

Gulf of Mexico Atmospheric Composition and Climate Study

(Aug/Sep 2006)

NOAA funded mission in collaboration with CalTech and CIRPAS

GoMACCS Twin Otter Science Team

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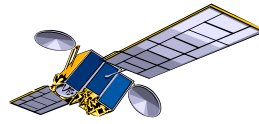
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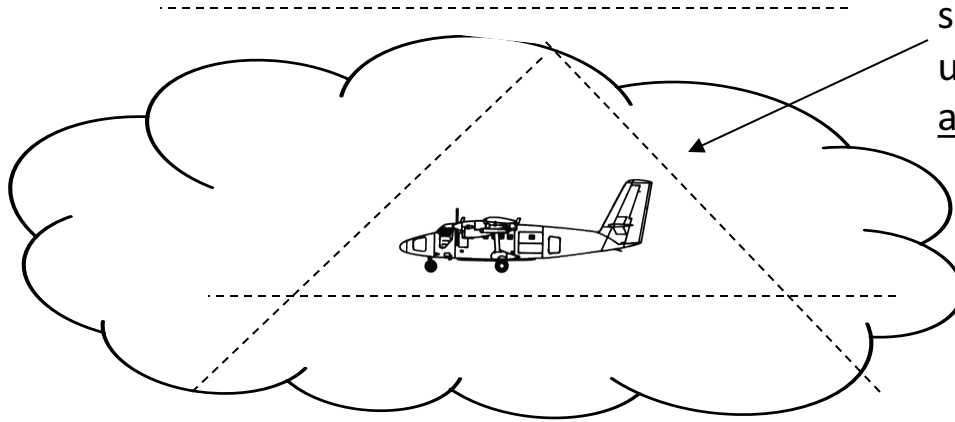
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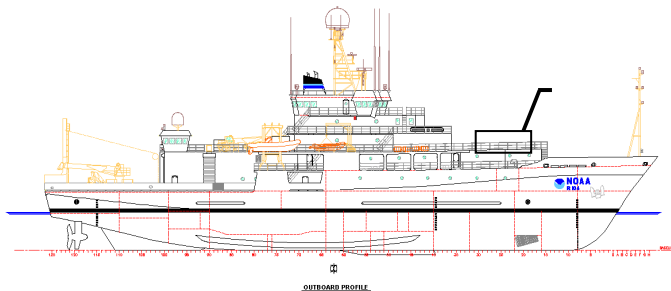
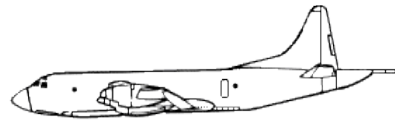


MISR, MODIS, Cloudsat?

In cloud measurements of aerosol size/composition, drop size distribution, LWC and updrafts (CIRPAS TO). Level legs and profiles.



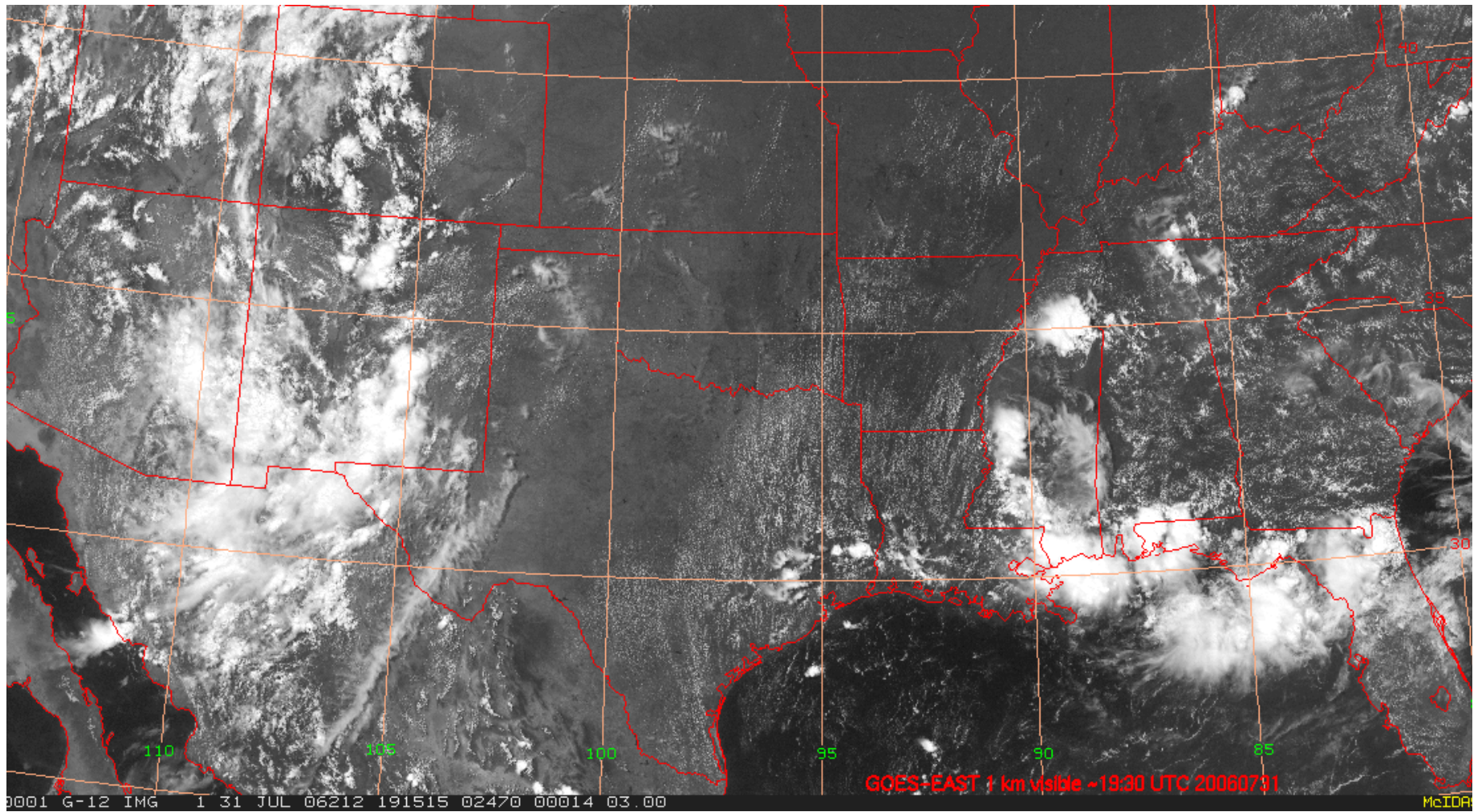
Below cloud measurements of aerosol chemical, physical, and optical, properties, $f(RH)$, CCN, updrafts (WP-3 and CIRPAS TO).



