Improving GOES Derived Rain Areal Coverage Estimate by using a Hybrid WSR-88D and GOES Classification for Deep Convective Systems

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Zhe Feng (zhe.feng@und.edu), Xiquan Dong, and Baike Xi, University of North Dakota
Patrick Minnis and Mandana Khaiyer, NASA Langley; Amir AghaKouchak, University of California, Irvine

Wednesday 8:30-4:00PM

Objective

1. Evaluate GOES IR-temperature-based precipitation retrieval in data rich Oklahoma region using surface observations
2. Develop cloud system classification using GOES cloud microphysics retrievals to improve GOES precipitation area estimate in deep convective systems

Precipitation Data

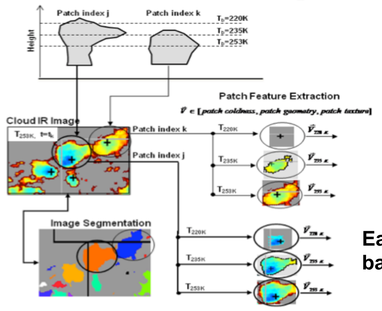
PERSIANN-CCS Precipitation Retrieval (UCI)

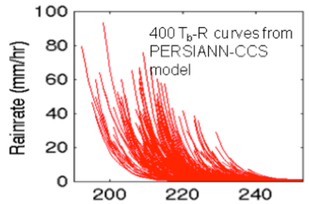
- Cloud patch identification, retrieval based on patch T_b features
- Calibrated with radar + gauges

Advantage:

- No reliance on local pixel T_b, high resolution (0.04°, hourly)

Issue: Assumes raining over entire identified cloud patch

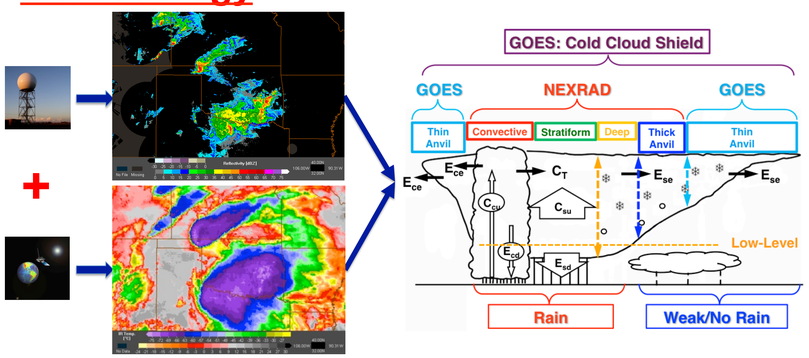




Each cloud patch has a unique T_b-RR curve based on their patch features

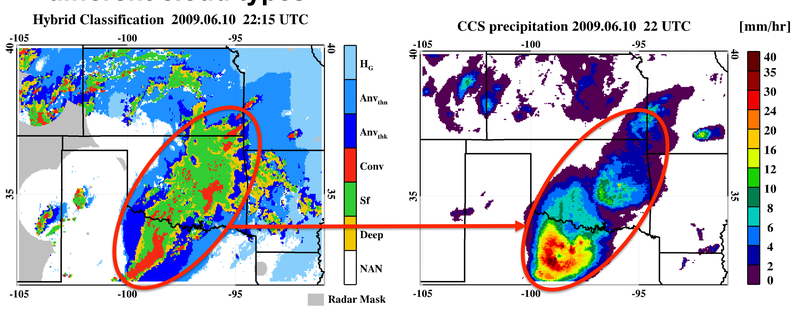
Hong et al. (2004)

Methodology

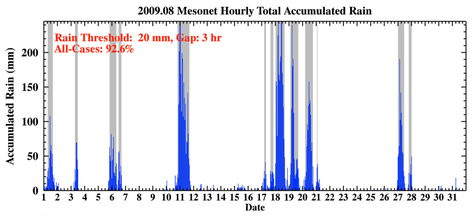


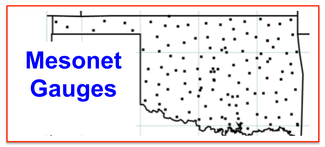
Hybrid Classification

- Combine radar and GOES Observations
- Classify precipitating clouds and anvil clouds
- Compare CCS rainfall against Mesonet surface gauges
- Find insights from GOES retrieved microphysics for different cloud types

