Position Paper on NOAA Operational Stratospheric Temperature Measurements

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The basic retrieval technique currently utilized by the NESDIS for operational temperature profiles is outlined in Table 1 for the three distinct layers 1000-100 mbar, 70-10 mbar and 5-0.4 mbar. This layered structure is, essentially, dictated by the available rawinsonde information up to 10 mbar and the more limited rocketsonde data above that level. The points we wish to stress are three-fold:

1. The TOVS system is comprised of 3 seperate instruments; MSU,HIRS-2 and SSU, with seperate channels within each instrument. Thus, a failure mode can occur that will reduce the available information, but will not be catastrophic. Retrievals can be produced that will have inherently different properties.

2. For 10 mbar and below, the updated regressional retrievals are self-healing in that changes in the system, either due to a failure mode or to launch of a new instrument, are adjusted within a few weeks.

3. Above 10 mbar this self- healing process is not possible as the rocketsonde data are much more limited both in time and space. Hence, a collective is made after the fact and a series of analysis- rocketsonde comparisons published.

To indicate the magnitude of the problem, we present in Figure 1 the average values of the analysis minus rocketsonde matchups for 4 periods from October '80 to February '85. We see that the range of adjustments is about 4-6 degrees and that unless these are taken into consideration we would have little hope of being able to detect a trend of about 1.5 degrees per decade.

Finally, in Figure 2 we present the analysis minus rocketsonde comparisons at 1- and 2- mbar for the period September '81 to October '83, plotted by station as function of latitude. We note that at the time of preparation of this figure the data from the Eastern Test Range (Cape Kennedy, Antigua, Ascension Island) and Shemya were not available. They have since become available and are consistent with the presented values. For both levels, it is clear that the values at Primrose Lake are the major departure from average. The question is whether they are part of a pattern of satellite bias with latitude (or air mass) or are merely a reflection of some difficulty at site. Also, there are no data beyond 8 degrees south in the Southern Hemisphere.

In summary, we have indicated that the requirement exists for a high quality, independent stratospheric temperature measurement system with which to verify the satellite instrument to instrument consistency. Such a system does not exist.

Table 1.

TIROS OPERATIONAL VERTICAL SOUNDINGS (TOVS)

LAYER MEAN TEMPERATURES BETWEEN STANDARD PRESSURE LEVELS

0.4
1
2
5

MULTIPLE LINEAR REGRESSION OF 9 MEASURED RADIANCES FROM STRATOSPHERIC CHANNELS OF SSU, HIRS AND MSU TO OBTAIN TEMPERATURES AT LEVELS FROM 5 TO 0.4 MB. REGRESSION COEFFICIENTS DERIVED BY REGRESSING RADIANCES SIMULATED FROM CLIMATOLOGICAL SAMPLE OF 1200 ROCKETSONDES-RADIOSONDES AGAINST TEMPERATURE FROM THAT CLIMATOLOGICAL SAMPLE.

COEFFICIENTS ARE NOT UPDATED.

10
30
50
70

MULTIPLE LINEAR REGRESSION OF TOVS MEASURED RADIANCES TO OBTAIN TEMPERATURES AT LEVELS FROM 70 to 10 MB. REGRESSION COEFFICIENTS DERIVED BY REGRESSING MEASURED RADIANCES AGAINST NEARLY COINCIDENT RADIOSONDE DATA FOR RECENT PERIOD.

COEFFICIENTS UPDATED EVERY 1 TO 2 WEEKS, STRATIFIED IN 5 LATITUDE BANDS (90-60S, 60-30S, 30S-30N, 30-60N, 60-90N).

100
1000

TROPOSPHERIC RETRIEVALS DERIVED BY EIGENVECTOR (STATISTICAL) TECHNIQUE (SMITH AND WOOLF).

COEFFICIENTS UPDATED EVERY WEEK.

