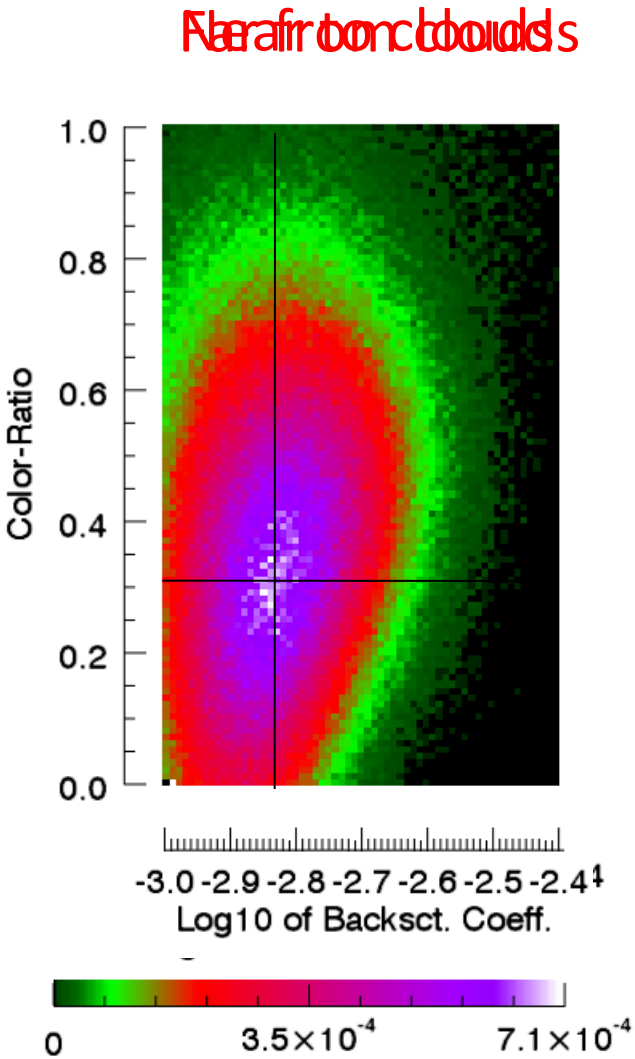
Wood et al.

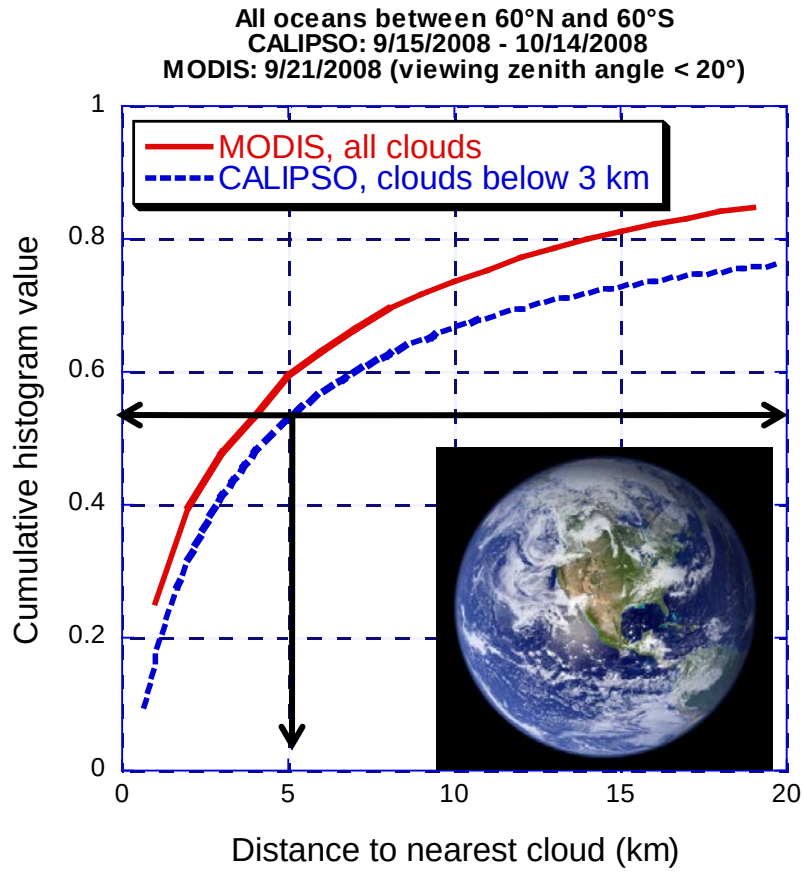
Cloud effects on aerosol properties

Cloud effects on aerosol: The challenges

- Clouds exert major influences on the physical, chemical and optical properties of aerosols.
  - a large fraction of aerosol mass (including possibly SOA) is produced in clouds via aqueous phase processes. Many of these processes are not well understood and represented in models.
- Clouds, via precipitation formation, are the primary sink for cloud condensation nuclei and a major sink of nucleation mode aerosol
  - true even in environments with very low precipitation rates, e.g. marine stratocumulus. The effects on aerosols are not well quantified globally and obfuscate conclusions drawn from aerosol-cloud correlative studies
- The presence of clouds makes it challenging to learn about aerosol properties via remote sensing
  - clouds exist in anomalously humid microenvironments and aerosol radiative properties close to them will differ from those at far-field. Poses challenges for interpretation of aerosol-cloud property correlations.

Cloud impacts on aerosol remote sensing





from **MODIS**: 60% of all clear sky pixels are located 5 km or less from all clouds

from **CALIPSO**: 50% of all clear sky pixels are located 5 km or less from low clouds

Cloud effects on aerosol: ASR Opportunities

- In-situ observations
  - state-of-the-art physicochemical aerosol measurement technology within ASR program to examine chemical and physical signatures of cloud processing
  - Airborne platforms, new CVI on G-1.
- Remote sensing
  - ARM remote sensing Facilities (e.g. new HSRLs) provide remote sensing data on the cloud-clear sky boundary at much higher spatial resolution than is typically available from space
  - Precipitation radars can help quantify aerosol loss rates in a variety of environments
- Modeling
  - Process scale modeling to examine aerosol processing rates in clouds (e.g. explicit microphysics LES coupled with chemistry)
  - WRF-Chem, CAM, and MMF models for regional and global assessment