PROGRESS REPORT

THROUGH

May 1981

VISSR Atmospheric Sounder (VAS)
Development and Performance Evaluation

Contract No.: NAS5-21965

Prepared by

Space Science and Engineering Center
The University of Wisconsin
Madison, WI

for

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

I. General

On April 20, 1981 P. Menzel traveled to Greenbelt, MD to attend the performance review of the Synchronizer/Data Buffer. Recent improved performance was verified and the need for replacing all integrated circuits with tarnished leads was discussed. On May 26, 1981 P. Menzel and W. Smith traveled to Greenbelt, MD to discuss VAS data distribution. UW programs with KCSFSS, NMC, and MSFC were proposed.

Documentation delivered recently includes Postlaunch Study Report of VAS-D Performance (March 1981) and Prelaunch Study Report of VAS-E Performance (March 1981).

II. Data Processing and Technique Development

For March and April, nearly four weeks of Monday to Friday VAS operation in the dwell sound mode was scheduled at 1229 GMT, from GOES-4, for sounding generation over the east Pacific off the west coast of the U.S. These retrievals were to be sent to NMC for the purpose of evaluating the impact on the LFM forecast model.

From March 16 to April 16, 22 dwell sounds were transmitted through Wallops Island. Of these, the last eight were qualitatively all clean; four were quite useless; and the remaining eight were something less than perfect, as significant percentages (25-30) of the data showed large calibration changes (as 30°C too cold in channel 8). Even where the data seemed reasonable, comparison of the window channel brightness temperatures with surface observations (and the operational GOES IR temperatures on two days) indicated some bias for the VAS values to be cold by a few degrees. Resulting retrievals from the VAS data, on several days, also showed a bias toward colder values compared to radiosonde reports.

The "noisiness" of the retrievals was significant enough that later in April, attempts were made to improve the signal to noise ratio. One method consisted of the generation of smoothed radiance fields, from which the retrievals would be made, instead of the raw radiance measurements. The other method would allow a much larger sample to be used for a particular retrieval, up to 125 fields of view, where previously the limit was 25. Both methods have initially yielded smoother retrieval fields (as expected), but the cold bias in the data still seems to remain. No particular channel is seen as being either miscalibrated or noiser than anticipated. At the end of May, one retrieval data set was satisfactory and was sent to NMC.

III. VAS Instrument Support

The VAS-D spin budget was reevaluated March 13, 1981. A 17% reduction in the number of spins was realized; the spring 1981 spin budget is 77 spins, down from the peak winter value of 93. This reduction had been predicted as detector responsivity increases with decreases in the nominal scanner temperature going from winter to summer.

Prelaunch estimates of the VAS-D spin budget were in error. Due to a misunderstanding with SBRC, the UW analysis of VAS-D large detector single sample noise included the effects of radiance losses in the calibration test equipment twice. The 12% calibrator reflectance losses were compensated for by SBRC and again by UW. This error has been corrected and the correct prelaunch spin budget value is 83 spins.

Further comparisons of VAS radiance determinations with TIROS-N and radiosonde radiance determinations revealed that the VAS radiances (brightness temperatures) for bands two through four are consistently lower by two to three°C than corresponding TIROS or radiosonde values. This trend was also observed in the prelaunch analysis of vacuum test data. A possible explanation for the observed radiometric offset is that the detector used by all the CO_2 bands on VAS-D has a constant voltage offset, but that it is emphasized only in the radiances in bands two through four. This could occur because bands two through four have the poorest detector responsivity (voltage per radiance unit) and they view the coldest targets (so they use less of the available dynamic range of the detector).

IV Numerical Model Studies

Several model runs of the ANMRC limited-area numerical weather prediction model were done on the NCAR CRAY-1 computer, for the April 10-11, 1979 case (the Wichita Falls tornado). The first University of Wisconsin experiment dealt with the sensitivity of the model to the Asselin time filter used to remove gravity-inertia waves. With the heaviest filtering applied, waves in the surface pressure traces at various locations, which had periods of one-two hours, were noticeably damped (amplitudes were approximately halved, compared to the unfiltered run), while waves with periods over three hours for these six hour forecasts were affected very little. The second experiment dealt with modifications done by Graham Mills to the initialization fields, for a nine-twelve hour forecast run. Previous over-intensification of the upper level jet over northern Mexico was reduced by an empirical correction for height curvature and use of an updated observational data set (of TIROS-N satellite measurements). Vertical velocities were only slightly

changed, but extreme oscillations in surface pressure, near the low center in Coloardo were greatly reduced. The final experiment dealt with the nine - twelve hour forecast run, with the improved initialization just described, but with large scale (non-convective) precipitation included. Initial examination shows little difference with the non-precipitating run in the Texas Oklahoma area as is reasonable, since no modeled large-scale precipitation fell in that area; however, the vertical velocity and moisture profiles near Wichita Falls were quite encouraging. Relative maximum upward motion at about 500 mb and maximum moisture at low levels illustrate a destabilizing situation conducive to severe weather. Examination of the time change of vertical motion at some other representative locations showed consistency in these test results.

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June 2, 1981

Ms. Vanessa Scott
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Dear Ms. Scott:

In accordance with Article III of Contract NAS5-21965, I am submitting the required Progress Report for activities through May 1981.

If you have any questions or desire further information, please contact me at (608) 262-6361.

Sincerely,

Paul Menzel

Paul Menzel
Program Manager

WPL:sf

Enclosure

cc: H. Montgomery, (10 copies)