

Issued: 10 May 1978

MONTHLY REPORT

for

APRIL 1978

VISSR Atmospheric Sounder (VAS)  
Development and Performance Evaluation

Contract No.: NAS5-21965

Prepared by

Space Science and Engineering Center  
University of Wisconsin  
Madison, WI

for

National Aeronautics and Space Administration  
Goddard Space Flight Center  
Greenbelt, MD

## I. General

SSEC work on the VAS program continues to emphasize (a) construction of the TIROS-N receiving system, (b) preparation for the upcoming VAS thermal vacuum test, (c) development of applications software on McIDAS for mesoscale sounding and modelling, and (d) implementation of the VAS Data Base Manager.

## II. Data Processing System Development

Testing of the videocassette archive system is underway to determine bit error rates. Implementation of an improved image search capability is planned. Techniques for efficient accurate cassette tape transcribing are being investigated. Meanwhile the cassette archive has functioned operationally for over three months recording high quality visible and IR images.

Work is continuing on the bi-mangler which will enable simultaneous input formatting of VISSR signals from both geostationary satellites. Completion and successful insertion into the receiving system is anticipated for July 1978.

Implementation of the VAS Data Base Manager also should be complete in July 1978. Work on system software and peripheral attachments is continuing. The VAS Applications Processor has arrived but has not been checked out yet. Parts delivery for the VAS User Terminal is nearly complete and construction of some of the necessary computerized circuit board layouts is underway.

The TIROS-N receiving system has been redesigned to incorporate another microprocessor. Two task oriented microprocessors now form the nucleus of our system; one microprocessor will handle antenna control, the other will perform sorting, calibration, and earth location. Construction of the antennas on the roof of the SSEC building has begun. Software for satellite

orbit information and antenna control is being tested.

### III. VAS Instrument Support

SSEC inspected some of the IR FOV data for the VAS D detector package. Concern has arisen because the VAS D detectors are not conforming to specification in two ways: the HgCdTe detector FOVs are too small in the N/S direction, and the extended FOV's of the InSb detectors are too large in the E/W direction. Questions were raised to determine (a) what is causing the discrepancy between physical size and responsivity half power points of the HgCdTe detectors, (b) why the response fall off in the extended FOV data is not explained by diffraction considerations alone, and (c) whether the E/W biases for the HgCdTe detectors are crossed as they should be. Judgement of whether the sampling characteristics of this VAS detector package are adequate will be made upon resolution of these questions.

Software for calibration coefficient determination is written and ready for installation into the SBRC Dartmouth Time Sharing System in early May.

### IV. Development of VAS Data Processing Techniques

SSEC/NESS software development on McIDAS continues. Multi-orbit amalgamation (displaying and analyzing more than one orbit at a time) is now possible as well as combination of polar orbiter and conventional data in satellite or lat-lon coordinates. Software has been written to use the CO<sub>2</sub> absorption method to determine cloud heights operationally with man interaction necessary only for subsequent editing. Work to determine the quality of man interactive temperature retrievals is also continuing; several retrieval schemes are being compared with nearly contemporaneous radiosonde data.

The enclosed quarterly NESS activity report for January to March 1978 provides more information on this work.



**SPACE SCIENCE AND ENGINEERING CENTER**

UNIVERSITY of WISCONSIN - MADISON  
1225 West Dayton Street  
Madison, Wisconsin 53706  
TWX (910) 286-2771

10 May 1978

Mr. J. B. Connor  
Contracting Officer, Code 289  
NASA--Goddard Space Flight Center  
Greenbelt, MD 20771

Dear Mr. Connor:

In accordance with Article III of Contract NAS5-21965, I am submitting the required Progress Report for the month of April 1978.

If you have any questions or desire further information, please contact me at (608) 262-0118.

Sincerely,

✓ Paul Menzel  
Program Manager

WPM/rmk

Enclosure

cc: H. Montgomery, Code 942 (10 copies)

## QUARTERLY ACTIVITIES REPORT

### Project 8-601. Mesoscale Soundings and Modeling Applications

#### 1. Interactive Retrieval Development (Hayden, Woolf, Nagle, Smith)

a. Encouraged by considerable success in obtaining subsynoptic detail in temperature profiles, efforts continue towards improving the retrieval technique. A topography correction to account for an inconsistency in applying statistics (which assume a measurement to 1000 mb) to measurements over high ground was investigated and abandoned as it resulted in no improvement. A reflected solar radiation correction was formulated but awaits testing. A set of retrieval coefficients from simulated radiances was generated and tested with good success. The motivation for the last experiment is to avoid statistical smoothing caused by the unexplained (and real) variance associated with imperfect satellite/radiosonde matching when measured radiances are used to generate retrieval coefficients.

