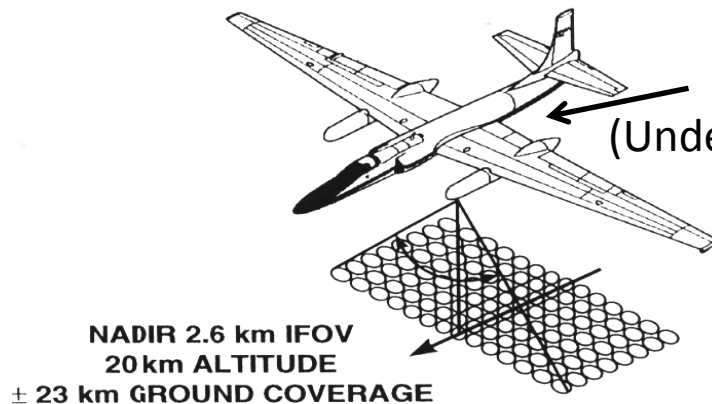


The May 2013 SNPP Cal/Val Campaign – Validation of Satellite Soundings

W. L. Smith Sr., A. M. Larar, H. E. Revercomb, M. Yesalusky, and E. Weisz



The ER-2 Aircraft Interferometers

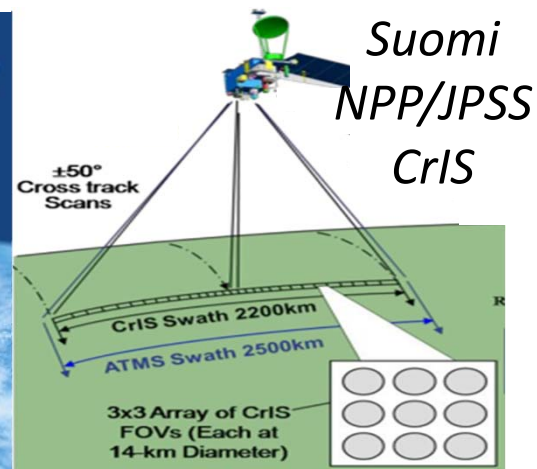
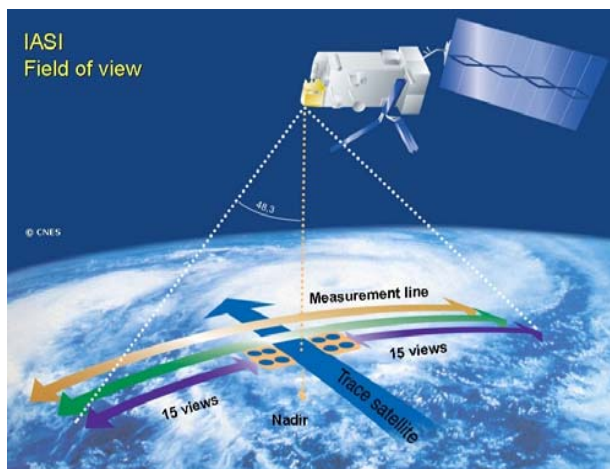
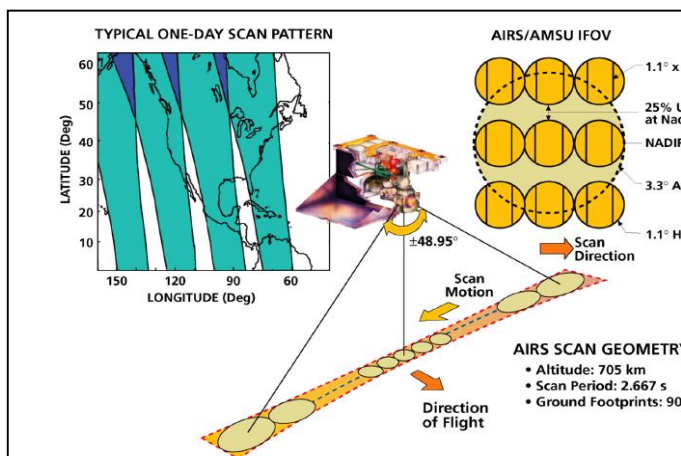


SHIS
(Underbelly pod)

- **NAST-I/SHIS-I** infrared Michelson interferometer
(9000/4500 spectral channels)
3.5 – 16 microns @ 0.25 /0.5cm⁻¹
- **Aircraft Accommodation**
 - NAST-I: ER-2 Super pod
 - SHIS: ER-2 Underbelly pod

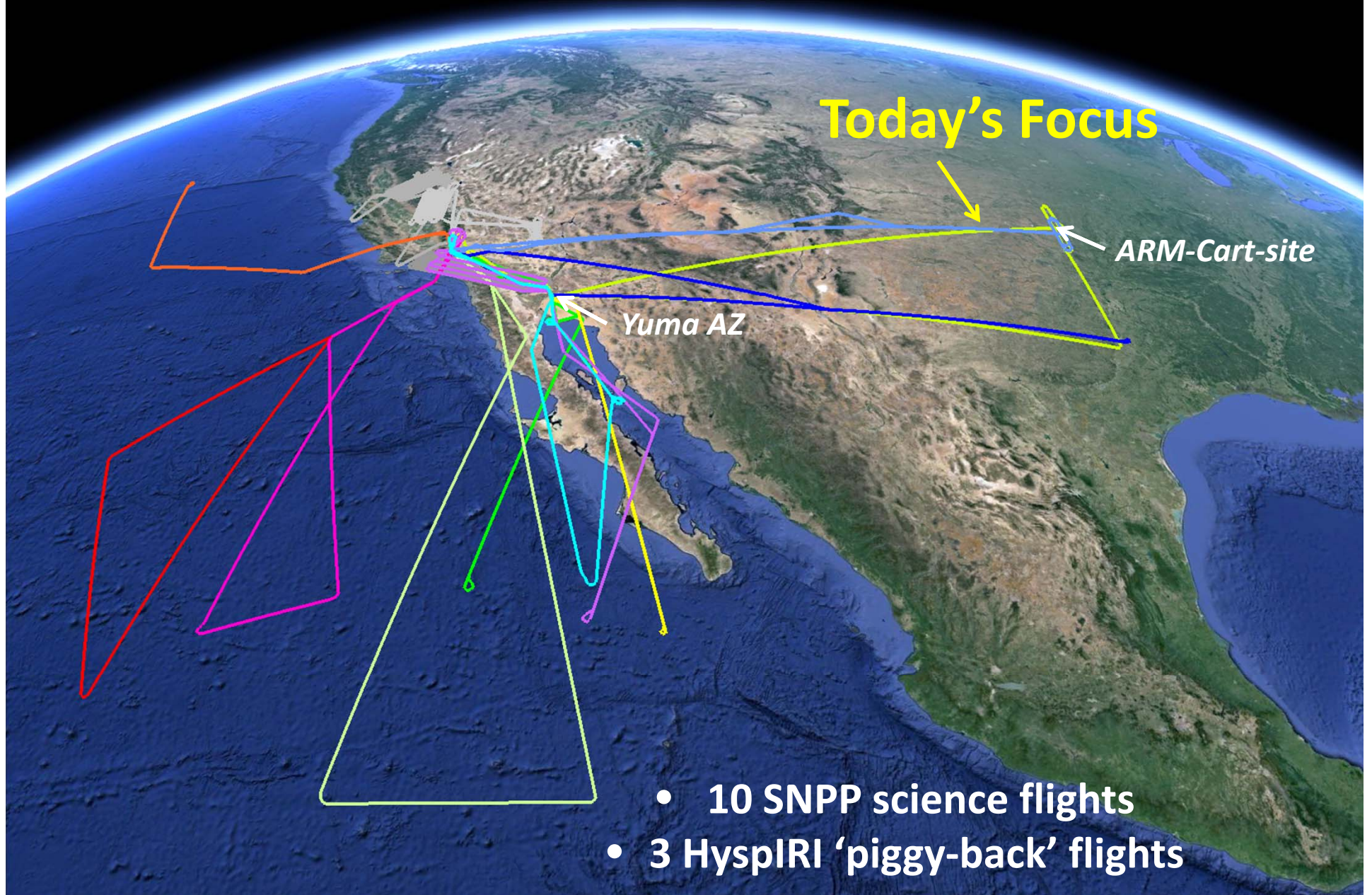
Instrument	Spatial resolution	Spectral Resolution	Useful Spectral Range	Spatial Sampling
NAST-I	2.6 Km @ 20 Km	0.25 (cm ⁻¹)	600-2800 (cm ⁻¹)	~ Contiguous Cross-track scan
SHIS	2.0 Km @ 20 Km	0.50 (cm ⁻¹)	600-2800 (cm ⁻¹)	~ Contiguous Cross-track Scan

