Identification of Z_{DR} columns for early detection of severe convection

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This presentation participates in OSPP

Outstanding Student & PhD candidate Presentation contest

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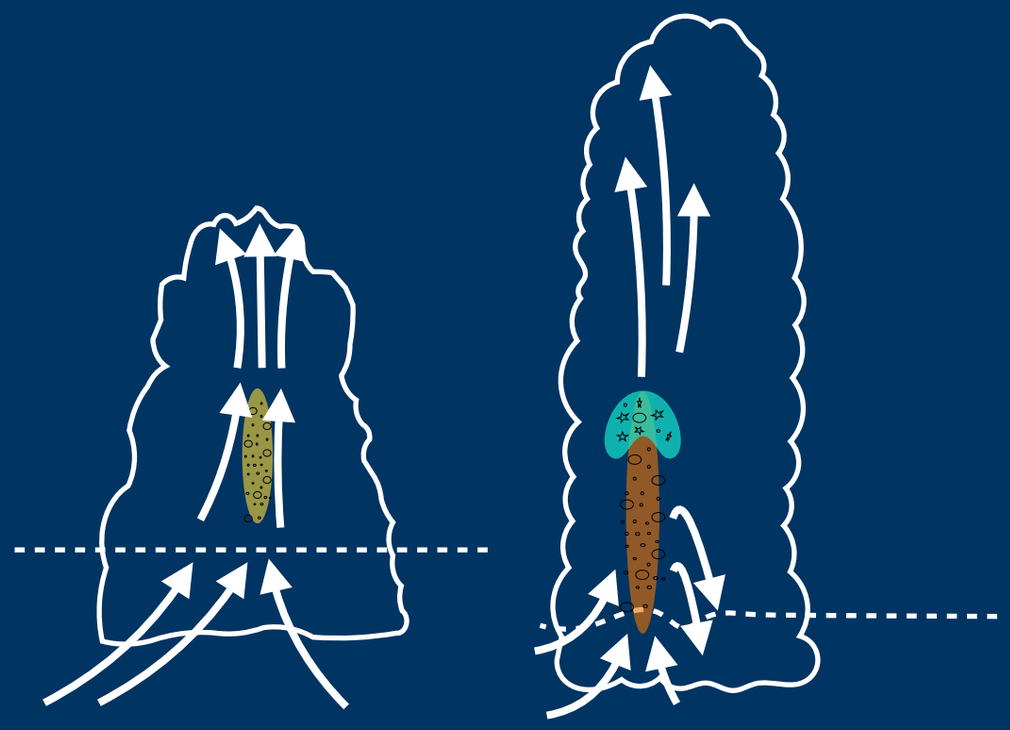
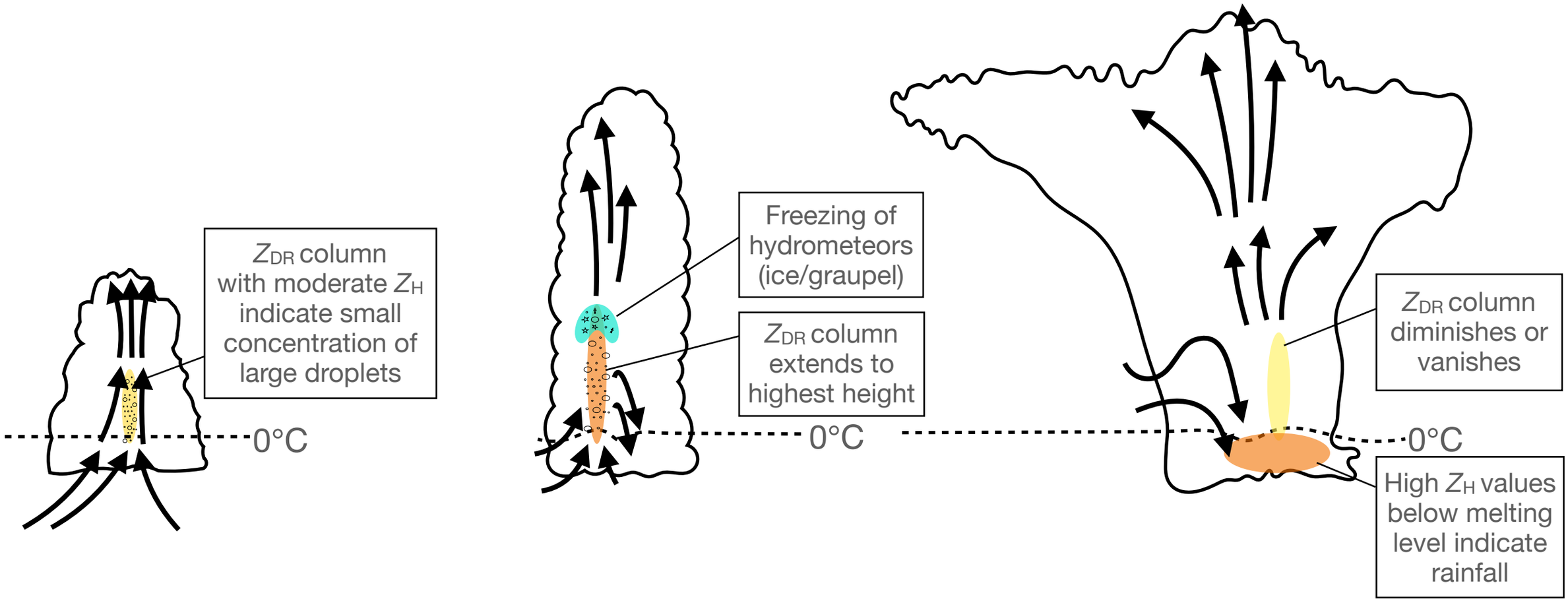


