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THE USE OF TOMS-MODIFIED VAS DATA FOR LARGE-SCALE NWP

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The objectives of VAS (VISSR[1] Atmospheric Sounder) research in the Global Modeling and Simulation Branch are twofold: 1) to examine to usefulness of VAS data for large-scale numerical weather prediction with data collected by GOES-W from February 9-18, 1984, and 2) to attempt to improve the temperature retrieval accuracy by using independent data, such as Total Ozone Mapping Spectrometer (TOMS) data, in conjunction with VAS radiances in the retrieval program.

Collocation statistics obtained by comparing VAS temperature soundings with those from nearby rawinsondes indicate good agreement in terms of the standard deviation of the differences with values ranging from 1 K to 1.5 K (see Figure 1). These differences also compare favorably with those obtained for HIRS/MSU[2]. However, the VAS soundings exhibited a substantial cold bias (shown on the rhs of Figure 1) in the middle and upper troposphere, with a maximum mean difference of nearly -3 K in the region of the tropopause.

A mean difference (or "error") of this magnitude make promising the use of TOMS in order to obtain an independent estimate of tropopause pressure for use in the retrieval program. Figure 2 illustrates a typical spatial collocation of TOMS and VAS radiances. The 1° x 1.25° gridded TOMS data (provided by Arlin Krueger), has been interpolated horizontally to the location of the VAS radiances for the TOMS data which are within ±3 h of the radiances. As may be seen in Figure 2, the 1700Z to 2300Z time period provides the best opportunity for this investigation, particularly in the northern hemisphere middle latitudes poleward of 20°. Equatoward of 20°, the horizontal gradient in the TOMS data and the tropopause pressure is too weak, as may be seen in Figure 3.

In order to improve the retrieval accuracy in the area of the tropopause, a critical issue is how well the TOMS data is correlated with tropopause pressure. This can be seen qualitatively in Figure 3. Generally, there seems to be good agreement between regions of low tropopause (high tropopause pressure values) and high values in the TOMS field. This is encouraging

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[1] Visible Infrared Spin-Scan Radiometer on GOES Satellites

