On the use of NEXRAD measurements over the SGP site

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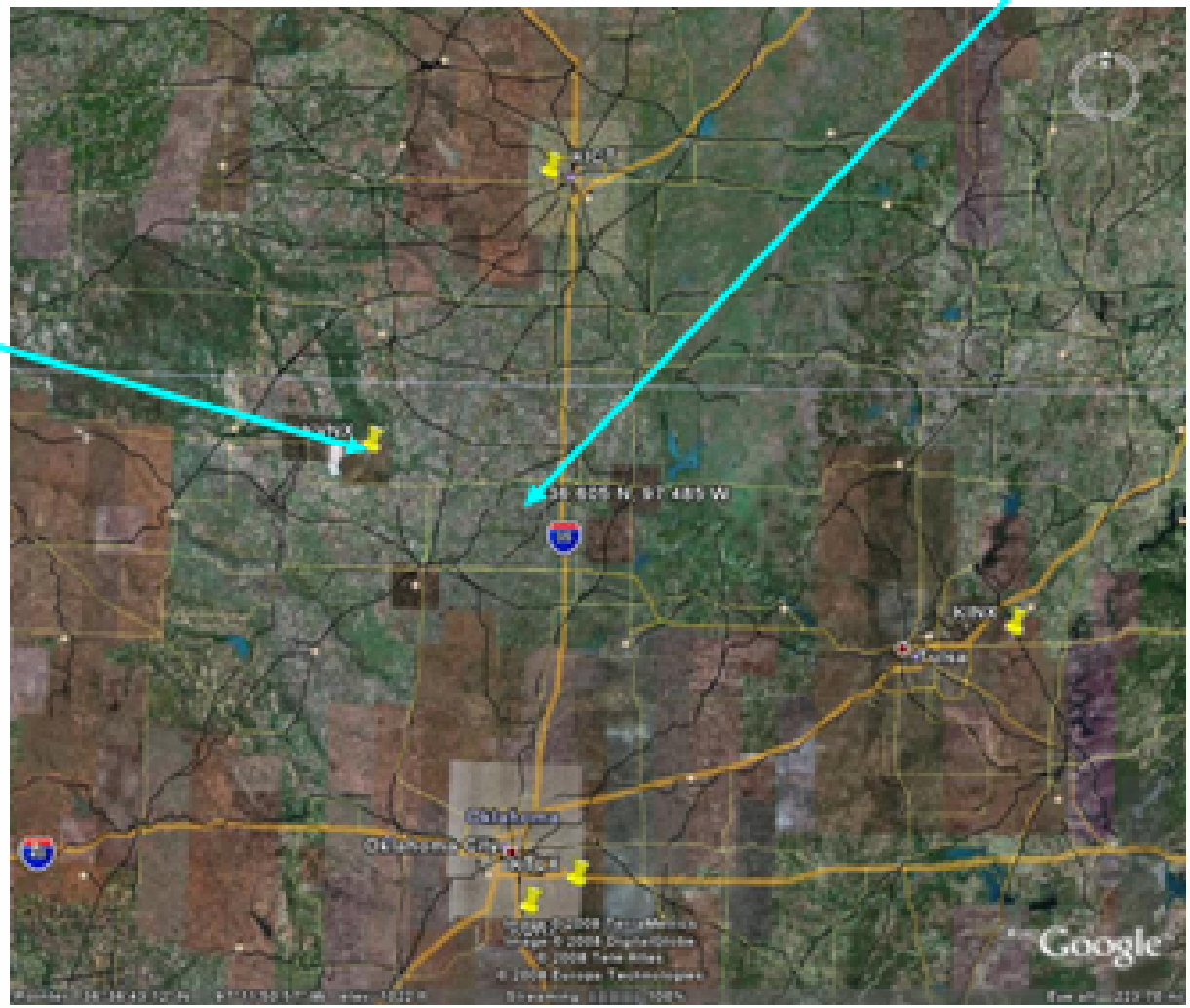