Storm Evolution



Developing

Vigorous

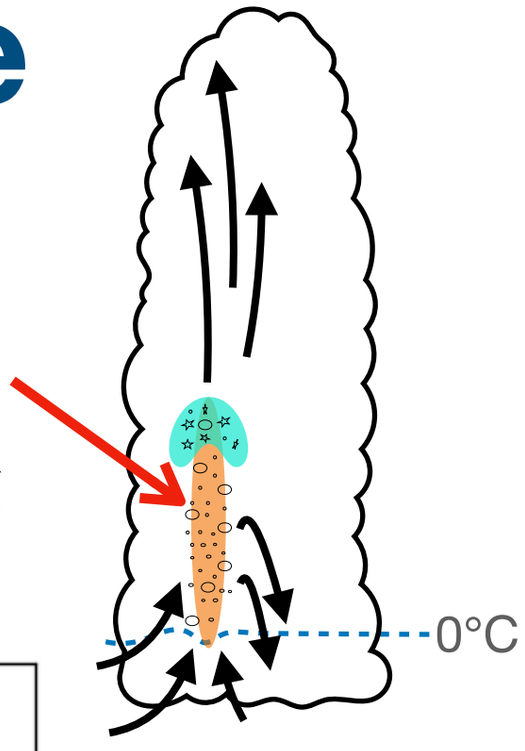
Mature

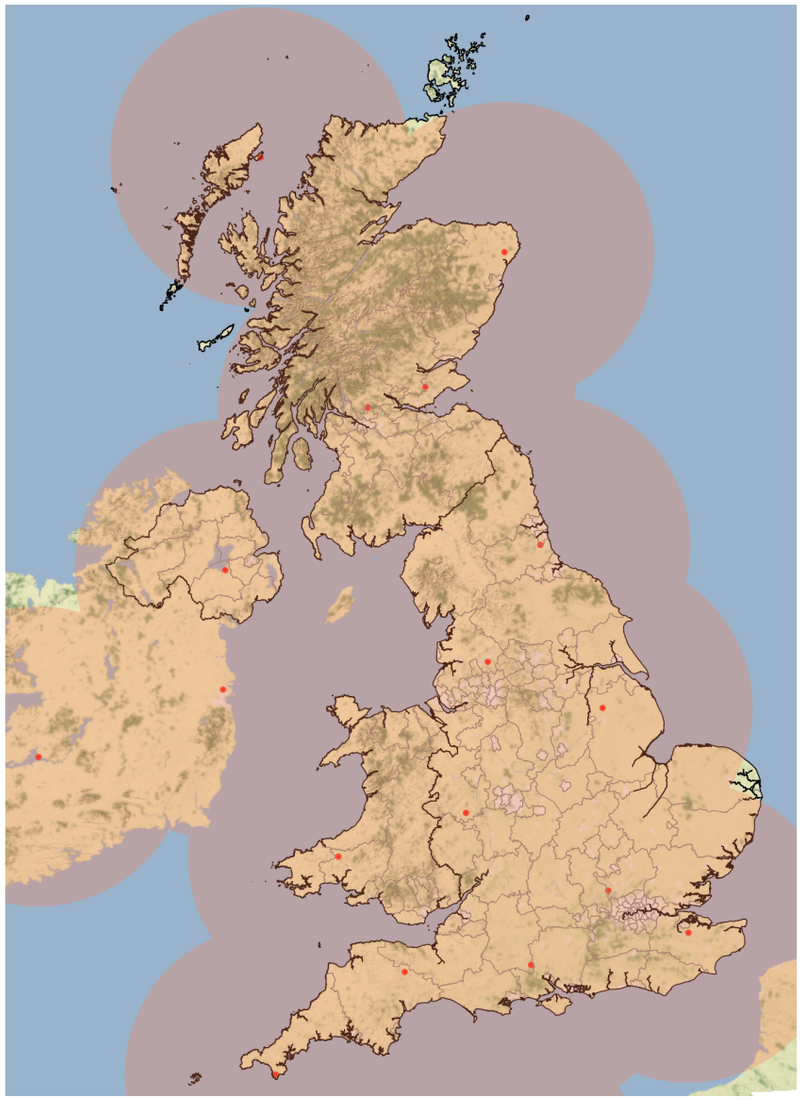
