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COLD SEASON 1989-1990 VERIFICATION OF THE 120 HR 500 MB FORECASTS

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Forecast 500 mb heights from the ECMWF (NMCGPH5XE) and UKMET (NMCGPH5XU) models for the 120 hr period have been available to NWS field forecasters since December 1989. An "eyeball" verification of the AFOS charts produced from these models, as well as the 120 hr MRF (NMCGPH5XH), was performed from December 13, 1989 through February 28, 1990. The aviation model initialization (NMCGPH5AH) was used for verification. A total of 196 forecasts were verified.

The geographical area of main concern was the eastern Pacific and western U.S., however it was often necessary to look a little beyond these boundaries to follow a short-wave trough, or find a well-anchored trough or ridge position.

The output from these three models is not homogeneous since the 120 hr ECMWF charts are produced from a 12Z database. This is 12 hours prior to the 00Z databases used by the UKMET and MRF models.

The parameters verified include the speed and amplitude of short waves and the position of long waves. The position of long waves was estimated by noting the location of what appeared to be well-anchored troughs or ridges. It was soon discovered that the long wave position forecast is the strength of all the models, a characteristic that has been noted by many other writers.

Individual model differences were apparent in the forecast speed and amplitude of short waves. The bar charts in Figures 1 through 4 show an accumulation of the number of times that the model (or models) made a particular type of error, or were nearly the same as the verifying chart. The error evaluations were necessarily subjective and fall into the following five categories:

Symbol	Short-wave Speed	Short-wave Amplitude	Long-wave Position
++	much too fast	too much amplitude	too far east
+	a little fast	a little deep	a little eastward
=	about right	about right	about right
-	a little slow	a little shallow	a little westward
--	much too slow	too little amplitude	too far west

With respect to short-wave speed, a phase difference of 180 degrees or more was considered to be in the ++ or -- range. The same rule applied to long-wave positions. As shown in the bar charts, there were not very many long-wave position errors in the ++ or --

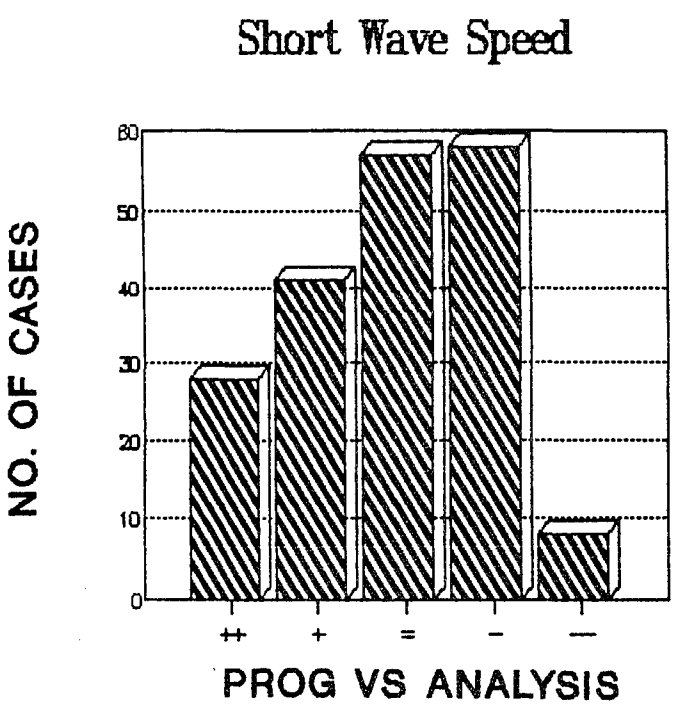
category. The rule for categorizing the short-wave amplitude forecast error was not as objective as that for speed, but most of the errors in the ++ or -- categories were due to a failure to forecast a cutoff low. In general, these models do not forecast the development of cutoffs, even though the potential for this kind of development can often be inferred from a pattern showing a split flow with a nearly stationary trough in the southern branch.

