CERES-SSF and MODIS Derived Properties for Deep Convective Clouds

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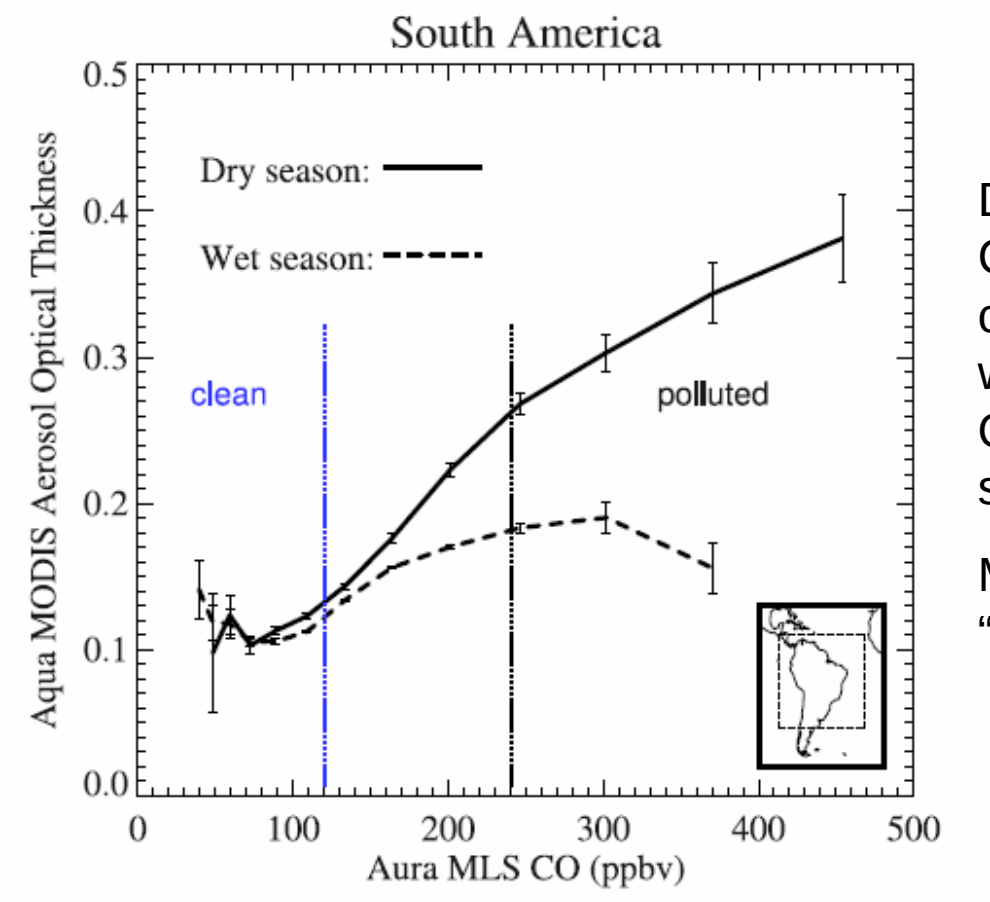
Goal: **Determine the effects of haze pollution on the properties of deep convective cloud systems.**

Source: NASA. Thunder storm clouds over Manitoba, September 1994, STS-64.