UKMO 3D Radar Composite

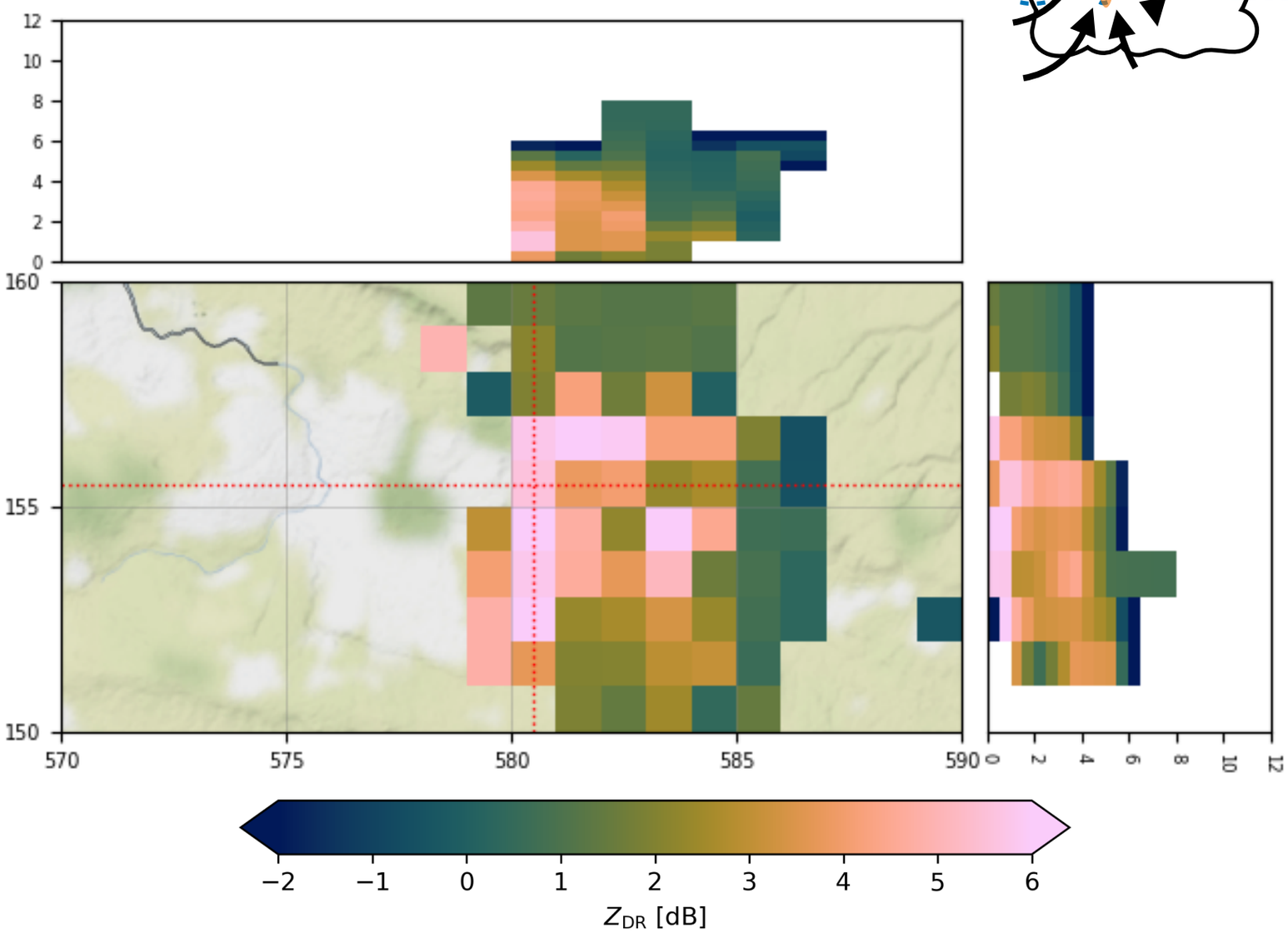
- 1km x 1km x 0.5km
- 3 case days studied with varying synoptic situations

