Tropical Cloud Life Cycle and Structure

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1. Cloud Life Cycle Determination

A cloud tracking algorithm (Boer and Ramanathan, 1997) and infrared data from the MTSAT-1R geostationary satellite are used to observe the life cycles of mesoscale convective systems (MCSs) in the Tropical Western Pacific (TWP).

2. Cloud Tracking, C-POL, & MMCR Spectra Loops

(See video loops below)

Video 2a. Illustration of cloud tracking using MTSAT data. Numbers identify a cloud track for an MCS (also identified by color).

Video 2b. C-POL and MTSAT Data. Time series of the C-POL data overlaid with the coincident infrared MTSAT image. See Jensen et al. poster at right for details.

Video 2c. MMCR Spectrum Classifier. Hydrometeor phase classification during M-PACE at NSA. See Luke et al. poster to right. Also see Kollias et al. poster to right on uses of the MMCR spectra.

VIDEO SCREEN DISPLAY HERE

3. TWP Storm Regimes

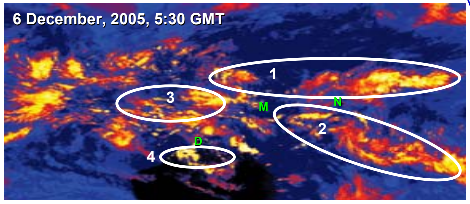

Fig. 3. TWP storm regimes (yellow is cold, blue is warm): 1. Intertropical Convergence Zone (ITCZ), 2. South Pacific Convergence Zone (SPCZ), 3. Interspersed island convection, 4. Interspersed coastal convection. ARM TWP sites sample across the storm regimes given by green letters: D = Darwin, M = Manus, N = Nauru).

4. TWP MCS Crossroads

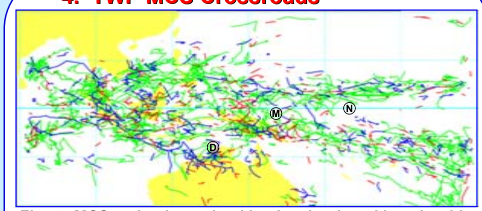

Fig. 4. MCS paths determined by the cloud tracking algorithm and their duration: t ≤ 6 hrs, 6 < t ≤ 12 hrs, t > 12 hrs. ARM sites indicated: D = Darwin, M = Manus, N = Nauru. Tracks identify common storm regimes in Fig. 3.

5. MCS Statistics

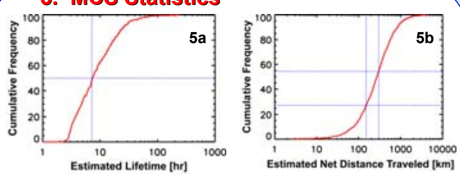

Fig. 5. Statistics for tracks shown in Fig. 4, when tracks last 3 hrs or longer (because satellite data is only hourly).

5a. MCS lifetime. About 50% of the MCSs last < 7 hrs. Many MCSs last for days.

5b. MCS net horizontal propagation (distance between the start and end locations). 73% would propagate outside of a standard general circulation model 300 km grid cell (if started from its center). 46% traverse the entire width of a grid cell.

SUMMARY

- **Cloud tracking using geostationary satellite data provides a context of the cloud state observed at the ARM Sites, including the cloud's life-cycle stage and its representativeness of the region.**
- **Examples are presented of the duration and paths of mesoscale convective systems within the Tropical Western Pacific.**
- **This information will be used to interpret the cloud microphysical retrievals and overlap structure measured at the ARM sites.**

6. Plan for ARM Data Interpretation

Using the type of information shown in Figs. 4 & 5, the life state of the storm system will be used to provide context to the ARM profiles of cloud microphysics properties and overlap structure.

Of particular interest are:

- The new ARM spectral processor at Darwin (e.g., see posters by Luke et al. and Kollias et al.)
- The C-POL at Darwin (see poster by Jensen et al.)

Reference

Boer, E. R., and V. Ramanathan, 1997: Lagrangian approach for deriving cloud characteristics from satellite observations and its implications to cloud parameterization. *J. Geophys. Res.*, 102, 21,383-21,399.

Acknowledgements

We thank Richard Wagener and Lihong Ma (ARM External Data Center) for assistance with the MTSAT data.

This research was supported by the Office of Biological and Environmental Research of the U.S. Department of Energy as part of the Atmospheric Radiation Measurement Program.

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