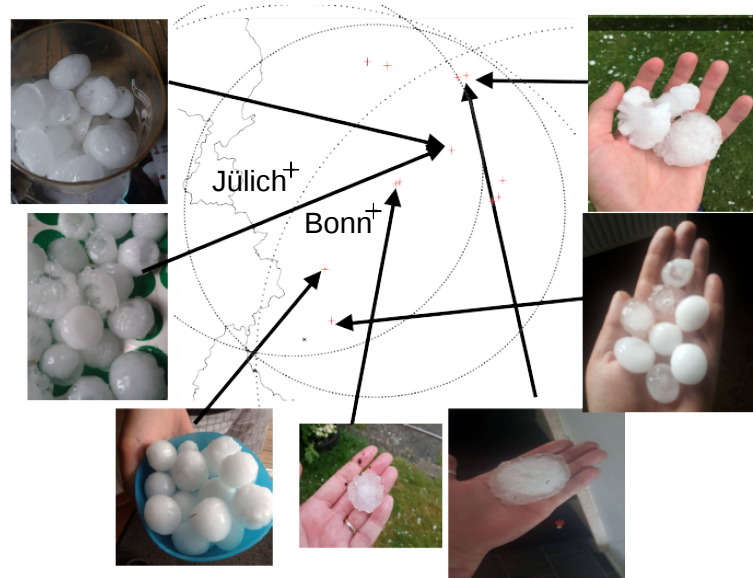


# Information Content of Differential Reflectivity $Z_{dr}$ Column for Precipitation Nowcasting

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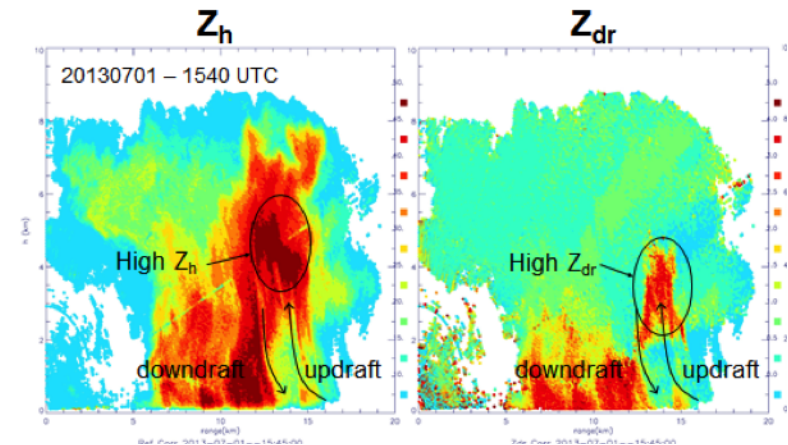
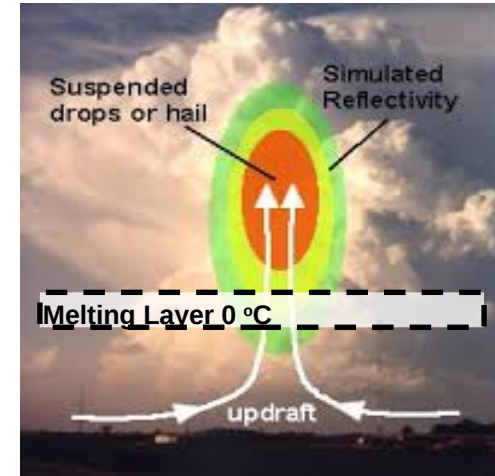
Bonn, Germany



# Background / Motivation

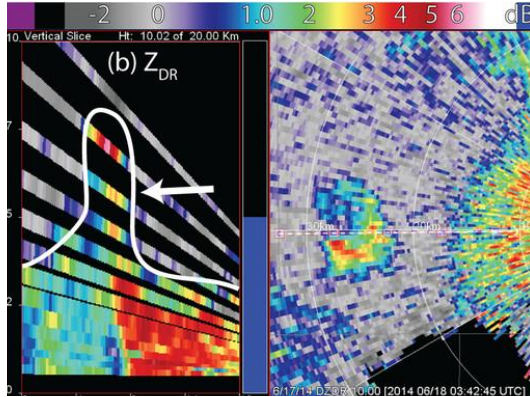
## Zdr Columns:

- a region of large oblate rain drops above the melting layer
- Indication of updraft
- Nowcasting tool for strong convection and effects at the surface (strong rain, hail, ...)
- How are Zdr Column properties connected to updraft intensity?