$Z_{DR} \geq 1$dB &
$Z_H \geq 10$dBZ

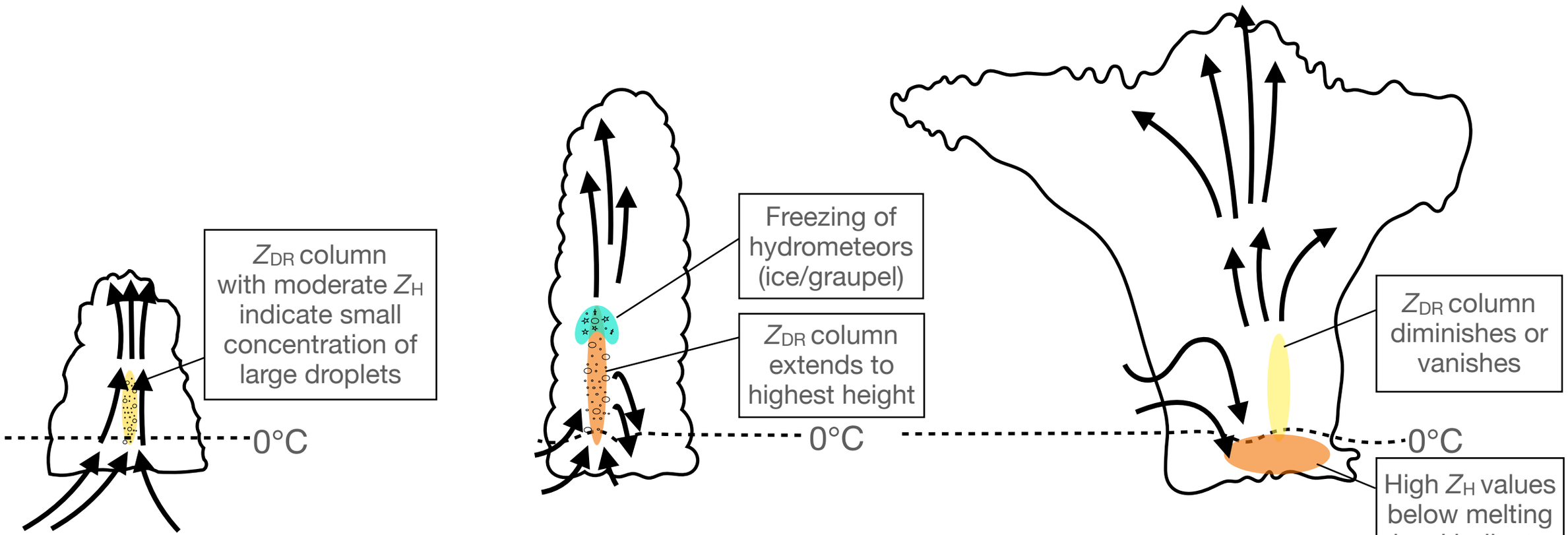
Max $Z_{DR} \geq 2.5$dB &
Max $Z_H \geq 25$dBZ