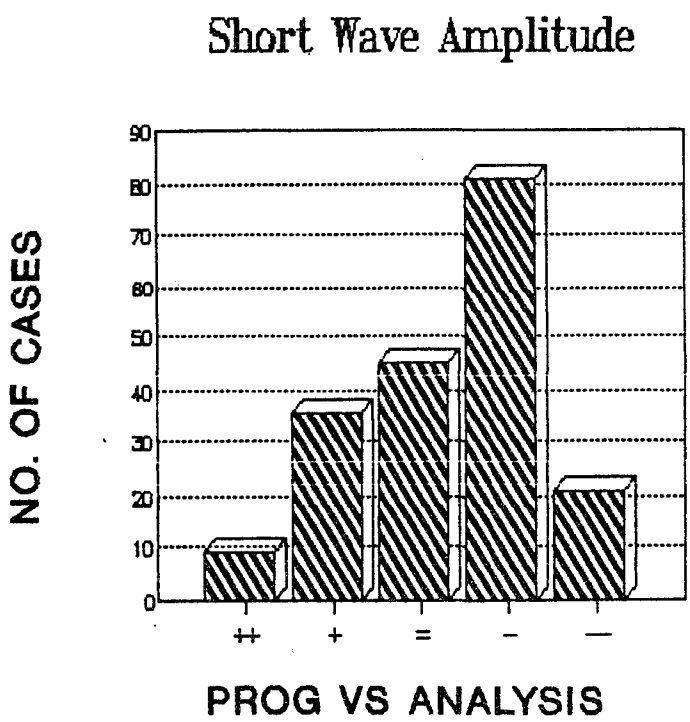
The bar charts show that all three models forecast short waves to move too slow more often than too fast, and that all three forecast short-wave amplitudes to be too shallow more often than too deep during this particular season. The MRF and ECMWF models nearly always did a better job of accurately representing the height patterns than the UKMET. It seems that the UKMET significantly underforecasts the short-wave amplitudes. This is consistent with what other investigators have found; the flow in the UKMET model tends to be too zonal.

Short-wave speed and amplitude forecast errors did not always follow typical meteorological reasoning. For example, if a trough amplitude was forecast too deep, the movement was not necessarily too slow. In the other case, if a trough was forecast too shallow, the movement was not necessarily too fast. In fact, there were many cases in which troughs were forecast to be too shallow and too slow, or too deep and too fast.

Another characteristic was that all three models tended to err in the same direction. In other words, if one model was too slow, the others tended to be too slow also. This was not always the case, but the majority of forecasts fit this pattern.

In summary, this subjective evaluation suggests that for this past winter season, the three global models all showed a tendency to be too slow and too weak on short-wave features and a little fast on long-wave features. Overall, the ECMWF 120 hr prog appeared to be a little better than the 120 hr MRF and UKMET 500 mb progs.





