WESTERN REGION TECHNICAL ATTACHMENT
NO. 87-01
December 16, 1987

ERROR IN MRF/AVN MEAN RELATIVE HUMIDITY CHARTS

Several forecasters recently called SSD stating that the mean relative humidity of the aviation (AVN) model output looked overly moist. The calls began right after the old spectral model was replaced by the MRF version of the spectral in the AVN time slot. Discussions with NMC revealed that an error was introduced in the way the MRF RH fields are post-processed. This occurred in May 1986 when the vertical resolution of the MRF was changed from uniform to variable spacing. When the MRF was introduced into the AVN time slot on November 17, 1986, forecasters began to notice. The problem was cosmetic only and was corrected on December 4, 1986 in both the MRF and AVN runs. Forecasters should now find the AVN moisture fields to be much more reasonable.

Details of the error are discussed in the attached memo.

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL WEATHER SERVICE
National Meteorological Center
Washington, DC 20233

December 16, 1986 W/NMC23:PC

MEMORANDUM FOR: I. Randy Racer
Chief, Services Development Branch

FROM: Peter Caplan PC
Meteorologist, Medium-Range Modeling Branch

SUBJECT: Error in Mean Relative Humidity Charts

The following material was requested by Steve Zubrick on 12/12/86, for possible incorporation in a TPB or a GENOT:

An error has been found and corrected in the procedure used to produce the 1000-500 mb mean relative humidity forecast and analysis maps from the spectral model (MRF and AVN). The error, which caused the maps to look too moist, is related to a change made in the vertical resolution of the model, in which a uniform spacing was replaced by a variable spacing, finest near the surface. The code that performs the vertical averaging for the production of maps was never changed, however, and the result was to average, roughly, only the 1000-800 mb stratum.

The corrected code, now in place (since December 4, 1986), calculates the average

$$\overline{RH} = \frac{\sum_{k=1}^{K} q_k \Delta\sigma_k}{\sum_{k=1}^{K} q_{s_k} \Delta\sigma_k}$$

where q and q_s are, respectively, the specific humidity and the saturation specific humidity; $\Delta\sigma_k = \Delta p_k / p_s$ is the fraction of the total mass of the column contained in the kth layer, p_s is the surface pressure, and the index K is set to mark the first layer centered above the halfway point, = 0.5. It can be seen from the formula that the average is not strictly a true relative humidity average, but is rather a q_s-weighted relative humidity average or the saturation ratio (of the column taken as a whole) with respect to precipitable water. Although this form of averaging tends to minimize somewhat the contribution of colder layers, nevertheless the result is usually the production of drier-looking averages.

cc:
S. Zubrick