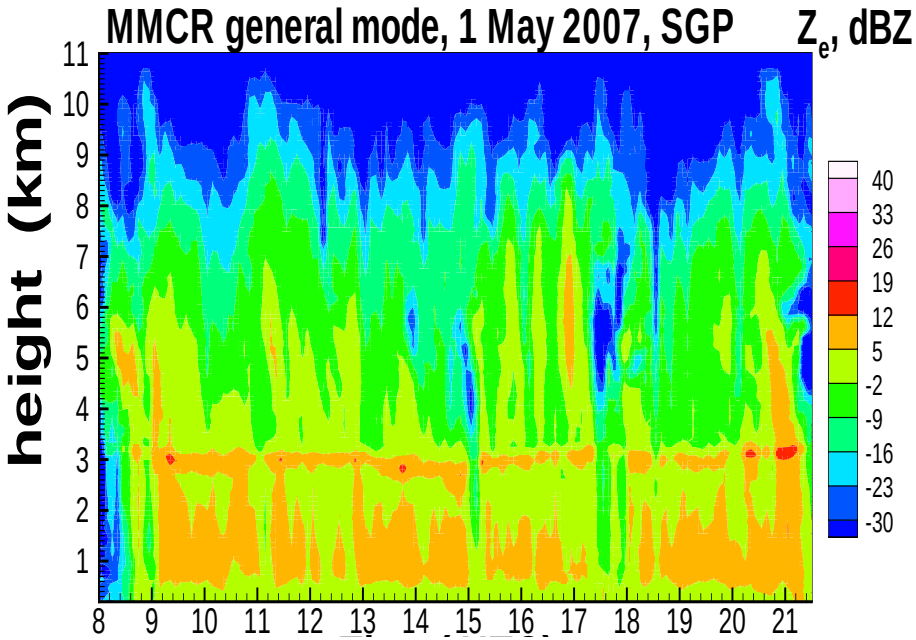
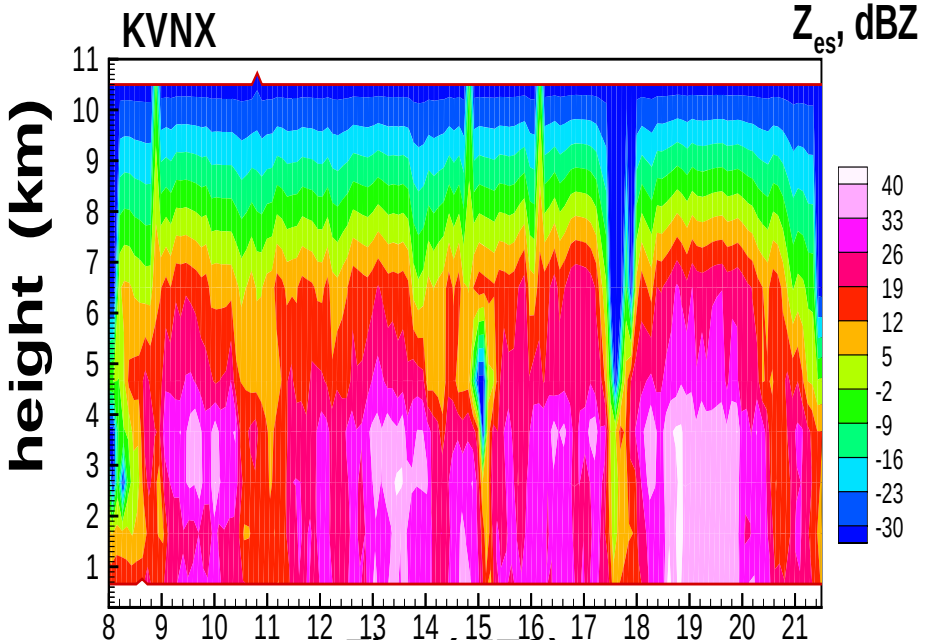
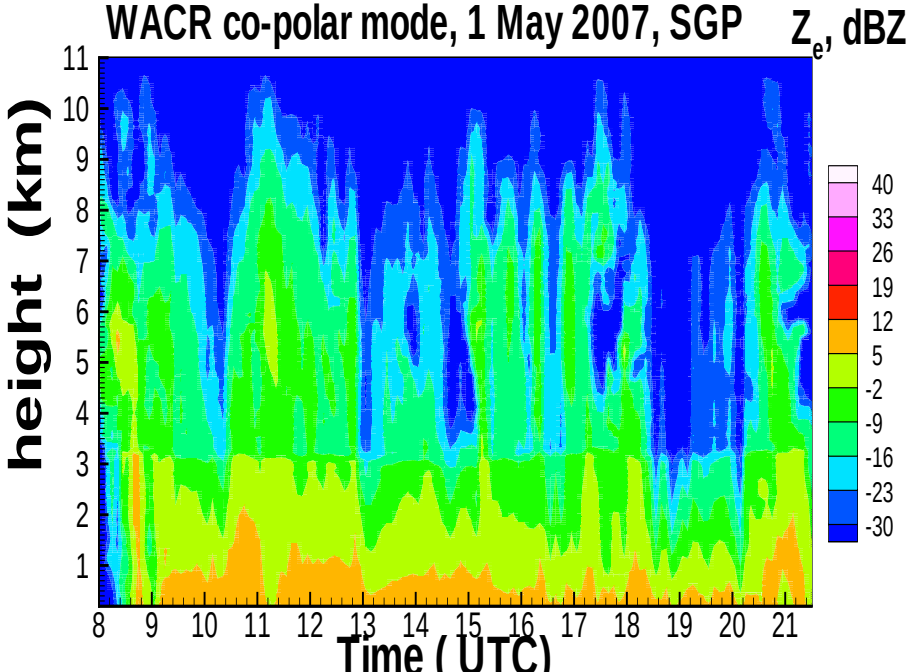
KVNX
NEXRAD
(WSR-88D)