[2] High Resolution Infrared Sounder/Microwave Sounding Unit

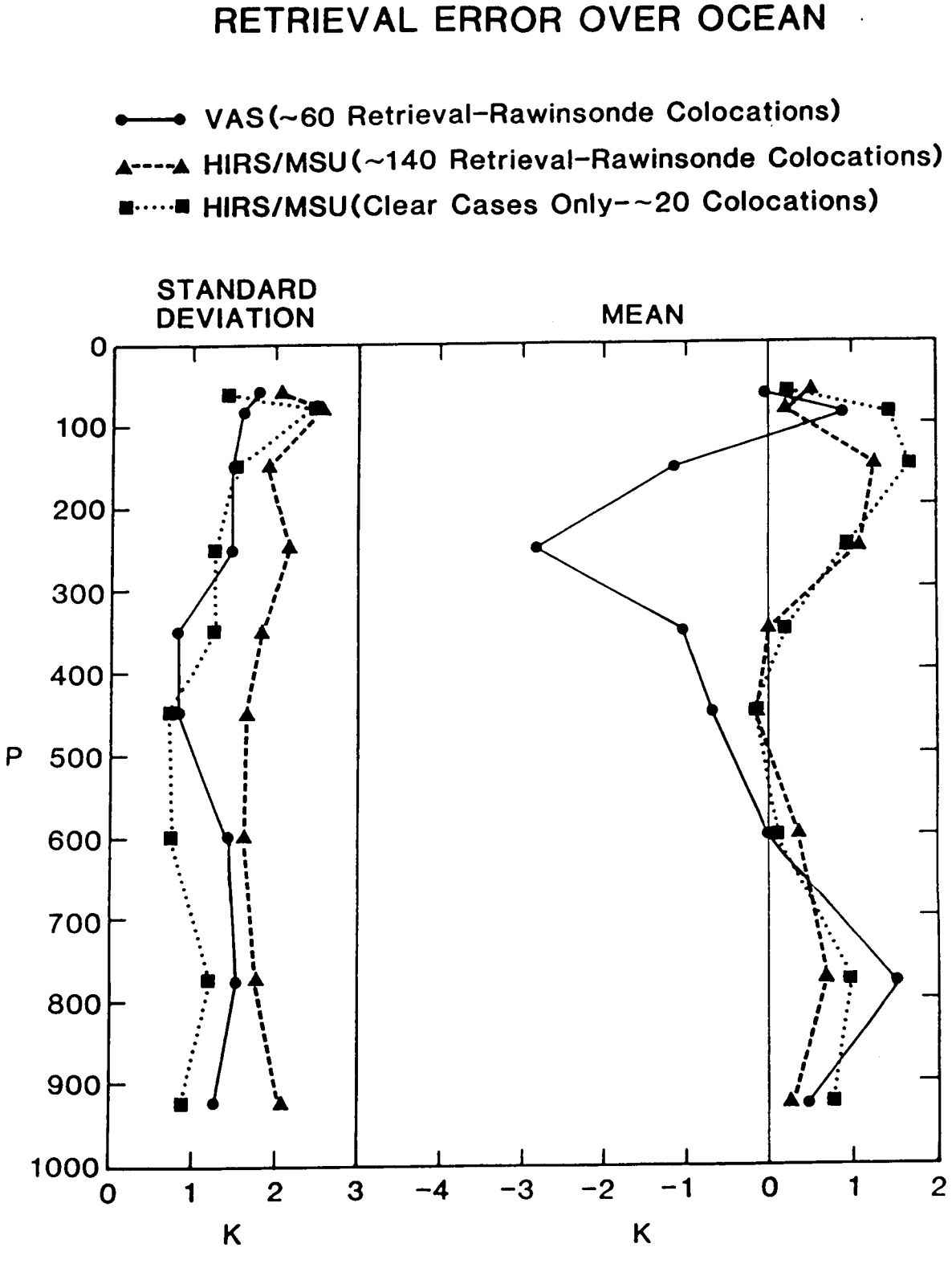

Figure 1. RETRIEVAL ERROR ESTIMATED FROM COLLOCATIONS OF VAS AND HIRS/MSU SOUNDINGS, RESPECTIVELY, WITH RAWINSONDES.