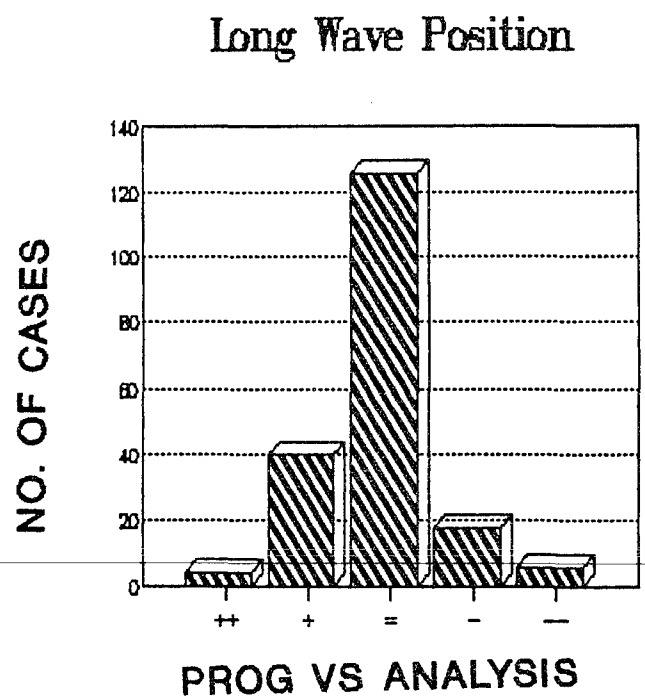
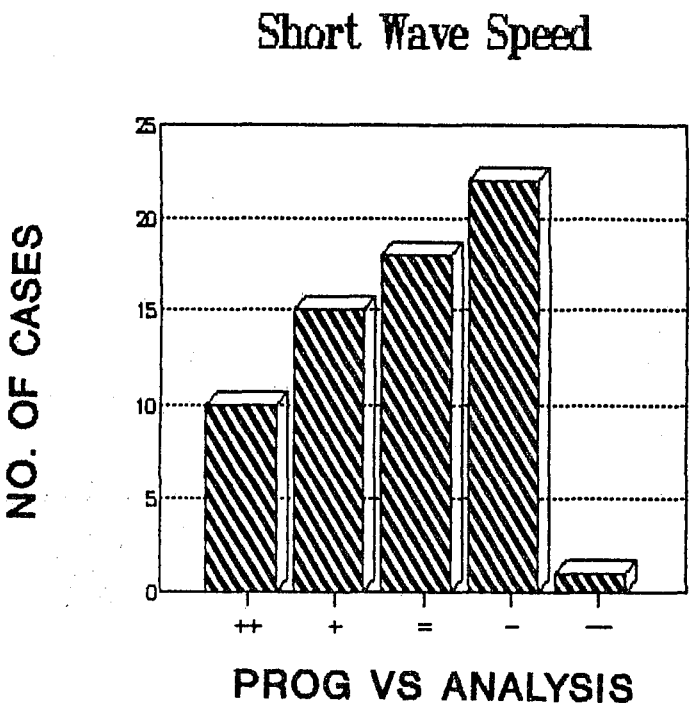
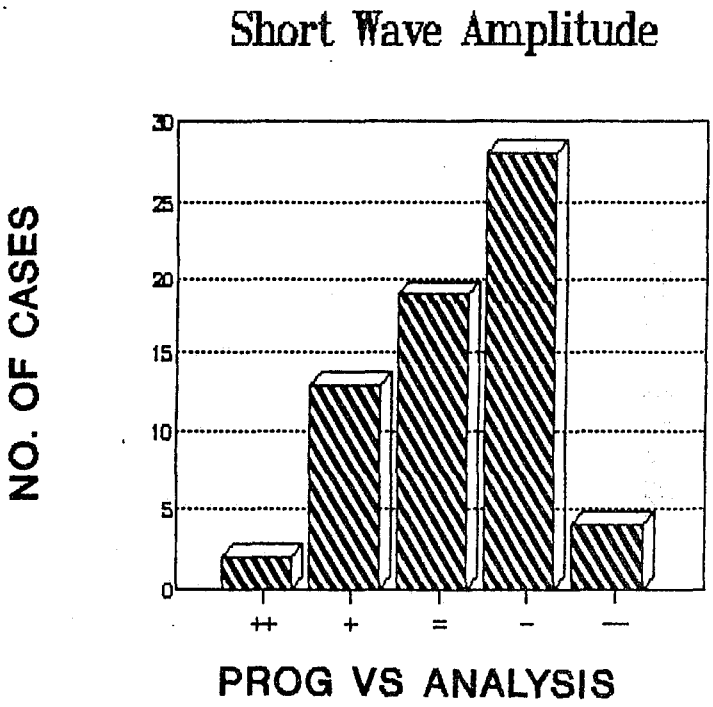


Figure 1. 120 hour 500 mb forecast verification for the MRF, UKMET and ECMWF for the 1989-1990 cold season. Symbols indicate a range of ++ for much too fast/too much amplitude to -- for much too slow/too little amplitude. See the text for additional explanation of the symbols.