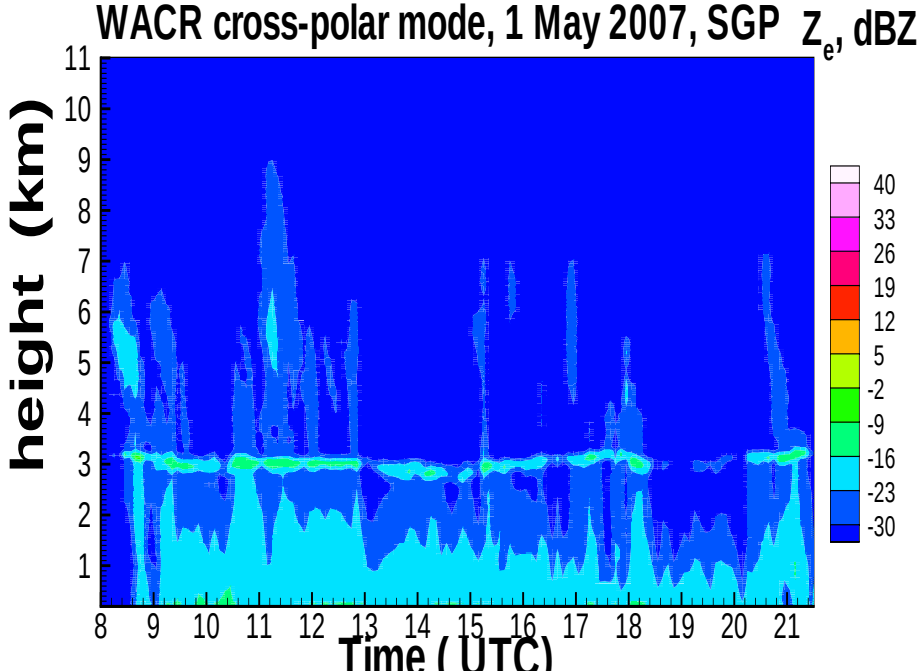


A precipitation event as seen by different radars







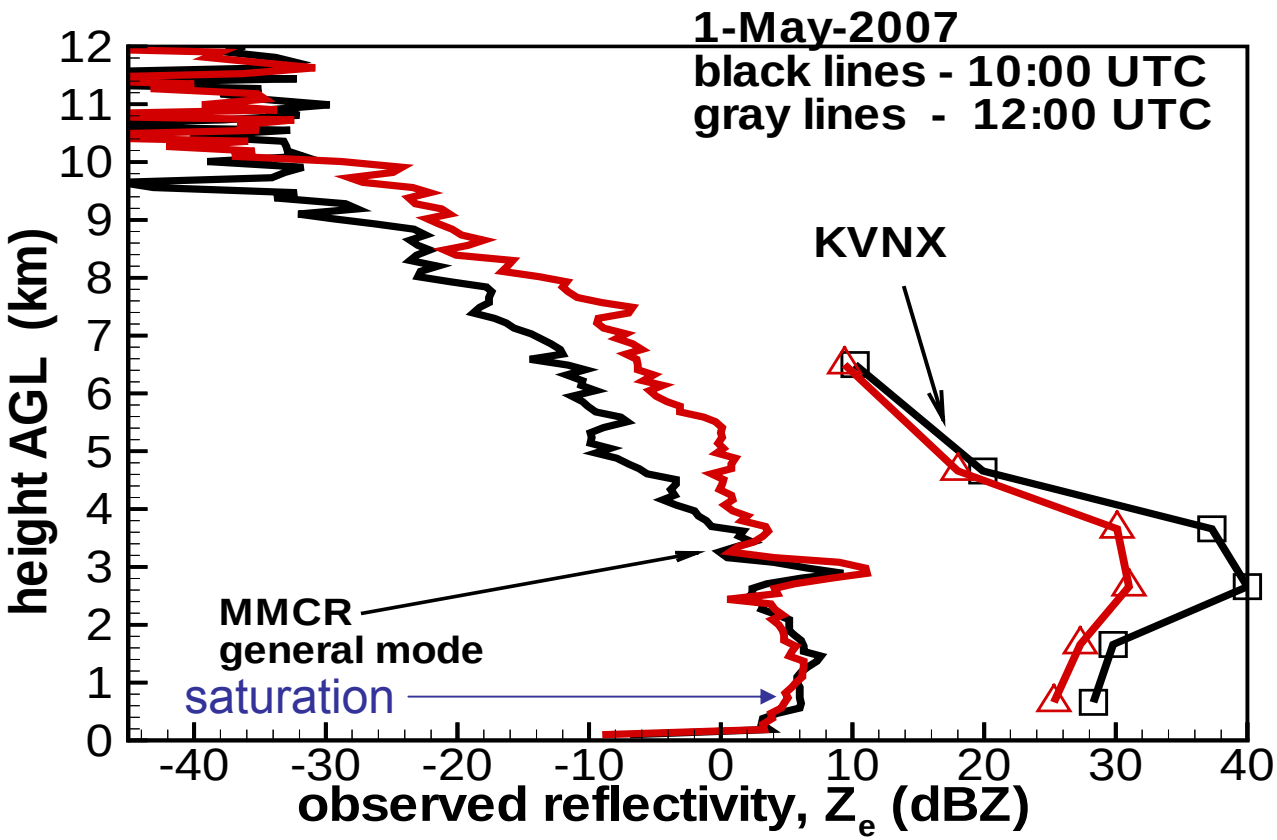


A closer look at MMCR and KVNX reflectivity profiles

vertical and horizontal resolution issues:

NEXRAD resolution ~ 1 km^3, profiles available every 5-6 minutes only, typically 6 – 8 data points in a profile

NEXRAD super-resolution ~ 0.25 km^3 (now available)

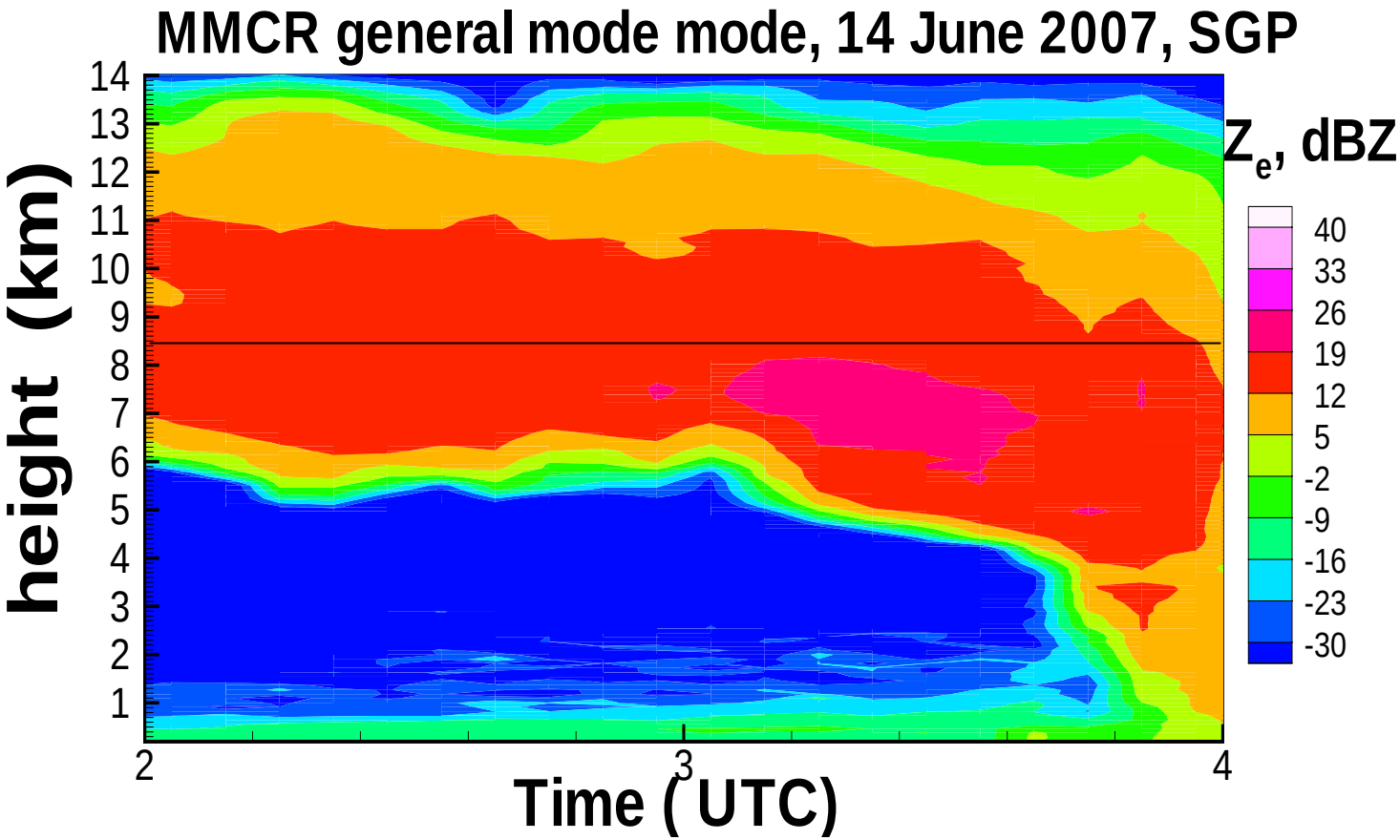


How accurate are NEXRAD reflectivity measurements ?

