CLOWD FG Summary

CLOWD-BBHRP, J. Comstock
- Keep on truckin' !

RACORO & Instrumentation, A. Vogelmann
- Approach, Operations, Instrumentation

RACORO Radiation measurements, C. Long
- SPN-1, HydroRad-3, 1.6 µm on MFR

RACORO Spectroradiometer research, S. Marshak
- COD retrievals, Leaf albedo & aerosol properties

Topic Areas

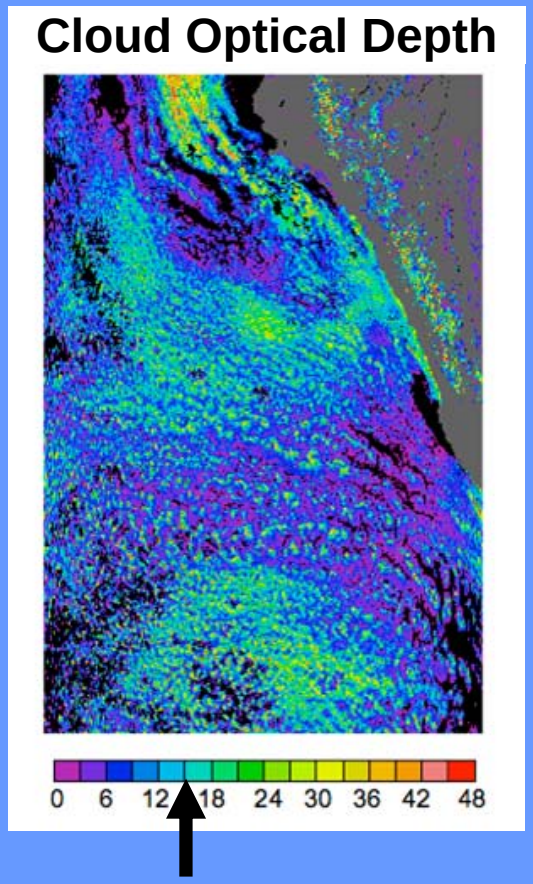
- Boundary-layer clouds constitute the largest uncertainty in climate models (IPCC, 2007)
  - Marine boundary layer (MBL) clouds
    - **MBL cloud albedos poorly simulated (Zhang et al., 2005; Bender et al., 2006; Zhu et al., 2005)**
    - **Main source of uncertainty in GCM tropical cloud feedbacks (Bony and Dufresne, 2005)**
  - Modeling continental boundary layer clouds
    - **Poor agreement w/ observations (Lenderink et al., 2004)**
    - **Subgrid scale to boot!**

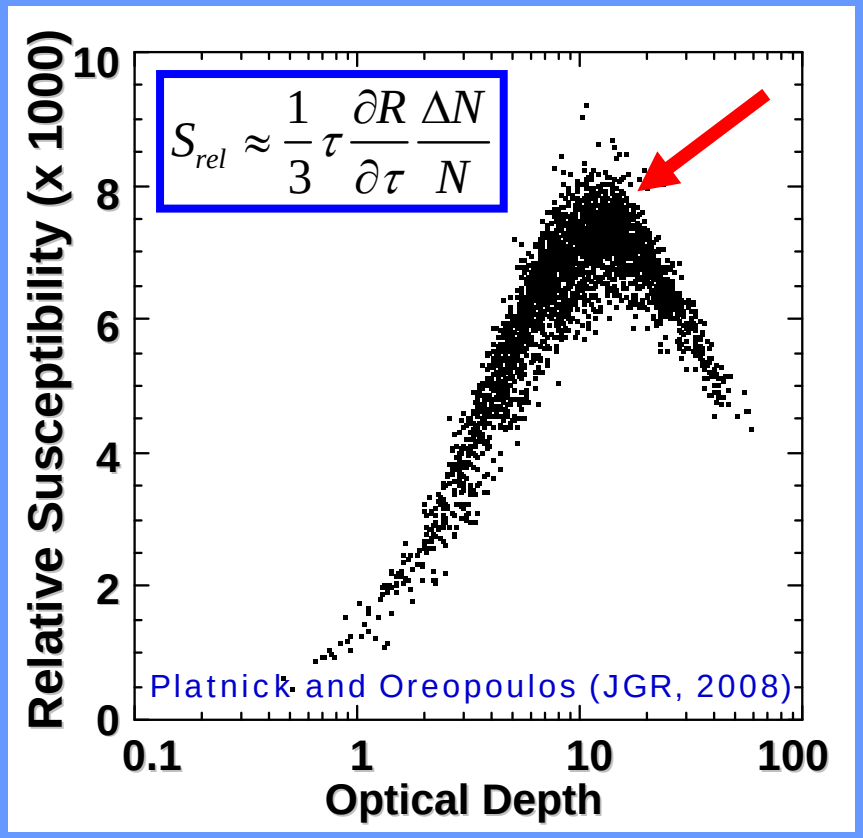
Topic Areas (cont.)