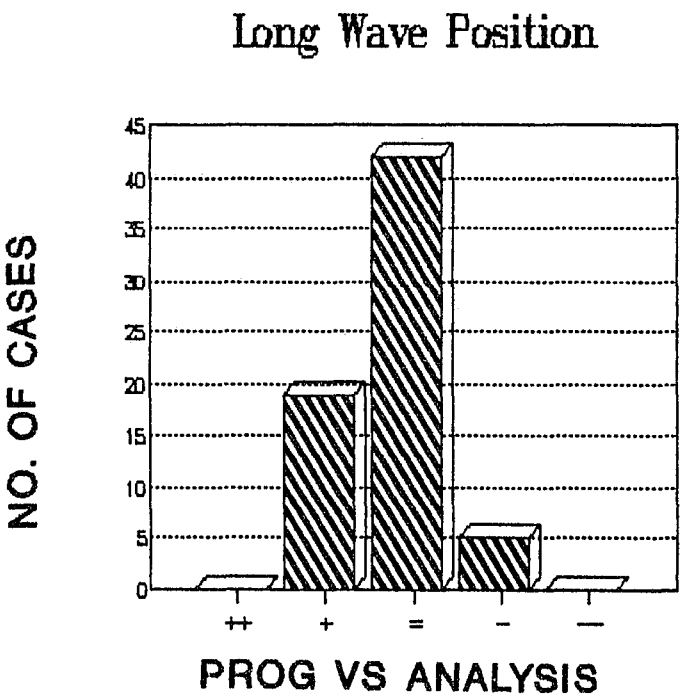
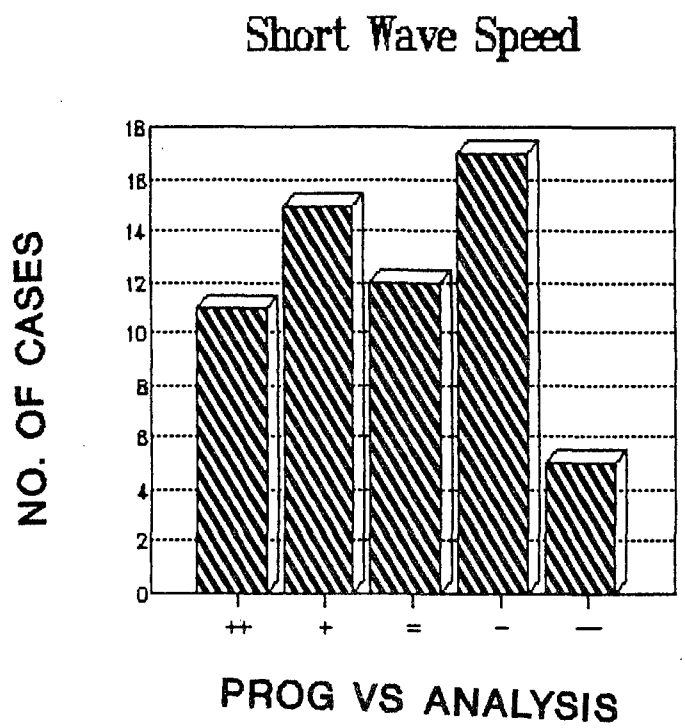
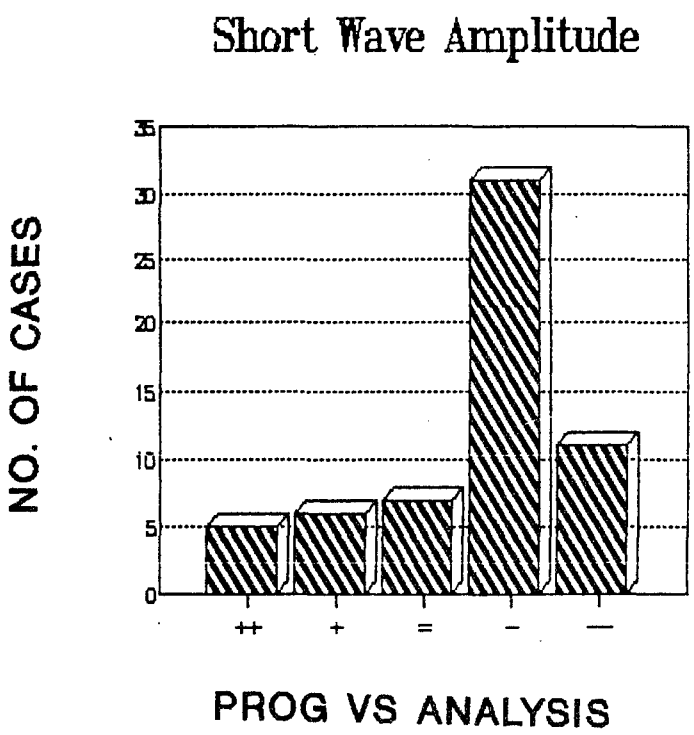