Method



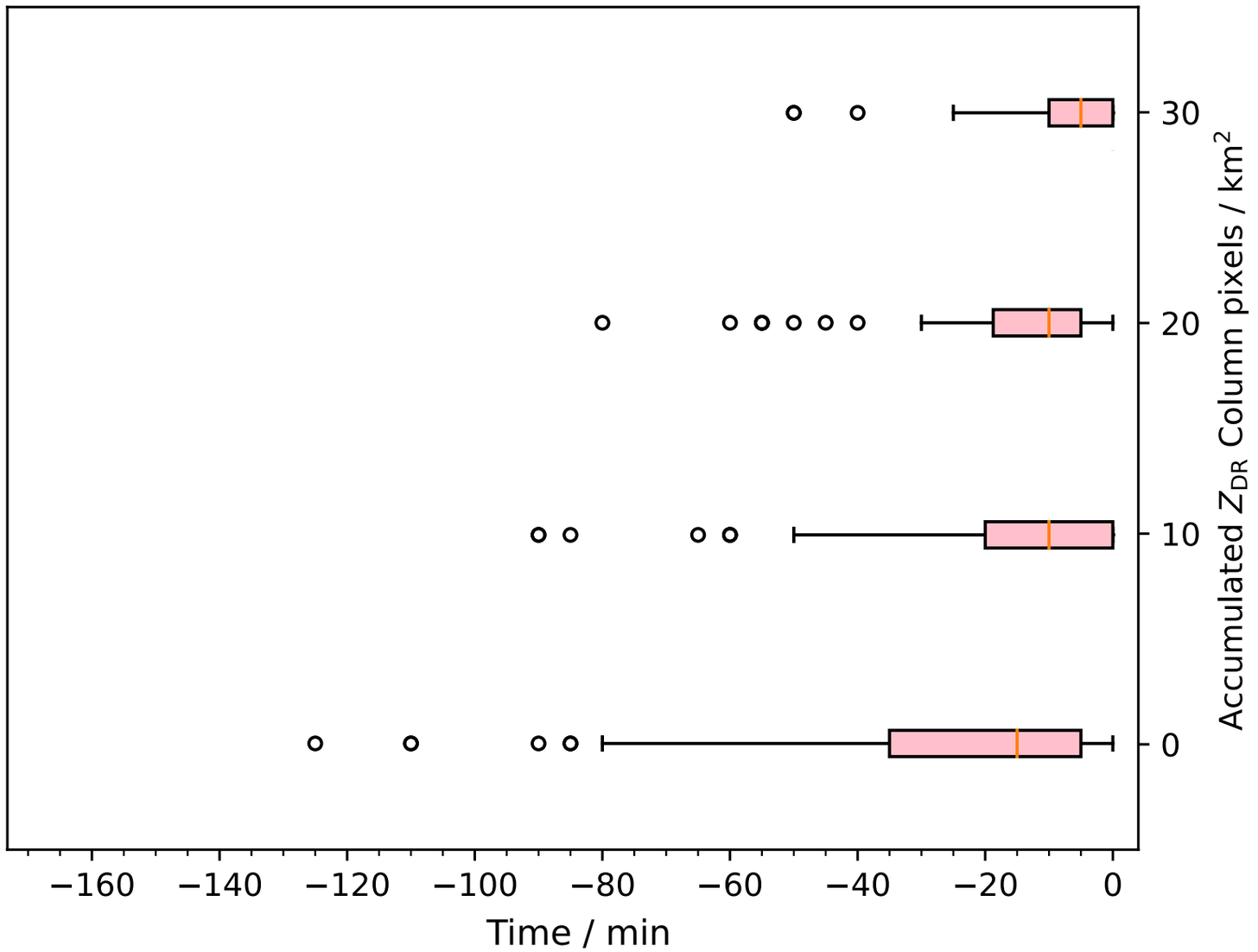
Tracking (FFT Cross-correlation)

