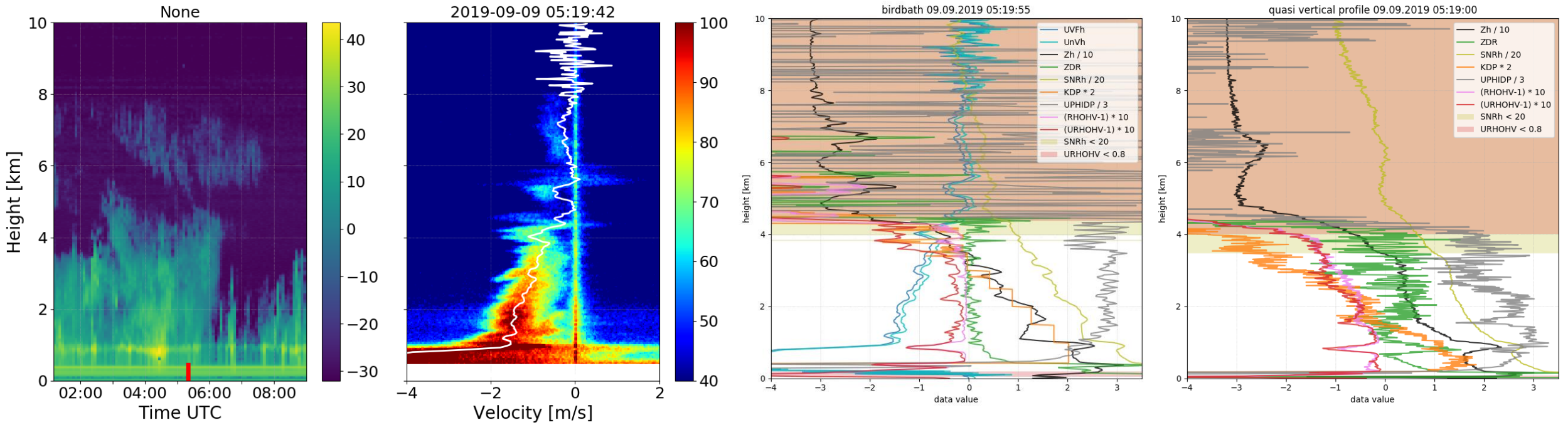




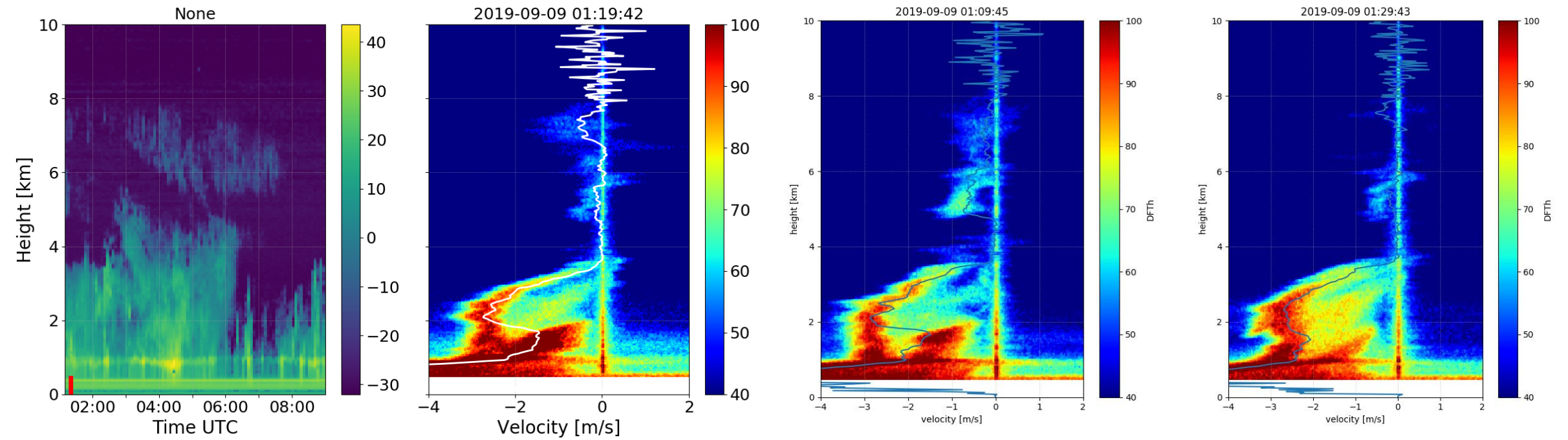