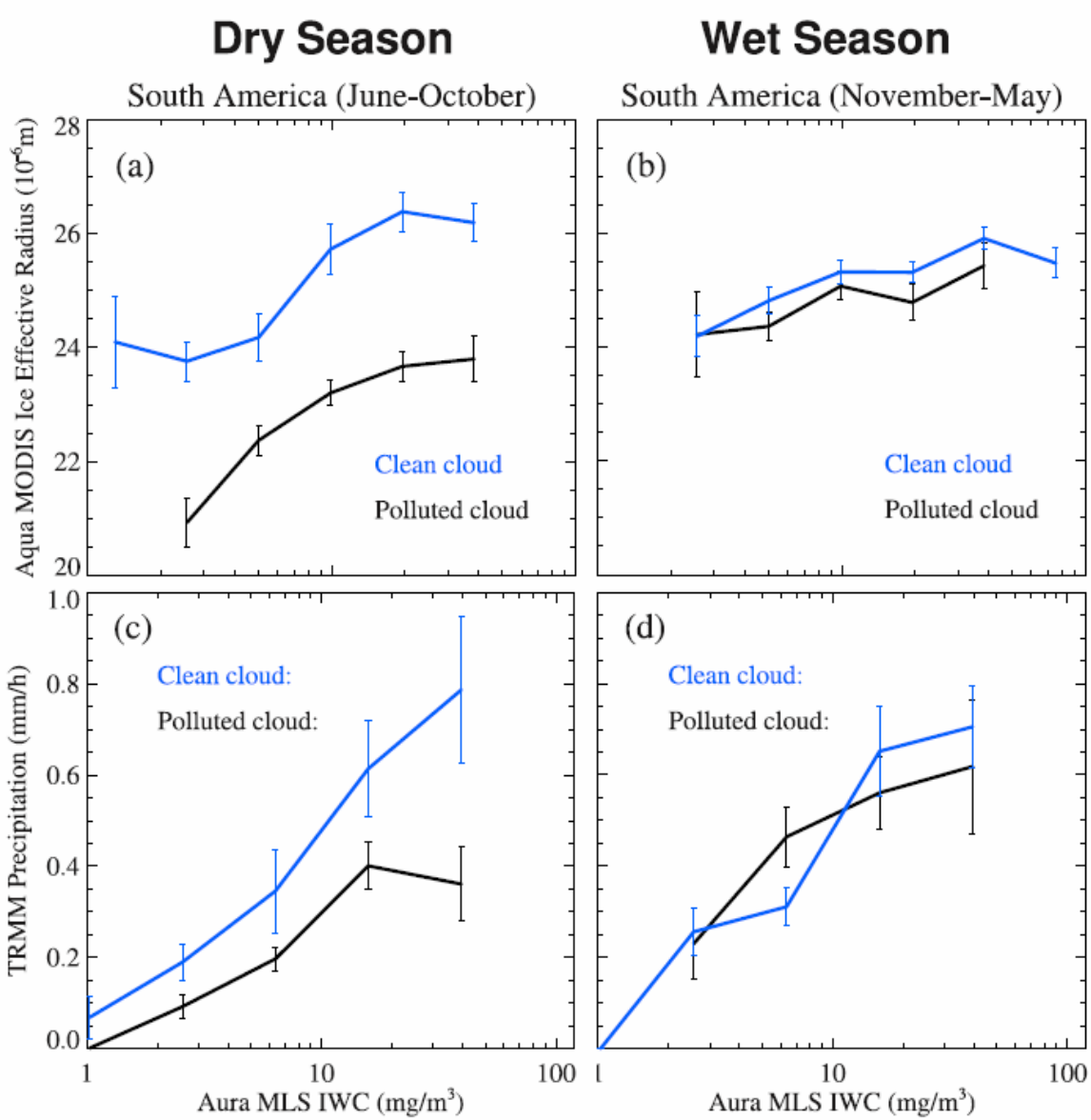
Haze and Ice Particle Sizes in Deep Convective Clouds



Daily Aura MLS upper tropospheric CO and MODIS aerosol optical depth collocated for ~ 5° lat-lon regions within South America for dry (June – October) and wet (November – May) seasons.

MLS CO used to distinguish between “clean” and “polluted” clouds.

