DCS Cloud-Precipitation Properties Derived from Aircraft-Surface-Satellite Observations during MC3E IOP

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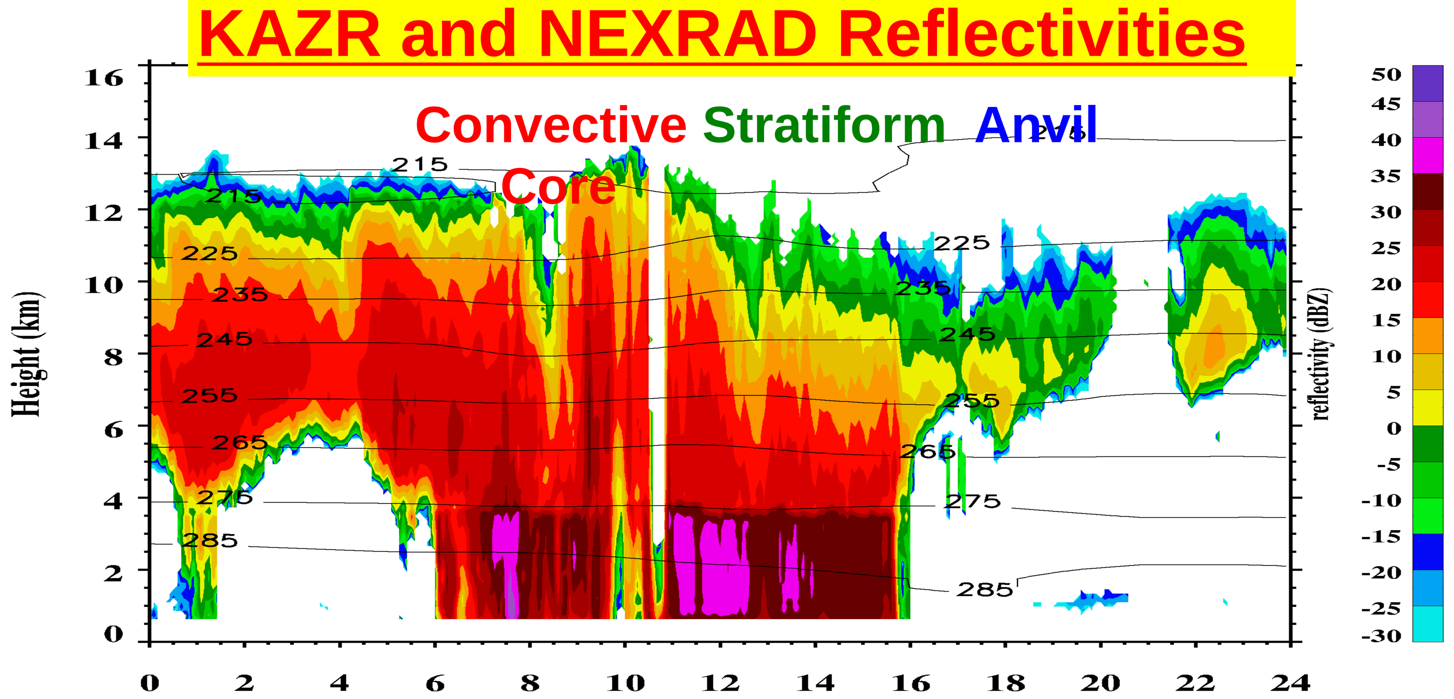
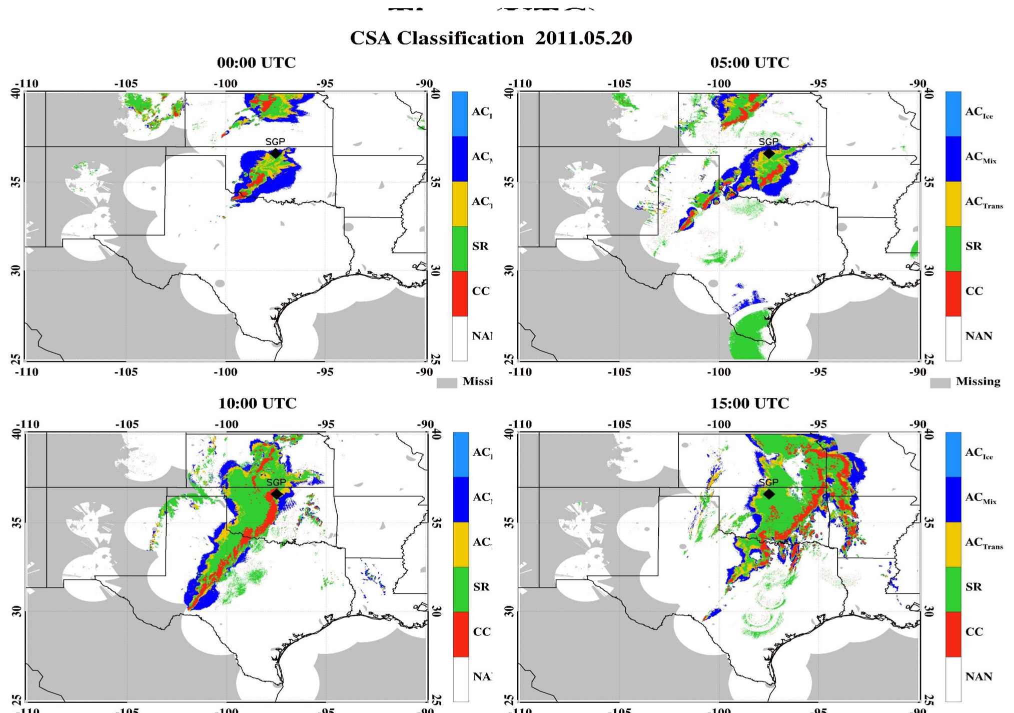
Datasets and results available for ARM/ASR