Figure 2. 120 hour 500 mb forecast verification for the MRF for the 1989-1990 cold season. Symbols indicate a range of ++ for much too fast/too much amplitude to -- for much too slow/too little amplitude. See the text for additional explanation of the symbols.





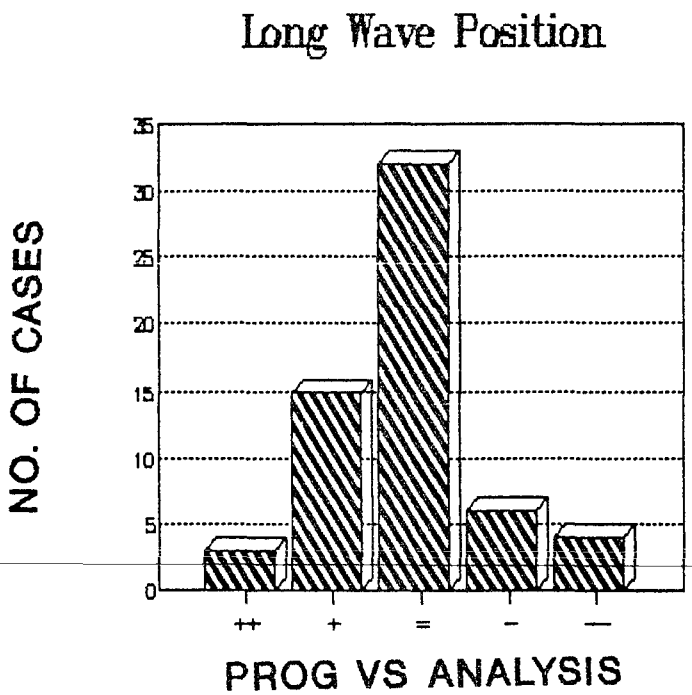
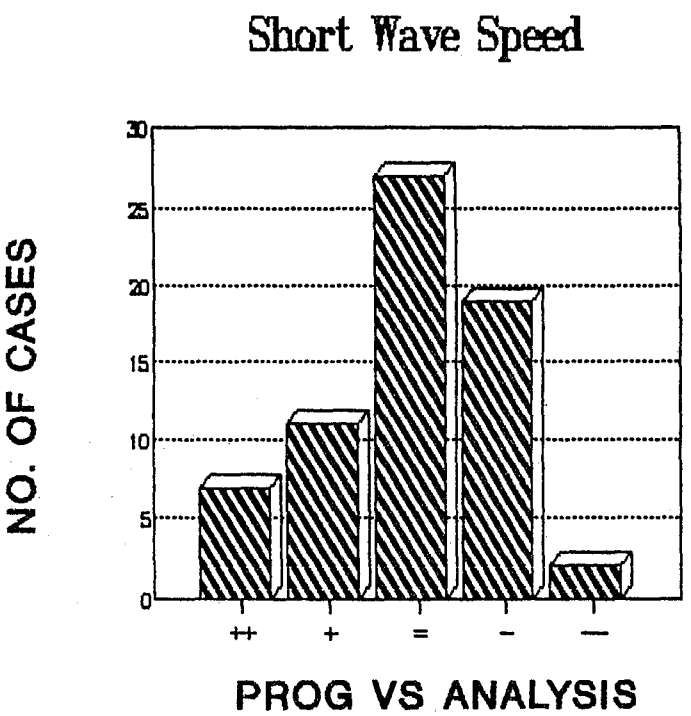
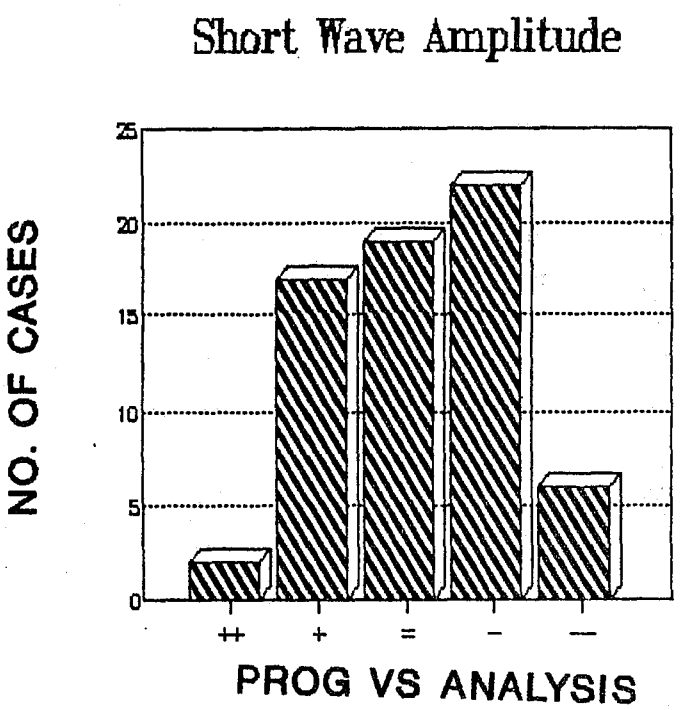