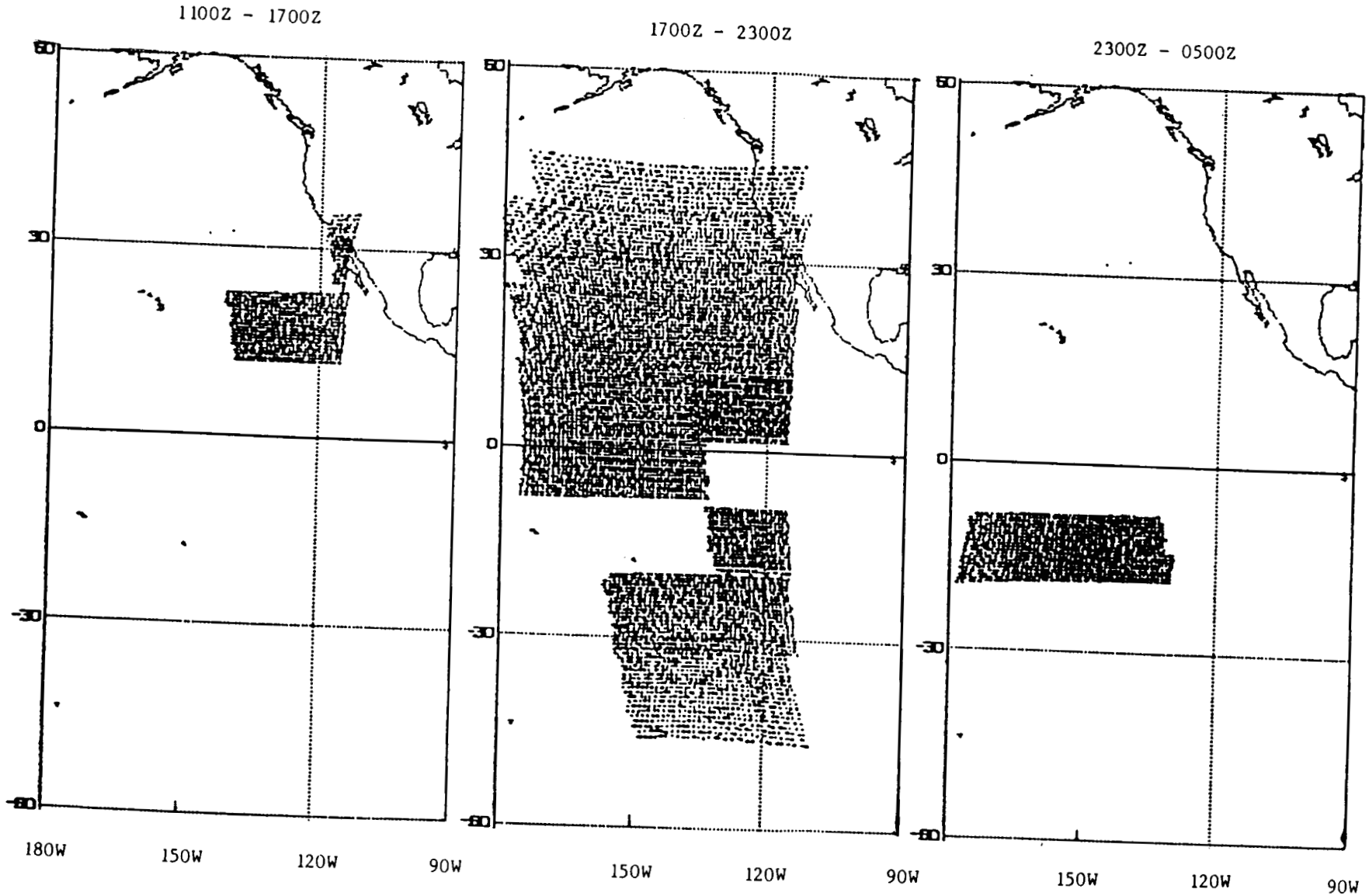

Figure 2. COLLOCATED VAS RADIANCES AND TOMS DATA FOR THREE 6 H TIME PERIODS DURING 10-11 FEBRUARY 1984.

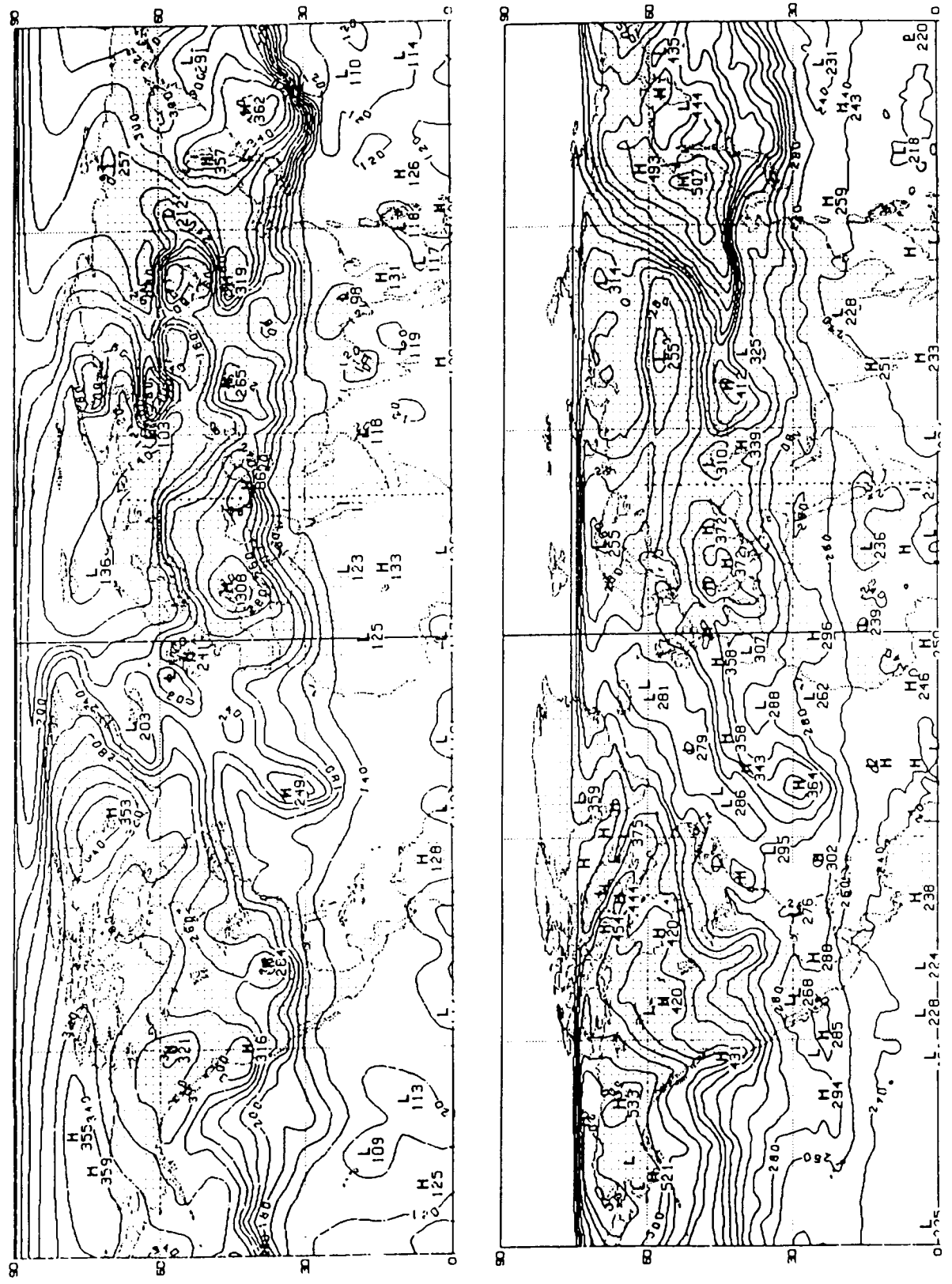

Figure 3. THE 6 H FOROECAST OF TROPOPAUSE PRESSURE (in mb) FOR 1200Z 16 FEBRUARY 1984 (Top) AND THE TOMS DATA (Bottom) AT 12 PM LOCAL TIME (IN DOBSON UNITS).

because 1) the retrievals with a low tropopause are the least accurate, and 2) regions of low tropopause are well correlated with the synoptic disturbances which represent the greatest potential for forecast improvement from the satellite data.

