Post-processing of ARM SGP wind profiler for dual-frequency rain profile retrievals

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Objectives

- Rain rate profile retrievals from attenuation of 35 GHz ARM cloud radars

- The reconfigured ARM wind profilers provide a reference Rayleigh reflectivity profile to estimate rain attenuation

- The validity of reflectivity measured by the wind profiler in its two modes has to be carefully checked: elimination of potential errors (noise floor estimation, saturation) and calibration with collocated disdrometer measurements

2) Dual-wavelength rain profile retrievals

- Linear relation between rain rate and attenuation at 35 GHz (Matrosov 2006): $a\,(dB\,km^{-1}) = 0.28\,R\,(mm\,h^{-1})$

- Estimation of gas attenuation from soundings, detection of the presence of clouds using lidar measurements

- The differential attenuation between 35 GHz and 915 MHz can be directly converted into rain rate
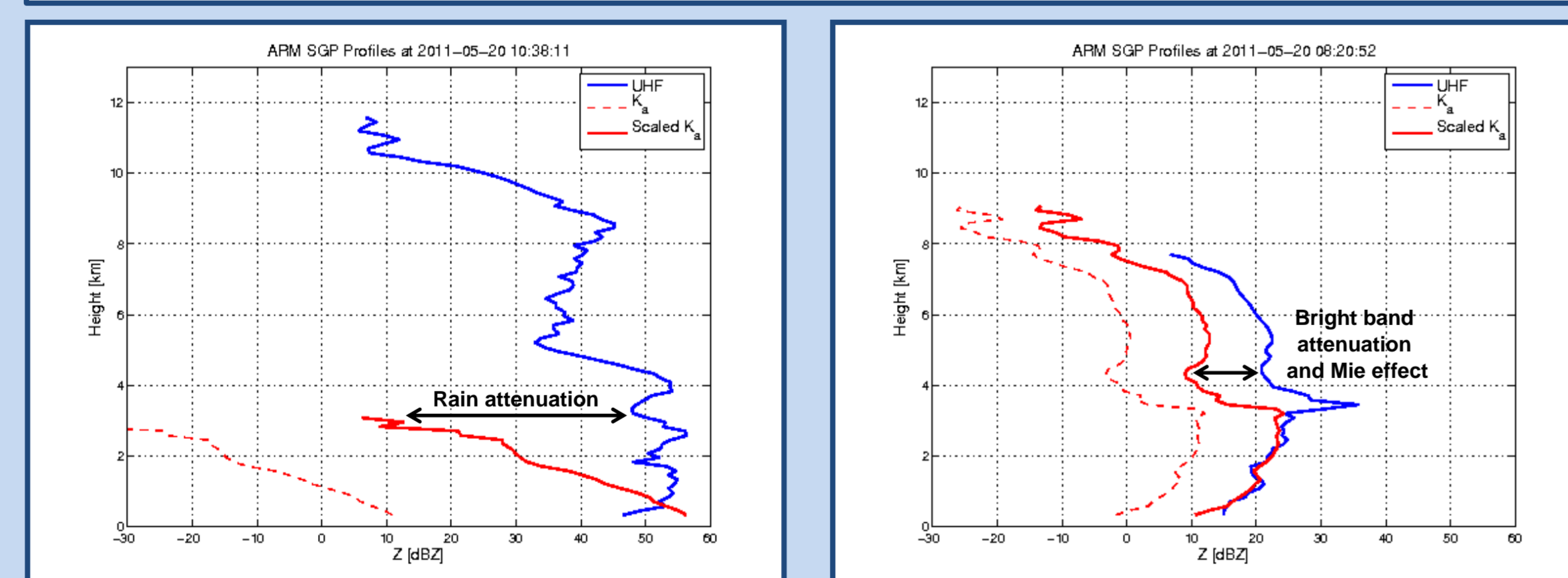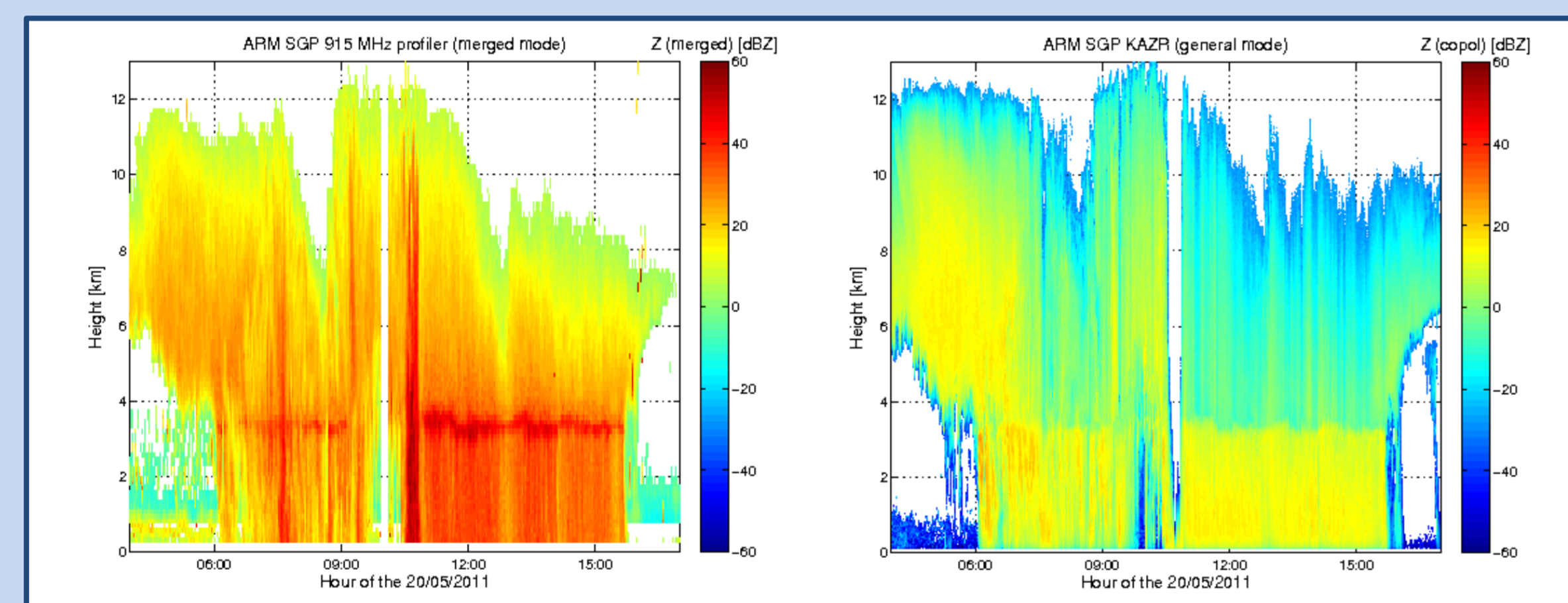
Future work