In situ aerosol: $f(RH)$, CCN, size, composition; gas-phase

Deployment Strategy

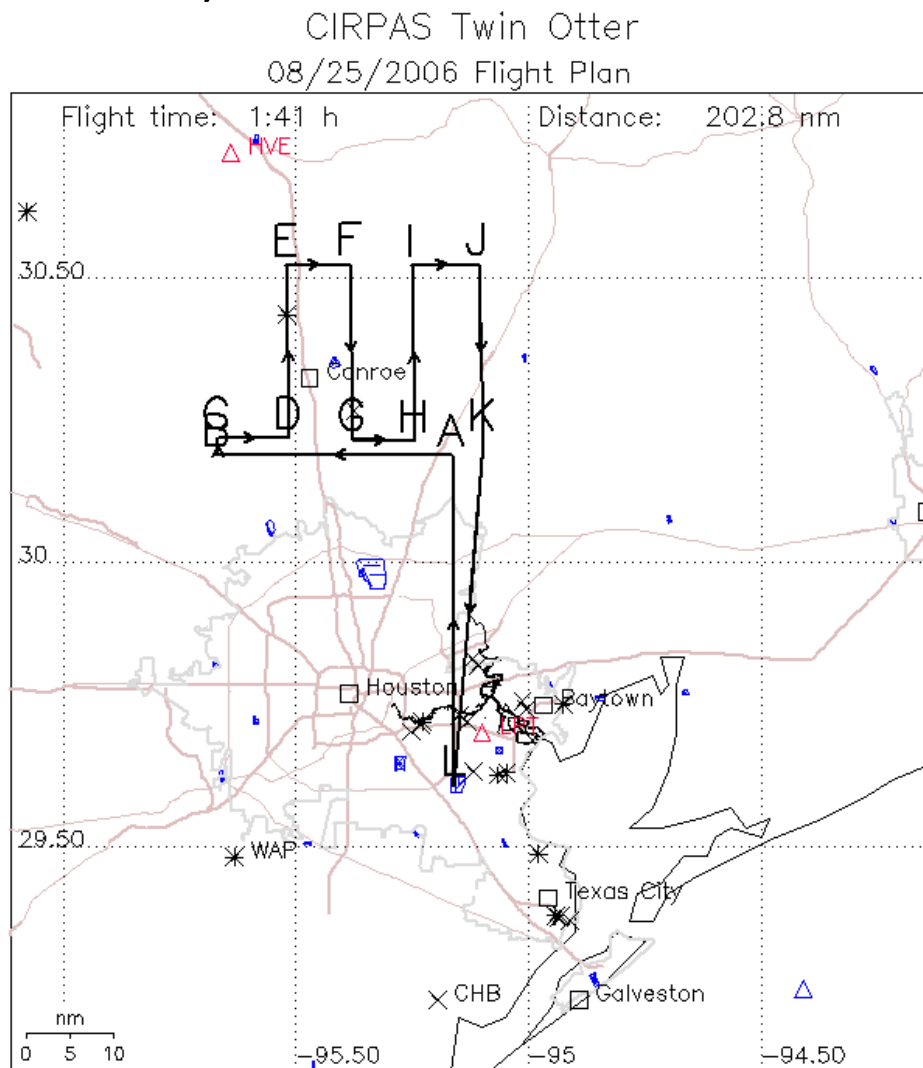
- CIRPAS TO is was the primary platform for cloud studies
 - Complementary measurements from WP-3, RHB, and NOAA TO
- Measurements below, within and above cloud to measure in-situ aerosol properties used to calculate CCN (size distribution, chemical size distribution), CCN, cloud droplet number concentration, drop size distributions, updraft velocities, liquid water content, and cloud radiative properties;
- Statistical sampling rather than single cloud studies;
- Attempt to study wide variety of aerosol conditions with consideration of sources;
- Target warm phase cumulus (mediocris)