# Extra



# Extra

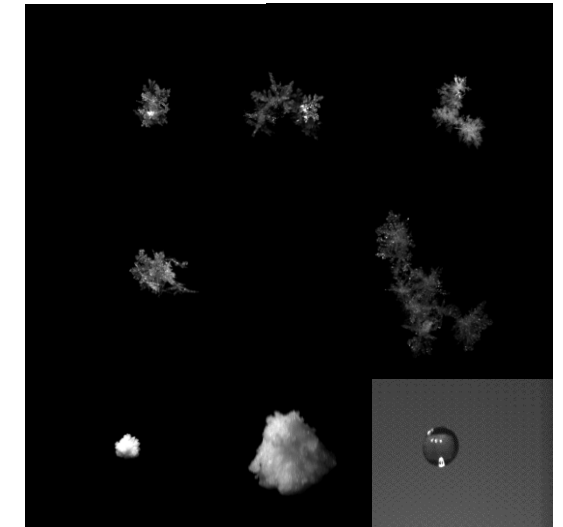
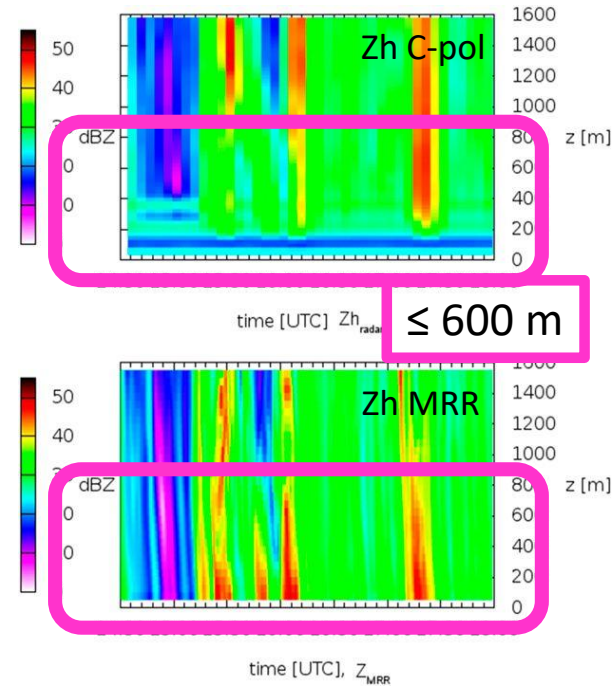
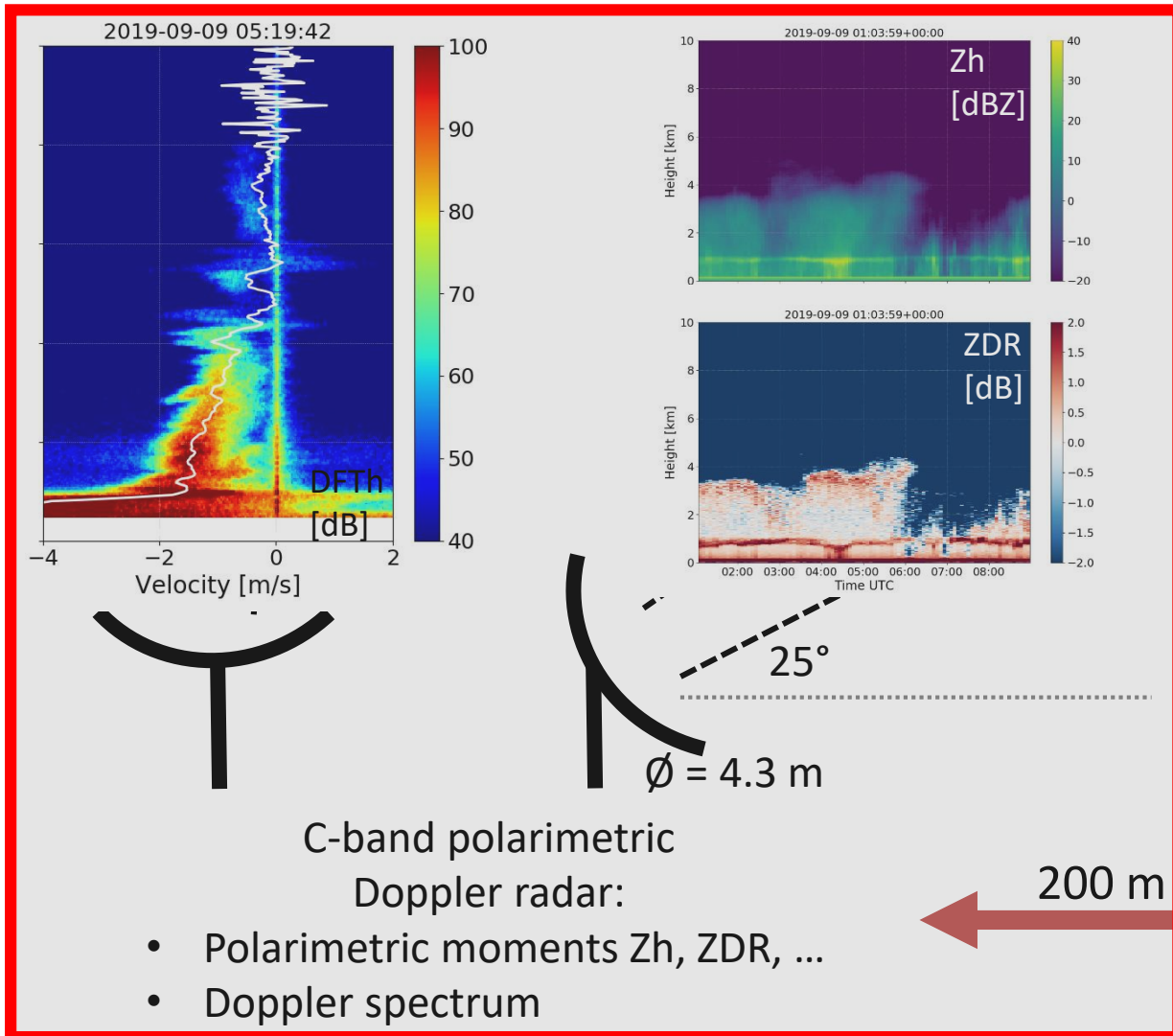