1. 2D and time-height NEXRAD over SGP and its classified DCS components (Convective core, Stratiform region, and Anvil clouds).
2. Surface precipitation from NEXRAD Q2 and OK Mesonet measurements
3. Time series of NEXRAD, corrected KAZR reflectivity and fall speed, LWP, disdrometer etc.
4. UND citation aircraft in situ measurements
5. GOES retrieved cloud properties.

A Case Study: May 20th, 2011





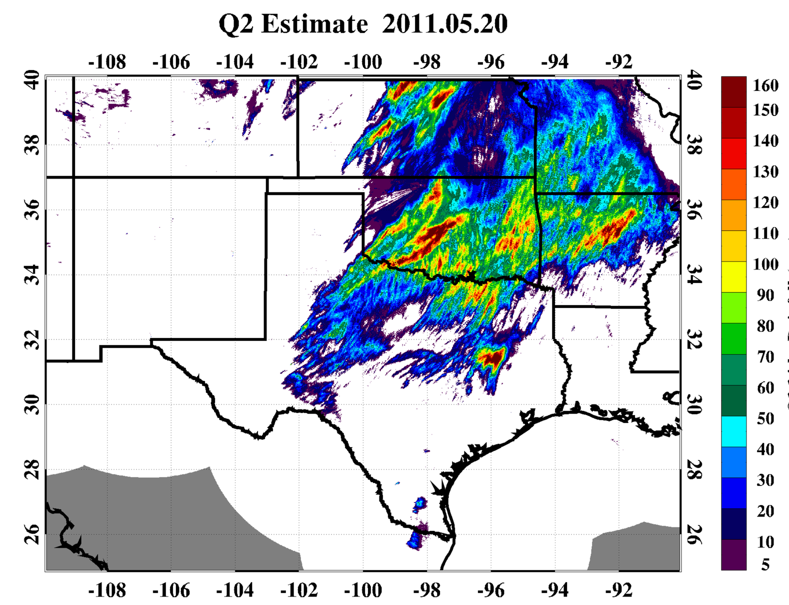
➔The frontal squall line system originally located at Southwest of the ARM SCF, advanced over the SCF around 0:00 UTC, maturing later.