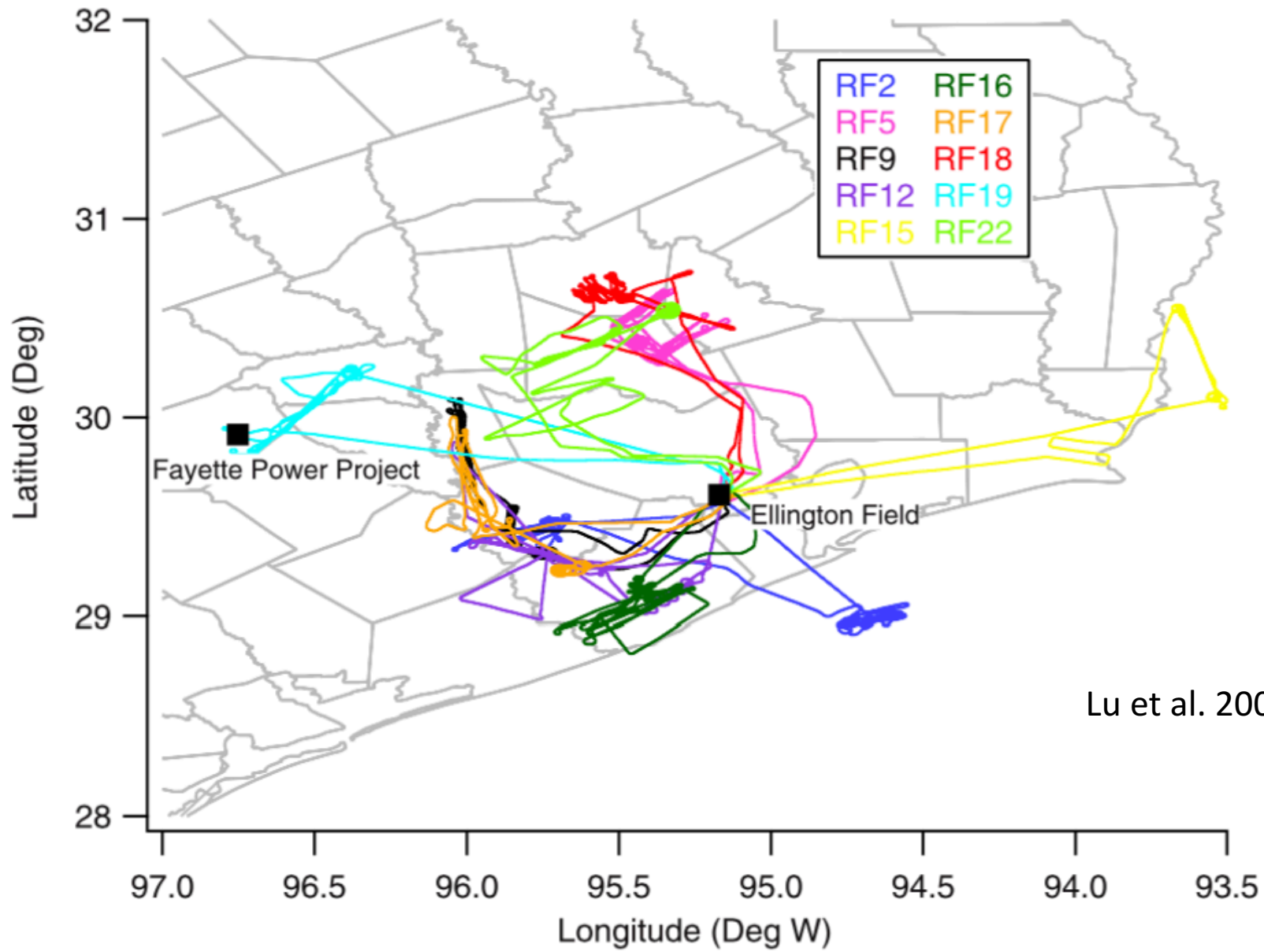


2:30pm local time

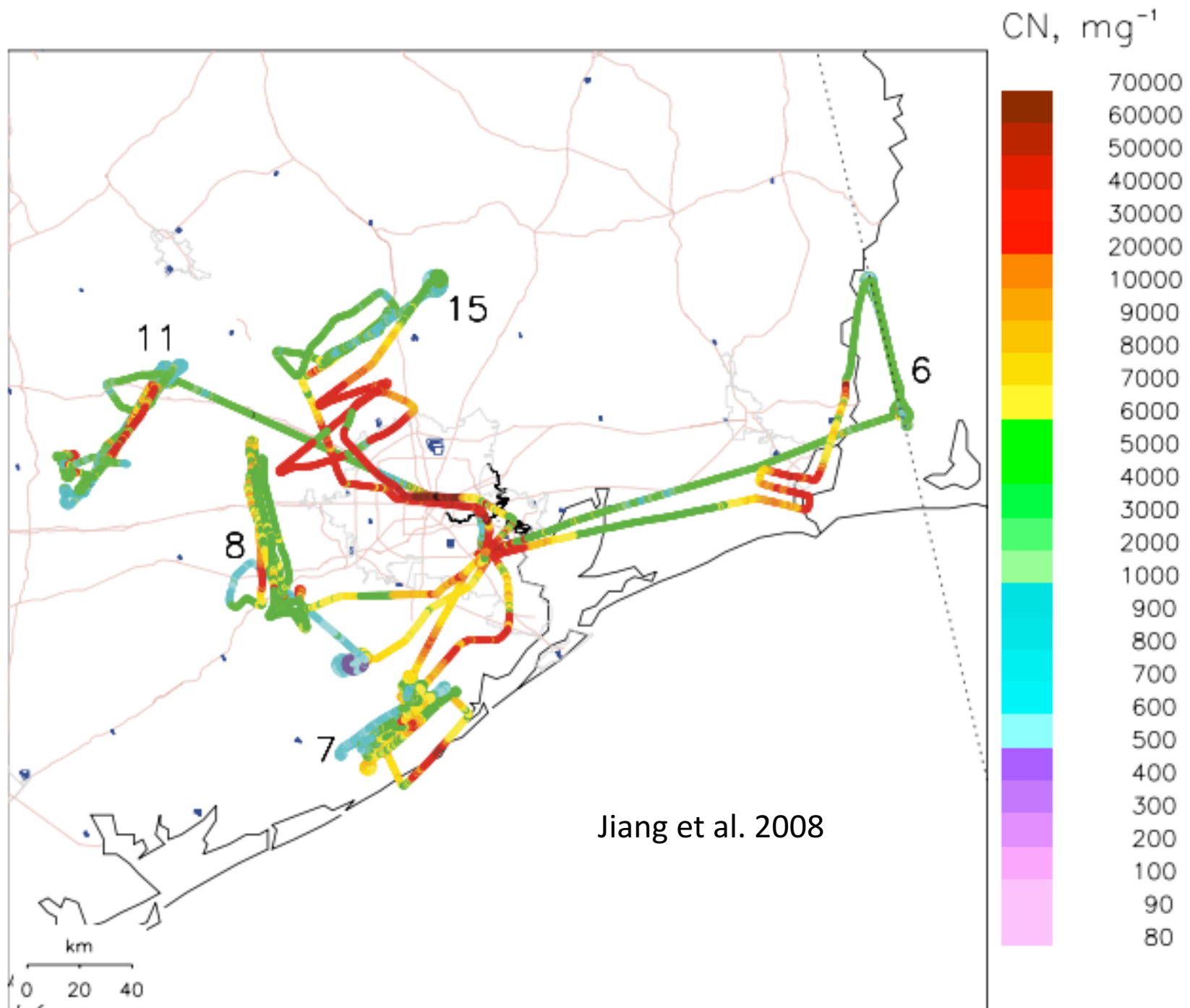


Often operated north of Houston (Conroe area) to avoid sea breeze interaction with continental convection (and air traffic)