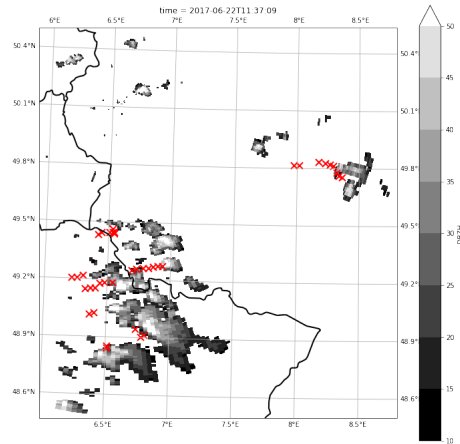


# Methodology

## 1. Zdr Columns Identification and Tracking

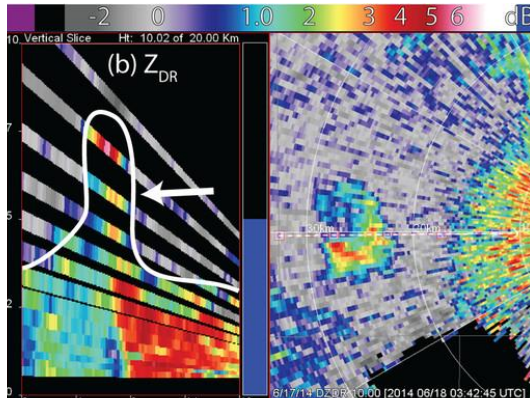


Snyder et al. 2015

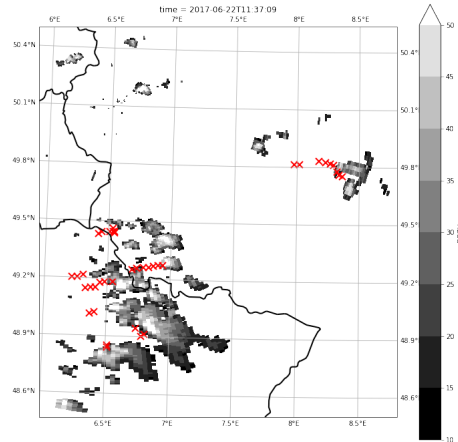


# Methodology

## 1. Zdr Columns Identification and Tracking



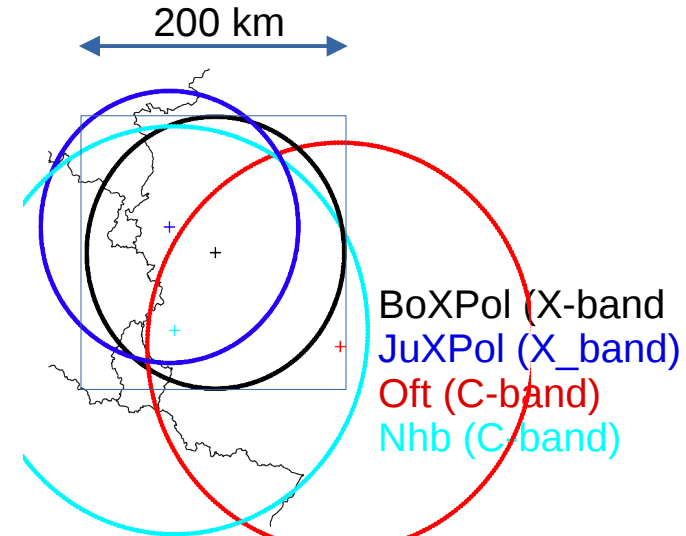
Snyder *et al.* 2015



## 2. Multi-Doppler Analysis - 3D Wind field retrieval

Open source code:

PyDDA (py-ART package Jackson *et al.* 2020)





