Synergistic Observations from AIRS and MODIS in a Drifting Aqua Orbit

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Motivation

Why combine measurements from MODIS and AIRS?

- Cloud processes are essentially instantaneous.
- Vertical information is needed for detailed understanding of these processes
  - Cloud phase, optical depth, height from MODIS.
  - Temperature, water vapor, cloud properties from AIRS

The value of a drifting orbit

- All cloud studies with Aqua (and A-Train) data are at 1:30 local times
- Orbit drift will enable global studies of processes with strong diurnal cycle.
  - The twenty-year Aqua record at fixed local time will provide a baseline.

Deep Convection over Land and MJO Processes

- Deep convection rapidly increases after 1:30 PM local time, following daytime surface heating

- The dissipative phase, including low-level cloud and thermodynamic state, has not been observed by comparable satellite instruments at local times later than 1:30 AM.

- The Madden-Julian Oscillation interacts with the Maritime Continent; this interaction is modulated by a strong local diurnal cycle
  - Additional Aqua local times will observe this process.

Shallow Convection

- Shallow marine clouds dissipate significantly during the day.
  - Aqua in local times after 1:30 PM will observe this.

- Shallow marine cloud cover is greatest at dawn
  - Information after 1:30 AM will provide insights about pre-dawn cloud formation processes.

- Cloud amount, height, phase, organization, and open vs. closed cell characteristics have been shown to depend on the time of day with geostationary (and other types of) data.
  - These cloud dependencies (from MODIS) along with changes in thermodynamic state (from AIRS) will be observed over an additional four hours of local time in a drifting Aqua orbit.

Aqua information not available from other satellites

- No other comparable instruments will sample the diurnal cycle globally until hyperspectral IR plus imaging in a geosynchronous ring.

- Geosynchronous observations are less useful at higher latitudes with significant low cloud cover (e. g., Bering and Labrador Seas, Southern Oceans).

- Additional local times will test feedback strengths estimated from the existing Aqua record at 1:30
  - Relevant to both deep and shallow clouds.