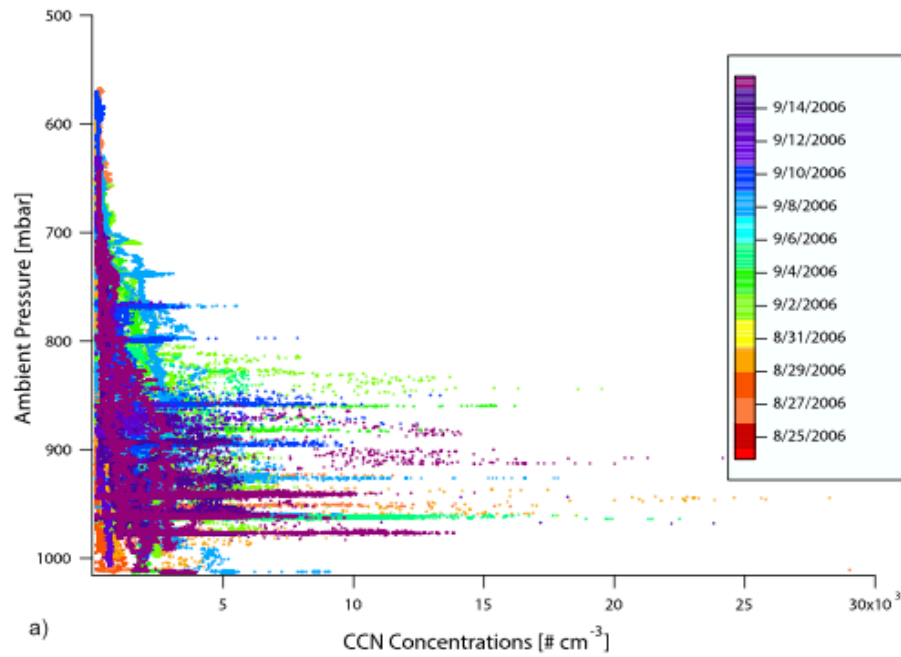




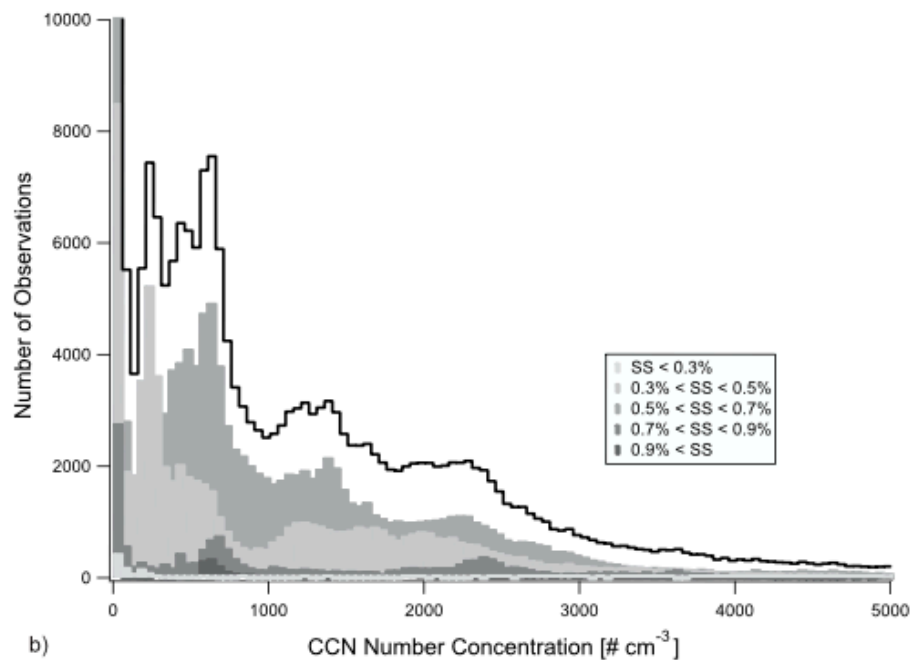
Lu et al. 2008



LANCE ET AL.: CCN MEASUREMENTS DURING GOMACCS

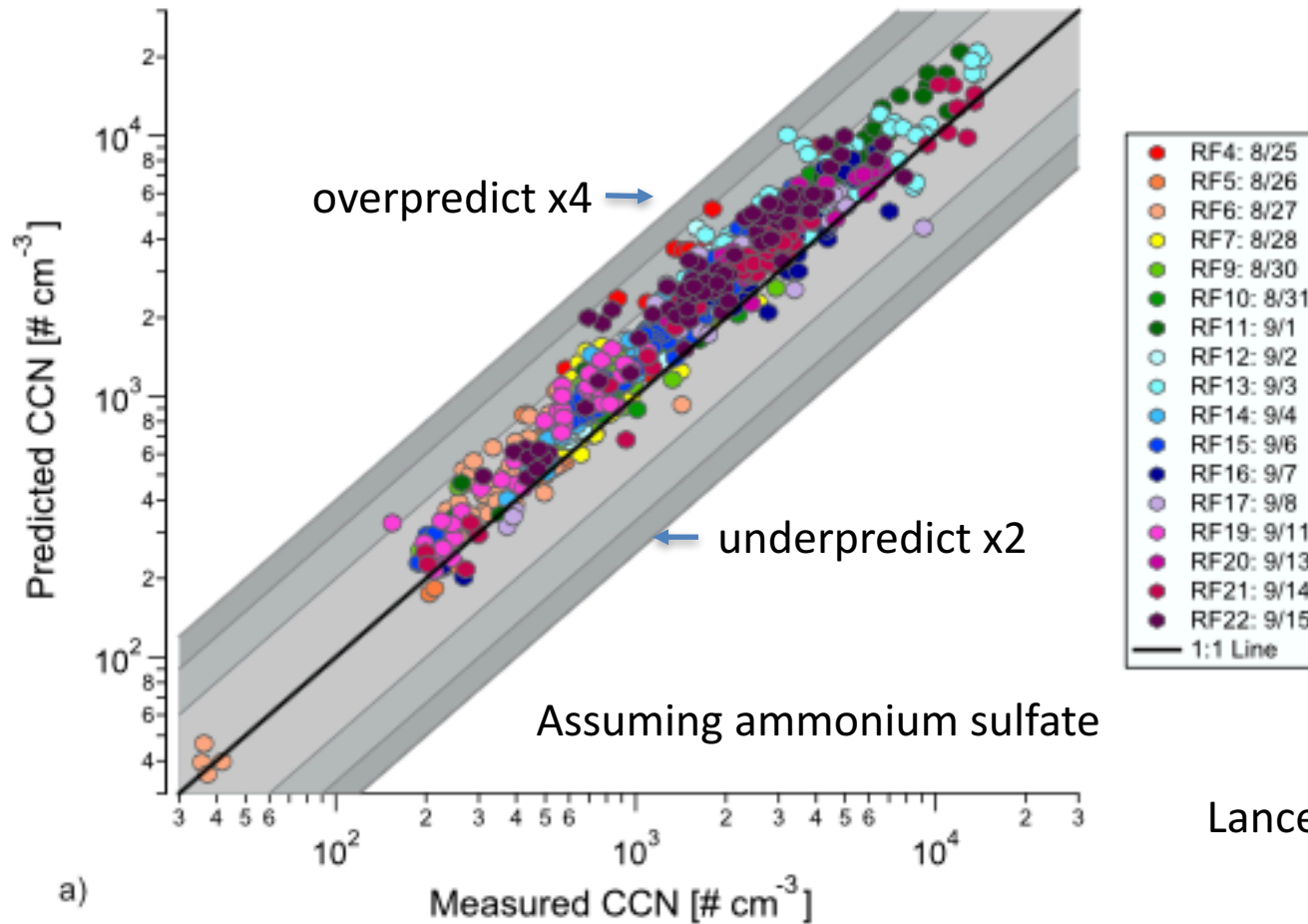


$0.3 < S < 1\%$



Lance et al. 2009

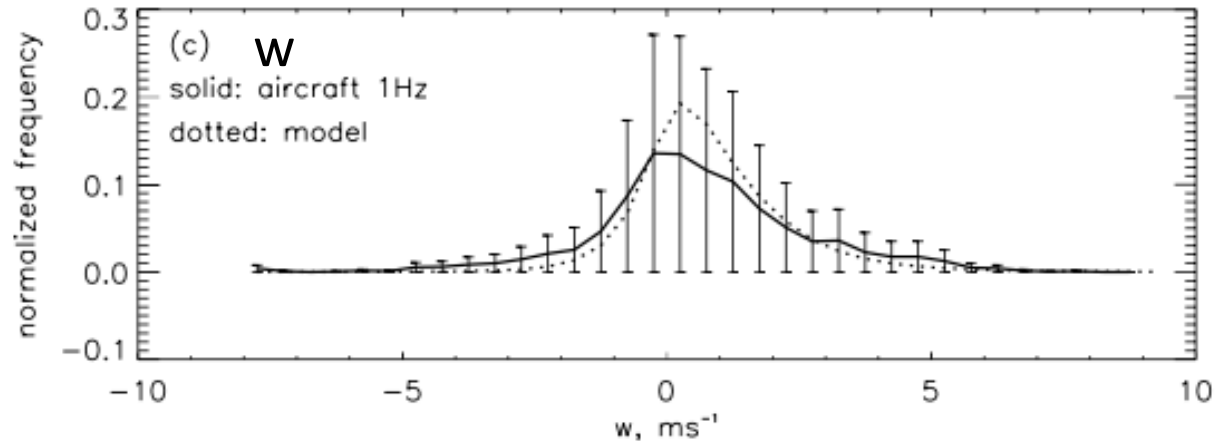
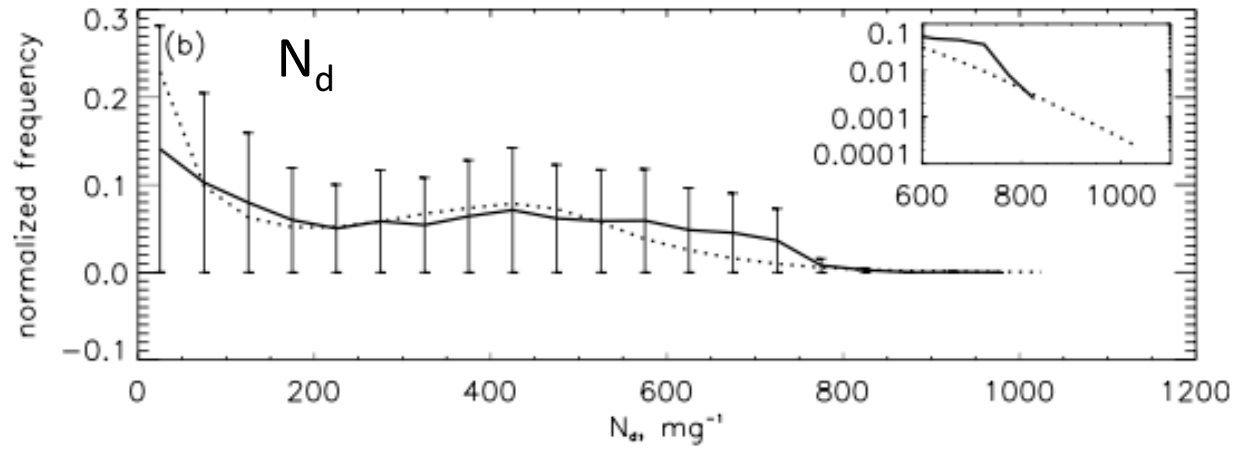
