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NASA ACTIVITIES AND INTERESTS IN THE 1979 REGIONAL AND STORM SCALE EXPERIMENT

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ABSTRACT

A brief overview is presented of NASA's planned involvement in an interagency severe storms field measurement program

INTRODUCTION

During the past decade or more, a major concentration of research has gone into the large and small ends of the atmospheric scales of motion, leaving a gap in the understanding of phenomena associated with the middle (mesoscale) scale. This gap includes the important processes involved with the onset and development of severe storm systems. It is widely acknowledged that our lack of knowledge about the organization of mesosystems forms one of the greatest obstacles to developing a general understanding of the mechanisms of severe local storms and the parameterization of them in numerical and statistical models.

To learn more about mesoscale systems and their mechanisms, NASA will conduct an Atmospheric Variability Experiment (AVE) in the Spring of 1979 and start planning for a larger field experiment in the early 1980's. This effort is directed toward the acquisition of correlative data sets for application to investigations of storm initiation and development. NASA's objectives for the field experiments include:

(1) Improve the understanding of the mechanisms associated with the development of severe weather, especially those which might be observable from satellite sensors.

(2) Determine to what extent satellite data can be used to detect and monitor the development of severe storms.

(3) Obtain a better diagnostic understanding of the coupling between synoptic and mesoscale processes associated with severe storm systems.

Plans are for the 1979 NASA AVE experiment to be part of an interagency cooperative mesoscale field experiment and research project called Little SESAME. The involvement depends upon the degree of sponsorship and resources made available by other governmental agencies for the basic Little SESAME Project.

The primary objective of the 1979 AVE experiment is to acquire correlative sets of rawinsonde, satellite, and radar data during periods of severe weather. The data will be used in studies of meso-synoptic processes responsible for the formation and development of severe convective activity associcated with phenomena such as tornadoes, damaging winds, hail, floods, turbulence, etc., that affect the property and personnel safety. The secondary objective is to compile a data set for investigating atmospheric variability, and associated severe storm development with emphasis on the determination of mechanisms for the formation of severe storms.

EXPERIMENTS

The meso-, regional, local, and convective scales involve very complex physical processes including important contributions from the underlying geography, intense heat release and non-linear interactions between the larger and smaller scales. Because the important physical processes, scientific methods/techniques and the state of knowledge are all scale dependent, two experiments will be conducted during the period of April to July, 1979. One will be on a regional scale and one on a storm scale.

The regional scale experiment shown in Figure 1 will consist of three 24-hour periods and will involve 23 National Weather Services (NWS) rawinsonde sites and 20 supplemental rawinsonde sites taking measurements at 3-hour intervals during a severe outbreak of weather. Rapid scan visual and infrared imagery recorded by the GOES satellite at 3-5 minute intervals will be made. Weather radar data will be obtained from photographs of the scope taken every 15 minutes during severe outbreaks from stations located in the experiment area.

The storm scale experiment will consist of three 24-hour periods and will involve 23 National Weather Service rawinsonde sites (same as regional scale) taking measurements at 3-hour intervals, and 20 supplemental rawinsonde sites taking measurements at 90 minute intervals during severe weather (Figure 2). GOES satellite rapid scan visual and infrared imagery

recorded at 3-5 minute intervals will be obtained. Weather radar data in the form of photographs of the storm cells as displayed on the scope will be obtained from sites near or in the experiment area.

Rawinsonde data will be reduced by the NASA-AVE technique which will include a quick-look assessment and documentation of each experiment. The data obtained from the experiment will be made available to all investigators and the scientific community by hard copy or on magnetic tape.

POTENTIAL RESEARCH

The number of potential scientific studies that could be conducted using the data available from these experiments are numerous. Some possibilities are:

(1) Examination of conditions which lead to the severe and unusual weather events throughout the experiment day. This would include vertical motion (lifting mechanisms), kinematic parameters, convective instability, air structure, etc.

(2) Perform studies of budgets of energy (transformations included), moisture, and vorticity to determine the source of energy for the storms and the mechanisms responsible for the release of the latent energy.