The Satellite Instruments

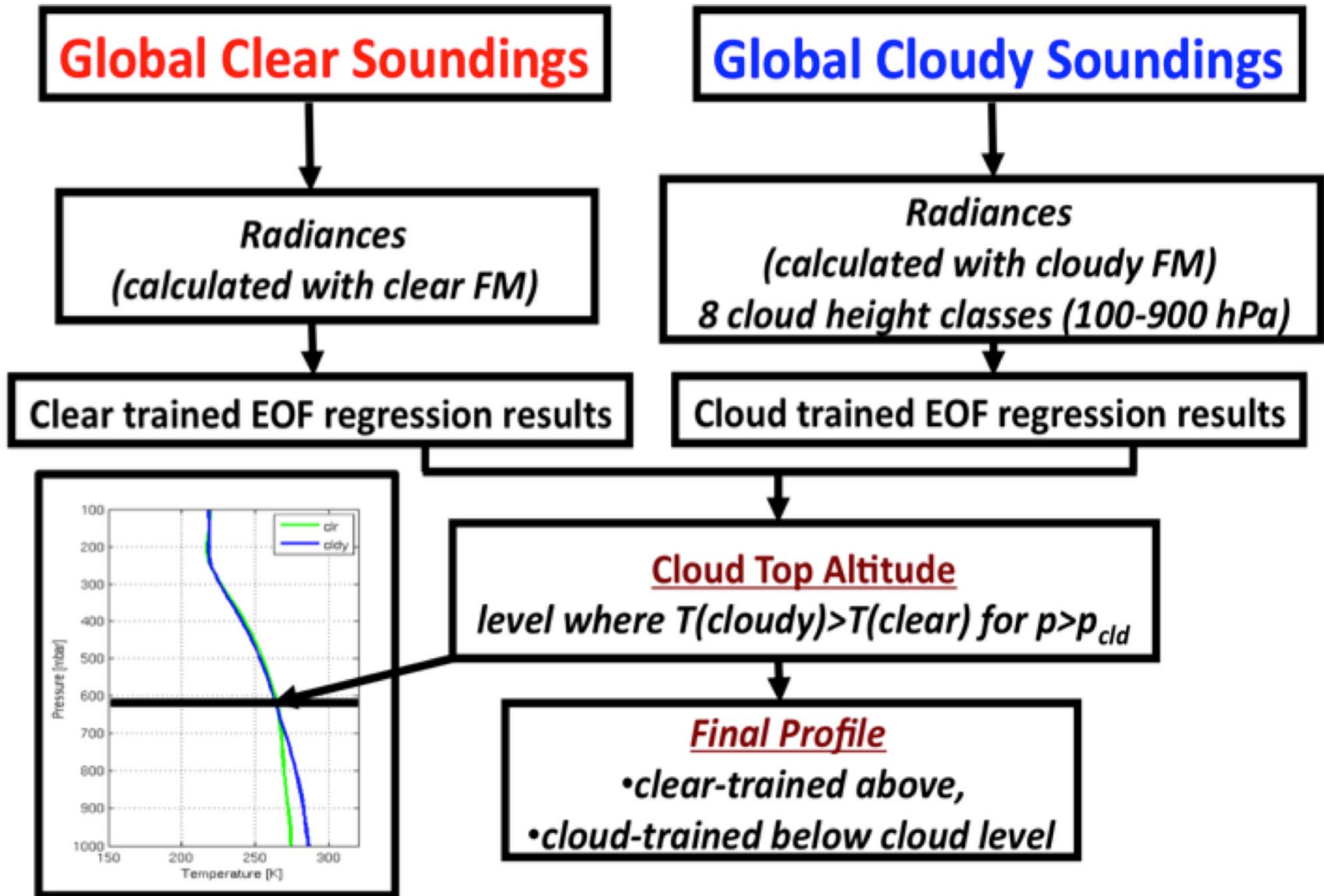


Instrument	Spatial resolution	spectral res. (cm ⁻¹)	spectral rng. (cm ⁻¹)	spatial sampling
AIRS (2002 -)	3x3 13.5-km (50 km)	~1200 resolving power	645-2700	Contiguous Cross-track scan
IASI-A (2006 -) IASI-B (2012 -)	2x2 12.0-km (50 km)	0.25	645-2760	Contiguous Cross-track Scan
CrIS (2011 -)	3 x 3 13-km (50 km)	0.6	645-2700	Contiguous Cross-track

Suomi-NPP Cal/Val Flight Tracks



The Dual Regression Retrieval Algorithm



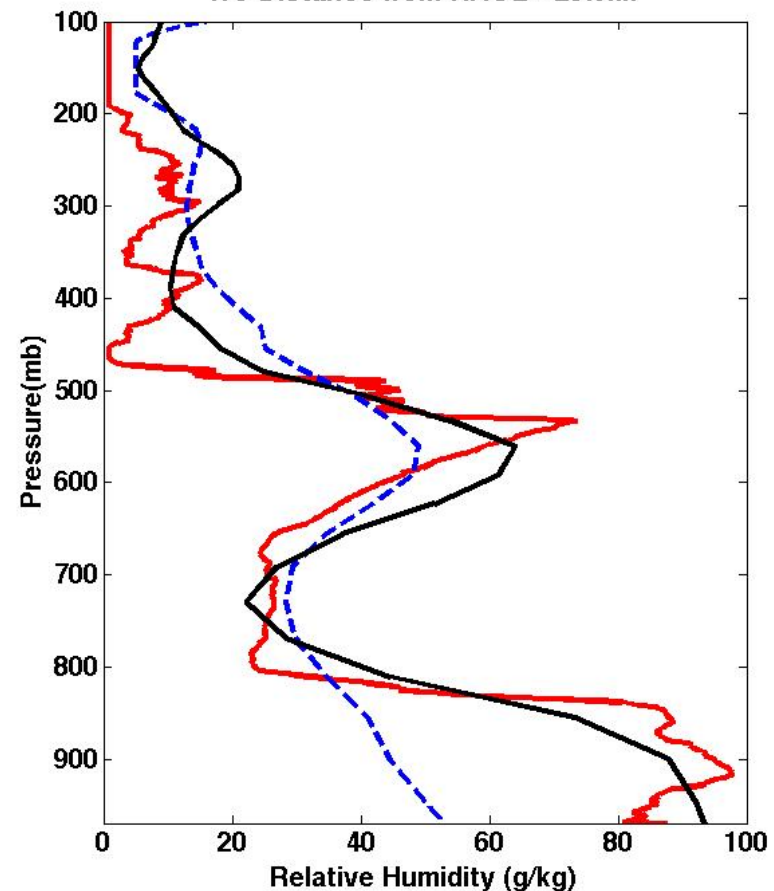
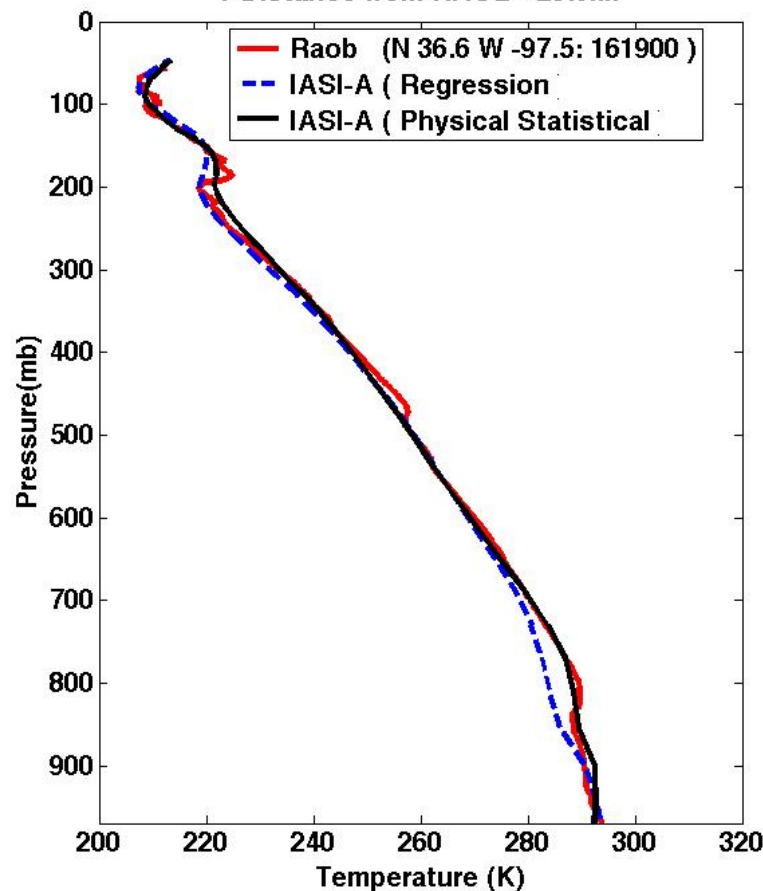
To be discussed by Nadia Smith of Friday Morning