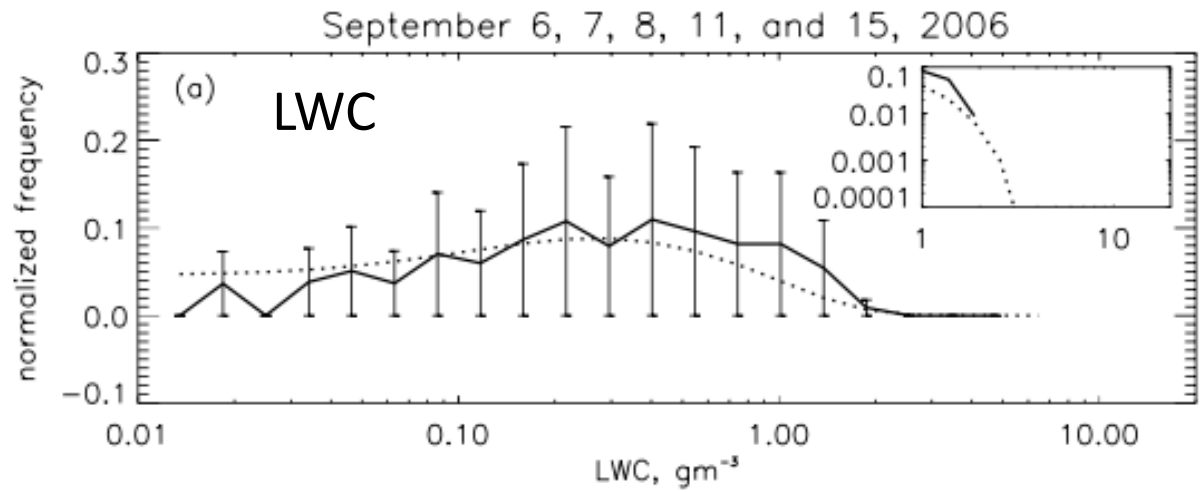
LANCE ET AL.: CCN MEASUREMENTS DURING GOMACCS



Lance et al. 2009

“externally mixed fraction of the aerosol contributes much of the CCN closure scatter, while the internally mixed fraction largely controls the overprediction bias.”

PDFs of
cloud
condns