Need to compare MMCR measurements with NEXRAD measurements for clouds that are observed without intervening rain and melting layers

Need to account for the difference in NEXRAD and MMCR radar wavelengths and spatial resolutions

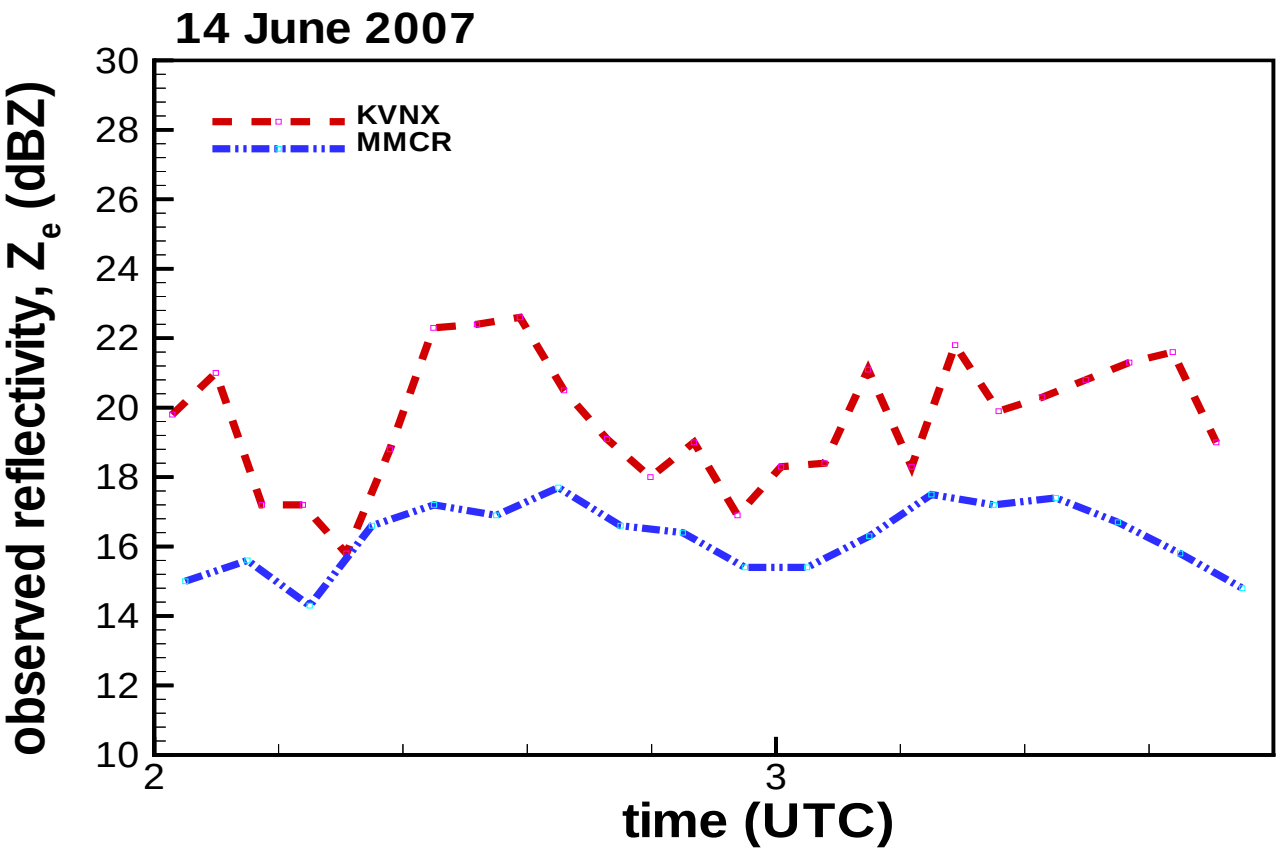
Comparisons of MMCR and NEXRAD measurements in thick ice clouds



