UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL ENVIRONMENTAL SATELLITE, DATA, AND INFORMATION SERVICE
Washington, D.C. 20233

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TO: Distribution

FROM: E/RA21 L. McMillin L. Mc.

SUBJECT: MSU Results from the Pitch-up Maneuver

I have received a copy of a JPL interoffice memorandum, dated 5/15/84, entitled "Assessment of the interactions of the sidelobes and the backlobes of the MSU antenna assembly on the NOAA-A spacecraft (NOAA-6. TS Instrument Serial Number PFM) during the pitch-up maneuver of March 15, 1984." That memo stated that "With 95% confidence, there is no correlation between the changes in the output of any receiver channel with respect to the changes in the antenna scan positions, with less than a 5% risk of being wrong."

I also have a copy of memo by L. Crone of NESDIS, dated 6/12/84, entitled "NOAA-6 Pitch-up Maneuver." Crone's memo clearly demonstrates a scan position bias. The reason the two conclusions differ is that JPL did not remove the time-dependent change from the data, and thus their analysis had to sort this effect out from the scan dependent effect. The signal change with time was three or four times larger than the scan effect. In addition, the JPL analysis was done in a way that a negative correlation from one channel can cancel a positive correlation in another channel. As will be shown later, channels 2 and 4 are negatively correlated with channels 1 and 3. This effect also contributed to the JPL conclusion.

The scan biases shown by Crone appear to be the result of two effects. In the 0 position, the instrument is tilted back toward the spacecraft and this spot is most likely to be contaminated by thermal radiation from the spacecraft. This effect is evident in the data in that the zero position for all four channels is higher than for the other scan positions. The other effect appears to be contamination from an active source on the spacecraft. There are two reasons for this conclusion. One is that, with the exception of the zero position, the scan biases for channels 1 and 3 are highly correlated with each other and highly negatively correlated with channels 2 and 4 which, in turn, are positively correlated with each other. This effect is consistent with a pattern from a polarized source since channels 1 and 3 share the same polarization and are orthogonal to channels 2 and 4. The other suggestion for an active source is the wavelength dependence of the effect. The magnitude of the scan bias for channel 4 is much smaller than for the other channels. Such a sharp cutoff with wavelength is consistent with an active source, but it is hard to reconcile with any passive effect. For these two reasons, I suspect that the scan bias is caused by interference from some active source on the spacecraft.

These data establish that there is a scan bias when viewing space. Unfortunately, they are not sufficient to establish the magnitude of the effect in the temperature ranges encountered in earth data. This is because the bias at the space temperature is a product of the proportion of the contaminating object that is sensed by the instrument, and the difference in temperature between the scene and the contaminating source. Either an estimate of the source temperature or a measurement at a background temperature different from space is required to extrapolate the scan bias to another temperature. Since an observation at another space temperature is not possible, this leaves ground tests as the most likely means of obtaining the information. I am also informed that ground tests would probably not be useful because targets can't be placed far enough from the instrument to simulate conditions in space. This leaves identification of the source as probably the only feasible method. If the source can be identified, and the effective radiating temperature determined, a correction can be made.

The nature of the scan biases raises another question. Since indications are that the error comes from an active source that was on during the pitch-up maneuver, there is a significant possibility that other sources may exist that were turned off during maneuver.

In summary, the pitch-up maneuver established that there is a scan dependent error in the MSU data. The magnitude of the error when the instrument is observing space is about one-half K for channel 1 and less for other channels. Unfortunately, while the maneuver determined the magnitude of scan dependent error while viewing space, the information obtained during the maneuver is insufficient to determine the magnitude of the correction while viewing the earth.

Attachment

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