LES vs a/c



Solid: a/c
+ std devn
Dotted: LES

Irradiance Closure



Methodology used here:

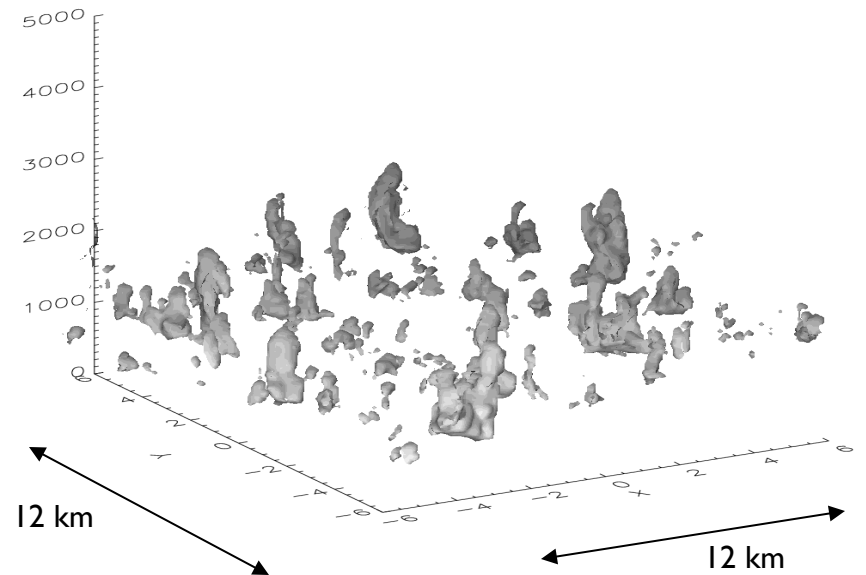
- Run LES using observed soundings
- Calculate spectral irradiance from modeled clouds
- Compare PDFs of observed SSFR irradiance with model-derived irradiance (3D)