Comparisons of MMCR and NEXRAD measurements in the thick ice cloud at 8.5 km AGL

MMCR – 5 min by 1 km (8.5 ± 0.5 km) averages to match the KVNX data

The mean KVNX – MMCR reflectivity difference is ~ 3.8 dB

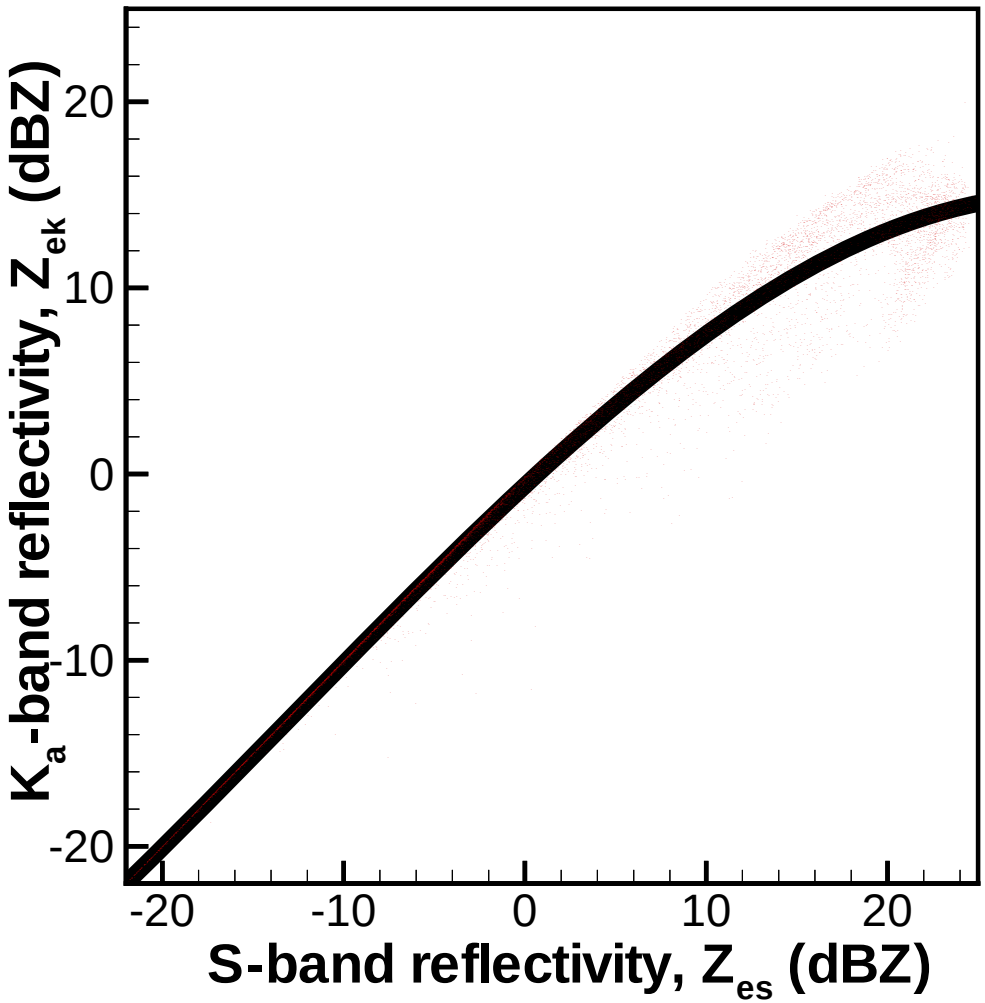


Need to account for the S-band (KVNX) – Ka-band (MMCR difference)

λ=10 cm λ=0.846 cm

$$Z_{MMCR} = -0.62 + 0.904Z_{KVNX} - 0.00720Z_{KVNX}^2 - 0.000187Z_{KVNX}^3$$

calculations for non-spherical particles using a large microphysical data set collected from different in situ ice cloud samples