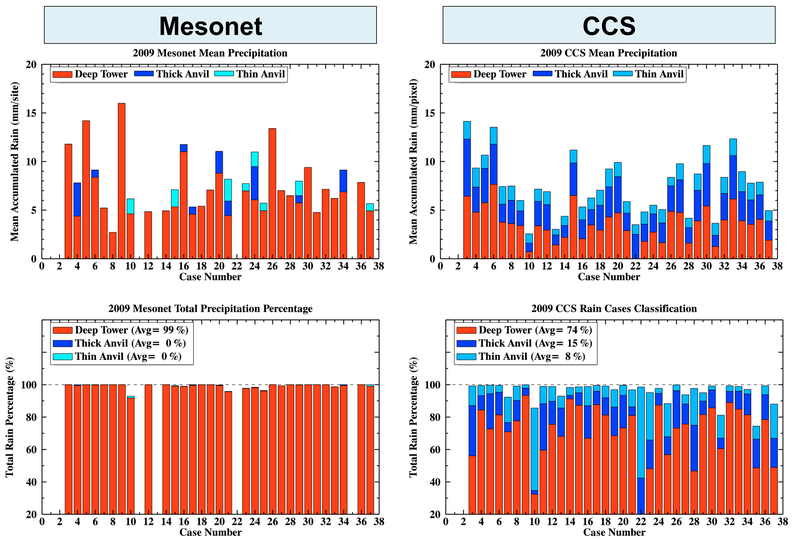


CCS Comparison with Mesonet



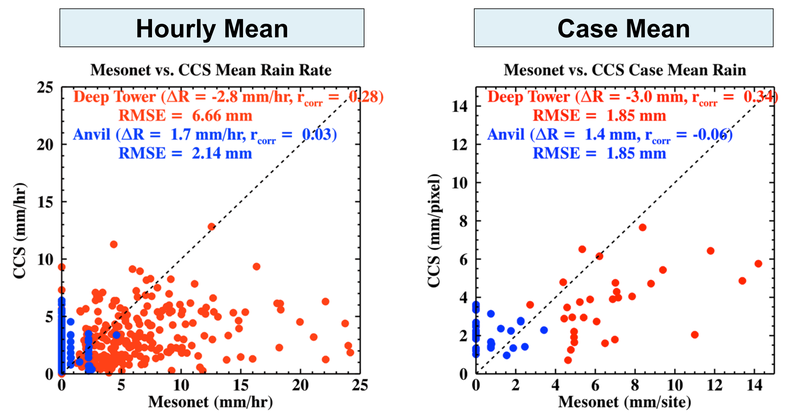


- Compare significant rain events in Oklahoma
- Jun – Aug 2009 (37 cases)
- Case must last more than 2 hours
- CCS cannot differentiate Conv/Sf/DeepCloud, simply these classification and group as Deep Tower



Rainfall comparison result:

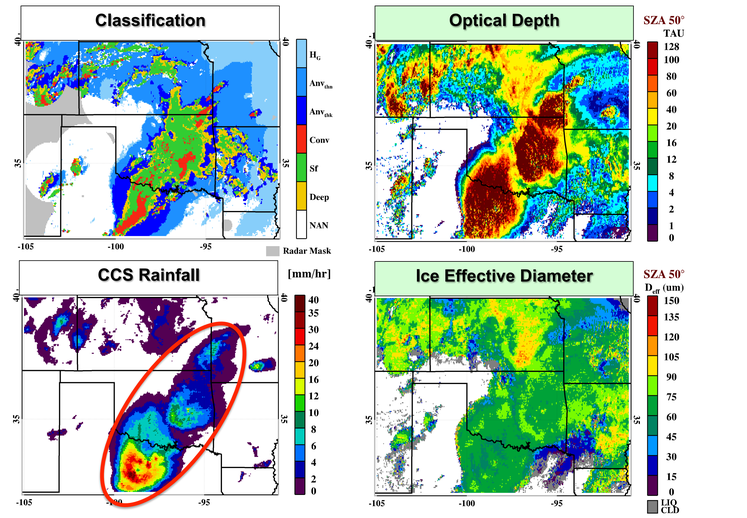
- Mesonet: almost all from Deep Tower (99%)
- CCS: significant amount from anvil
  - Deep Tower: 74%
  - All Anvil: 23% (Thick: 15%, Thin: 8%)



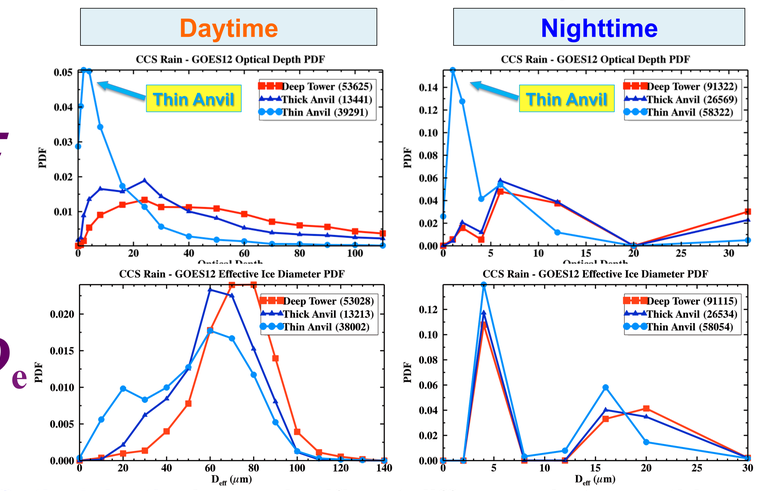
Comparison Summary

- CCS underestimate deep tower rain: -2.8 mm/hr
- CCS overestimate anvil rain: +1.7 mm/hr

Insight from GOES Cloud Microphysics

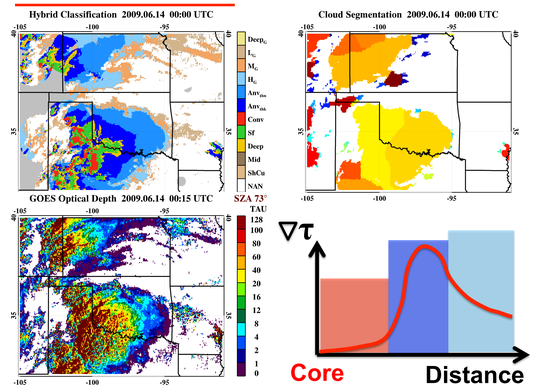


- Use CCS derived rainfall as mask
- Separate GOES cloud microphysics with Hybrid Classification
- Derive and compare statistics of cloud property differences



- Optical depth shows significant difference between thin anvil and other two types
- Difference exist for both daytime/nighttime
- Therefore the optical depths in thin anvil region may be used to improve non-raining area classification

Future Work



- Identify cold cloud shield
- Compute cold core to anvil τ gradient
- Peak gradient signals the transition from raining deep tower to anvil
- Use patch-based τ gradient to filter non-raining anvils