# Extra



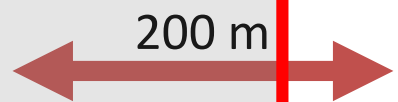
# Idea: weather radar + MRR + in situ sensors

- MOHp (DWD) Hohenpeißenberg, ~ 1000 m a.s.l., 50 km SW of Munich



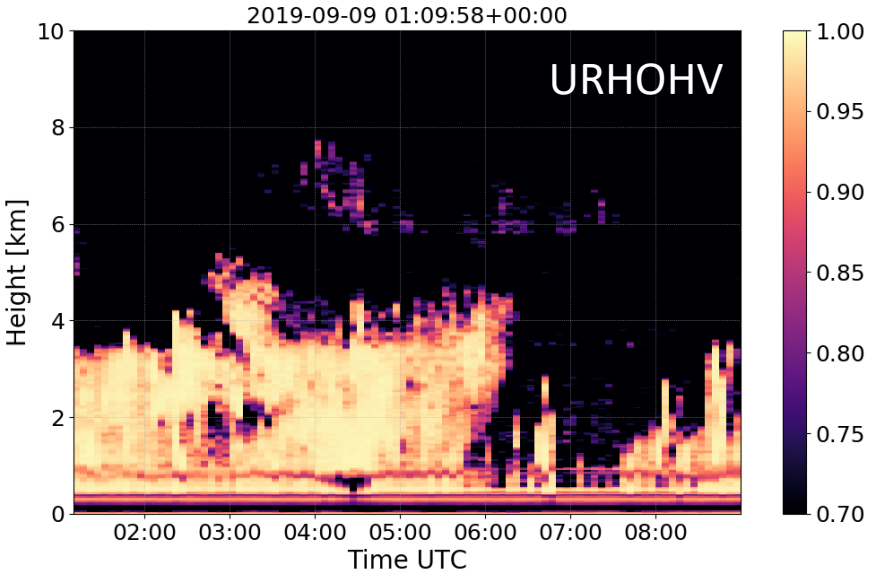