Comparisons of MMCR and NEXRAD measurements in the thick ice cloud at 8.5 km AGL

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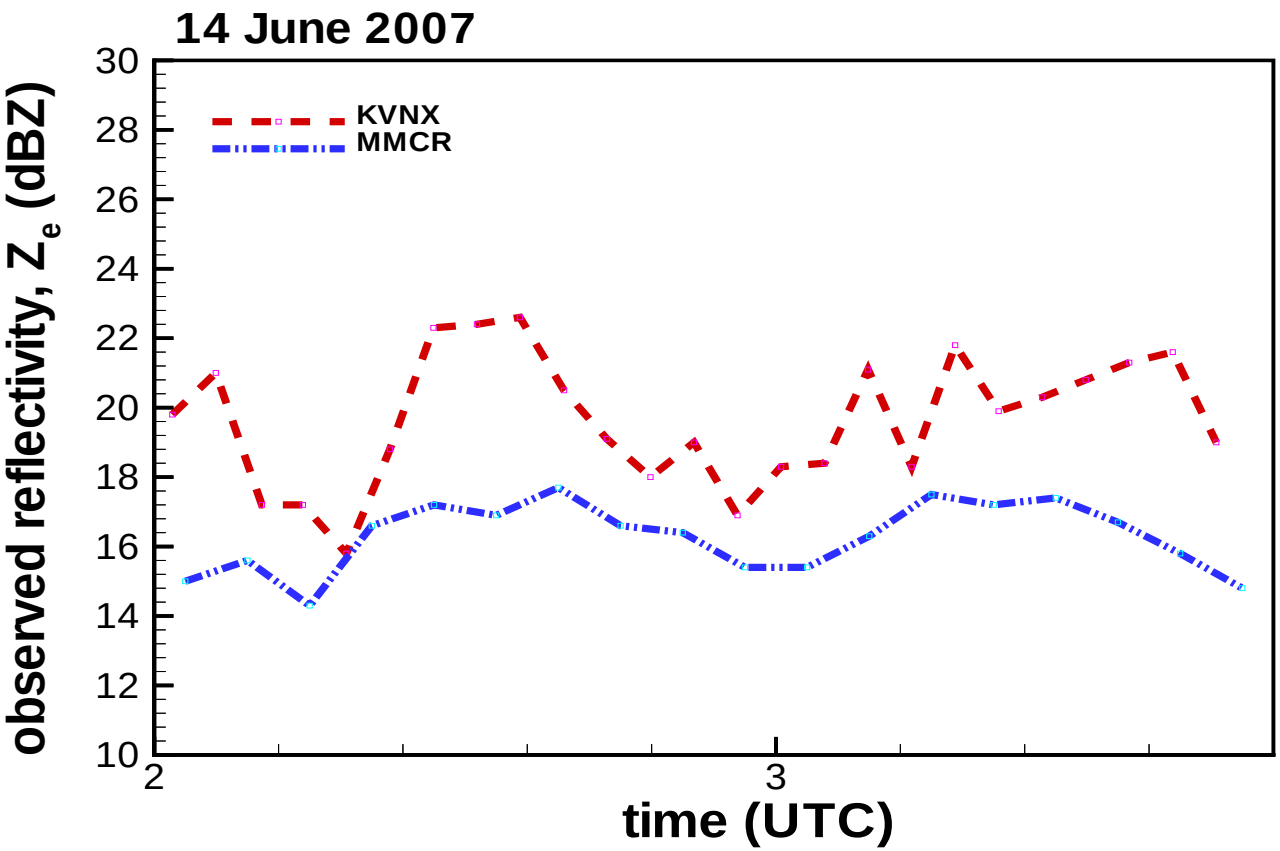
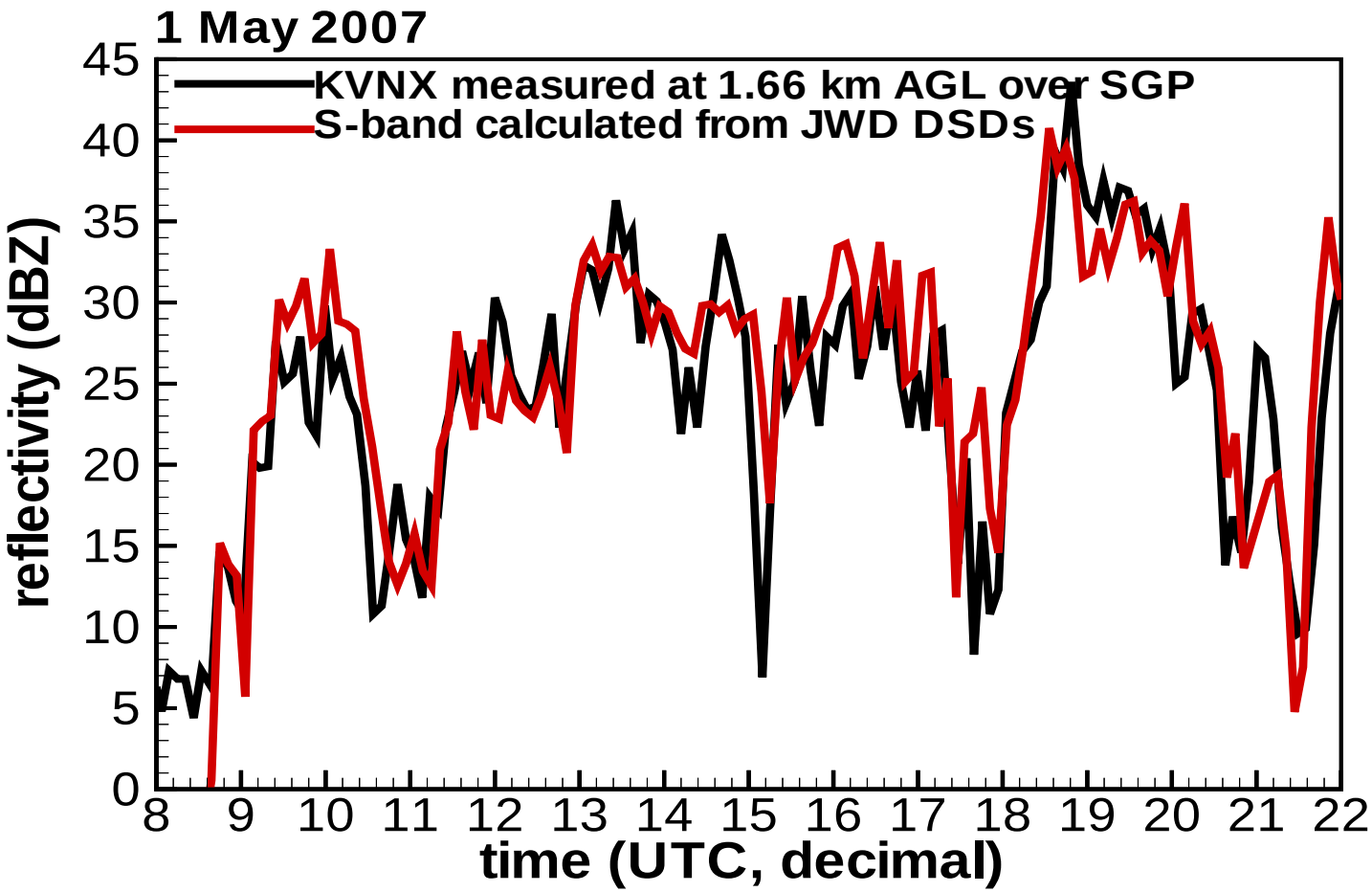
At a 19 dBZ S-band reflectivity level, we can expect ~ 5.5 dB S-K_a band reflectivity difference due to non-Rayleigh scattering at K_a-band. Since measurements show ~3.8 dB difference, MMCR reflectivities may be about 1.7 dB too "hot" compared to KVNX