Identify (Otsu)

Detect (Contiguous volume)

Severe Event (Accmulation Threshold of 50 MAXDBZ >= 50)

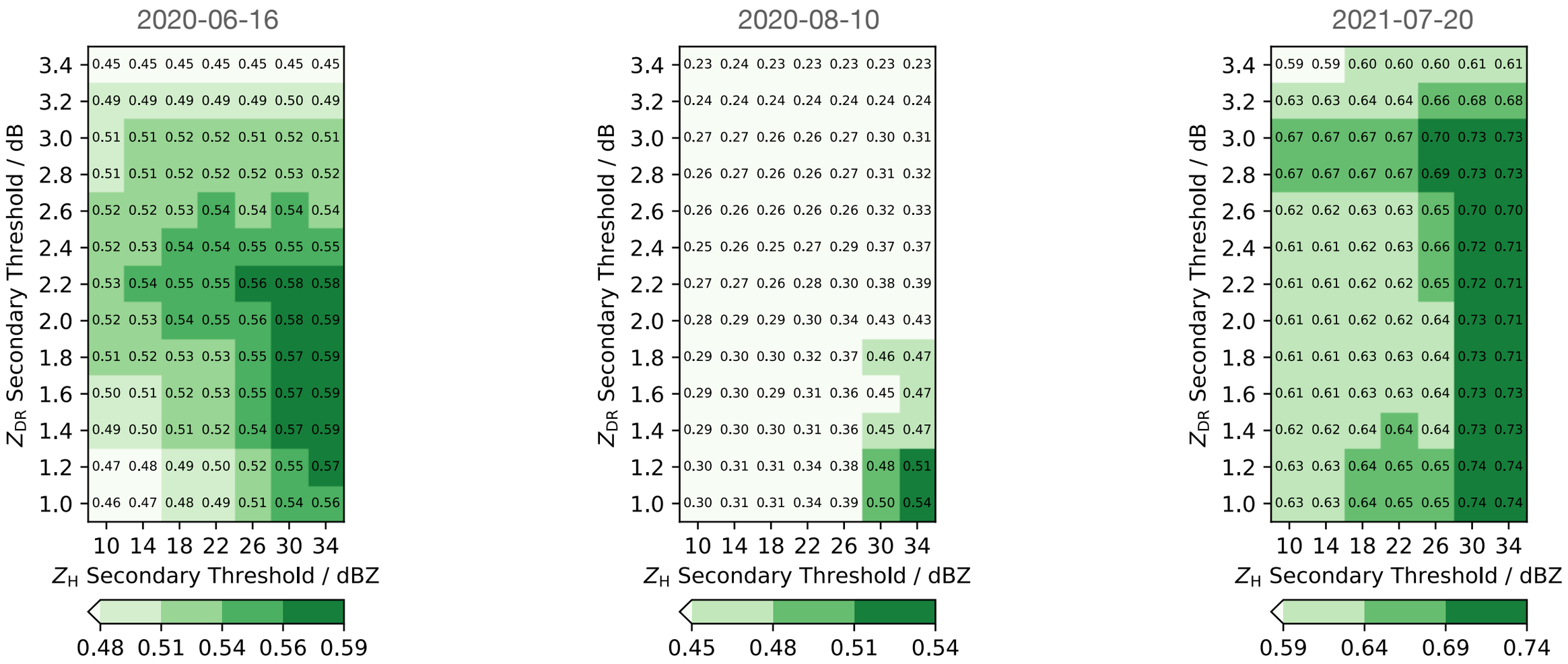
When do Z_{DR} columns appear before severe events?