❖ Aerosol Indirect Effects (AIE)

- **Aerosol effect on cloud albedo remains the dominant uncertainty in radiative forcing (IPCC, 2007)**
- **Thin, boundary layer clouds are very sensitive to changes in aerosol loading (least saturated)**

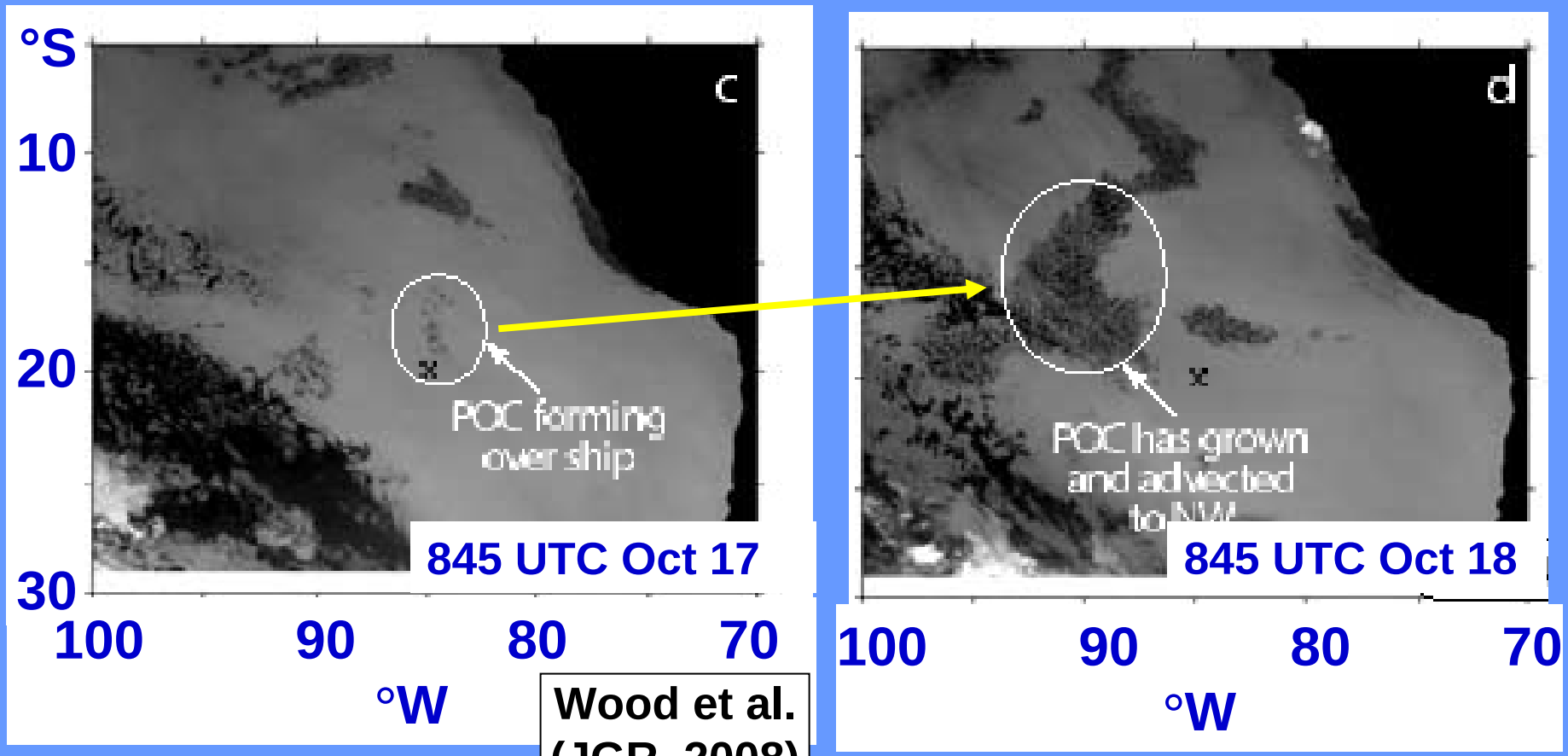
Cloud Relative Susceptibility





Topic Areas (cont.)

- MBL broken cloud fields & Rapid transitions (Rifts zones or POCs)
  - **Difficult retrieving cloud properties within broken fields**
  - **Large impact on the global radiative energy budget**



Wood et al. (JGR, 2008)

CLOWD Context & Needs

- Comments
  - Common/pervasive
  - "Tweeners"
    - Important to transitions/evolution
    - Broken/inhomogeneous
- Topics
  - Boundary layer representations
  - Cloud-aerosol interactions
  - Precipitation interactions (many SGP BL clouds drizzle)
- Needs
  - Accurate & fast cloud property profiling (LWC, Reff)
  - Concurrent aerosol profiling
  - Drizzle intensity
  - Limited-area scanning?

Some CLOWD Science Questions

- Radiative closure
  - **Can RT calculations using the observed cloud fields attain closure with the observed surface radiative fluxes? (CLOWD-BBHRP)**
  - **What PDFs of small-scale cloud property variations are needed to achieve surface radiative closure?**
  - **Can high-resolution BL models simulate those PDF and their seasonal variations?**
- Cloud-aerosol interactions
  - **Is aerosol compositional complexity required to achieve closure on drop number concentration?**
  - **What is the role of aerosol loading in varying the microphysical and macrophysical properties of boundary layer cloud fields?**
  - **What are the linkages between aerosol, cloud dynamics/microphysics, and the initiation of drizzle in warm, shallow clouds?**