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MONTHLY REPORT

for

OCTOBER 1977

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

Work is continuing on acquisition and programming of the TIROS-N receiving unit, development of man interactive processing techniques with Nimbus 6 data on McIDAS, and preparations for interfacing McIDAS to the newly ordered VAS Data Base Manager.

The SSEC VAS ground processing system design review has been scheduled for January 10, 1978 at the University of Wisconsin.

II. Data Processing System Development

Work on the microprocessor antenna controller is nearly completed. The software for tracking geosynchronous satellites has been written using antenna simulator hardware. Transfer to the real antenna control hardware awaits calibration of the position indicator and signal strength as well as further algorithm testing. Implementation and testing will proceed upon installation of the RF feed that is on order.

Work is underway for equalization of the record and playback processes on the video cassette archive. This should eliminate the flakes in the IR and visible VISSR displays.

Part of the TIROS-N data handling software has been written in modular form and tested independently. Programs for checking the parity of the TIP input buffer, verifying the sequence of minor and major frame counts, verifying the S/C time code, and relating scan angle to scan element block number have been written. The logic for unpacking the HIRS-2 and MSU signal outputs, converting them to radiances, and locating the individual fields of view has been charted and the programs are being written. Testing and tuning of the TIROS-N antennas is still underway.

SSEC has decided that the Harris /6 midicomputer should be the VAS Data Base Manager (DBM). The major requirement of this midicomputer as outlined in our proposal of 1 April 1977 is the real time ingest of raw data from three geostationary satellites (which is in excess of 5.25 MBPS). SSEC is ordering the Harris /6 and a 300 Mbyte disk with controller immediately, is making preparations to establish data links to the VAS DBM, and is readying McIDAS to interface to it. This will allow testing of data ingest software packages and also will enable data set acquisition for technique development.

III. Development of VAS Data Processing Techniques

The combined SSEC/NESS research on McIDAS with Nimbus 6 SCAMS and HIRS data is continuing. The enclosed quarterly NESS activity report provides more information on this work. Most recently techniques for cloud height determinations using the HIRS CO_2 multichannel information (observed and cloud corrected) have been developed. Comparisons with techniques established for VISSR using visible and single IR window channel data are underway.

IV. VAS Instrument Support

After several conversations with F. Malinowski of SBRC, we agreed that the following seven scanner temperature gradient conditions should be used in determining acceptable algorithm coefficients.

(a) Stabilized scanner temperature configuration without any purpose introduced temperature gradients.

(b) A scanner temperature gradient produced by the SMS heater only that has the SMS 5°C (or more) hotter than under (a).

Turn off SMS heater and allow to cool.

(c) A scanner temperature gradient produced by the GSE gradient blackbody that results in the scanner shutter cavity being 6°C (or more) hotter than the secondary mirror shield.

(d) Same as (c) plus an internal blackbody temperature 3.5 $\pm$ 1°C higher than that measured under (c).

(e) Same as (c) plus an internal blackbody temperature 10.5 $\pm$ 1°C higher than than measured under (c).

(f) A scanner temperature gradient produced by the heaters in configuration (e) plus the BF heater causing the BF to be 10°C (or more) hotter than the SMS.

(g) A scanner temperature gradient produced by the heaters in configuration (f) plus the SMS heater causing the SMS to be 5°C (or more) hotter than it was under (f).

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10 November 1977

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 October, 1977.

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

Sincerely,

Paul Menzel

Paul Menzel
Program Manager

WPM/rmk

Enclosure

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

IV. Satellite Applications in Mesoscale Synoptic Systems

1. Interactive software development

a. Real-time (direct read-out) coupled sounding-wind retrieval system: Effort concentrated on the development of data access and display algorithms for use with the University of Wisconsin McIDAS system. Capability now exists to use a single orbit of Nimbus-6 HIRS and SCAMS data for man-interactive processing of clear column radiances and temperature retrievals at full spatial resolution of the HIRS instrument (30 km). Current work is devoted to expanding the capability to allow ingest of any of the archived Nimbus-6 data, refining and editing algorithms to allow the operator more flexibility, and collecting statistical information on colocated radiosonde and Nimbus measurements to improve the temperature and water vapor retrievals.

b. VISSR and AVHRR surface temperature retrieval at mesoscale resolution: A two-dimensional histogram method using visible and IR data at 4 km resolution has been developed for determining surface skin temperatures over land. The man-interactive aspects of the program are similar to those for achieving high quality full resolution sounding. The task of developing the algorithm and accessing VISSR data with the McIDAS system has been delegated to graduate student help. An important aspect of this program is the employment of a physical model for inferring surface air temperature from the instantaneous observations and hourly time variations of surface "skin" temperatures.

c. Mesoscale physical-statistical analysis and model initialization

system: Several simple analysis models are under development to aid in data editing and display. The emphasis so far has been on speed of execution as opposed to physical elegance.

2. Hardware proposal and development support

a. Direct readout and processing of TIROS-N data: The preliminary, general design of a system for receiving and processing TIROS-N (HIRS-2, MSU and APT) data in real-time was accomplished in cooperation with UW-SSEC personnel. The processing system is designed around a microprocessor (Intel SBC-80/10) which will provide automatic antenna control for tracking the satellite, as well as the quality control, calibration and archival tasks usually included in the initial ingest processing. During the procurement of the necessary hardware, other microprocessor (software) development systems were used to initiate the software development. As a means of familiarization with microprocessor programming, several relatively simple processing tasks were programmed and independently tested.

b. Tropopause radiometer: A mathematical model of a two-channel limb scanning radiometer was developed. One of the two channels is in the 4.3μm CO_2 absorption band; the other is in the 14μm band. A number of parameter variation studies were performed in an attempt to optimize the system for tropopause height and temperature structure. Initial results indicate that this technique could be employed to obtain tropopause sounding (the 50-400 mb layer) with high vertical resolution (~2 km) and precision (~1°C). A formal proposal for a hardware system definition study is in preparation.

3. Meteorological studies

Experimental data from the DST have been provided to the meteorology department at three spatial resolutions in order that they may examine the data input in case studies. Man-interactively derived temperature profiles from individual fields of view which are manually quality controlled contain the most meteorological information.

4. Support of NESS operations

Sounding retrieval: Further examination of the lack of variance in the DST HIRS temperature retrievals has pointed out some deficiencies in the eigenvector approach which excessively smooths the data. Experiments showed that the retrievals could be improved by excluding some of the noisier or redundant channels. The hypothesis that improvements could be made by decoupling the eigenvectors for the short and long wave CO_2 channels is being tested. Another potential improvement due to the increase of horizontal resolution and the exclusion of radiances with cloud induced errors is also being tested.