- Upper Quartile: Up to 20 minutes from Z_{DR} column detection to storm labelled as ‘severe’

- Leadtimes decrease with requirement of a stronger Z_{DR} column signal as precursor

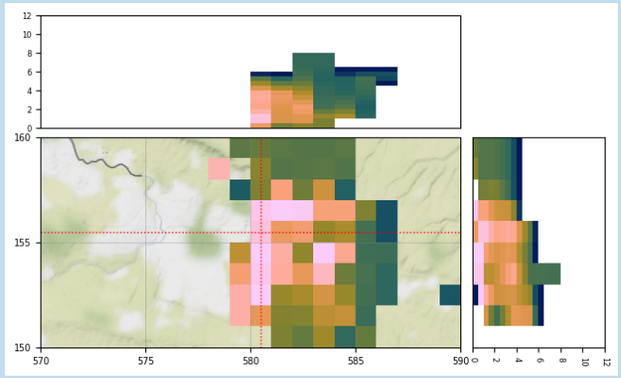
How well could Z_{DR} columns nowcast severe events? (Critical Success Index)



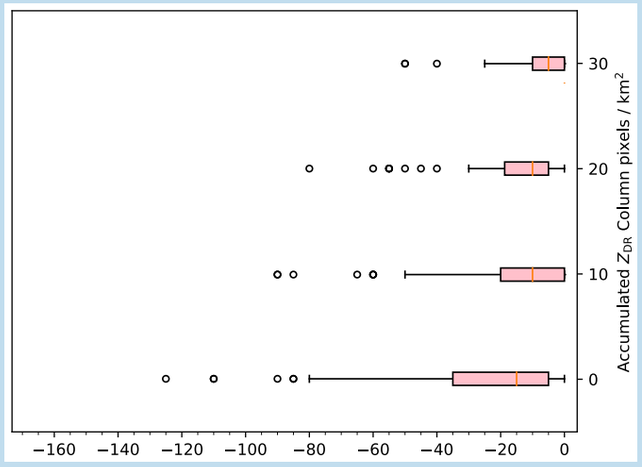
- Highest CSIs occur for high Z_{DR} values (~2.0dB) and moderate Z_H (~30dBZ)

- Low Z_{DR} secondary threshold suggests hail contamination

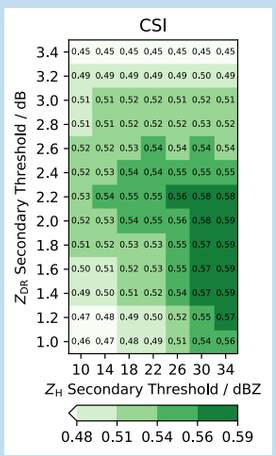
Conclusions

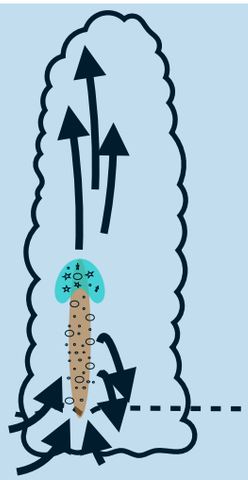


Z_{DR} columns seen in UK 3D radar composite and associated with high-impact events



Z_{DR} columns are detected up to 20 minutes before a storm is considered severe





Secondary thresholds of Z_H ~ 30dBZ, Z_{DR} ~ 2.0dB work best

Consistent with physical understanding of Z_{DR} column microphysics