

TITLE: Application of Satellite Data to Tropic/Subtropic Moisture Coupling

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Our objective is to utilize various satellite products from a number of satellites together with data observed from platforms available during the FGGE Special Observing Periods to diagnose synoptic scale events in data-void regions. Our focus is on episodes of northeastward traveling cloud bands which move out of the ITCZ over the eastern North Pacific Ocean. We call these events "moisture bursts".

SIGNIFICANT ACCOMPLISHMENTS TO DATE IN FY-84:

1. Based on an objective definition of moisture bursts as observed in GOES West imagery, a climatology spanning two six-month cold seasons documented the mean characteristics of the bursts. About 10 events occur per month; their locations are distributed uniformly between the dateline and 110°W. A third six-month period, within the El Niño event of 1983-84, revealed a marked decrease and eastward displacement of burst occurrence, in spite of the intensification of convective activity in this region of the equatorial convergence.
2. Routine screening and validation of the FGGE data revealed the following shortcomings in spite of general high quality of the data set:
 - a) considerable missing data, even within the Special Observing Periods;
 - b) inconsistencies and errors within the coding and archiving of the FGGE data base, both at NCAR and at the World Data Center, which have not been encountered by other FGGE data users;
 - c) biases in the satellite-derived soundings with respect to co-located rawinsondes and dropsondes, which differ from those reported by other investigators, but are associated with geographic and synoptic variation.
 - d) time traces of co-located data which yield consistent but differing signals between satellite and in situ observations.
3. The primary advantages of satellite coverage are its temporal frequency (twice a day for polar orbiters) and its fine-scale horizontal resolution. We are developing procedures for taking advantage of these properties. These procedures include objective analysis of satellite channel radiance data, converted to brightness temperature; multiple regression and interpolation in space and time of VTPR channel data to a TIROS N framework to extend the time and space coverage; and eigenfunction decomposition in the horizontal, vertical and temporal dimensions, to summarize and synthesize the significant modes of variation.

4. Synoptic analysis has proceeded along three independent tracks:
 - a) Interpretation of synoptic fields analyzed by the European Center and NMC;
 - b) Preparation of additional synoptic products, based on the FGGE level II(b) observations, including satellite-derived wind fields, and detailed time-sections and cross-sections;
 - c) New synoptic analysis of satellite-observed brightness temperatures, calculated from individual channel data of the TIROS N instruments. Preliminary indications are that these data sources are of significance when used to investigate synoptic structure in data-void regions.

FOCUS OF CURRENT RESEARCH ACTIVITIES:

Current efforts are directed to the construction and statistical evaluation of the satellite channel-radiance fields. This information can then be incorporated into the synoptic interpretation of moisture bursts along with FGGE and NMC analyses.

PLANS FOR FY-85:

1. Relate the moisture burst climatology to typical upper level and lower level motion fields.
2. Perform a synoptic case study analysis of two moisture bursts using the fields of satellite data.
3. Perform balance studies of the moisture burst region to understand physical mechanisms and the relative utility of satellite observations.
4. Initiate a case study of a warm season moisture burst.
5. Initiate wind/cloud/moisture analysis in which predominant use is made of McIDAS.

RECOMMENDATIONS FOR NEW RESEARCH:

The sounding retrievals, moisture and temperature alike, have been tremendously useful, but they tend to reveal the satellite data in their poorest light--vertical resolution. We suggest continuing studies emphasizing the use of the moisture-observing capabilities of the satellites using both microwave and infrared channels. These studies should emphasize horizontal and temporal variations of satellite data and their relation to distributions of more conventional data. The horizontal resolution available from mapped single-channel data seems to provide an inexpensive yet valuable extension of the capability of currently-available information from satellite vehicles.

LIST OF PUBLICATIONS AND PRESENTATIONS:

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- McGuirk, J., and A. Thompson, 1984: Transient tropical disturbances
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Amer. Meteor. Soc., Boston, MA.
- Thompson, A., J. McGuirk, L. Anderson, Jr., and N. Smith, 1984: Analysis
of tropical synoptic disturbances using satellite-derived soundings
and radiance data from selected channels. Preprint Vol., Conference
on Satellite Meteorology/Remote Sensing and Applications, Clearwater
Beach, FL, June 25-29, 1984. Amer. Meteor. Soc., Boston, MA.