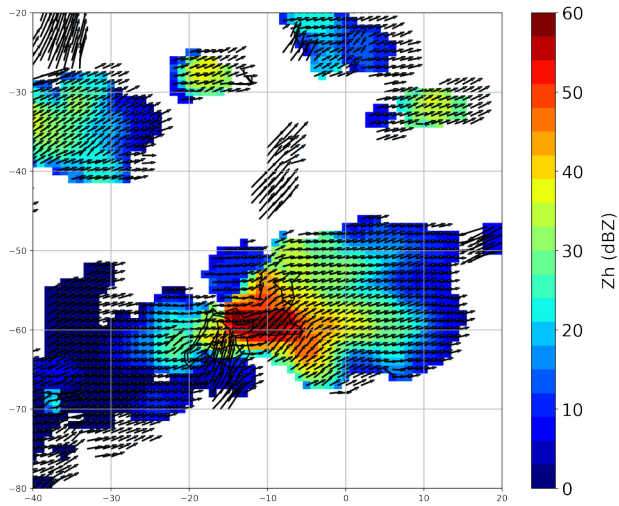
# Results:

## 1. Example Zdr Column / updraft

Zh at h=2 km (color)

Wind vectors at h=2 km

W at 4 km (black contours, 10, 20, 50 m/s)