A quantitative assessment for the correlation of tropopause pressure, obtained from TOMS by regression and that reported by rawinsondes over Europe is shown in Figure 4. The correlation exceeds 0.8 for the 10 day period examined and is only slightly lower than the correlation between rawinsonde tropopause pressure and an analysis of tropopause pressure which used the rawinsondes.

In the future, we plan to conduct analysis/forecast experiments utilizing TOMS-modified VAS retrievals.

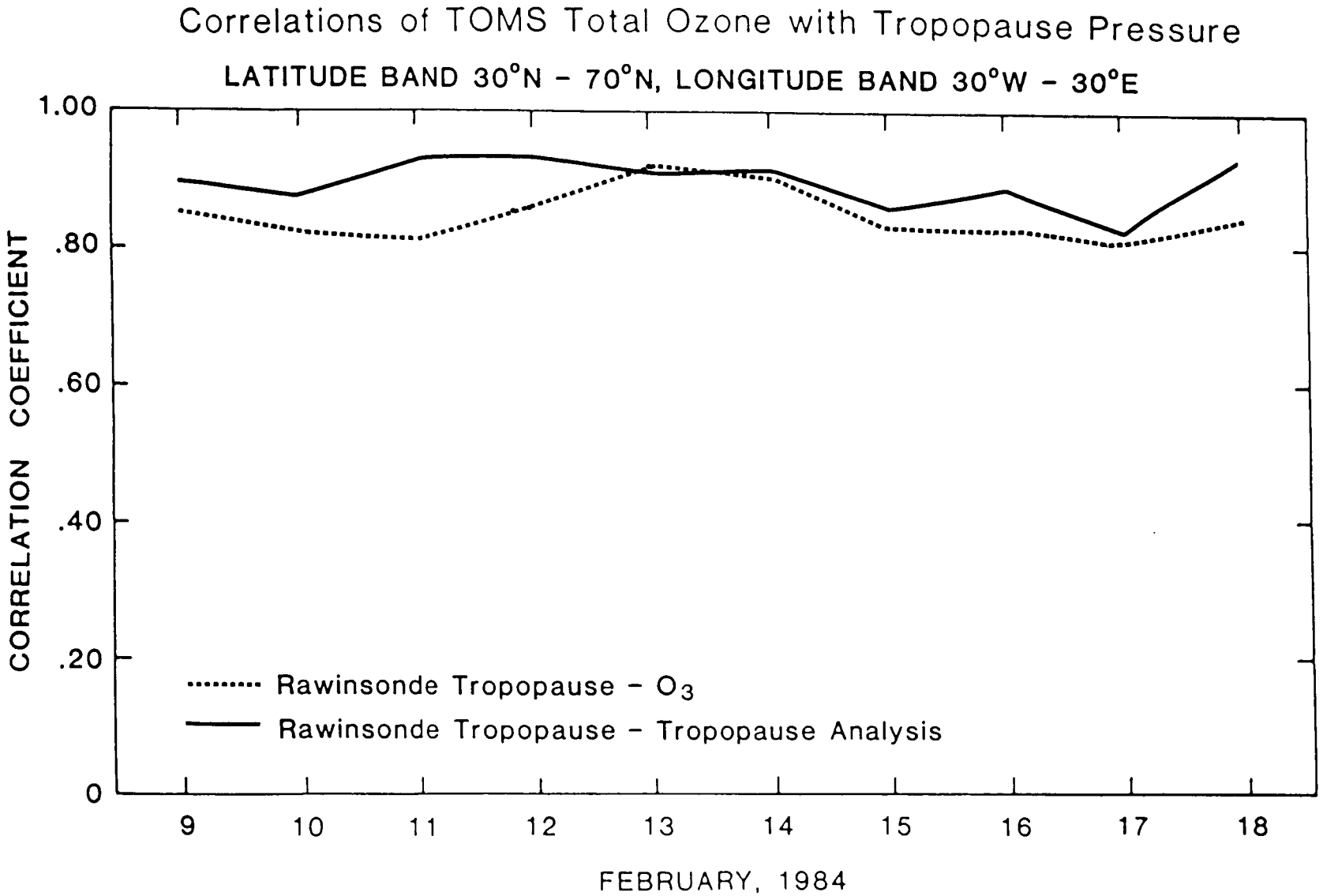

Figure 4. CORRELATION OF TROPOPAUSE PRESSURE DETERMINED FROM TOMS AND RAWINSONDE REPORTED PRESSURE.