(3) Relate satellite observations to results from various analyses to determine what can be learned from satellite data about the conditions established from 3-hour and 1½ hour rawinsonde data.

(4) Investigate the role of the jet stream in the formation of convective activity.

(5) Develop improved storm forecast capability through the development of models of severe storms and their environment which use space technology and conventional ground based data sources.

(6) Perform correlative analyses of the satellite and ground measurements to determine the critical atmospheric variables or storm severity indicators which may be required for future sensor system developments.

These are only a few of the possibilities. Research results from the utilization of these experimental data in studies relating to the understanding and knowledge of severe weather will be documented and made available to the scientific community.

CONCLUSION

In 1980, using the results of the 1979 field experiment, NASA will conduct applied research on severe storms dynamics and the atmospheric environment to determine the conditions which lead to severe storm development in order to improve the understanding of storm initiation. NASA will develop and demonstrate the utility of the analysis and interpretation technique/method for severe storms data where measurements from space sensors are combined with conventional measurements of atmospheric parameters. Participation with the Convective Storms Division of NCAR is planned on a research study scheduled for the Summer of 1980 under the sponsorship of NSF. Sponsorship of electrical field and lightning measurements, selected ground based sensing and satellite data acquisition, plus possible aircraft sensor contributions, is anticipated.

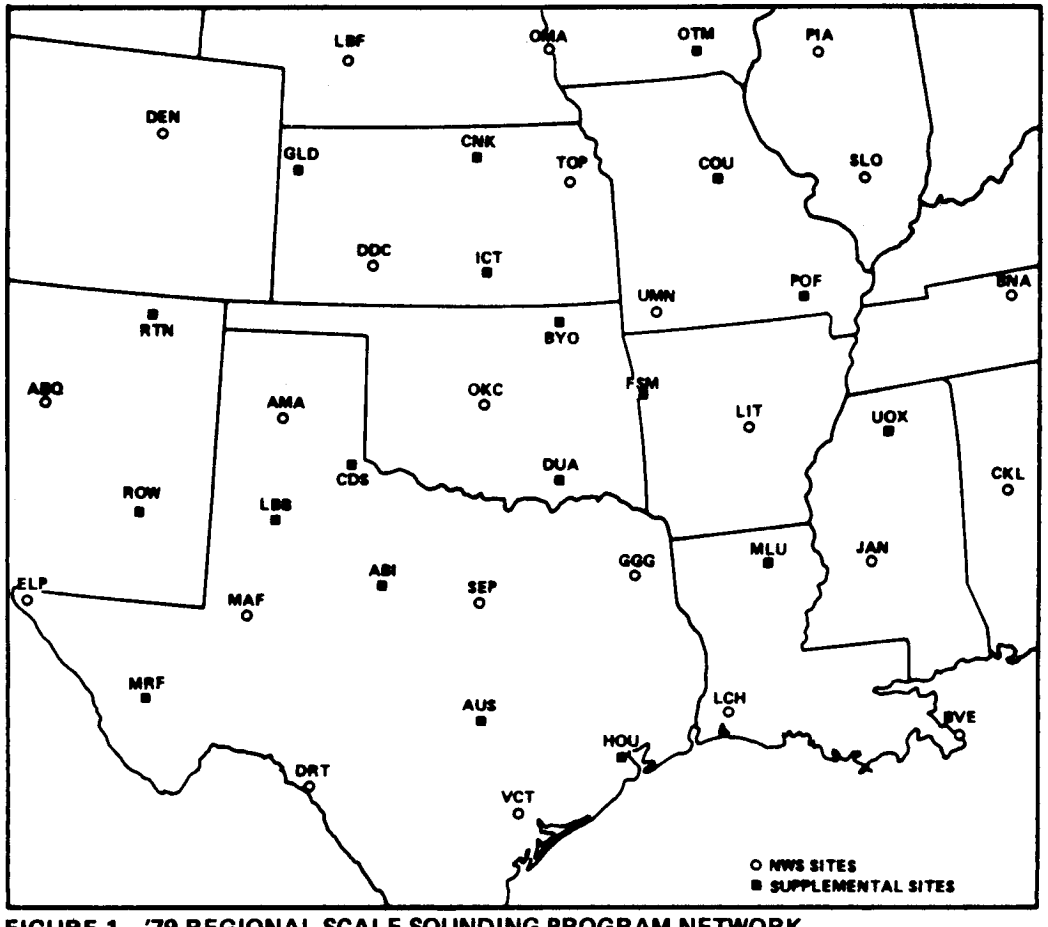

FIGURE 1 '79 REGIONAL SCALE SOUNDING PROGRAM NETWORK

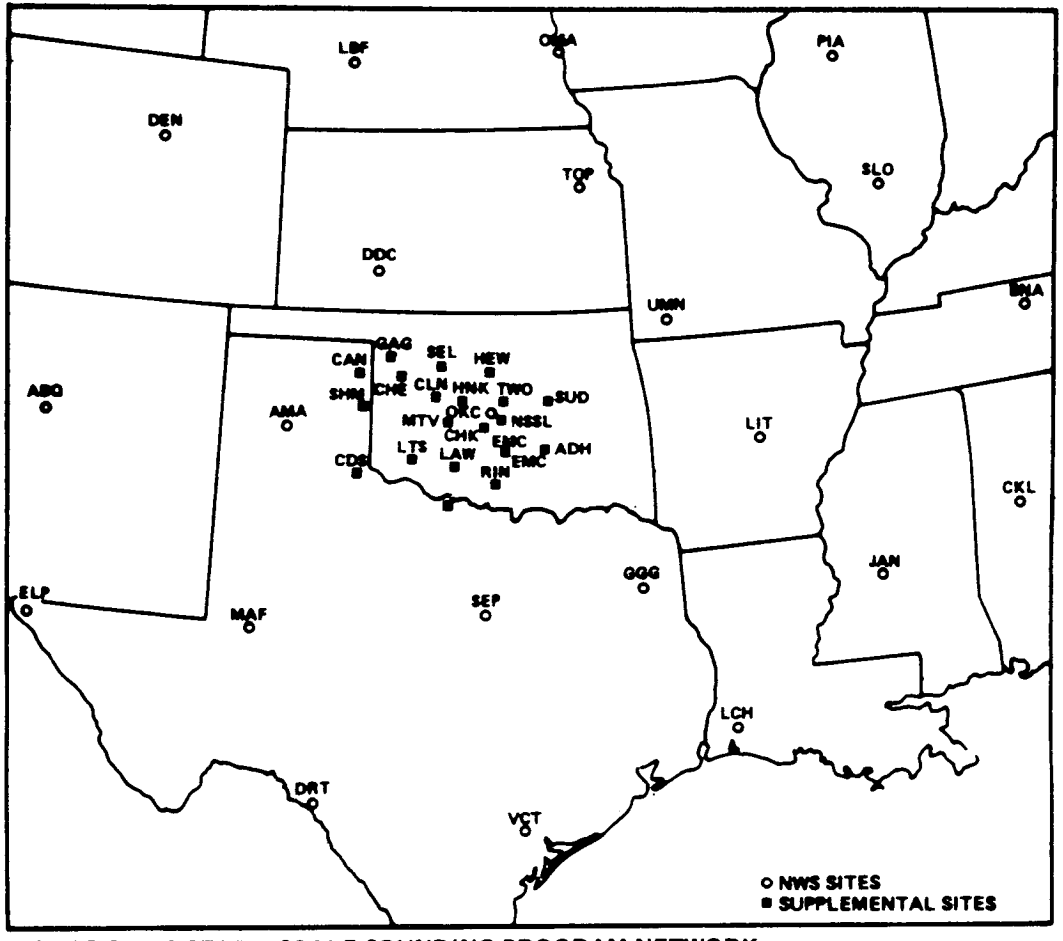

FIGURE 2 '79 STORM SCALE SOUNDING PROGRAM NETWORK