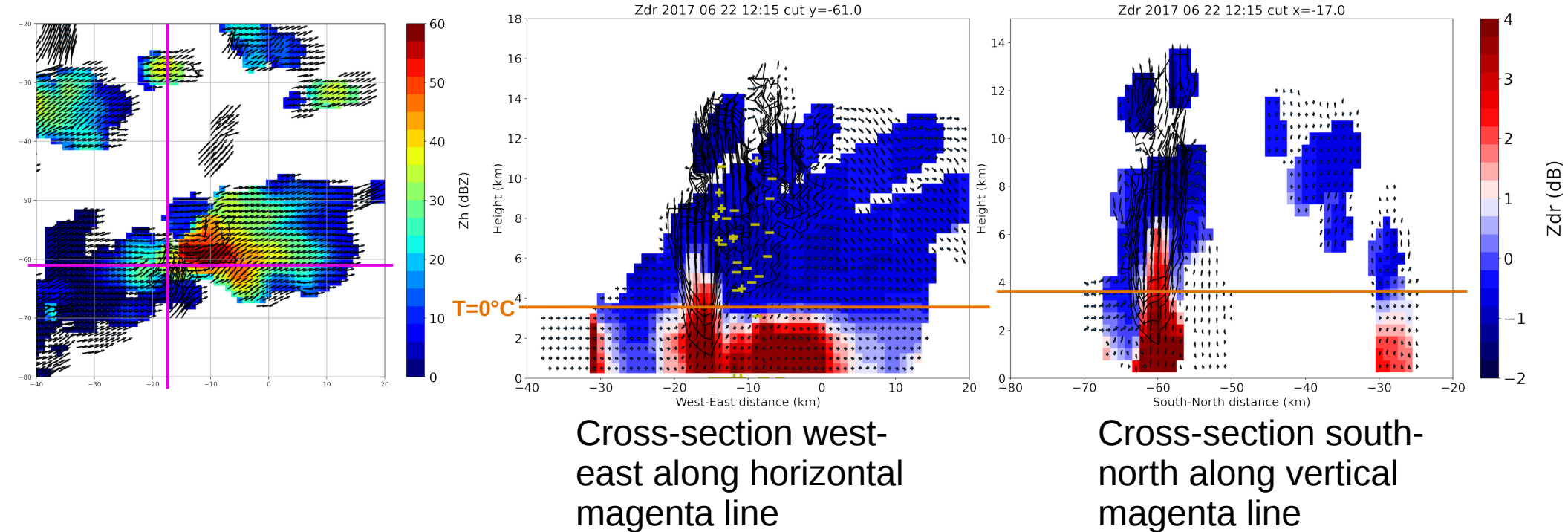


# Results:

## 1. Example Zdr Column / updraft

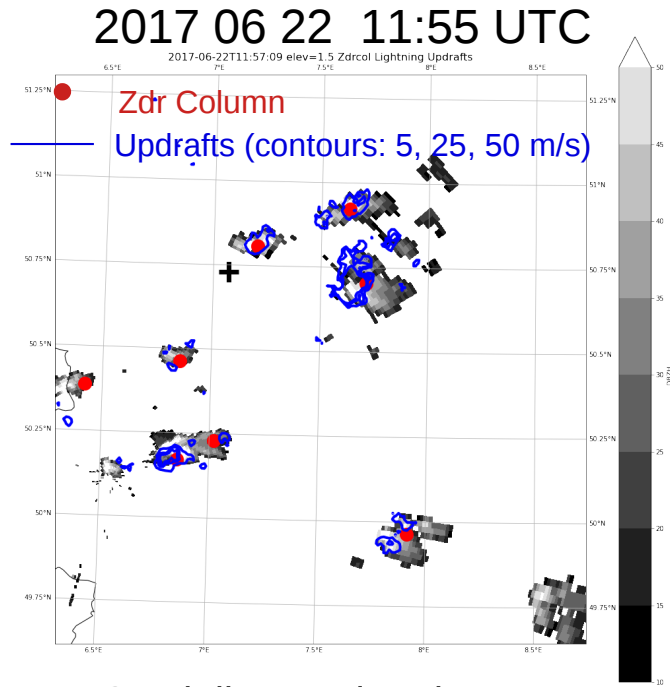
Zh at h=2 km (color)  
Wind vectors at h=2 km  
W at 4 km (black contours, 10, 20, 50 m/s)

Red Zdr > 1dB for identification of Zdr columns.



# Results:

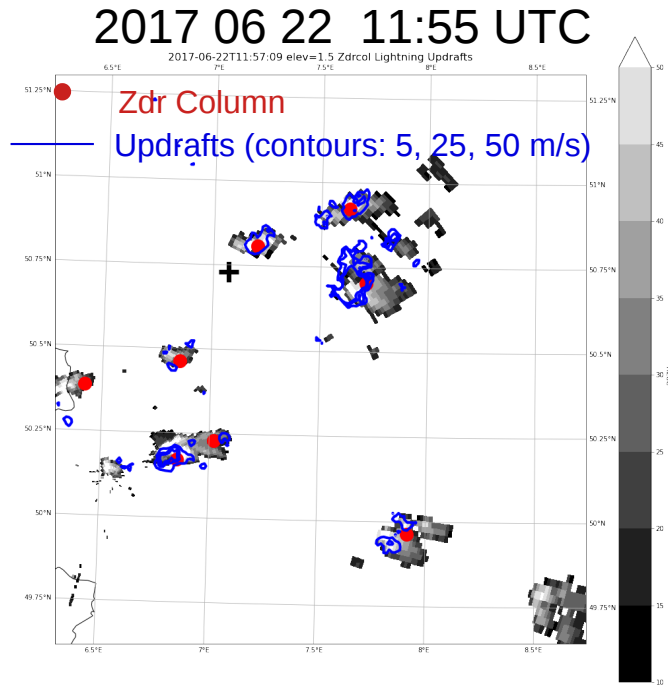
## 2. Zdr Columns-Updrafts in space and time



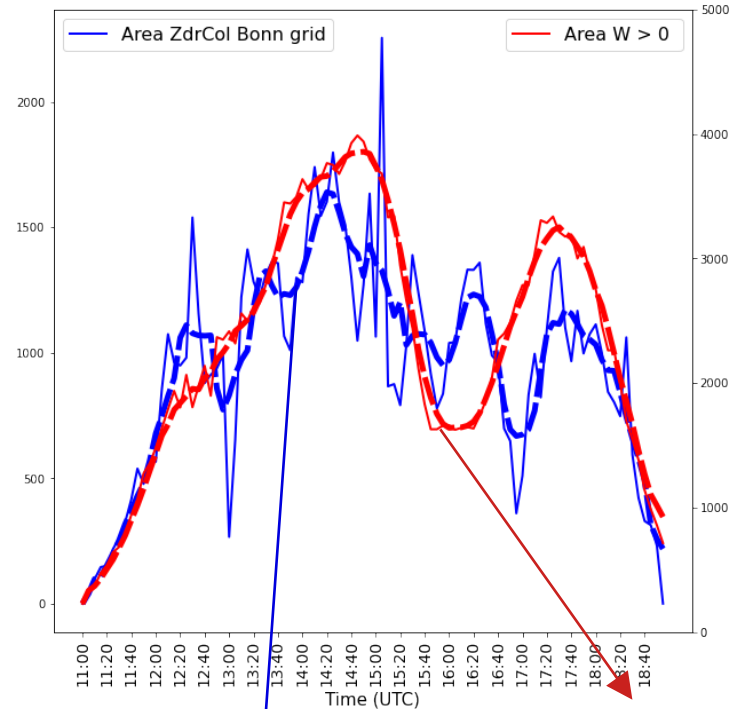
- Spatially correlated
- Similar advection
- First detection very close in time