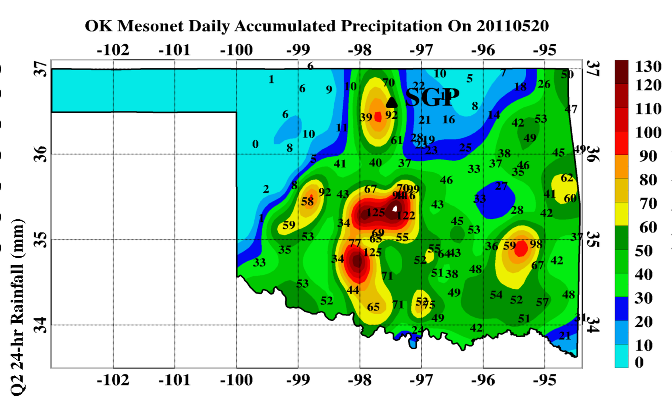
➔The convective cores started to pass over the SCF around 9:00 UTC and heavy precipitation occurred during 10:30-11:00 UTC with a significant change in cloud properties before and after the heavy precipitation.

➔Before precipitation, there were large graupel and ice particles with strong vertical motion in the convective cores.

➔After that, a stratiform region was developed with two distinguished layers: ice and water particles above and below the melting layer, respectively.

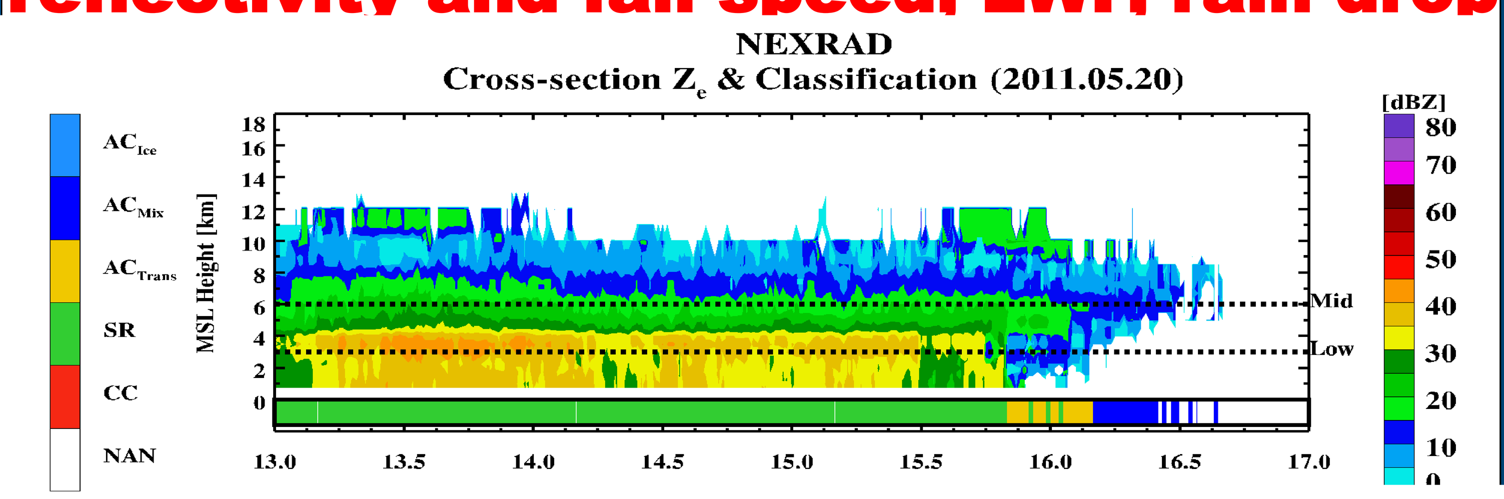
Daily Precipitation from NEXRAD Q2 and OK Mesonet measurements