b. Isentropic cross section analysis models for temperature and wind have been implemented on the McIDAS system to facilitate sounding quality control. The software permits analysis of radiosonde and satellite data separately or together.

c. Software has been developed to allow graphic display of coastlines and political boundaries as seen from a geostationary satellite with subpoint at an arbitrary longitude. This is a first step in preparing for geostationary sounding. The next step will involve remapping polar orbiter data in geostationary space. It is planned to experimentally process TIROS-N sounding in this geometry making use of current GOES data for cloud detection and surface temperature estimates.

d. A dynamic wind law obtained by time differentiation of the acceleration equations has been applied to data on both the IBM 360 and the McIDAS. In the former case, treating low resolution NMC analysis data, the program is stable, yielding rather small changes to the geostrophic wind. In the latter case,

functions in delay space being sharper by a factor of two or more than those achievable in spectral space. Retrieval simulations for a partial interferometer from the 600-750  $\text{cm}^{-1}$  region using 75 discrete observations with 0.1% noise in the delay region between 1.19 and 1.49 cm reveal that accuracies close to  $1^\circ\text{C}$  can be achieved between the surface and 10 mb. Results for smaller spectral intervals and other delay regions are only slightly inferior. Since these results are so spectacular a conscientious effort is being made to find an error in the simulation development. Also however, an effort is underway to obtain experimental confirmation of this potential breakthrough in passive sounding accuracy.

3. Meteorological Studies (Hayden, Smith)

A synoptic case study for 21 August 1975 over Europe using Nimbus 6 data processed on the McIDAS is being completed as a master's thesis by a University of Wisconsin graduate student. The object is first to make retrievals near radiosonde stations and compare objective analyses based on radiosonde only and satellite only. Second, the satellite data base is expanded and analysis comparisons repeated. Results of the first comparisons show close correspondence between satellite and radiosonde thickness fields.

The 23 August 1975 European case which was emphasized by NMC in examining the quality of Nimbus data is being redone with man-interactive sounding techniques. The study will be completed in the next quarter.

4. Support of NESS Sounding Operations (Woolf, Hayden)

a. Results obtained with the clear column radiance technique currently used on McIDAS were presented to the NESS research council and generated interest in seeking methods to accelerate the TIROS-N eigenvector method. Several improvements are known and will be pursued by the sounding research panel. It is planned to use the McIDAS system for evaluation of the improvements.

obvious gross errors arise in the dynamic wind. It is not known if the coding is erroneous or if the technique is unstable in high resolution application.

2. Hardware Proposal and Development Support (Howell, Smith, Small, Woolf)

a. A requirement is foreseen for a considerable volume of TIROS-N raw data and NMC processed data in the Madison data base manager. To serve this need a 9.6 kb line is being requested from Suitland to Madison.

b. Plans for making oxygen absorption measurements at  $7603.2\text{\AA}$  in support of laser sounding development were entered into the SEL budget. Otherwise no progress in this area.

c. A proposal is being prepared for the two channel tropopause radiometer.

d. Research on the slant/vertical viewing radiometer has been suspended in favor of development of interferometer techniques [see (f) below] which appear to be not only more promising but also more practical.

e. The development of microprocessor software for the TIROS-N data acquisition and preprocessing system continued with special emphasis during this quarter on the design and flow charting of logic for antenna control. The procurement of the receiving system components and the design of input and output interfaces to the microprocessor were the primary accomplishments with SSEC personnel. As these efforts reach the final stages (during the next quarter), additional software development (for input, output, and processing control) will resume.

f. In order to evaluate the accuracy and vertical resolution of remote temperature soundings using an interferometer having a limited delay region, partial interferograms were synthesized for several delay regions, and with various resolutions in delay, from line-by-line  $\text{CO}_2$  transmittance data in the  $15\ \mu\text{m}$  band ( $600\text{--}750\ \text{cm}^{-1}$ ). The simulations reveal that very high vertical resolving power can be achieved by this measurement technique, weighting



b. An agreement is being established with the Office of Operations to investigate man interactive enhancement of TIROS-N soundings prior to and during FGGE. The experiment is to consist of three phases: a development phase when MAB will implement techniques on the backup VIRGS computer located at the World Weather Building; a training phase when operators would be familiarized with techniques; and an operational phase which would involve three demonstrations, the last two of which would coincide with the special observing periods of FGGE.