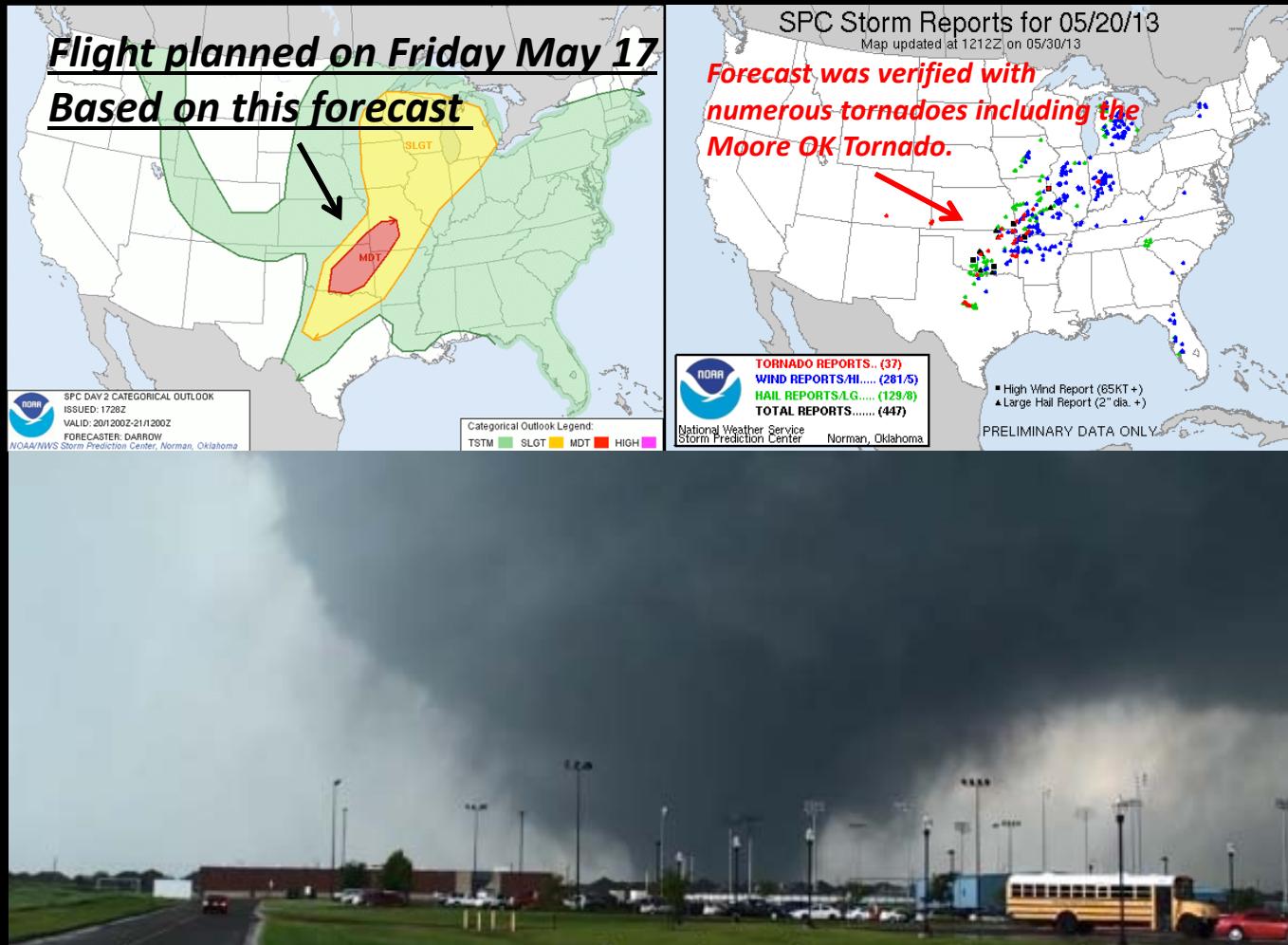
Physical Correction Using Forecast Model Profile

Problem: DR method uses a statistical training data set. Imperfect skill, due to lack of vertical resolution in radiances, leads to local statistical bias.

Solution: Calculate radiances from forecast profile (FP) and perform DR retrieval using simulated “Truth” radiances. Retrieval Error = Statistical Bias.