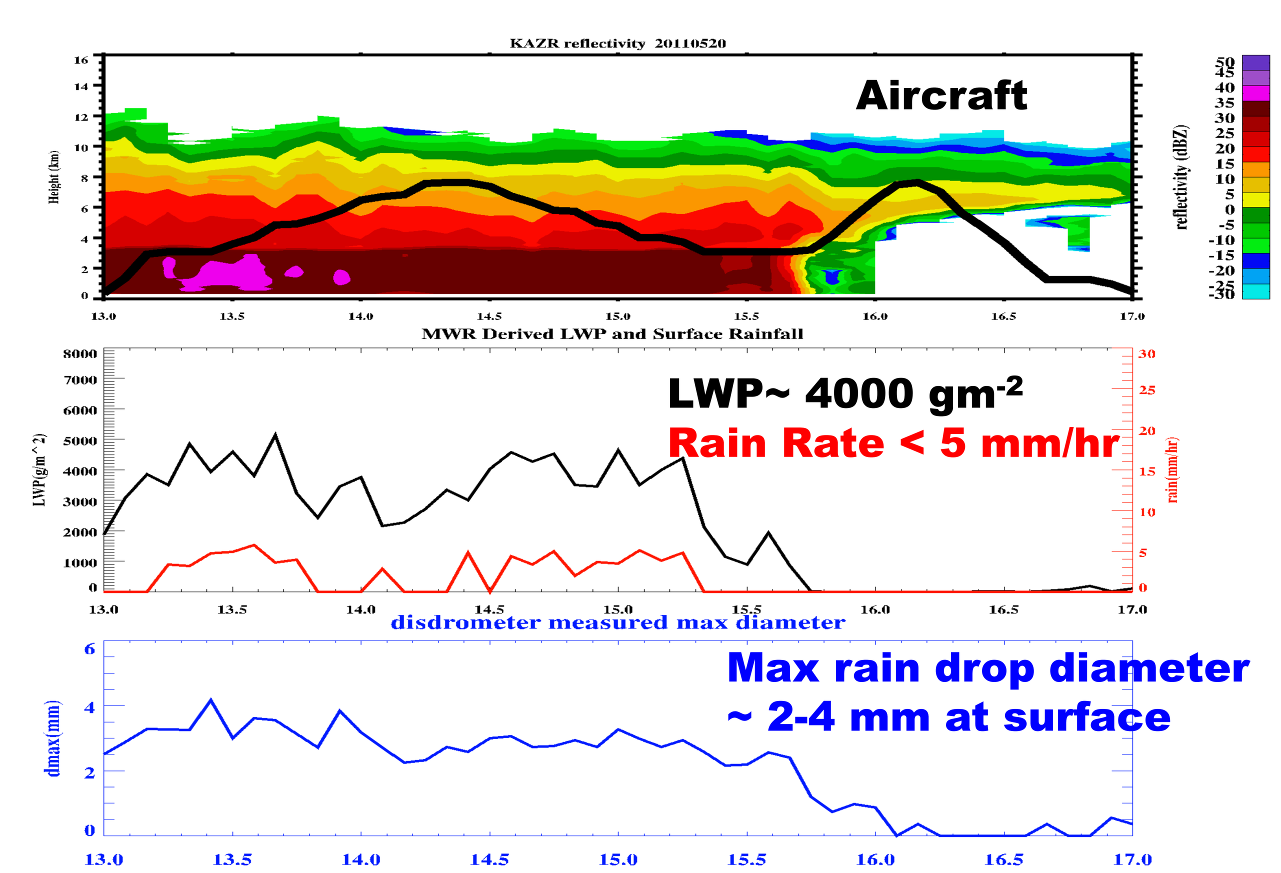




Max daily precipitation can reach up to 120 mm over central OK.

Time series of NEXRAD, corrected KAZR reflectivity and fall speed, LWP, rain drop