Source: Jiang et al. (2008)



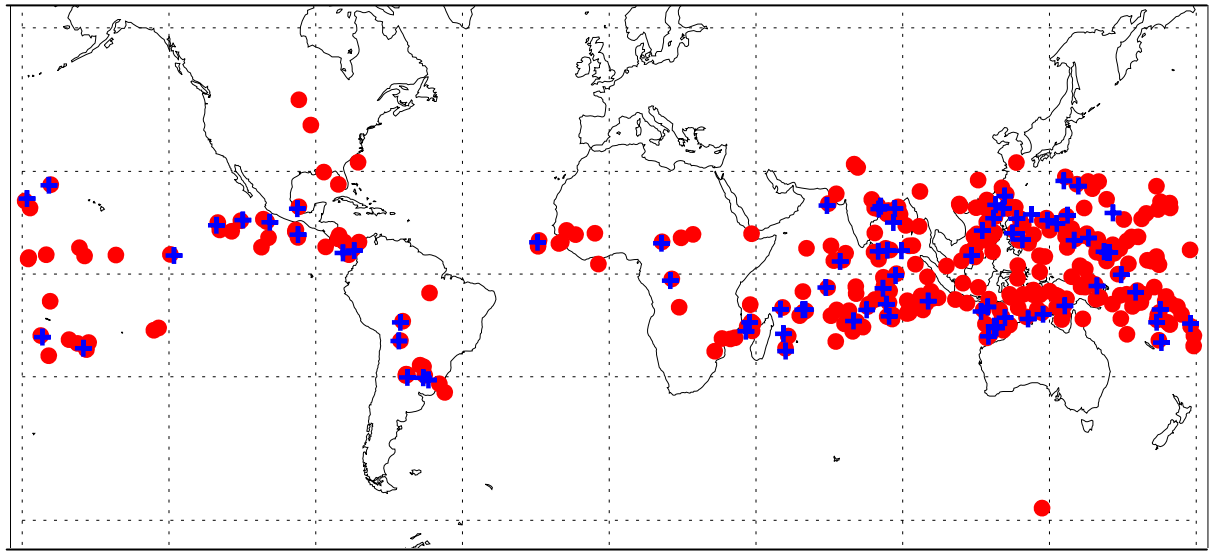
Effects of Haze on Convective Ice Cloud Properties and Precipitation

In polluted clouds ice crystals are smaller and precipitation is suppressed during the dry season.

Cloud properties and precipitation rates seemed largely unaffected by dynamical processes.

Source: Jiang et al. (2008)

Locations of Deep Convective Clouds



139 days searched, 60°S – 60°N, for deep convective clouds, yielding 272 SSF orbital segments with deep convective clouds on 62 days spanning Jan. – Aug. 2001.

CERES-SSF searched for FOVs with 11-μm brightness temperatures < 210 K.

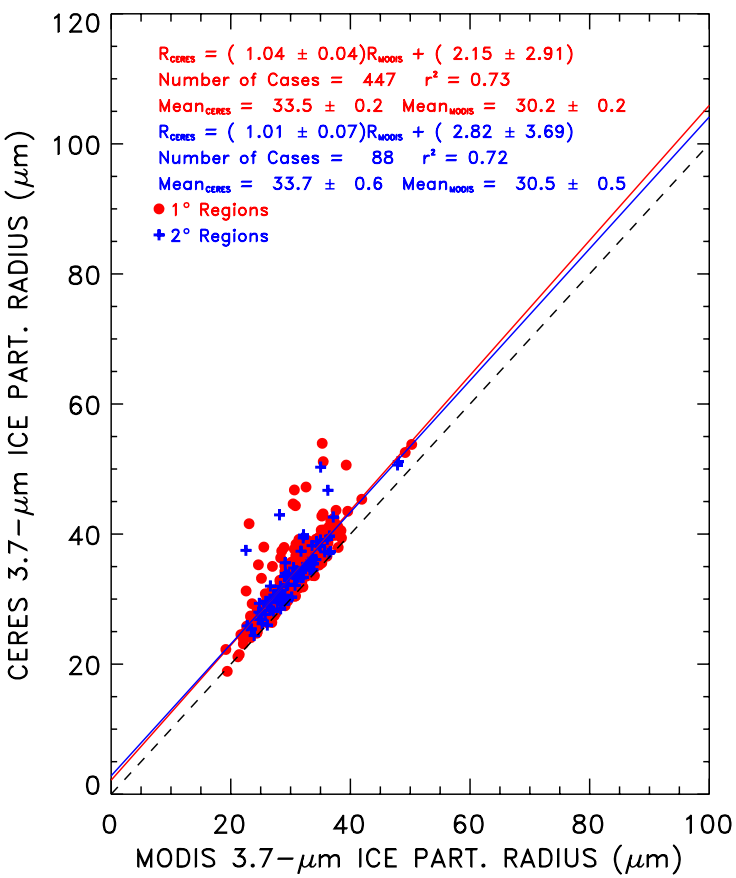
90% of the CERES FOVs within either 1° (•) or 2° (+) had to surpass the thermal threshold.