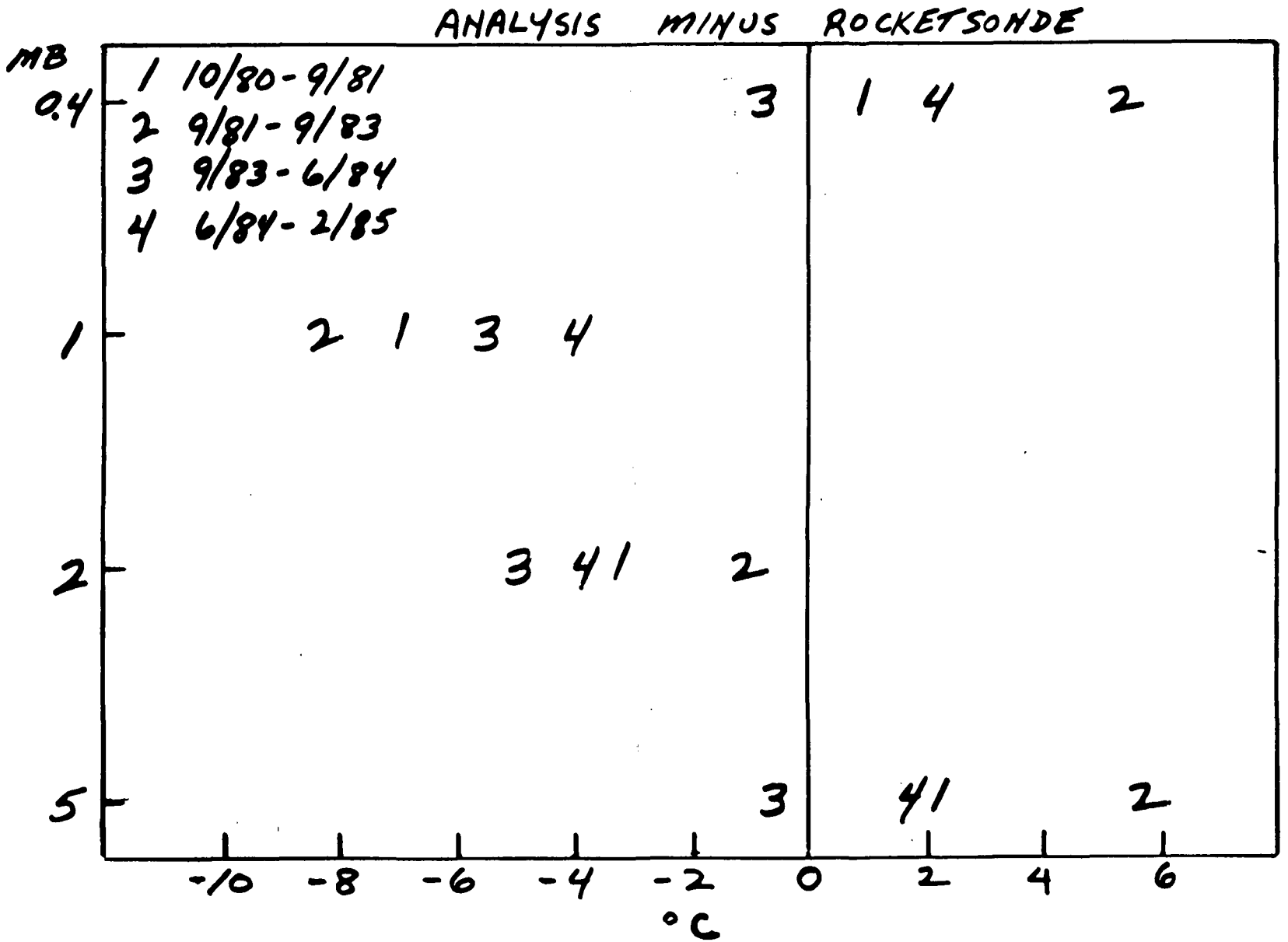
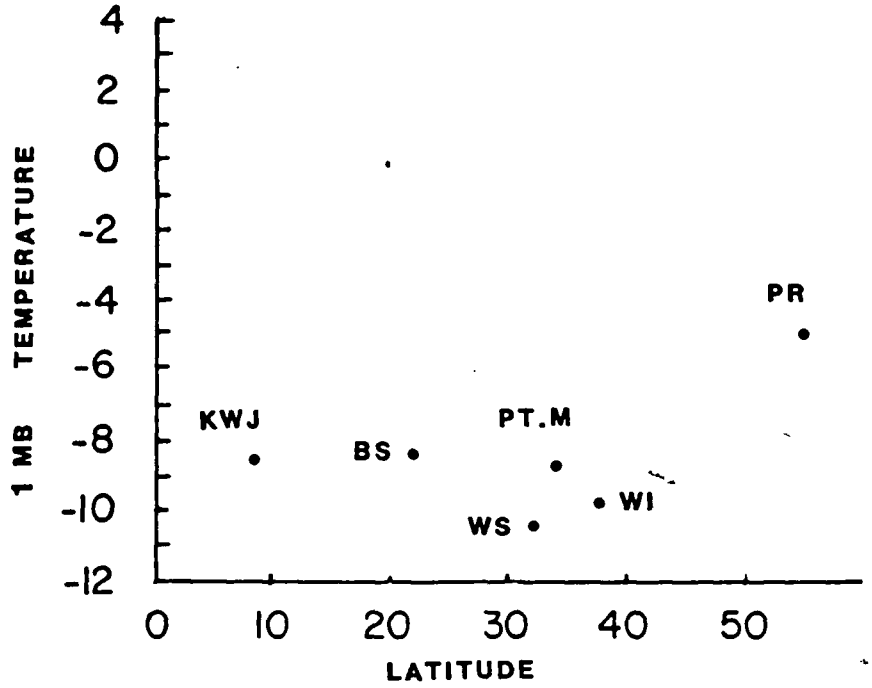