Statistical Bias = FP – FP radiance Retrieval

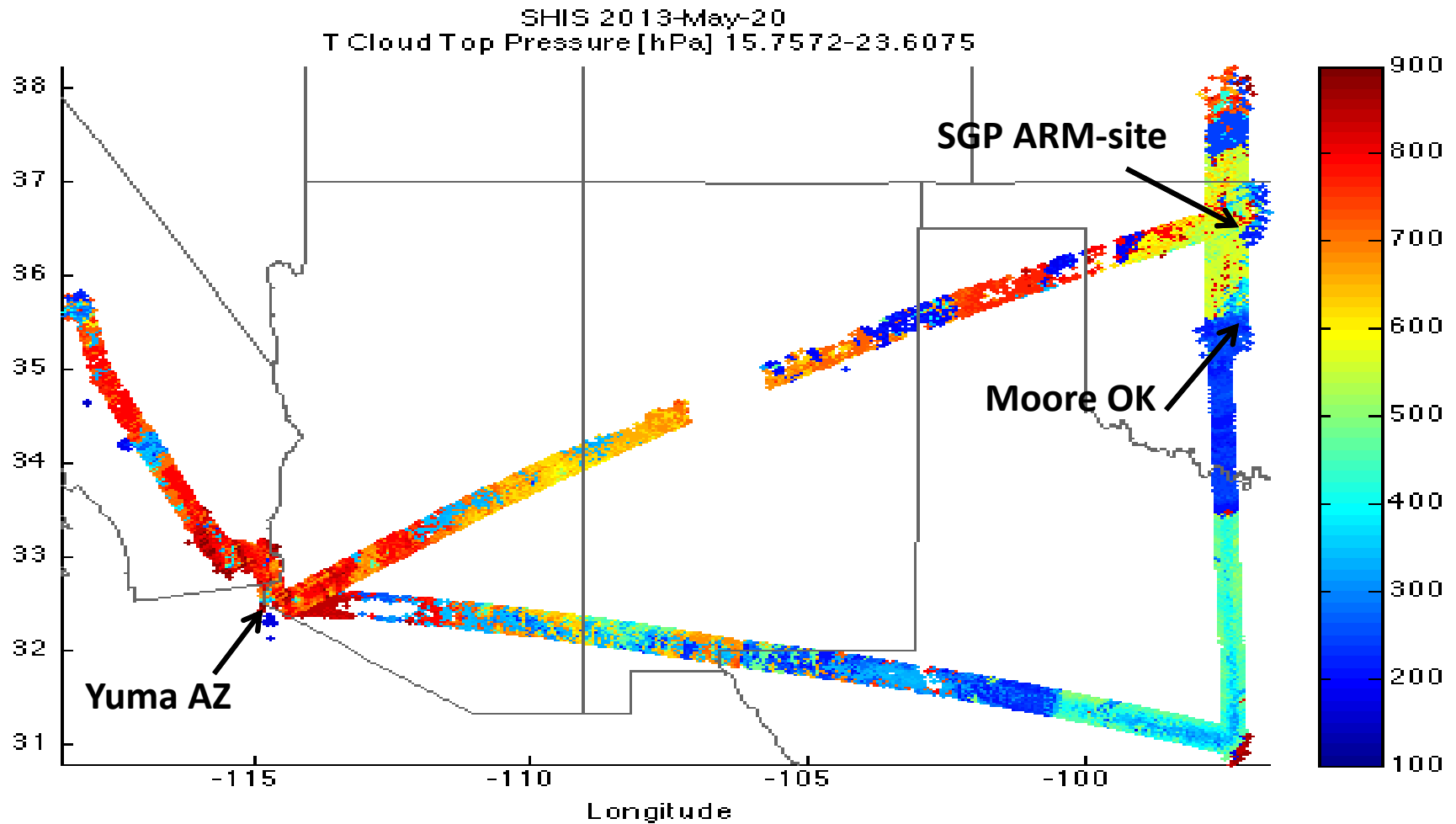




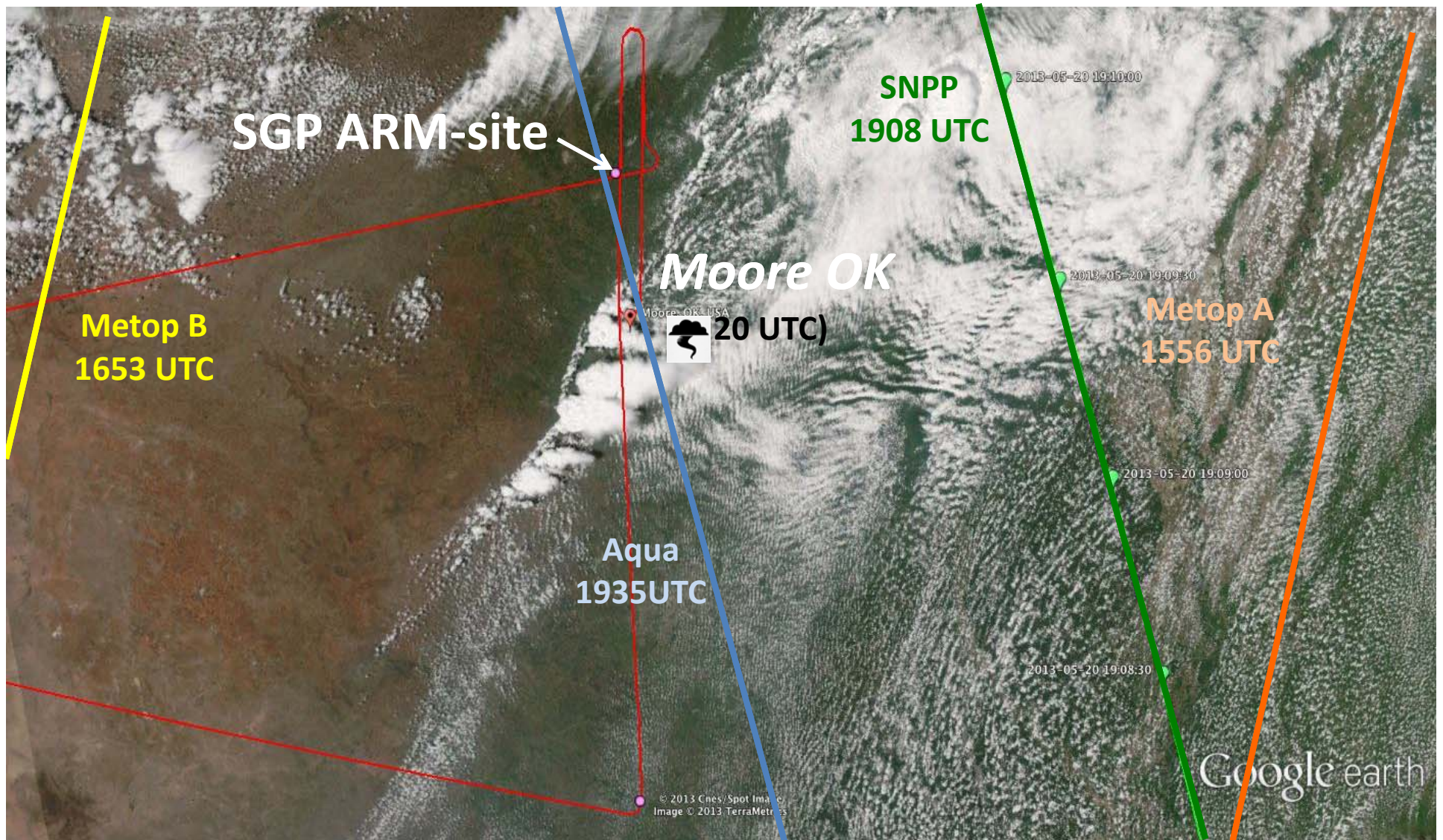
*The **2013 Moore tornado** was an EF5 Tornado that struck Moore, Oklahoma, and adjacent areas on the afternoon of May 20, 2013, with peak winds estimated at 210 miles per hour (340 km/h), killing 23 people (+2 indirectly) and injuring 377 others. The tornado touched down west of Moore at 2:56 PM CDT (19:56 UTC), staying on the ground for 39 minutes over a 17-mile (27 km) path, crossing through a heavily populated section of Moore. The tornado was 1.3 miles (2.1 km) wide at its peak.*

ER-2 Flight Track

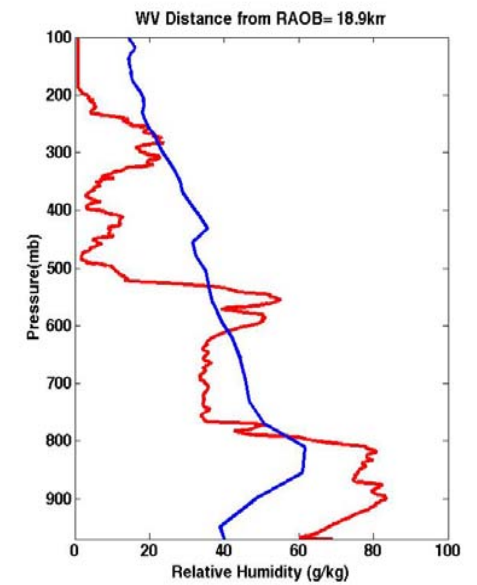
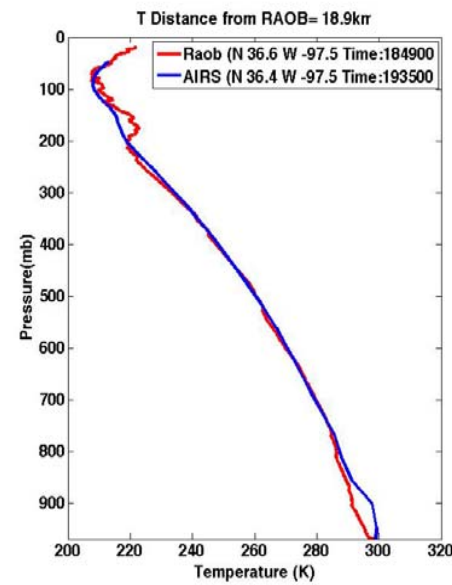
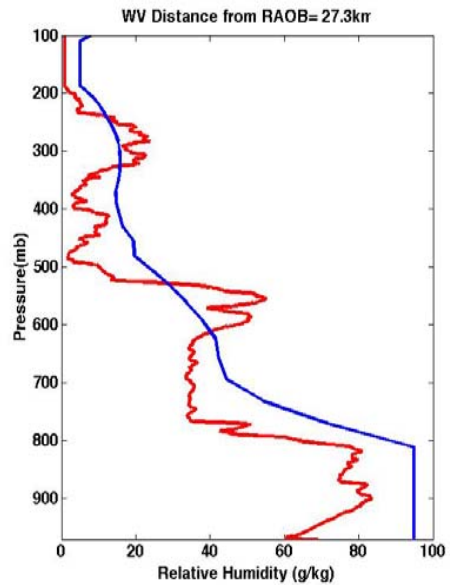
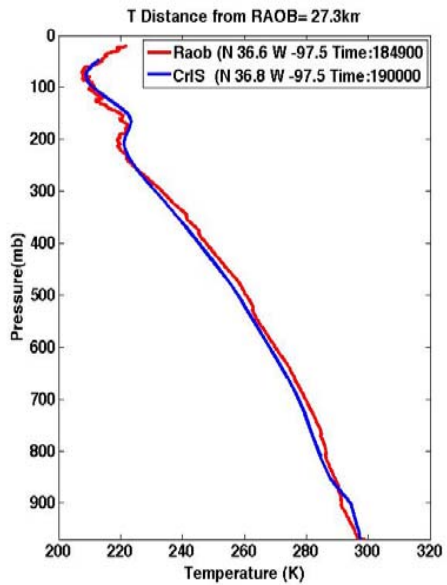
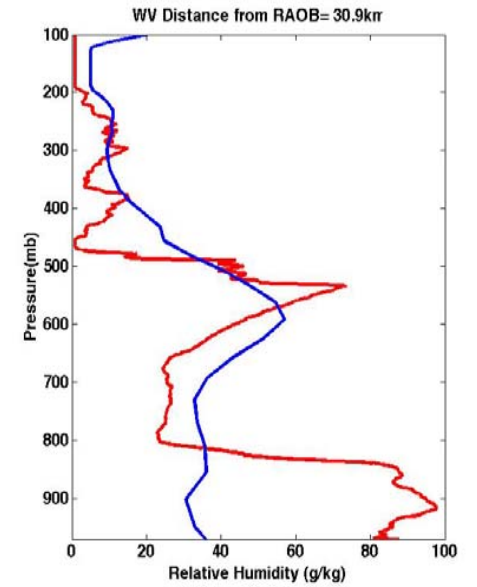
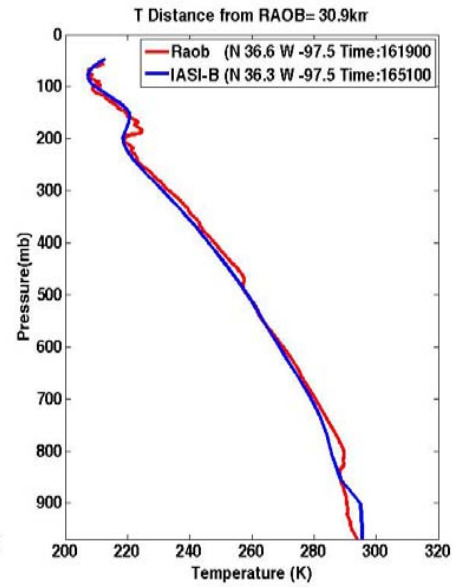
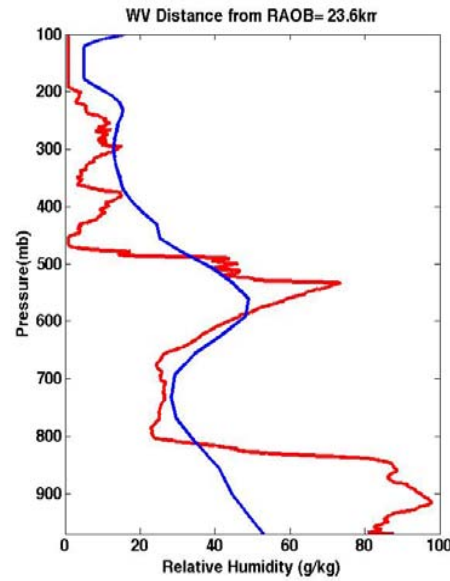
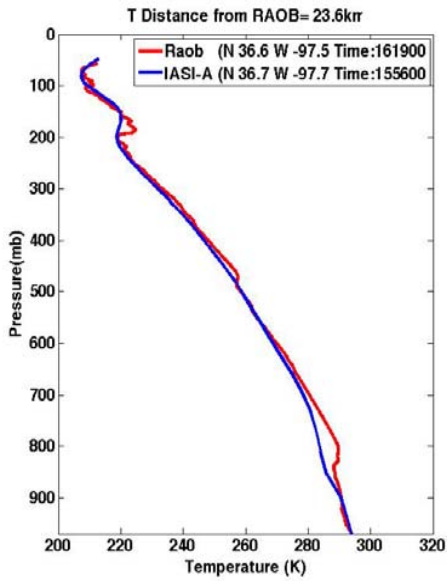
Cloud Pressure Altitude