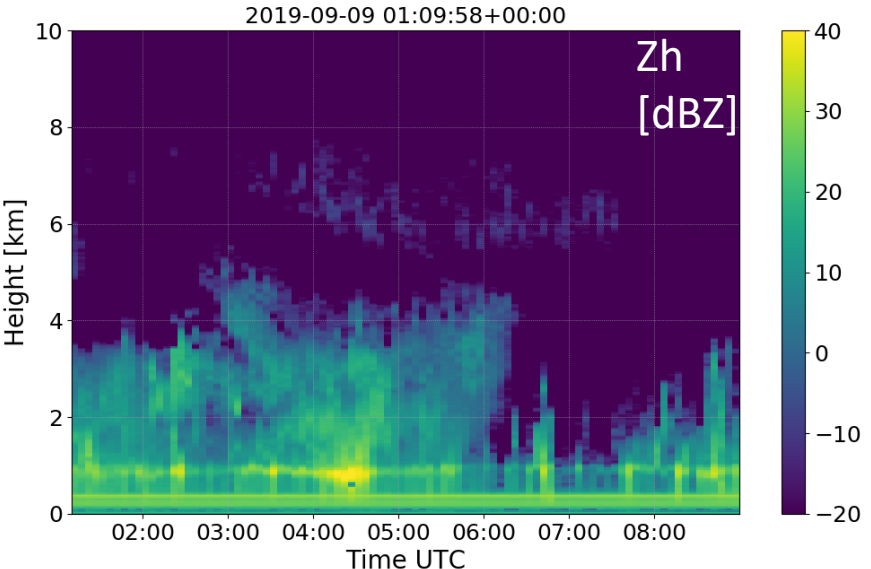
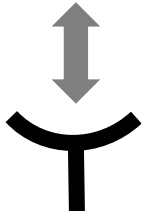
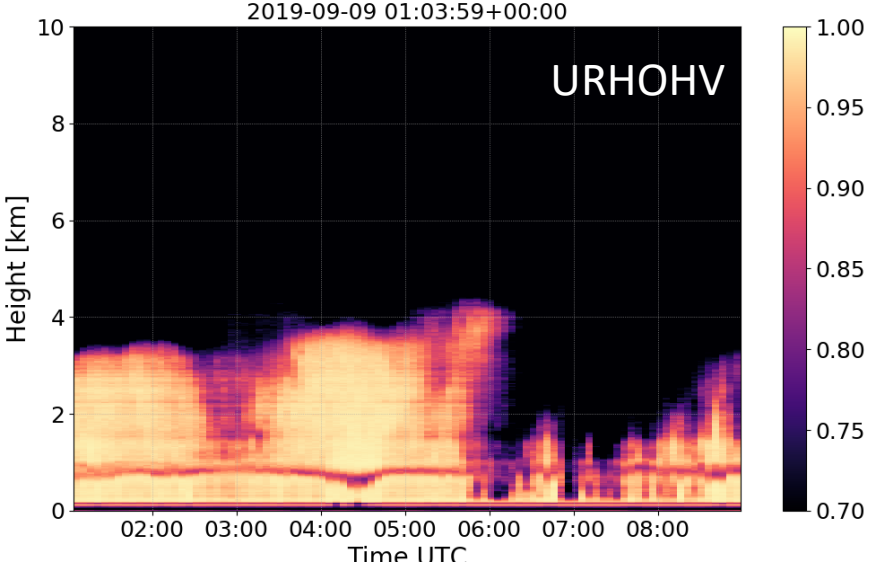
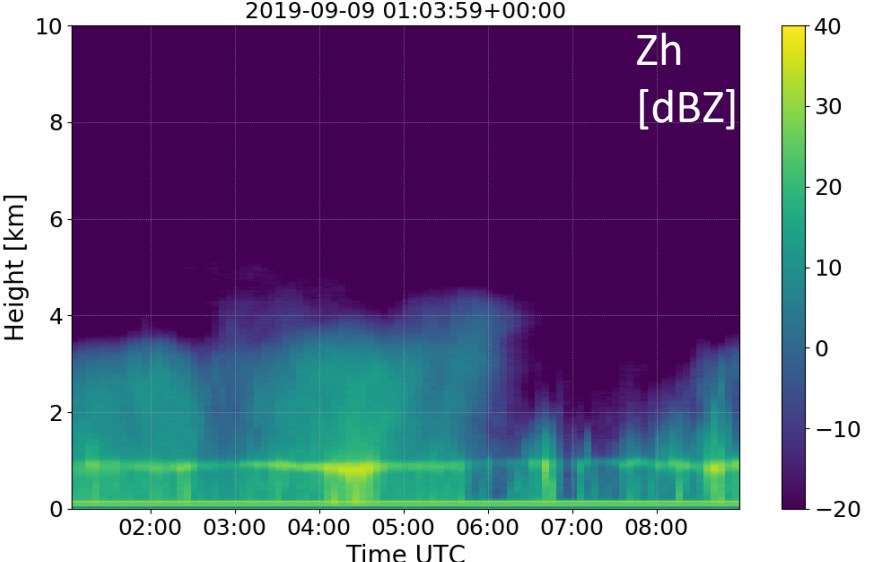
Precipitation gauges, disdrometers:

- Precipitation rate
- Particle size distribution
- Particle shape (Thies 3D)

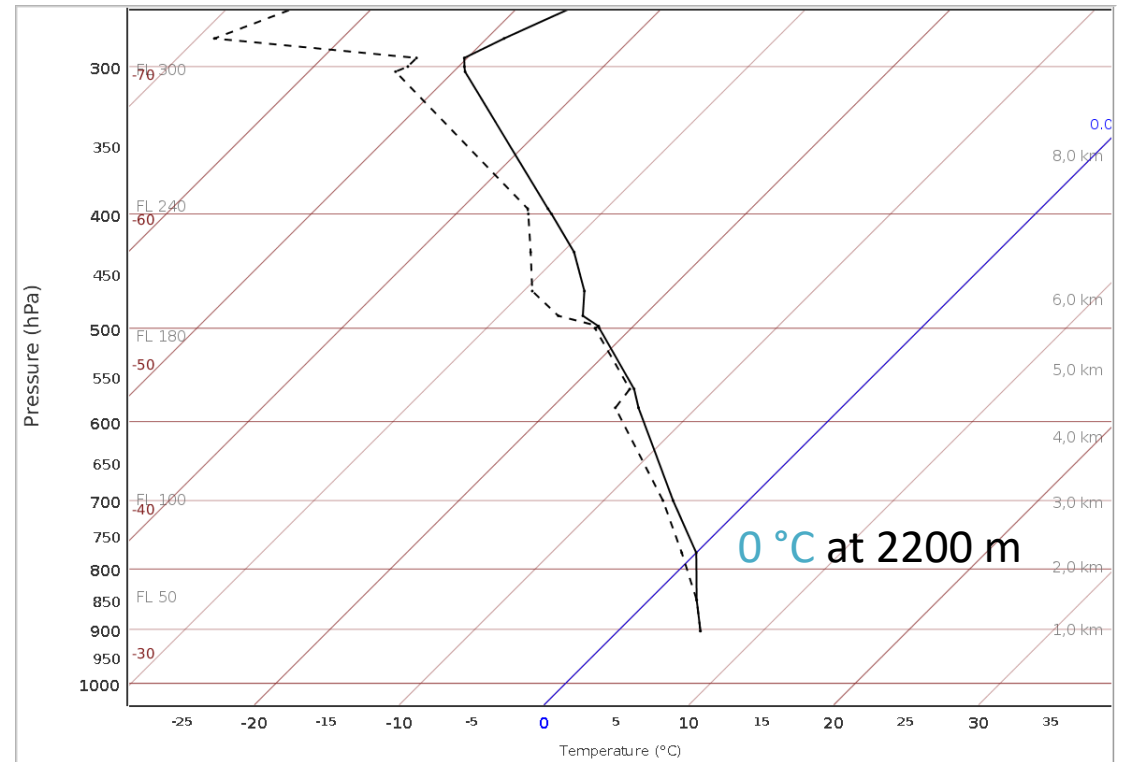
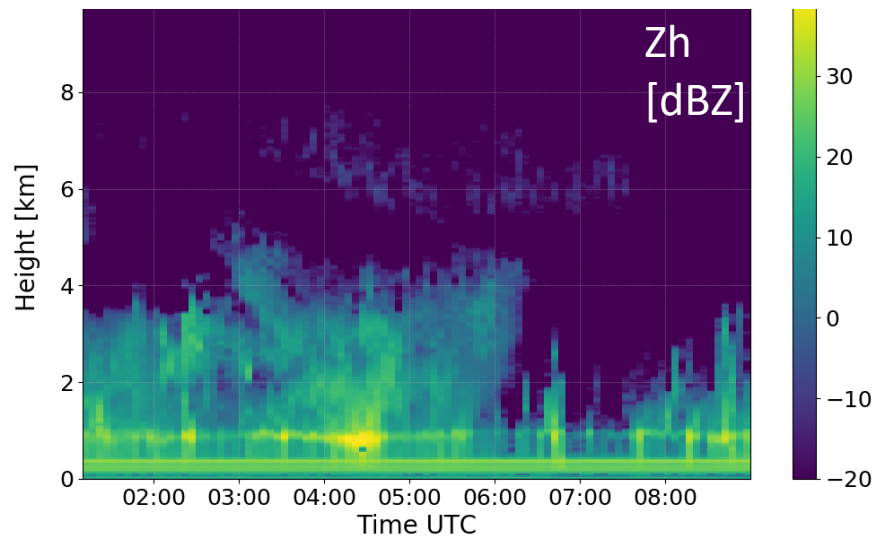
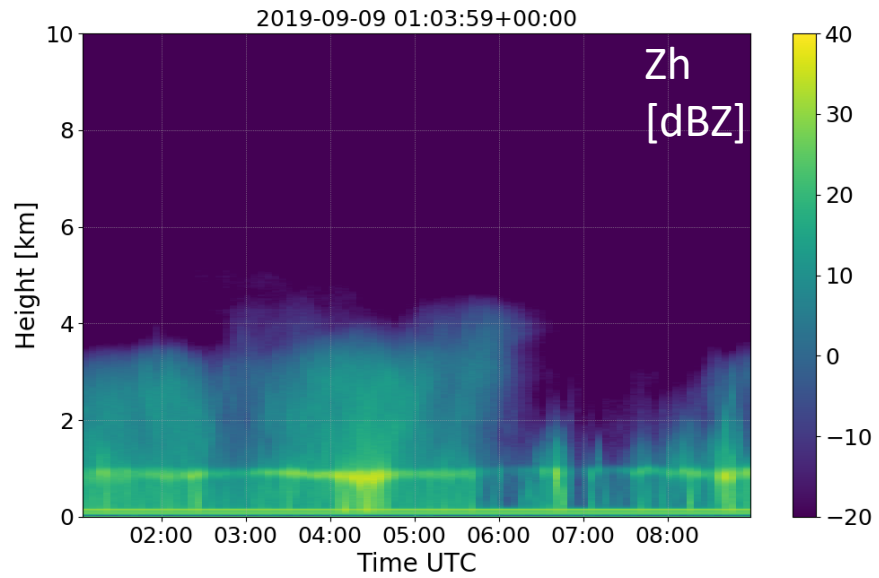


- K-band FMCW radar:
- Reflectivity Z
  - Doppler spectrum

# Example: 09 Sep 2019



# Example: 09 Sep 2019



# Example: 09 Sep 2019