Figure 3. 120 hour 500 mb forecast verification for the UKMET for the 1989-1990 cold season. Symbols indicate a range of ++ for much too fast/too much amplitude to — for much too slow/toolittle amplitude. See the text for additional explanation of the symbols.





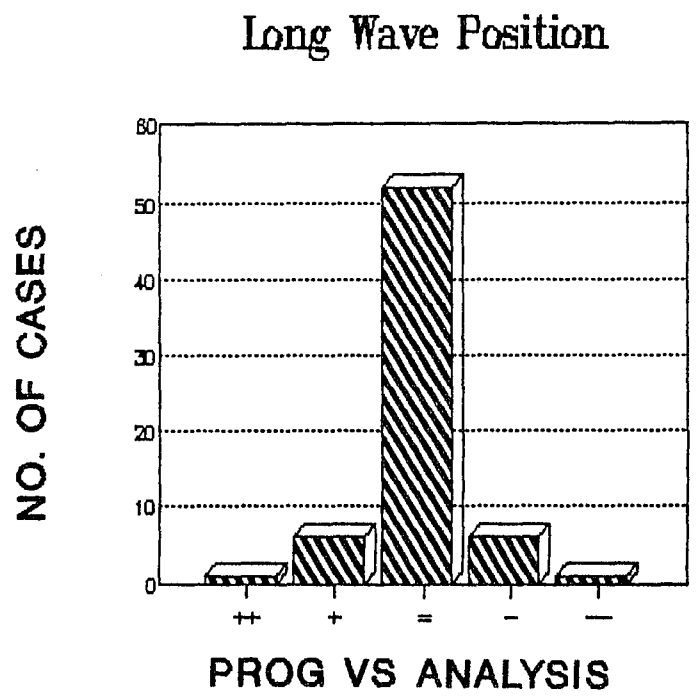


Figure 4. 120 hour 500 mb forecast verification for the ECMWF for the 1989-1990 cold season. Symbols indicate a range of ++ for much too fast/too much amplitude to -- for much too slow/too little amplitude. See the text for additional explanation of the symbols.