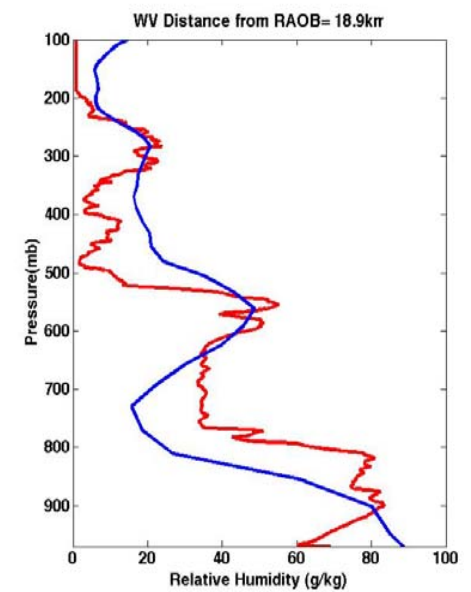
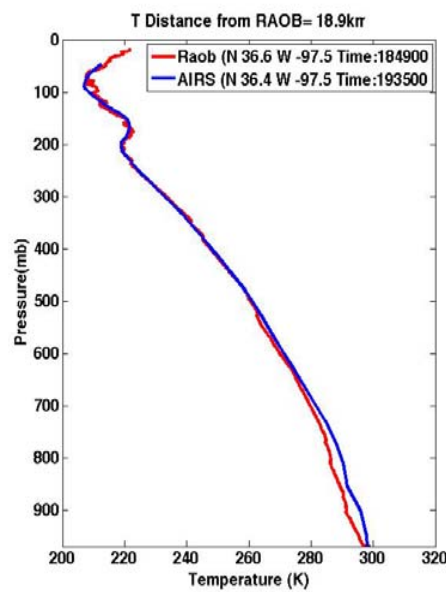
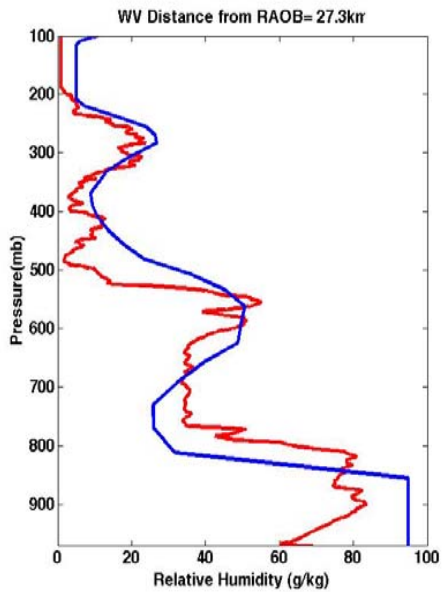
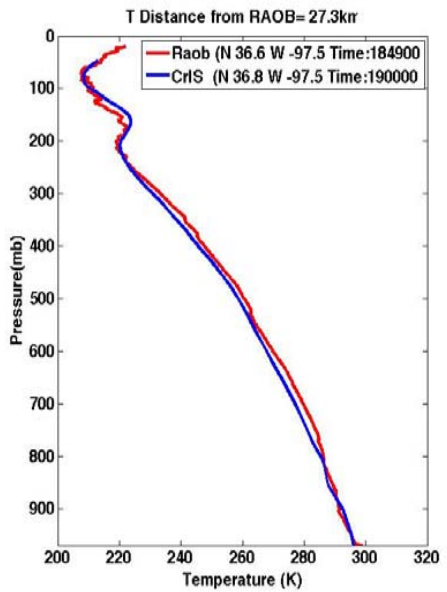
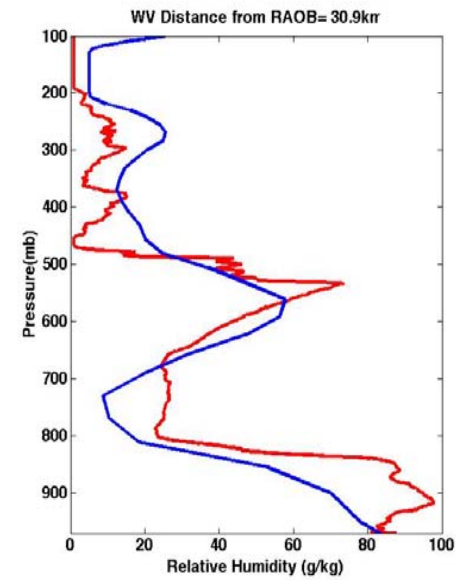
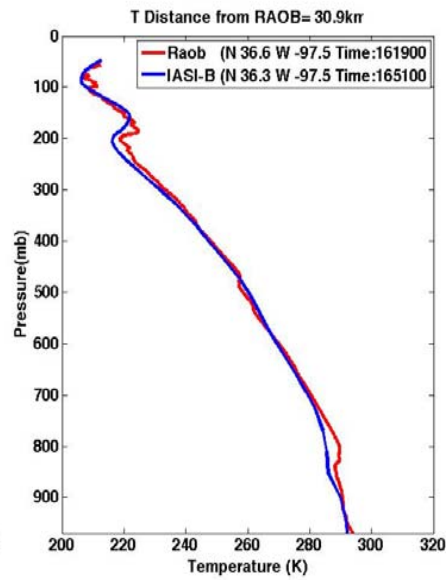
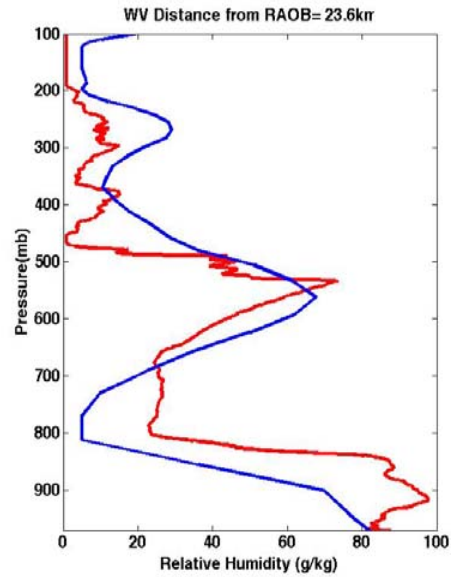
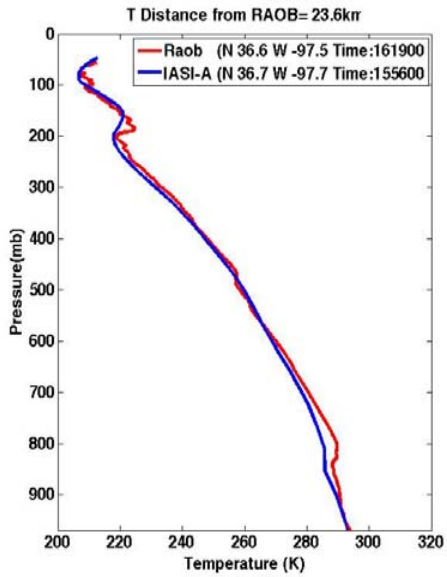
Aircraft Track and Satellite Orbits



Satellite Retrievals (raw) Vs ARM-site Radiosondes



Satellite Retrievals Vs ARM-site Radiosondes



Lifted Index Stability Parameter

The **lifted index (LI)** is the temperature difference between an air parcel lifted adiabatically $T_p(p)$ and the temperature of the environment $T_e(p)$ at a pressure height in the troposphere of 500 hPa (mb). When the value is positive, the atmosphere (at the respective height) is stable and when the value is negative, the atmosphere is unstable.