Example

Clouds in Houston sampled by aircraft during GoMACCS

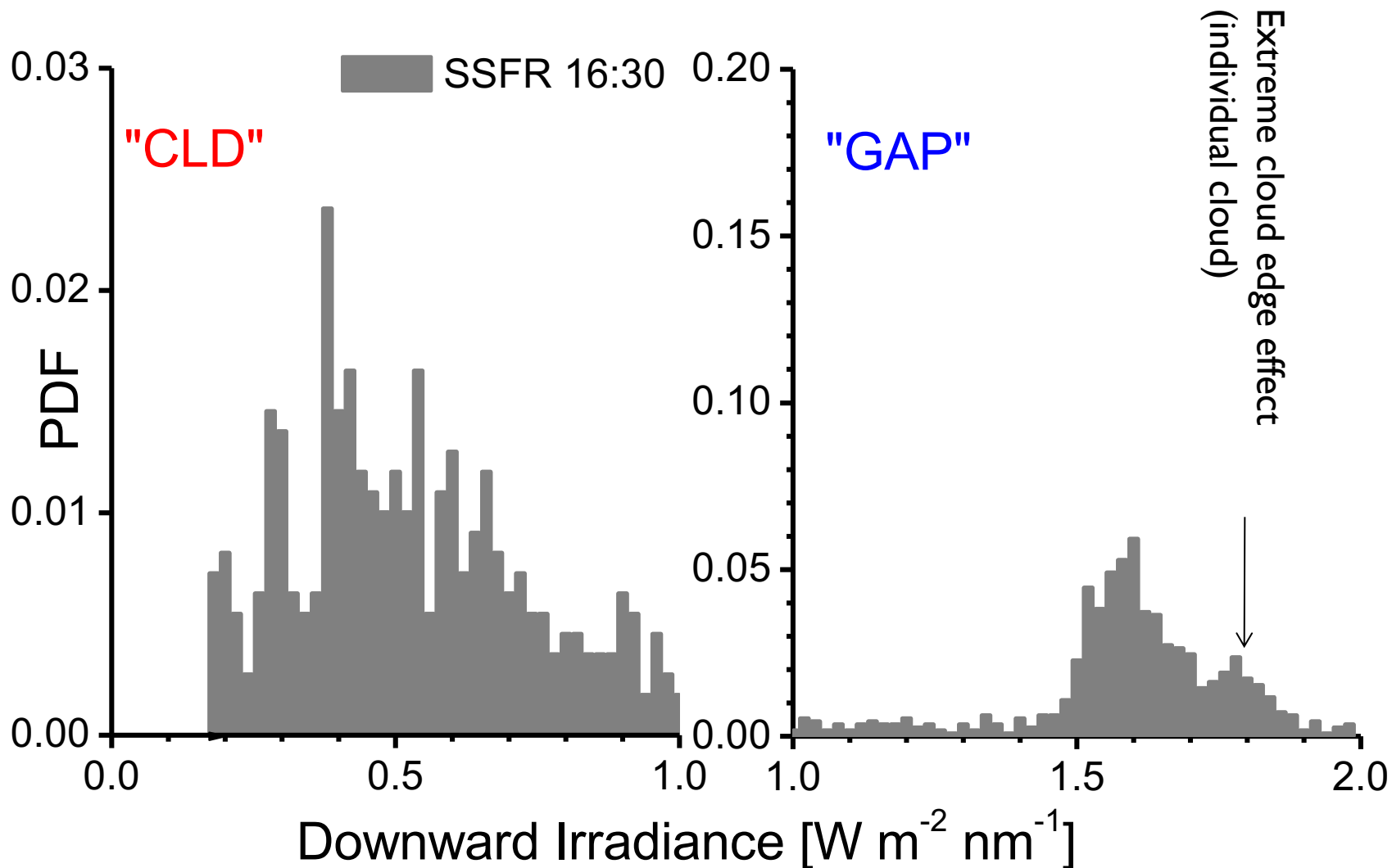
Spectral irradiance measurements using SSFR on level legs below cloud base