ANALYSIS MINUS ROCKETSONDE
MB
0.4
1
2
5
1 10/80 - 9/81
2 9/81 - 9/83
3 9/83 - 6/84
4 6/84 - 2/85
-10
-8
-6
-4
-2
0
2
4
6
°C

Figure 1

ANALYSIS MINUS ROCKET SEPT. 81 — OCT. 83



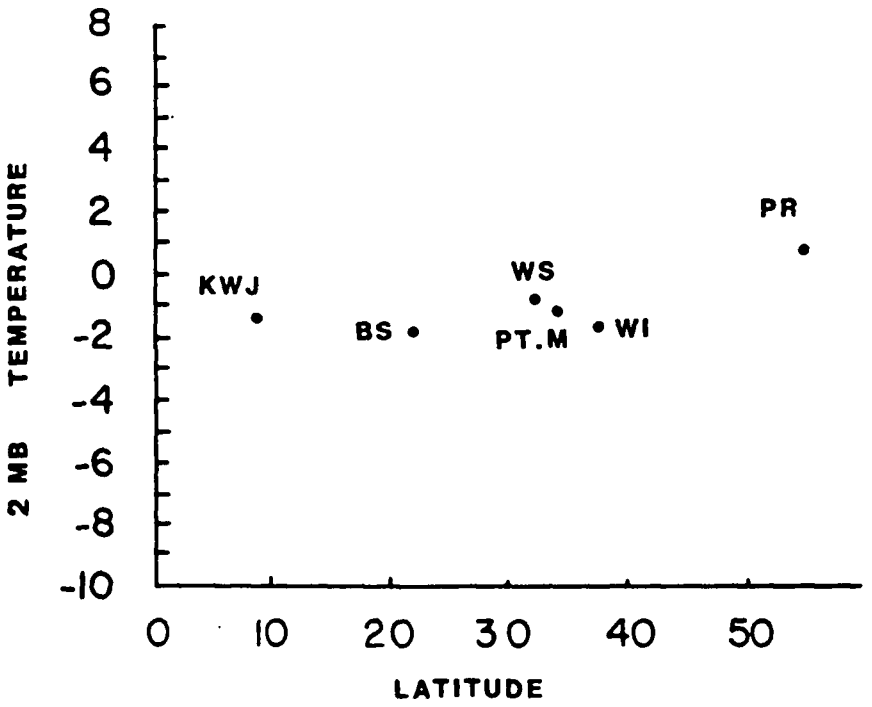


Fig. 24