# X-band Radar Observations of the Angular Dependence of **Specific Differential Phase Above the Bright Band**

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### Summary

- Study of observations of Specific **Differential Phase (K**<sub>DP</sub>) above melting layer
- Changes of  $K_{DP}$  due to elevation angle result in changes in hydrometeor classification
- Using knowledge of reflectivity and temperature could help improve adjustment of K<sub>DP</sub>

### Introduction

- Unlike reflectivity,  $K_{DP}$  is immune to radar miscalibration, attenuation, and partial beam blocking. Therefore, it is being studied more for information retrievals.
- Uses of  $K_{DP}$  include rain rate retrieval, hydrometeor classification, melting layer detection, ice water content retrieval.
- Being a differential measurement, suggested  $K_{np}$ varies depending on radar elevation angle, similar to  $Z_{np}$ . This variation has previously been theoretically derived.
- Study of  $K_{DP}$  measurements from X-band radar in Southern England during stratiform weather through Winter 2018.



# **K**<sub>DP</sub> and Elevation Angle

 Observationally confirmed relationship in Schneebeli et al. (2013):

 $K_{DP}(\theta = 0) = \frac{2K_{DP}(\theta)}{1 + \cos(2\theta)}$ 

- Relationship breaks down at elevation angles greater than 70° (see Hydrometeor Classification below)
- Differences in reflectivity and temperature may help  $K_{np}$  adjustment at high elevation angles





RHI from 17<sup>th</sup> May 2017 at Chilbolton Observatory, South England. Top:  $K_{DP}$ . Bottom: Hydrometeor Classification (Thompson et al. 2014). Left: Measured  $K_{DP}$ . Right: Adjusted  $K_{DP}$  using equation in Schneebeli et al. (2013) (above).



- Adjusting  $K_{DP}$  for elevation angle affects HCA output
- Difference between aggregates (pink) and dendrites (yellow), particularly between 4 and 6 km (-5 °C and -15 °C)
- Noisy, no change when elevation angle above 70°
- Accounting for reflectivity and temperature may improve K<sub>DP</sub> adjustment
- More important when elevation angle greater than 20°



## Conclusion

Observational confirmation of change in K<sub>DP</sub> with elevation angle • Accounting for reflectivity and temperature could improve K<sub>DP</sub> adjustment Important for RHI scans and high elevation PPI scans

### **Future Work**

• Study of IWC and K<sub>DP</sub> relationships



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