TITLE: Radar Analyses of Mesoscale Meteorological Phenomena During the AVE/VAS Correlation Field Experiment, NAS-8-34972.

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Significant Accomplishments to Date in FY-84:

The principal portion of the research effort concerns the radar analyses of mesoscale meteorological phenomena during the AVE/VAS Correlation Field Experiment. The overall program consists of first, the collection of radar data during the selected critical times of the field experiment and, second, the subsequent analyses of the collected data for specific items.

Two radars were concerned with the collection of digitized data, the primary one being at Texas A&M University and the secondary set at the National Weather Service site at Stephenville, Texas. The initial portion of the effort concerned the selection of scan sequences, times of data collection and calibration procedures for both the Texas A&M radar as well as the NWS installation.

The analysis portion of the effort was divided among several tasks. A 400 Km by 400 Km grid set of 10 Km by 10 Km grids was established (with orientation with respect to true north at the Texas A&M radar) that covered the area for the AVE/VAS experiment. This placement allowed intense coverage of the southeastern quadrant by the Texas A&M University radar as well as near complete coverage of the 1600 grids by the NWS radar. No special vertical coverages were possible with the NWS radar in that they could not deviate from their normal collection routine.

The analyses of the radar data for the AVE/VAS experiment have provided statistically significant values for each of the 10 Km by 10 Km grids within radar range. It should be pointed out that approximately 1700 individual values were integrated for the average value for each grid area. The resulting information for correlation with satellite data included the following derived items that were averaged for each grid area.

(a) Rainfall rate in mm/hr
(b) dBZ (reflectivity) values
(c) Accumulated rainfall values per hour
(d) Accumulated rainfall values for a 6-hour period
(e) Vertically integrated liquid water content per square meter
(f) Vertical height of the radar axis at the midpoint of each grid

The data from the Texas A&M Radar have been analyzed and presented, in all cases, as taped information for the entire 1600 grid areas. In addition, one complete sequence has also been presented as Xerox computer plots of the information listed above.

In addition, there were subsets of data collected for a cooperative US Army program near Ft. Hood, Texas. In this case, an 11 by 11 subset of 10 Km by 10 Km grids was used as a basis for the collection of rainfall data at all times that any precipitation occurred within this subset area. This concerned a hydrological forecast study.

Focus of Current Research Activities:

Additional products derived from radar data are being investigated. An example of one such product is the derivation of the errors in integrated rainfall with different sampling periods. This is of significance for correlation with satellite data in that normally a "step-function" type of rainfall rate is used to derive the total rainfall over a period. The question arises when one asks just how often must one sample for a certain degree of accuracy.

Plans for FY-85 and Recommendation for New Research:

Work shall continue on the error analysis descussed above and, in addition, a proposal is being submitted to NASA for assistance in a pilot radar and satellite study of precipitation efficiency. In this case let us say that:

> Incremental liquid water content of a precipitating cloud EQUALS the incremental amount of water condensed MINUS a total of incremental amount evaporated and that amount that falls out as rainfall
>
> or
>
> If, in a typical case, e = 0.15 Condensate
>
> then
>
> Total LWC (over lifetime) = 0.85 total condensed — total rainfall
>
> or
>
> $$\text{Efficiency} = \frac{\text{Total rainfall}}{\text{0.85 total condensate}}$$

The satellite data as well as rawinsonde data will assist in the determination of the evaporative portion of the equation.

List of Publications:

Arnold, J. E. and G. L. Huebner, "A composite look at a precipitating region using digital radar, GOES imagery, surface climatological rainfall data and 3-hour rawinsonde measurements," Conference on Satellite Meteorology/Remote Sensing and Applications, Clearwater Beach, Fla., 25-29 June, 1984.