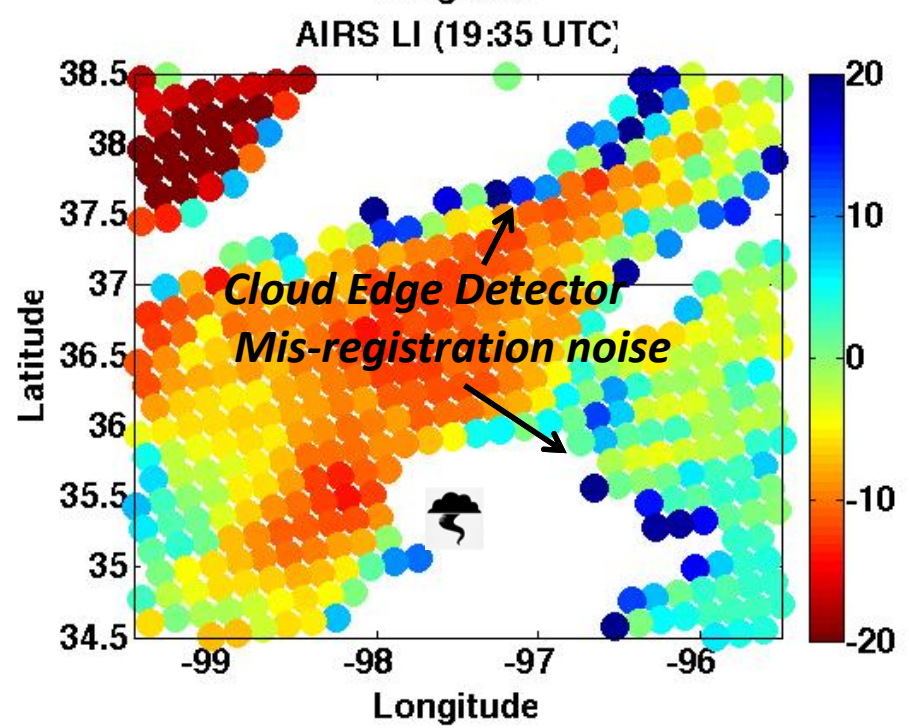
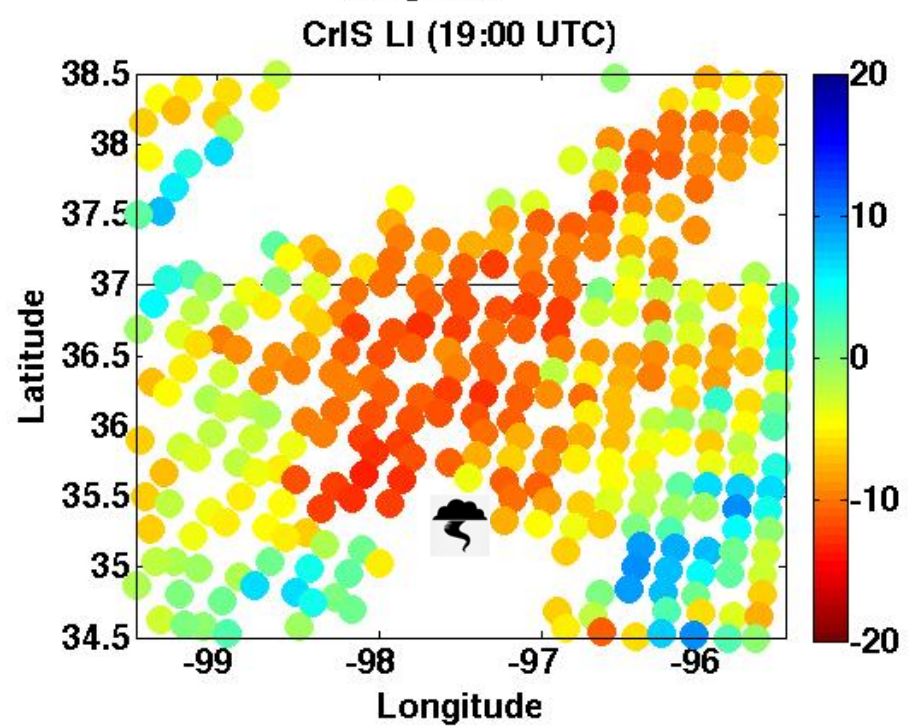
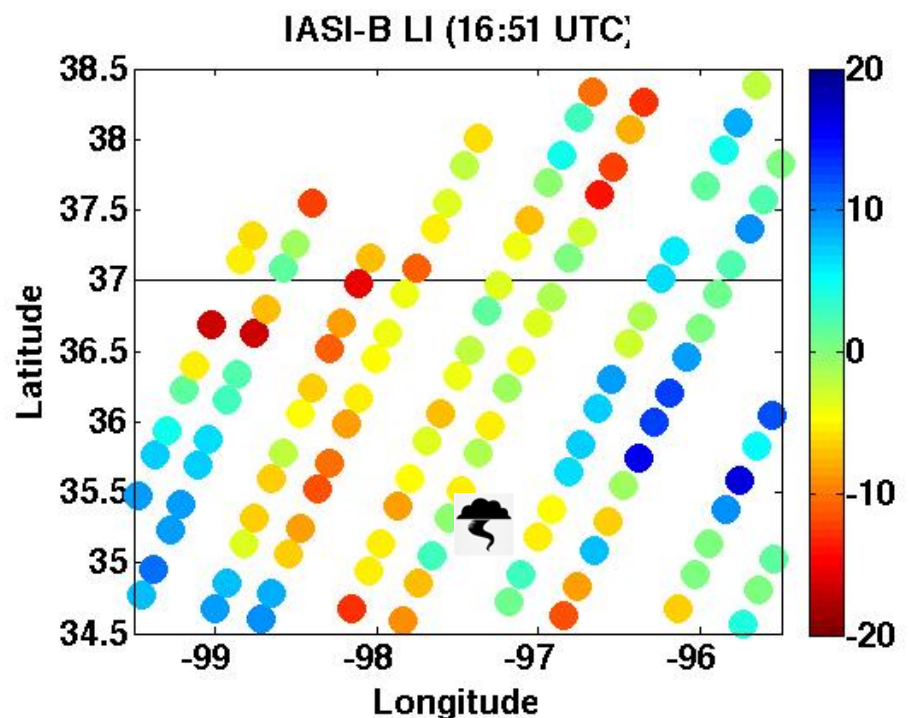
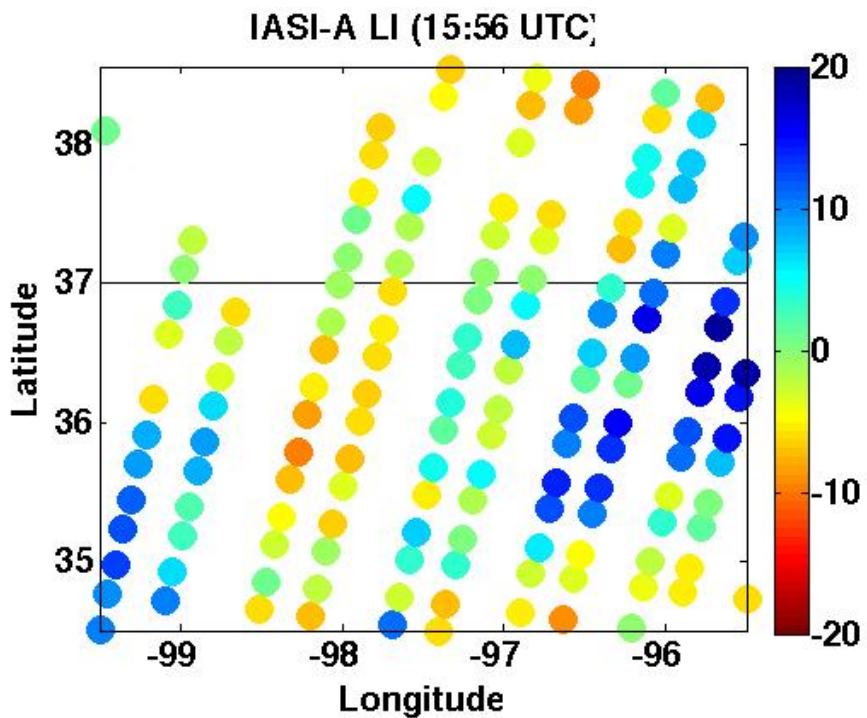
Thunderstorm Potential:

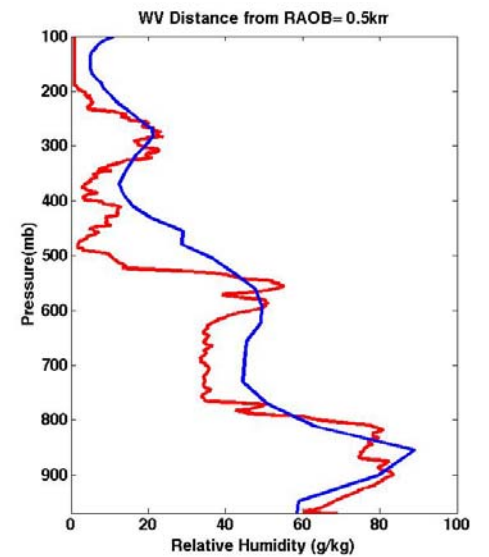
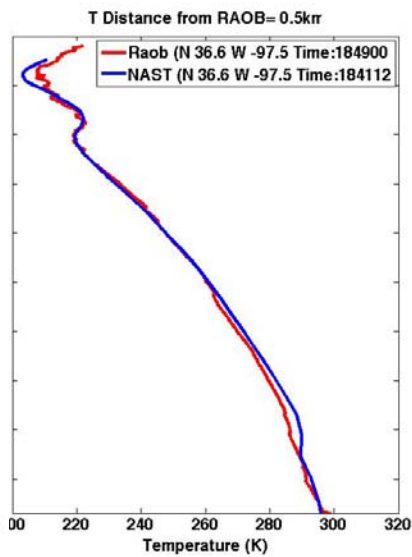
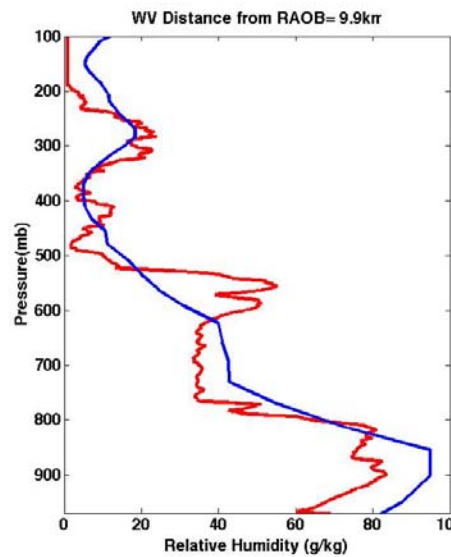
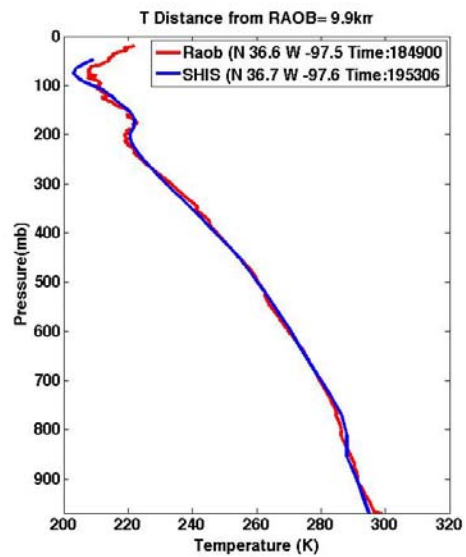
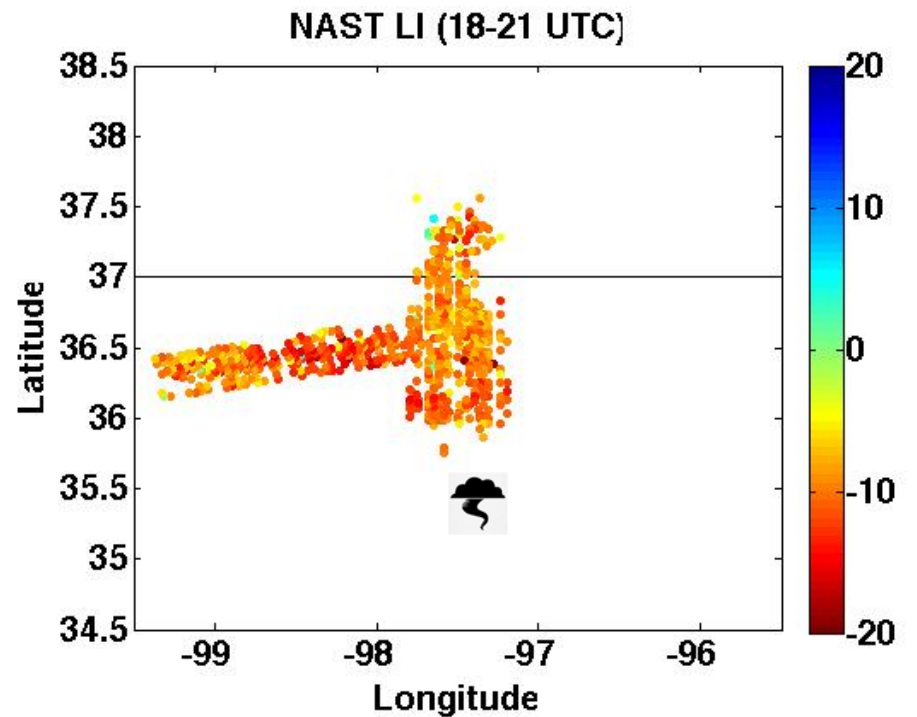
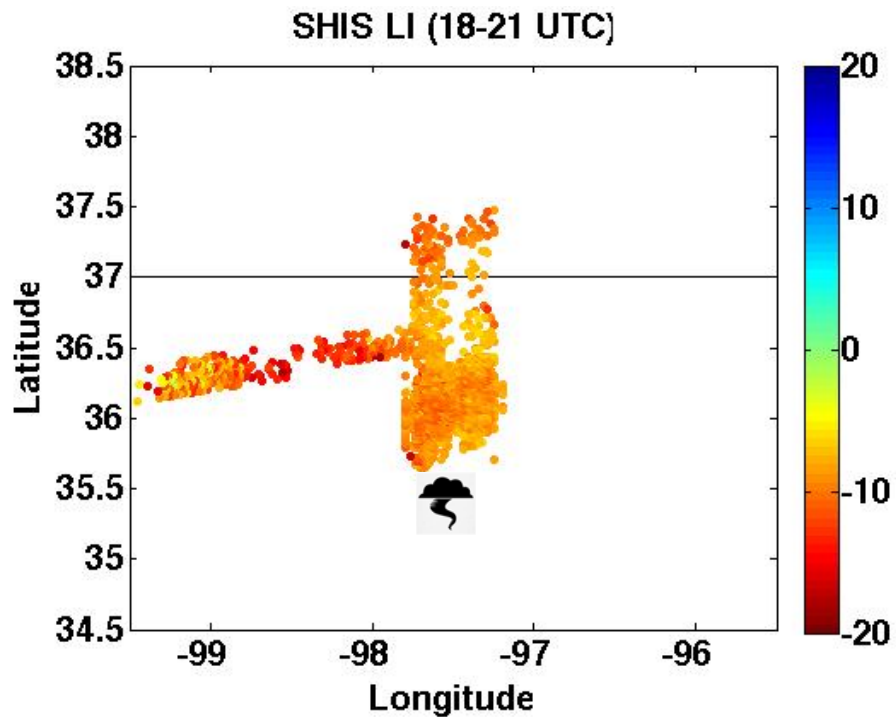
< -5 Very Unstable: Strong Thunderstorm Potential

-3 to -5 Unstable: Thunderstorm Probable

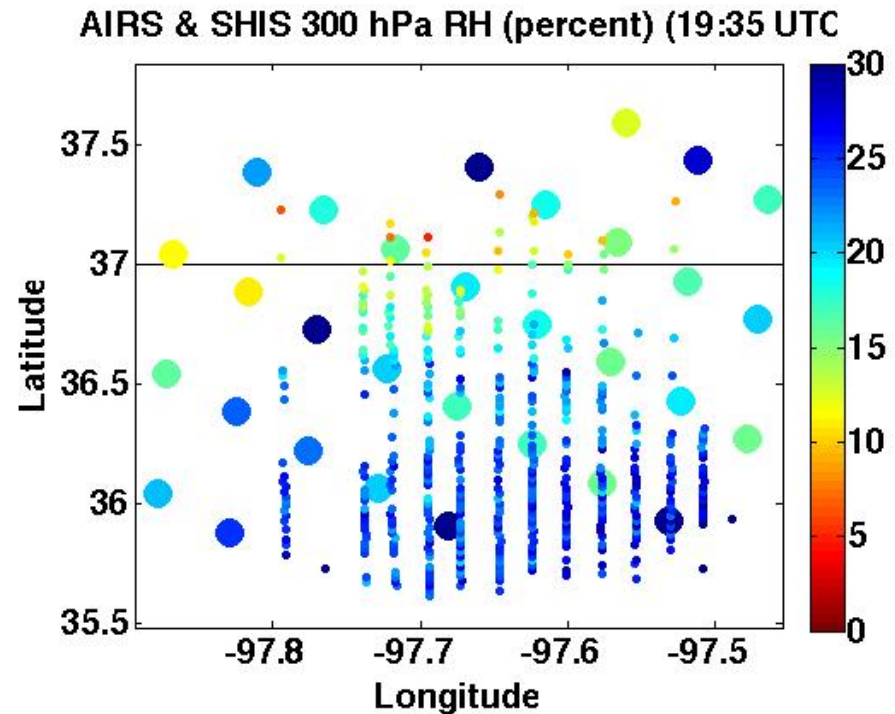
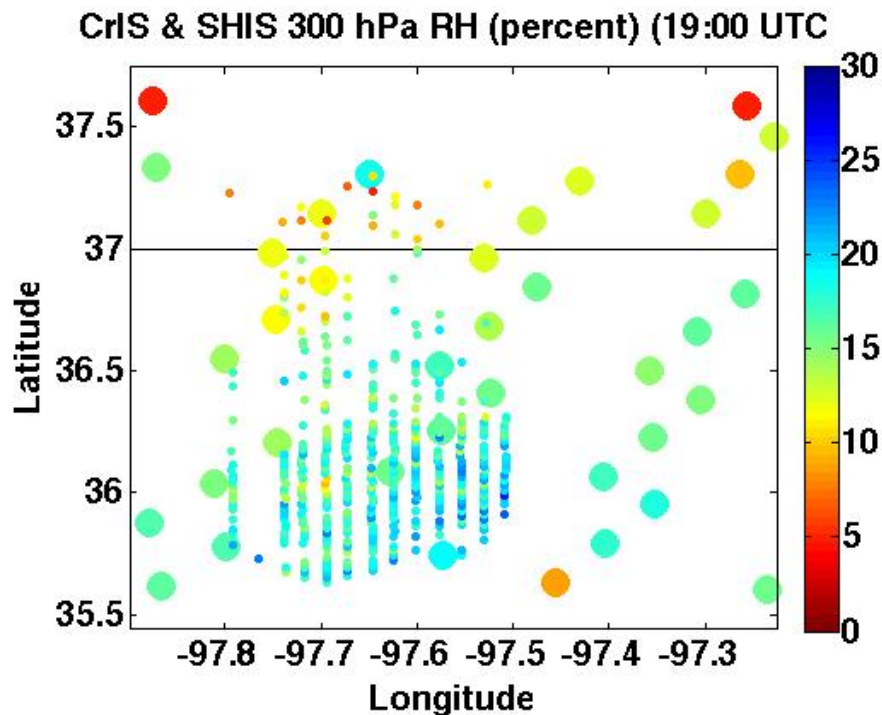
0 to -2 Marginally Unstable: Thunderstorms Possible