- Rain rate retrieval up to bright band level (validation near the ground with disdrometer)

- Possibility of use of reflectivity ratio between 94 GHz and 915 MHz for low rain rates

- Investigation of bright band attenuation and Mie effects in ice phase

1) Signal post-processing and reflectivity calibration of the wind profiler
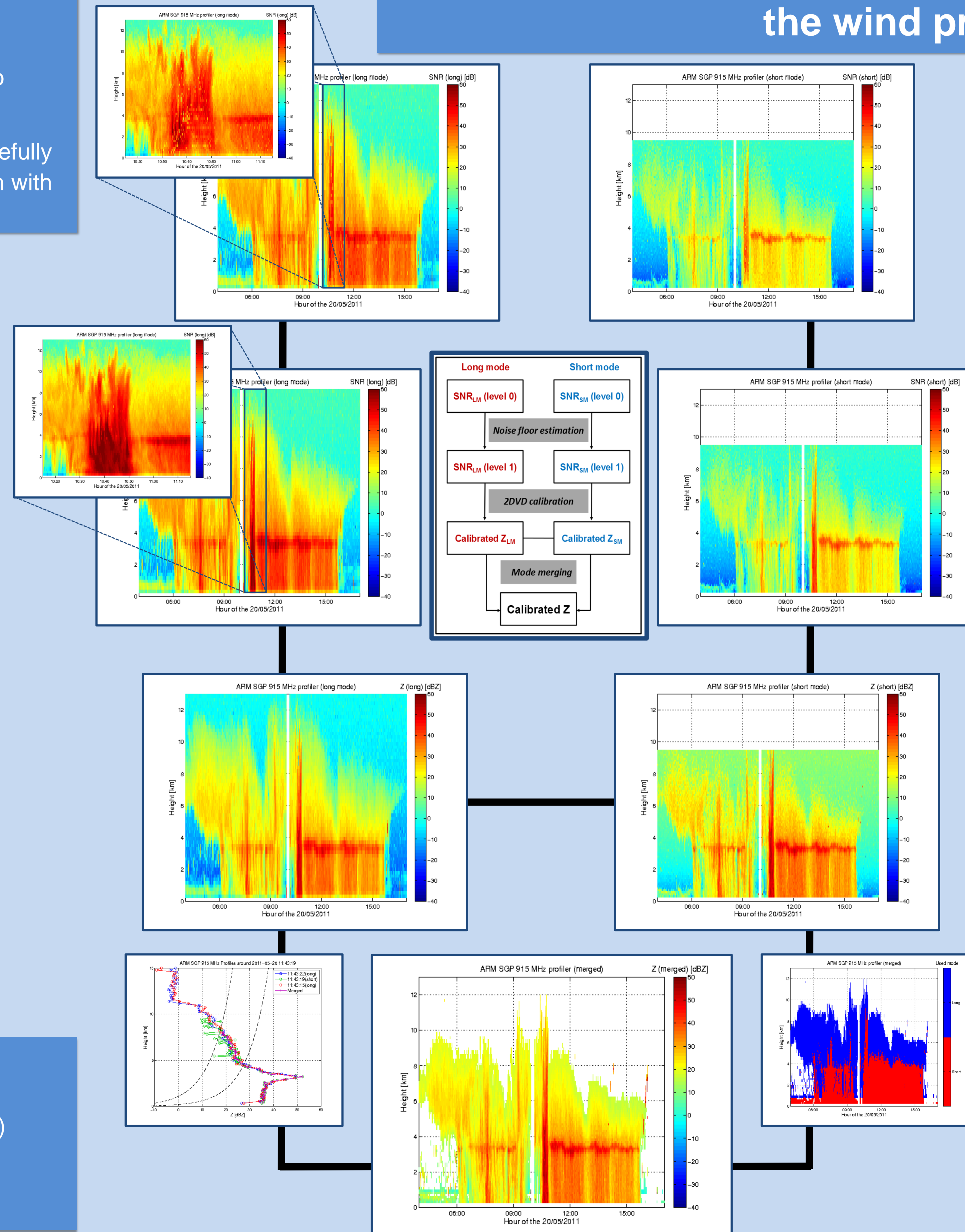
Noise floor estimation

- Large beam width (9º) associated with wind shear and turbulence lead to wide spectra

- Overestimation of noise level in bright band and convective precipitation

- Determination of noise level from clear air echoes for each profile

2DVD calibration

- Comparison of short mode reflectivity in the lowest range gate with collocated disdrometer measurements

- Comparison of both modes between 1 and 5 km height

Mode merging

- Short pulse mode has a good resolution while long mode has a better sensitivity at long range

- Merging of the modes to gather the assets of both modes a single profile

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