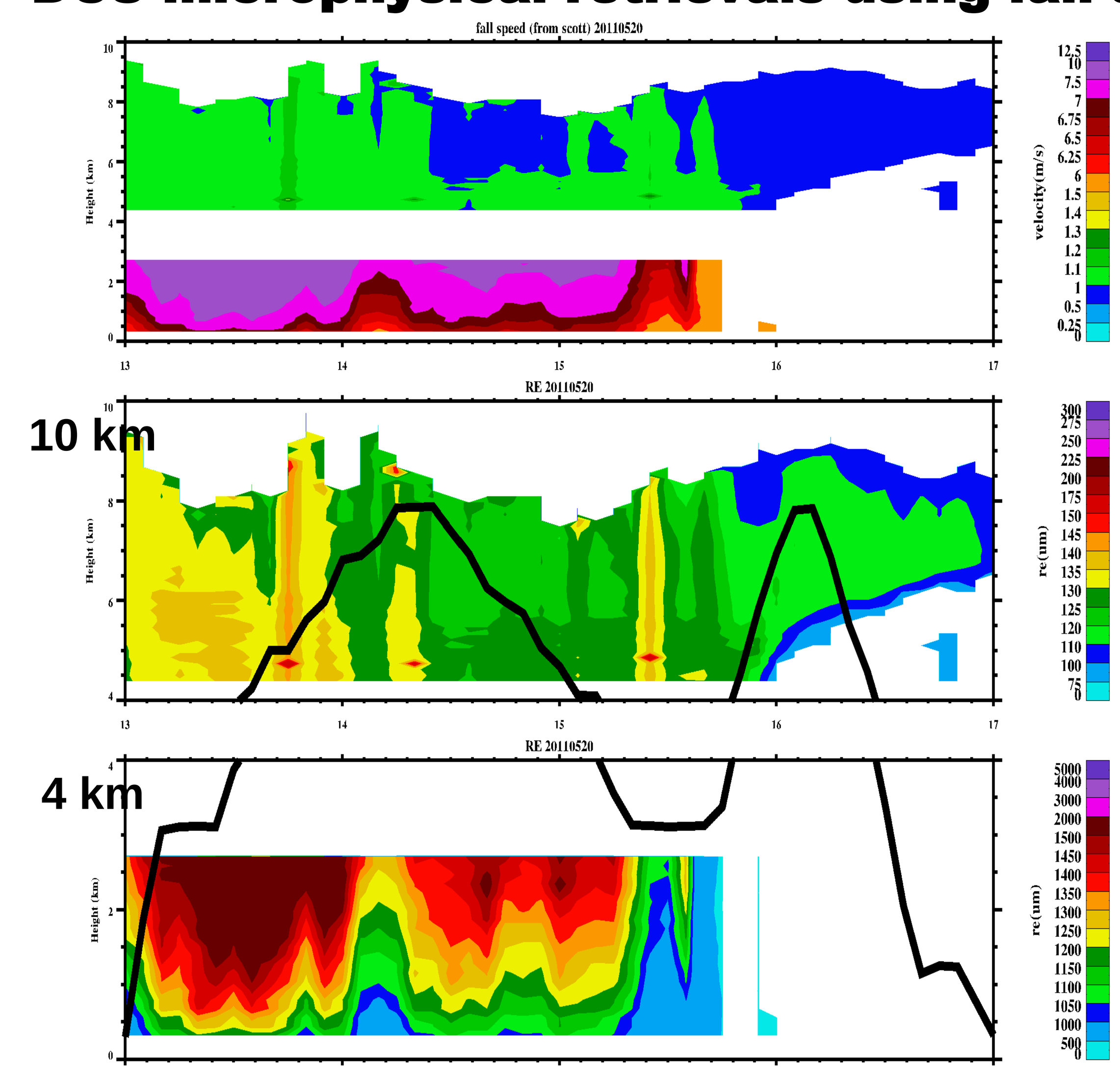


Summary

1) Above melting layer, the ARM and GOES retrieved re values (110-150 um) are close to aircraft in situ measurements.
2) Just below melting layer, ARM retrievals (re ~ 2 mm) agree well with aircraft data.
3) Near surface, ARM retrievals (re ~ 1-2 mm) agree well with max rain drop radii at surface measured by Disdrometer.

Microphysics Comparison

DCS microphysical retrievals using fall speed



➔Fall Speed derived from KAZR reflectivity.
> 4 km, V_{FS}~ 1 m/s
< 4 km, V_{FS} ~ 10 m/s

Based on relationship V_{FS} ~ r
> 4 km, water re=110 to 150 um (ice re=240-340 um, same as aircraft at 7-8 km)

Below melting layer, rain drop radii range from 1 to 2 mm, consistent to Disdrometer data at surface (D ~ 2-4 mm)