>0: Stable: Thunderstorms Unlikely

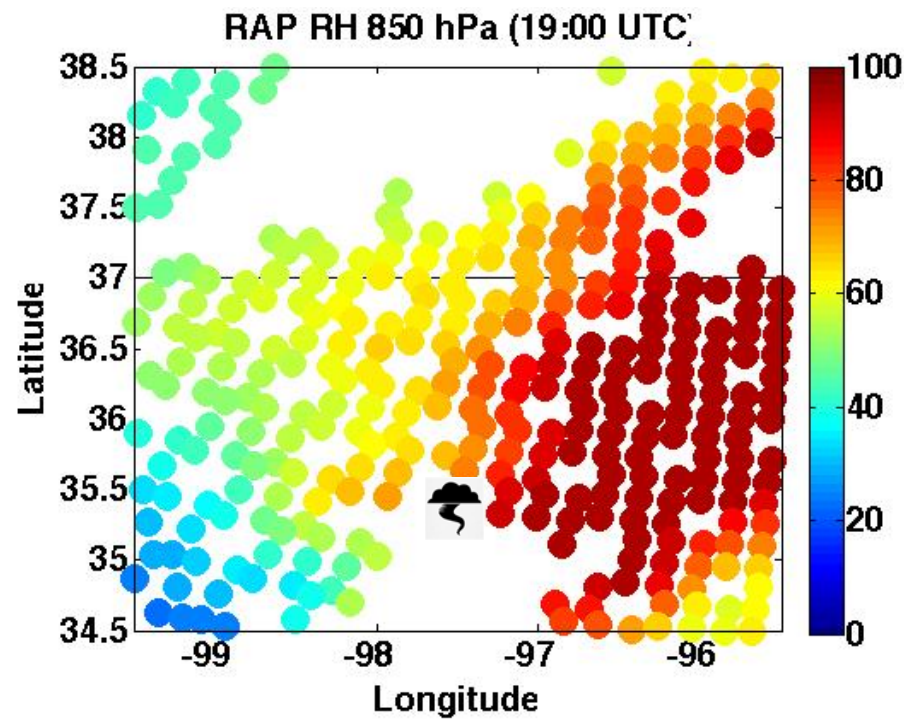
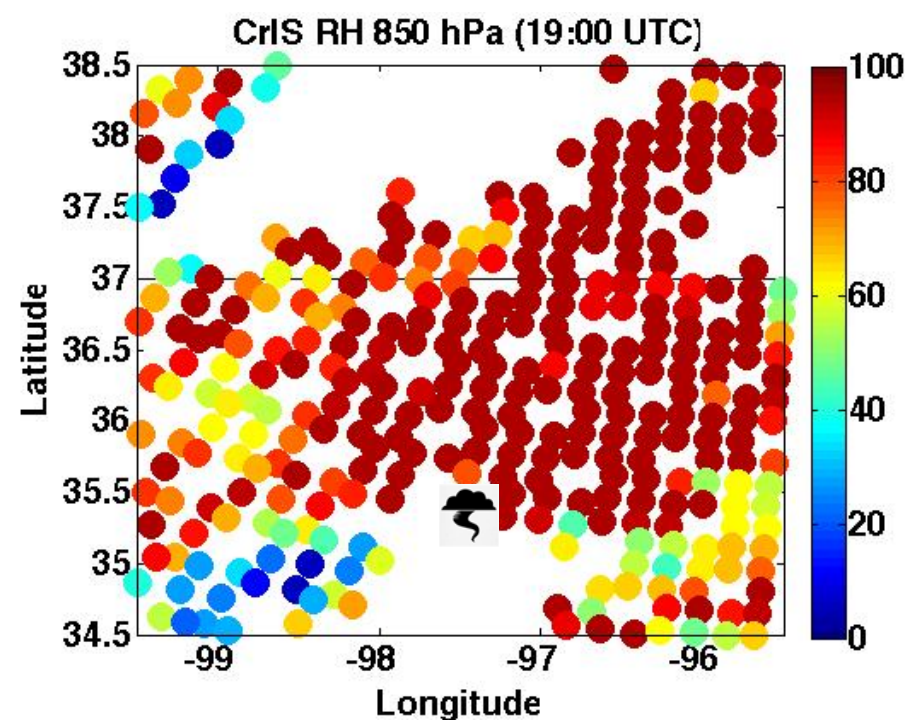
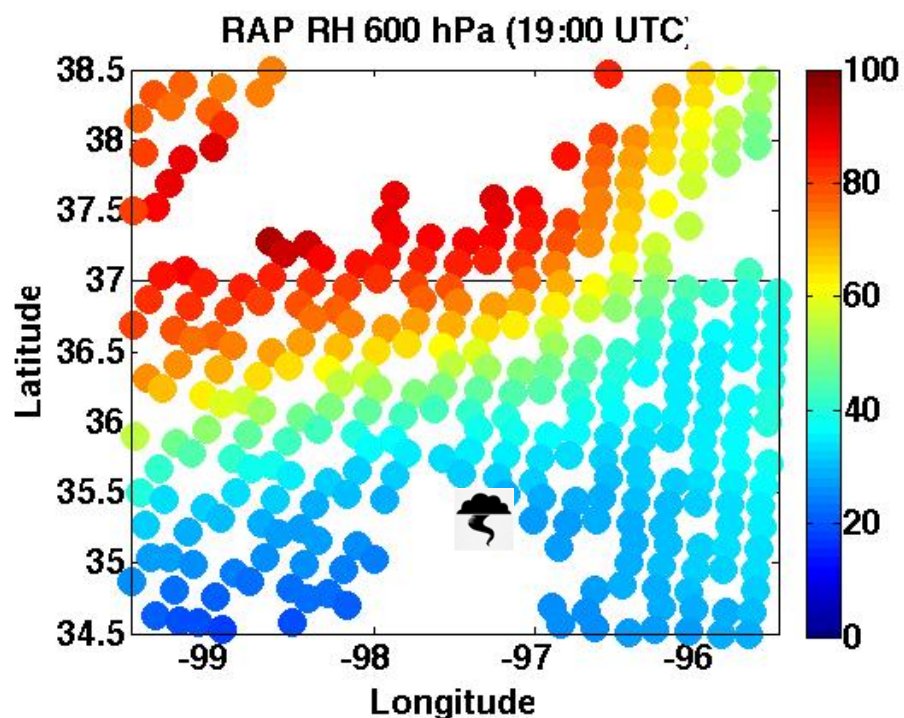
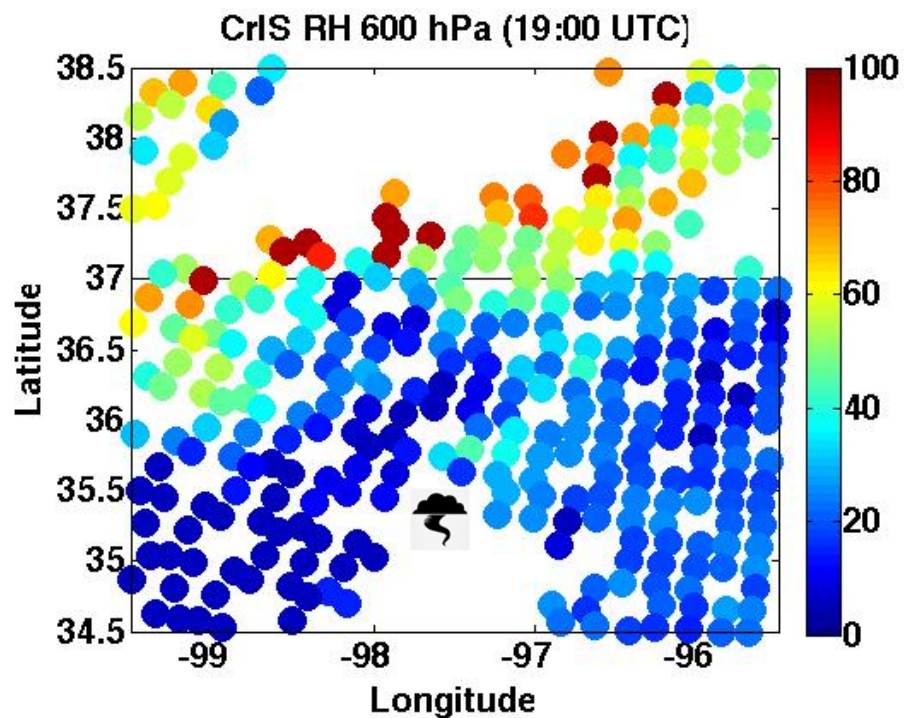




ER-2 Aircraft Soundings Are Used to Validate Satellite Sounding Time Variations



High spatial resolution (1 – km) ER-2 aircraft soundings are used to validate 35 minute time changes in relative humidity indicated by consecutive CrIS and AIRS humidity soundings



Summary and Conclusions

- AIRS, IASI, and CrIS retrievals provide comparable accuracy and spatial resolution
- ER-2 SHIS and NAST retrievals can be used to validate high spatial resolution features diagnosed from satellite data
- Satellite soundings provide mesoscale features not yet resolved by the highest spatial resolution NWP models (i.e., RAP/WRF)
- Next step is to validate mesoscale features of Chemistry retrievals obtained with the thermodynamic retrievals shown here.

Thank You for Your Attention