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Satellite Data Products for Quantifying Cloud Population

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U.S. DEPARTMENT OF ENERGY

Motivation

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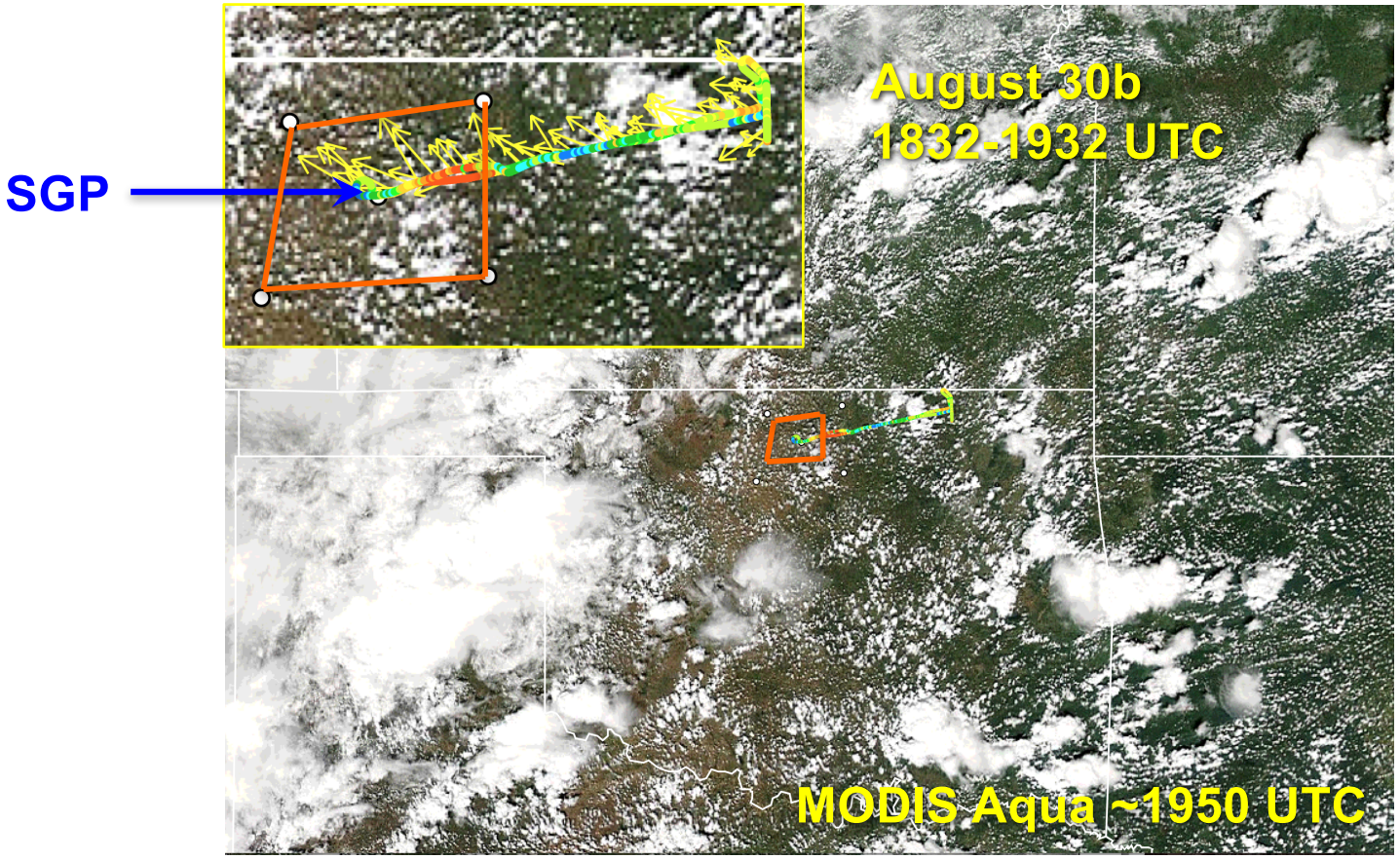
- HI-SCALE aircraft observations cover a large distance beyond SGP
- Cloud population distributions often have large spatial variability
- Satellite data provide useful complementary observations