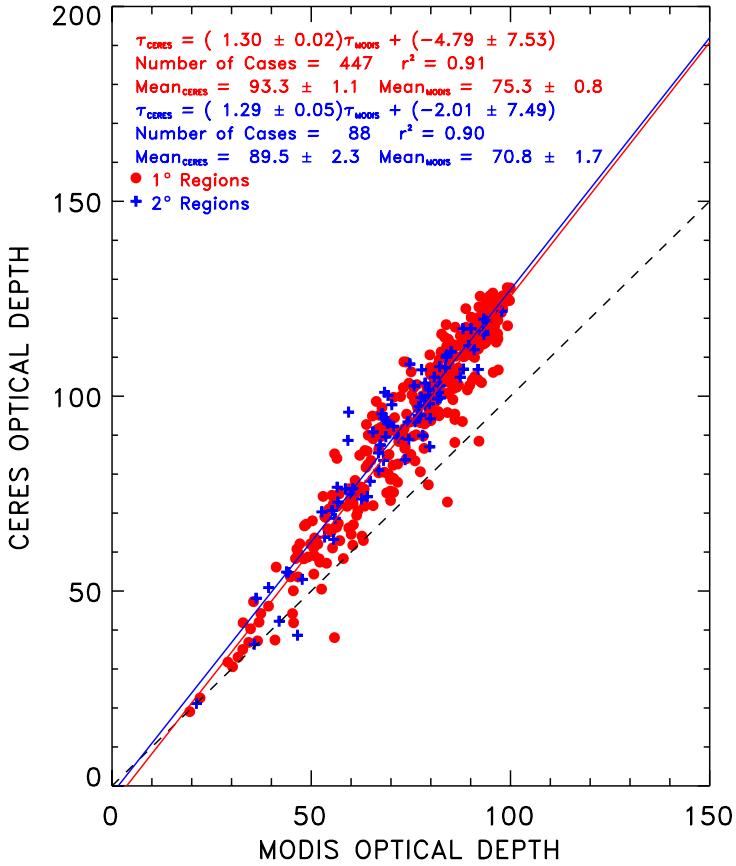
Within a single orbital segment, regions containing deep convective clouds were separated by distances > 1,000 km.

Satellite zenith angles limited to < 60° in order to ensure complete coverage by MODIS pixels.