LES modeling

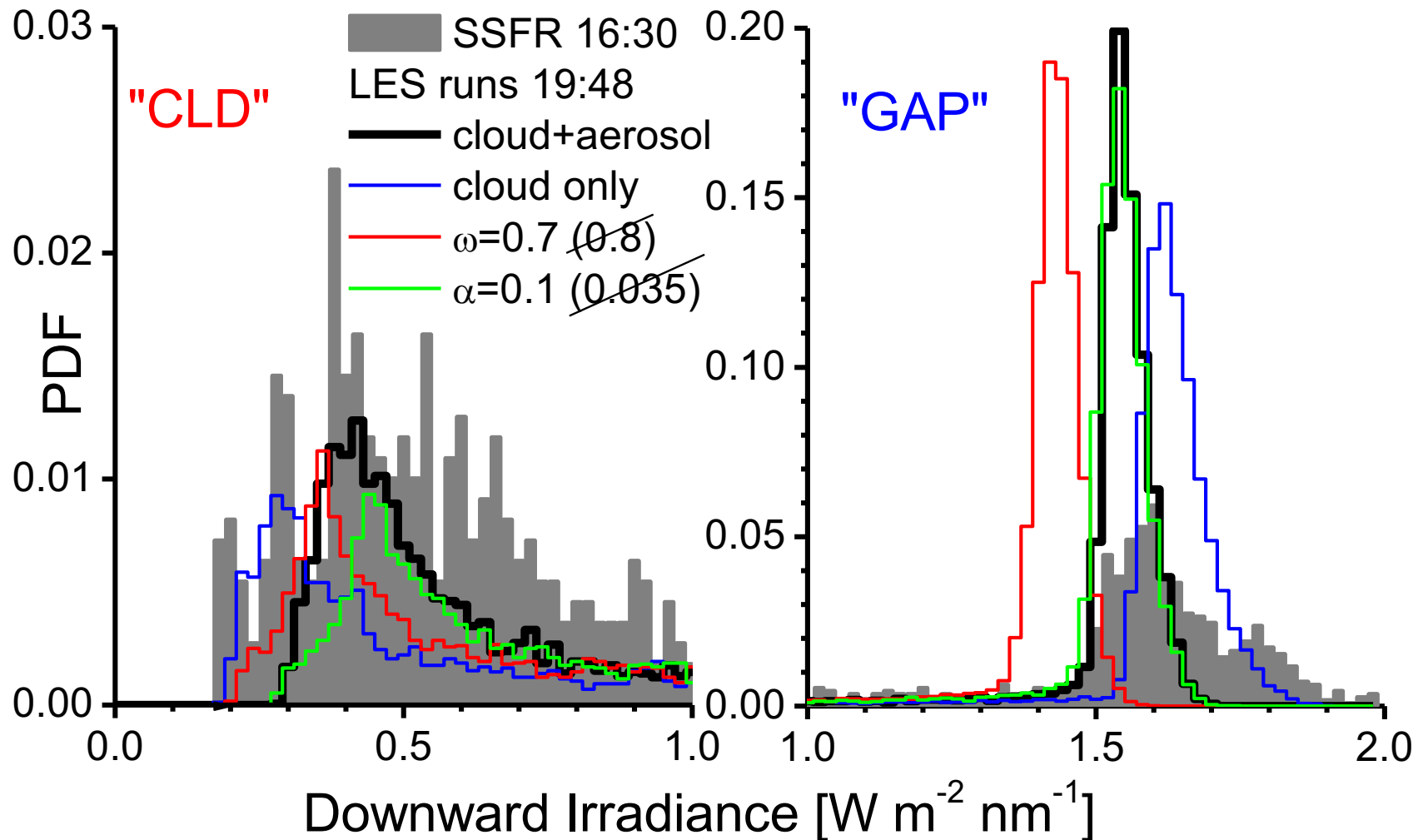


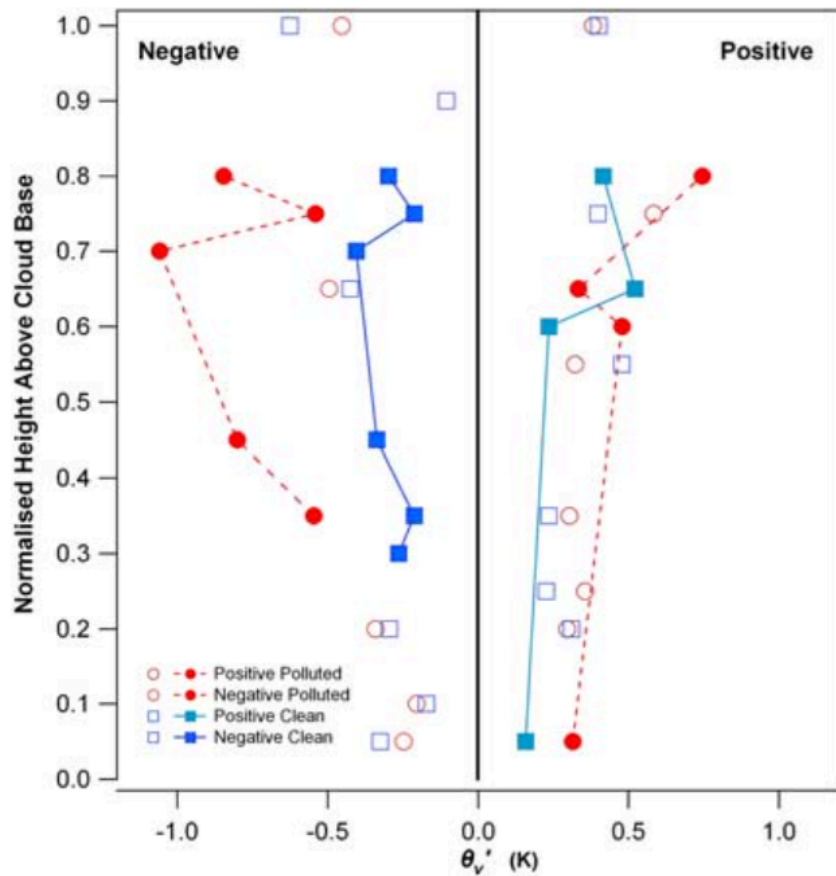
Jiang, Feingold, et al. 2008

Spectral Effects in Aerosol-immersed Broken Clouds



Spectral Effects in Aerosol-immersed Broken Clouds





Small et al. 2009