Strengths and weaknesses of MODIS vs. GOES satellite product

- **MODIS**
  - **Pro:** 250-500 m resolution, ideal for characterizing shallow cumulus clouds
  - **Con:** only 2 over pass (~10:30AM, ~1:30PM) per day
- **GOES**
  - **Pro:** continuous observations (~30min or better)
  - **Con:** 1 km resolution, smearing effect on small clouds
- **Continuous (GOES) observations are preferred for:**
  - Studying evolution of cloud populations
  - LES simulations for case study
- Issue with high-resolution satellite cloud product
  - MODIS: highest cloud property retrieval products are 1 km (MODIS team)
  - GOES: highest cloud property retrieval products are 4 km (NASA Langley)
  - Neither is ideal for shallow cumulus clouds

Derive cloud mask from native visible channel pixel-level data

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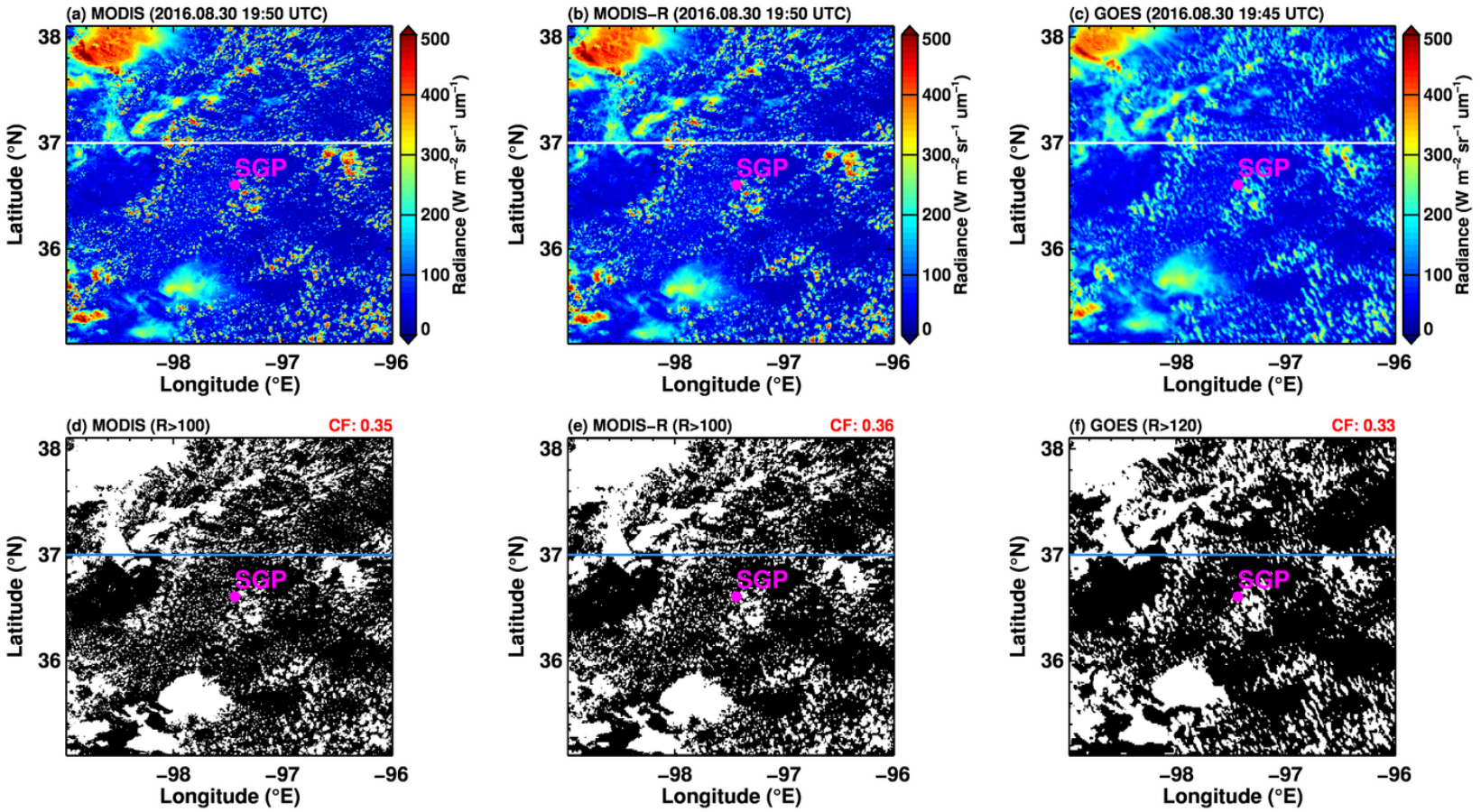
- Derive cloud mask on native visible channel data
- Compare GOES with MODIS to verify its cloud population detection capability