Deep Convective Clouds: CERES-SSF and MODIS MOD06

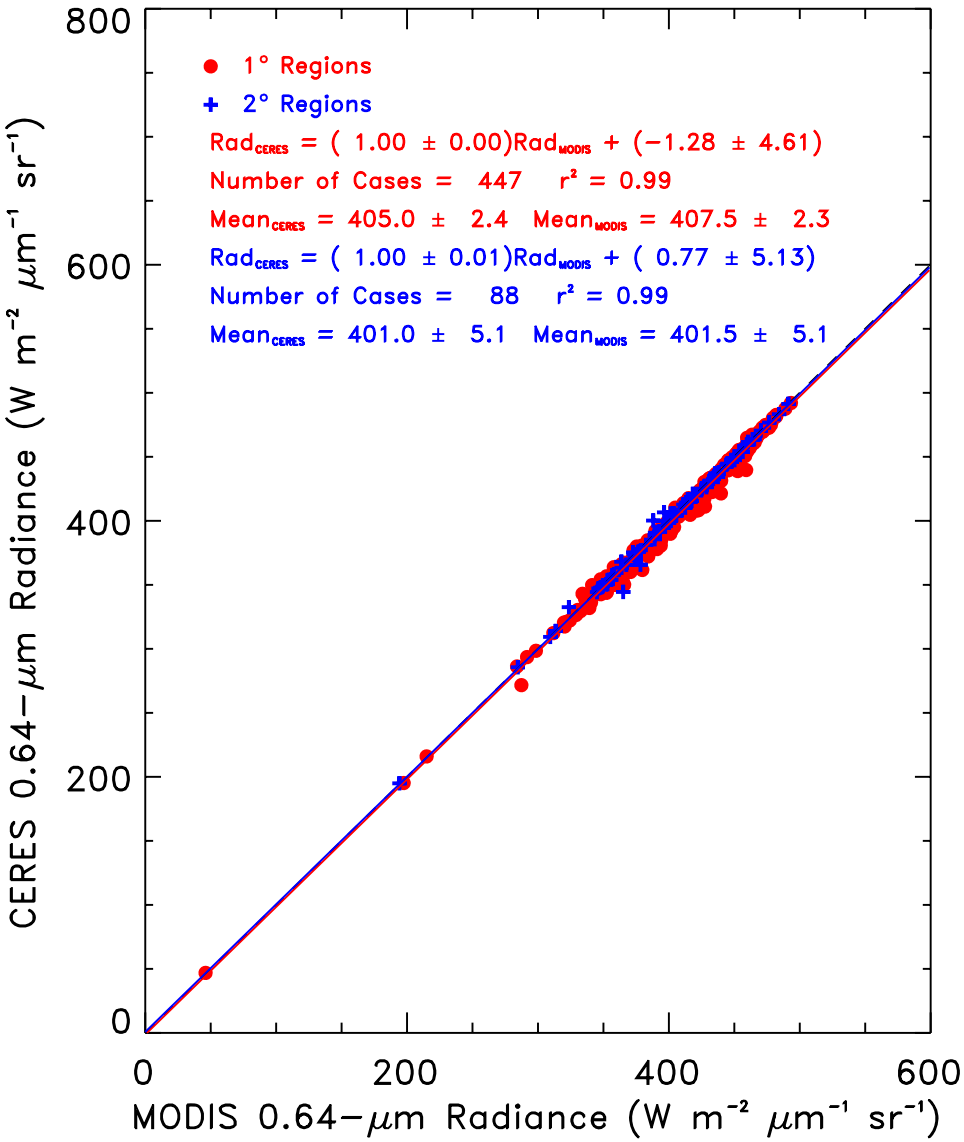
Optical Depth and Ice Particle Radius





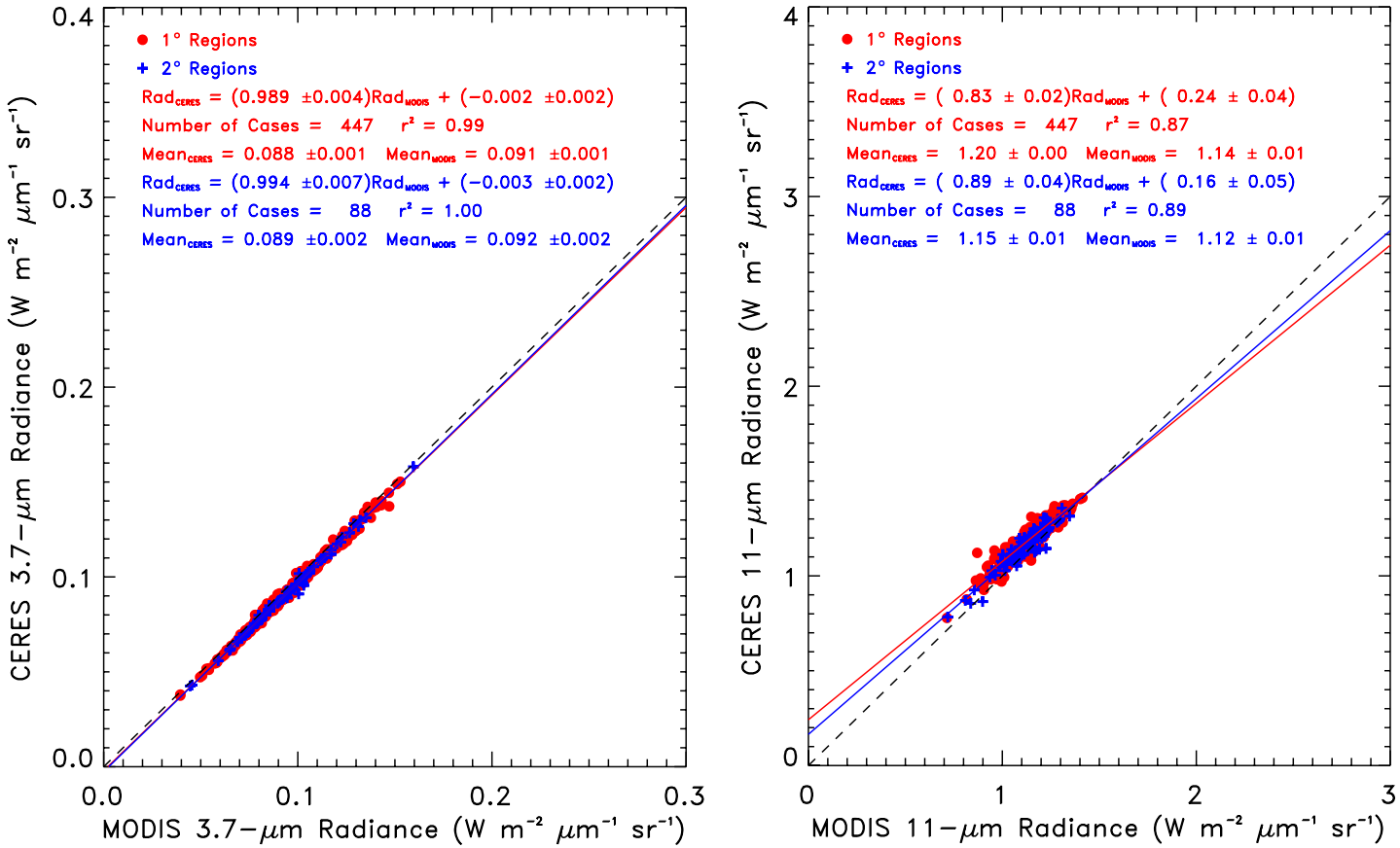
CERES-SSF ice particle radius approximately 3 μm larger (10% larger) and optical depths approximately 25% larger than their MOD06 counterparts.

Deep Convective Clouds: CERES-SSF and MODIS *0.64-μm Radiances*



CERES-SSF and MODIS 0.64-μm radiances agree within expected sampling errors.

Deep Convective Clouds:
CERES-SSF and MODIS *3.7-μm and 11-μm Radiances*



CERES SSF 3.7-μm radiances 2% smaller and 11-μm radiances 3% – 6% larger than MODIS radiances.

CERES estimate of reflected sunlight at 3.7-μm likely 3% −4% smaller than that estimated by MODIS, but the smaller reflectivity accounts for only about 1 μm in particle radius.

Why the Difference?

Different ice particle models.

Larger ice particles lead to stronger forward scattering at visible wavelengths.

Stronger forward scattering at visible wavelengths leads to larger optical depths.

Future Work

Since the CERES-SSF and MODIS properties are well-correlated, **use the SSF to search for daily correlations in the properties of aerosols and those of "collocated" deep convective clouds.**