Patterns of Convective Properties in the Tropics

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The Japan Meteorological Agency's MTSAT-1R began operation over the TWP on 28 June, 2005.

SUMMARY

Towards the goal of improving convective parameterizations, we are developing the means to determine the context of the cloud state observed at the ARM Sites through:

- Cloud tracking algorithm, to determine cloud's life-cycle stage and overall duration,
- The representativeness of observations within the region using a neural net cloud classification algorithm that will be able to classify the Cloud Regime, Convective Regime, and their variations during the diurnal cycle.

4. Plan for ARM Integration & Model Improvement

To improve TWP convective parameterizations, we will integrate the neural net classification with our cloud tracking algorithm and complementary profiling data available from:

- The new ARM spectral processor at Darwin
- The C-POL at Darwin

The results will be linked directly with modeling efforts through established collaborations (M. Zhang, SBU).

BMRC C-Pol Radar
- Located 25 km NE of Darwin ARM site
- Complete Volume Scan every 10 min.
- Gridded reflectivity and hydrometeor type (May and Keenan 2003)

Mesoscale Convective System paths determined by our cloud tracking algorithm and their duration: t ≤ 6 hrs, 6 < t ≤ 12 hrs, t > 12 hrs. TWP ARM sites indicated.

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1. OVERVIEW

A. Previous Work

Tracked clouds with geostationary satellite data to determine the context of the cloud state observed at the ARM Sites, such as the cloud's life-cycle stage and its representativeness of the region.

B. Goal

Expanding classification system for:
- Cloud regime classification
- Convective regime classification
- Subsequent tracking of features' paths and longevity.

C. Approach

Develop artificial neural network to classify TWP clouds using (only) infrared data, for operation throughout the diurnal cycle.

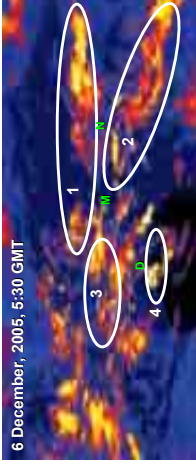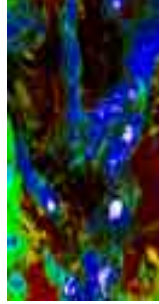## TWP Storm Types

6 December, 2005, 5:30 GMT

Fig. 1. ARM TWP sites experience different convective clouds within the TWP: (1) ITCZ, (2) SPCZ, (3) Island convection, and (4) Coastal convection. ARM sites: D = Darwin, M = Manus, N = Nauru). Plot color scheme: yellow is cold, blue is warm.

2. ARTIFICAL NEURAL NETWORK CLASSIFICATION EXAMPLE

A. MTSAT Input Image
False color image for the TWP region using visible and infrared data.

B. Neural Net Result
Neural net result using only infrared data, color coded by cloud group.

Color key
- Cumulus
- Low cloud
- Low or mid-level
- Mixed (Thin & thick cirrus, or Mixed hi/lo)
- Thin cirrus
- Thick cirrus
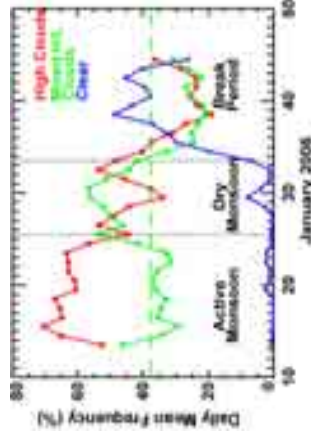- Boiler plate
- Deep convective
- Clear
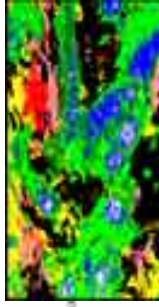
3. TWP-ICE CLASS FRENQUENCIES

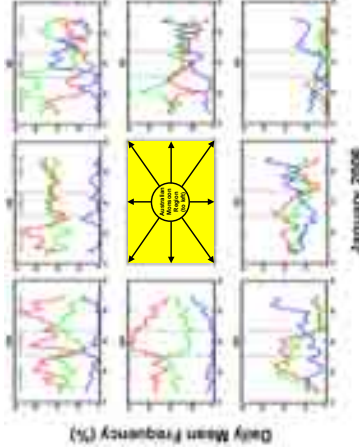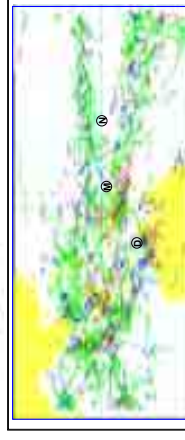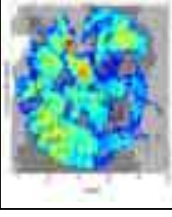Grouping the neural net classes by cloud type can distinguish between the three convective regimes observed during TWP-ICE: (1) Active Monsoon, (2) Dry Monsoon, and (3) Break Period.

A. Australian Monsoon Region

Region defined as 2.5 to 15°S, 110 to 150°E. Convective periods determined by Lori Chappel, "TWP-ICE Daily Synoptic Overview" (http://science.arm.gov/twpice/documents/twpice_synoptic_overview.pdf)

B. Surrounding Regions

The neural net is applied to equal-area regions that surround the Australian Monsoon Region to determine the representativeness of convection sampled during TWP-ICE relative to the broader TWP.

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