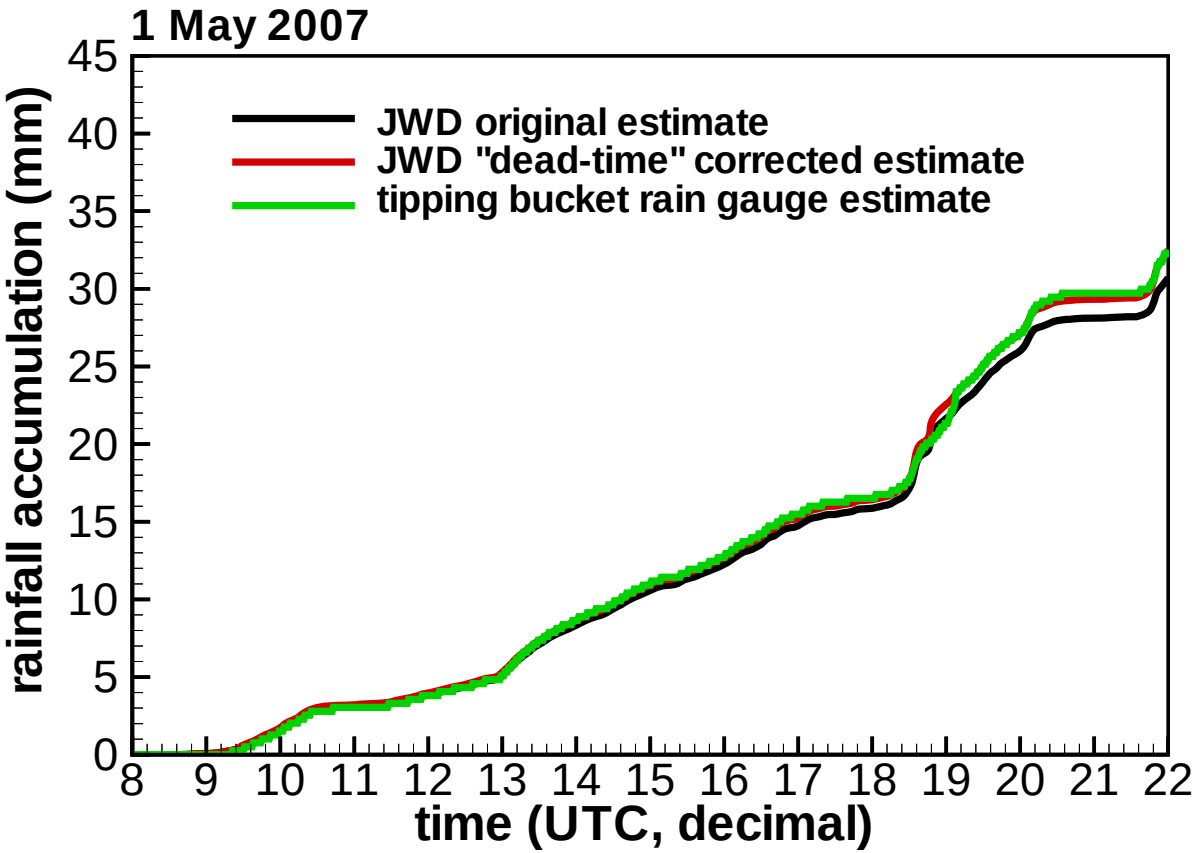


Comparisons of S-band rain reflectivities calculated from JWD DSDs and measured by the KVNX WSR-88D radar in the rain layer

On average KVNX reflectivities are lower than JWD calculations by 1.3 dB



How good are the JWD measurements ?



Conclusions

- KVNX NEXRAD measurements present a valuable data set for ARM, which can be used for studies of precipitating and thick ice clouds.

- KVNX radar volume scans can be used to reconstruct spatial low-resolution vertical profiles of non-attenuated S-band radar reflectivity over the SGP site every 5-6 minutes or so. Heights of the data points are not fixed and depend on the particular volume scan strategy chosen by the NEXRAD operators. This strategy can change from event to event and even during the same event. The lowest KVNX tilt (~0.5^{o}) might experience some beam blockage towards SGP.

- When using ARM cloud radars (MMCR, WACR) in conjunction with the KVNX data, differing spatial resolutions and radar wavelengths should be taken into account. Non-Rayleigh scattering effects at cloud radar frequencies can cause up to 10 dB difference between MMCR and KVNX reflectivities (more for WACR).

- Comparisons of MMCR and KVNX radar data indicate that their absolute calibrations are within ~1.7 dB (relative to each other).