Title: Statistical Structure of Convective Periods Derived from Satellite and Ground Based Data

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Research Goals:

Statistical structure and correlation functions serve to quantify the nature of patterns that an analyst sees in the data but about which has only qualitative feelings. They also provide a measure of random error that is not dependent on comparisons against other sources of information. Our goal is to document the characteristics of VAS soundings through use of these statistical tools.

Significant Accomplishments to Date in FY-84:

Our basic methodologies were developed and tested on radiosonde data during the AVE-SESAME I period (10-11 April 1979). This phase was completed during FY-83. During FY-84, we submitted a manuscript to Monthly Weather Review that describes these activities. The proposed article was conditionally accepted subject to revision. A modified version was recently re-submitted, and we are now awaiting the outcome of the review process.

The AVE-SESAME I period provided rawinsonde data at 250 km separations; however, VAS retrievals are frequently at an even closer separation. Thus, several months of FY-84 were spent analyzing rawinsonde data from the AVE-SESAME V case (20-21 May 1979) in which the station separation was 75 km. Based on these results, modifications to our original procedures were prepared.

The bulk of this year has been devoted to investigating the AVE-VAS II period (6-7 March 1982). Structure and correlation functions are being used to compare VAS retrievals obtained using a physical algorithm (NESS/Univ. of Wisconsin) with those from a regression technique (NASA/Goddard). Results from both procedures are evaluated against those from a special mesoscale network of rawinsonde stations that was operated during the AVE-VAS Field Experiment. The parameters being documented include temperature, mixing ratio, geopotential height, thickness, and precipitable water. Calculations were performed at several levels (or layers) in the lower and upper troposphere.

Results indicate that both forms of satellite retrievals generally yield weaker horizontal gradients than those from the sondes. For example, Fig. 1 shows that slopes of the satellite-derived structure curves for temperature at 300 mb are smaller than those from radiosondes; this indicates the smaller gradients. Anisotropic calculations also are being performed. Figure 2 shows that 300 mb heights are highly anisotropic, with gradients maximized along a northeast-southwest direction. However, results from the three data sets are comparable; thus, each portrays the mean directional gradients in a similar manner. A final type of calculation permits random errors to be estimated. Depending on the level and parameter, errors in the VAS retrievals are comparable, or only slightly greater than those from radiosondes. Signal-to-noise considerations are favorable for the VAS data.

Focus of Current Research Activities:

We are making final calculations on the AVE-VAS II case. Specifically, RMS errors are being removed from the structure and correlation curves. As a result,

systematic gradient differences between the data sources can be accurately determined, and maximum distances allowable for data interpolation can be assessed.

A major focus is report preparation. We have just submitted an article for the upcoming Conference on Satellite Meteorology. In addition, Paul Meyer is preparing his Master's thesis that will describe these efforts in greater detail. This thesis will be submitted to NASA for publication.

Plans for FY-85:

Results of the AVE-VAS II period will be condensed into a journal manuscript and submitted to the Journal of Climate and Applied Meteorology. In coordination with our other NASA contract, we will begin to investigate the physical retrieval procedure from first guess to final soundings. We will utilize data from AVE-VAS II; however, a much larger area will be considered than before.

Recommendations for New Research:

Convection was very limited during all of the 1982 AVE-VAS Demonstration days. Ground truth studies for pre-convective environments are needed to fully evaluate VAS's potential to aid in severe storm forecasting.

Publications Since June 1983:

Fuelberg, H. E., and P. J. Meyer, 1984: An analysis of the AVE-SESAME I period using statistical structure and correlation functions. Conditionally accepted for Mon. Wea. Rev.

Meyer, P. J., and H. E. Fuelberg, 1984: Structure function analyses of mesoscale VAS retrievals. Preprints Conf. on Sat. Meteor./Remote Sensing and Applications, In press.

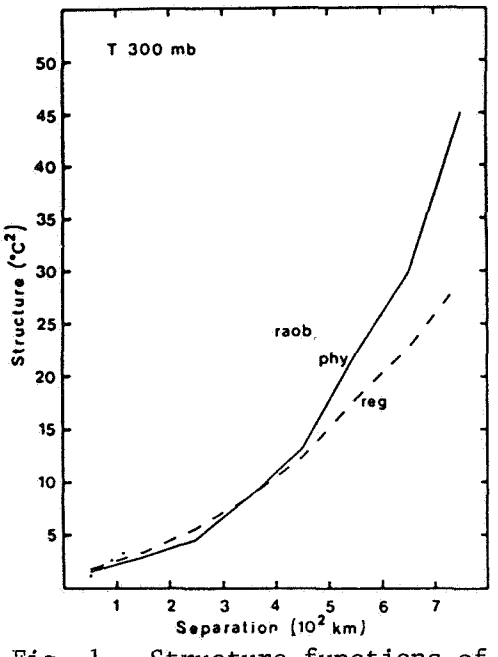

Fig. 1. Structure functions of temperature at 300 mb from regression (reg), physical (phy) and rawinsonde (raob) data.

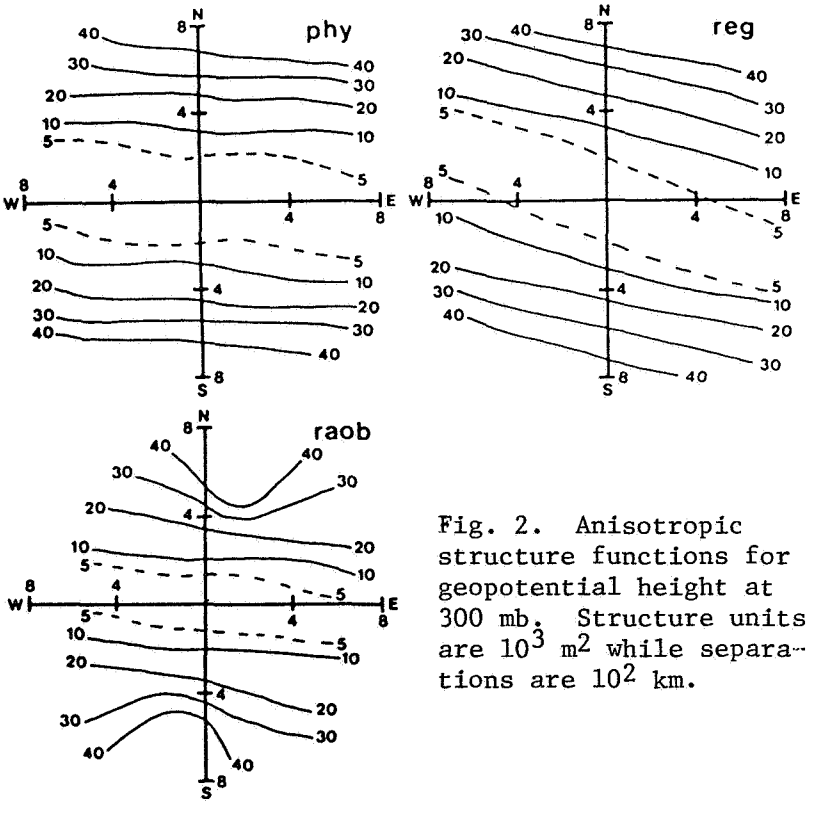

Fig. 2. Anisotropic structure functions for geopotential height at 300 mb. Structure units are 10^3 m^2 while separations are 10^2 km.