MODIS (500m) | **MODIS (1km)** | **GOES (1km)**



Radiance

Cloud Mask

Cloud size distribution comparison

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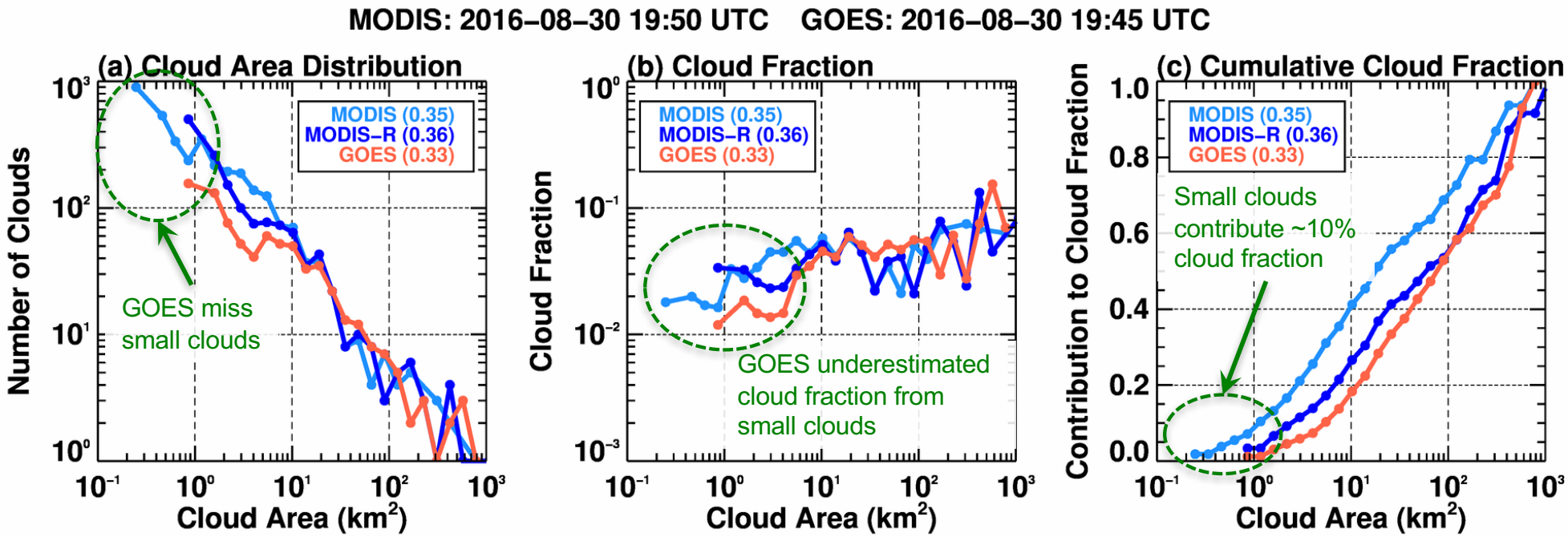
- GOES missed smallest clouds (area < 10 km^2) as expected
- Small clouds contribution to total cloud fraction ~10%
- Coarsening MODIS to GOES resolution reduced the difference
- Result is somewhat case dependent, some days compare better than others



Satellite data products

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- **GOES data product**
  - Time series of cloud fraction, cloud size distribution
  - Gridded 1km visible reflectance
- **MODIS data product**
  - Gridded 500m radiance
- Preliminary data version processed for all HI-SCALE days