# Results:

## 2. Zdr Columns-Updrafts in space and time



- Spatially correlated
- Similar advection
- First detection very close in time



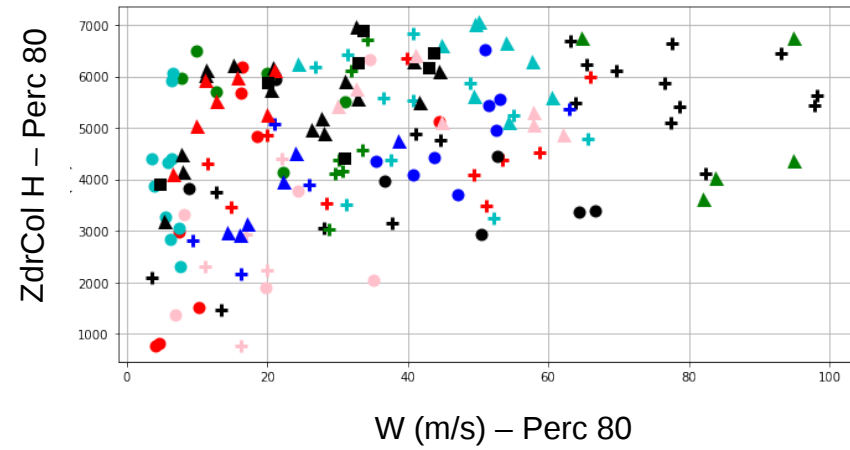
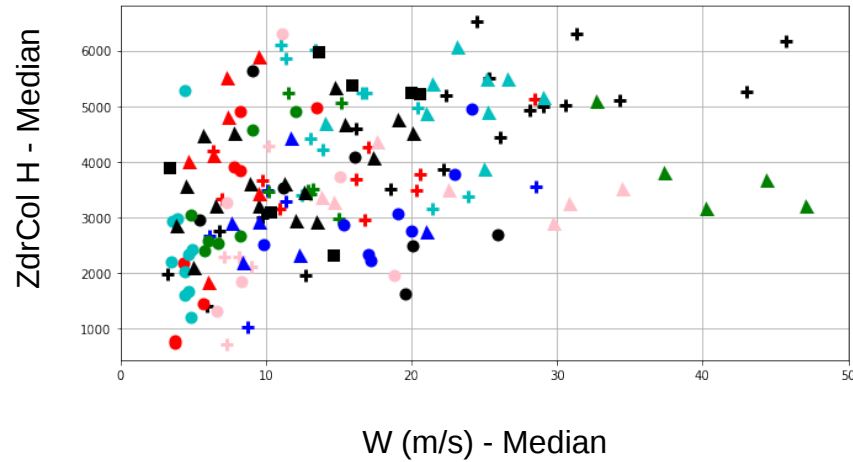
Corr= 0.855

Total area covered by the updraft

Total area of the Zdr columns

# Results:

## 3. Zdr Column Heights vs Updraft Intensity



Some tendency visible but... too much scatter, especially Perc 80

# Summary / Conclusion

- 1) Zdr Columns spatially correlated with updrafts
- 2) Area Zdr Col correlated to the area of the updrafts over time
- 3) Higher values of Zdr Column height tend to be related updraft strength
- 4) A Universal relationship connecting these parameters is not observed in our results
  - Complexity of kinematics and microphysics processes, very different among cells
  - Potential errors in Zdr Column heights due to the discrete conical scans, and the radar beam broadening with distance
  - Storm top sampling issues translate in errors in the updraft estimation



**Thank you!**

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BoXPol view from the top of the meteorology department building