# A COMPARISON OF RADIOSONDE MONITORING STATISTICS FROM THE METEOROLOGICAL OFFICE AND ECMWF

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A limited study has been undertaken which compares ECMWF monitoring statistics for radiosonde stations with those derived from the Observations Processing Database (OPD) of the UK Meteorological Office. The OPD contains the observations and the background and analysis fields from the UK global model operational assimilation system. The monitoring statistics presented here are derived from the archive of data on model sigma levels. The observed value on the model sigma levels is derived from a weighted mean of all observations in a layer centred on that sigma level.

The group of stations in WMO block 10 has been chosen for this study. In this area the radiosonde network is relatively dense and these stations regularly report at 0Z and 12Z. The ECMWF monitoring statistics for 0Z and 12Z analysis hours for the month of August 1987 are compared with those derived from the OPD archives for these same analysis hours. A comparison is made between the mean and standard deviation of the observation-background differences for the U and V components using all wind reports from the TEMP message. Because the UK operational forecast model and the ECMWF forecast model have very different vertical resolutions in the stratosphere, the monitoring statistics are compared in the troposphere but only at pressure levels above 850 mb so as to avoid the possible effects of each model's orography and boundary layer schemes. Where the station and model height are around 500 m, the monitoring statistics are only compared at pressure levels above 700 mb.

The vertical profiles of the bias of the U component are very similar in most cases. The first guess fields show a bias relative to the observations of between 0.5 and 1.0 $ms^{-1}$ (absolute value) in the lower and mid troposphere. Since the quality of the first guess fields of each operational model is expected to be good in this area and both profiles of bias show the same characteristics, the statistics suggest a quite small observational bias. An example is shown in Fig 1, for station 10338, using all observations valid for 12Z. There is a tendency for the UK model in this limited area to produce a stronger U component so that the value of the observation-background bias is usually negative. At two stations in southern Germany the value of the bias at this level approaches -3 $ms^{-1}$ for the UK model. The ECMWF model also shows a tendency to a negative bias in the U component. Since both models show the same tendencies this may suggest an observational error at these stations. An example is shown in Fig 2, which presents the statistics for station 10868 at 0Z.

The bias of the V component shows similar vertical profiles for the two models, with a rather greater bias relative to observations (in absolute terms) than the U component. The difference between the absolute values of the bias is small but the data suggests that the UK model has weaker background values of the V component of the wind field, ie the UK model has a more zonal flow over this particular area in summer. At stations 10739 and 10868, which are in an area of higher orography, there is noticeably less agreement between the bias statistics and greater irregularity in the vertical profiles of the bias of the V component. Perhaps the effects of the different model orography are important in this area. It is certainly difficult to judge the quality of the observations using these particular statistics.

The standard deviation of the difference between the observations and the first guess fields for the U component is typically 2 $ms^{-1}$ for these stations, at pressures from 850 mb or 700 mb to 500 mb for both models for both analysis hours. The UK model tends to give a slightly lower standard deviation than the ECMWF model in the lower and mid atmosphere, but at jet stream level the standard deviation is greater in many cases, with the standard deviation of the observation-background values reading 4-5 $ms^{-1}$ at 250 mb. An example is shown in Fig 3. A similar trend is noticed for the statistics for the V component. When comparing these results it should be remembered that the data assimilation schemes of the two models use radiosonde observations in different ways. The ECMWF scheme performs the analysis on standard pressure levels using the observations at these pressures. The UK scheme performs its analysis on model sigma levels. The layer mean values are derived from standard level and special level reports.

This limited study suggests that in an area where the radiosonde network is relatively dense there are consistent differences between the first guess fields of the two models which must be considered in the study of radiosonde quality. In a more general study of radiosonde quality using model forecast fields the criterion or criteria for selection of a rogue station should be carefully chosen to allow for model regional and/or seasonal biases. With more experience of the use of monitoring statistics it is felt that these model errors will be identified so the truly rogue station can be identified. Regional maps of the mean and standard deviation between observations and background fields for a number of variables plotted on standard levels are a very useful additional tool in the identification of any station inconsistent with its neighbours.

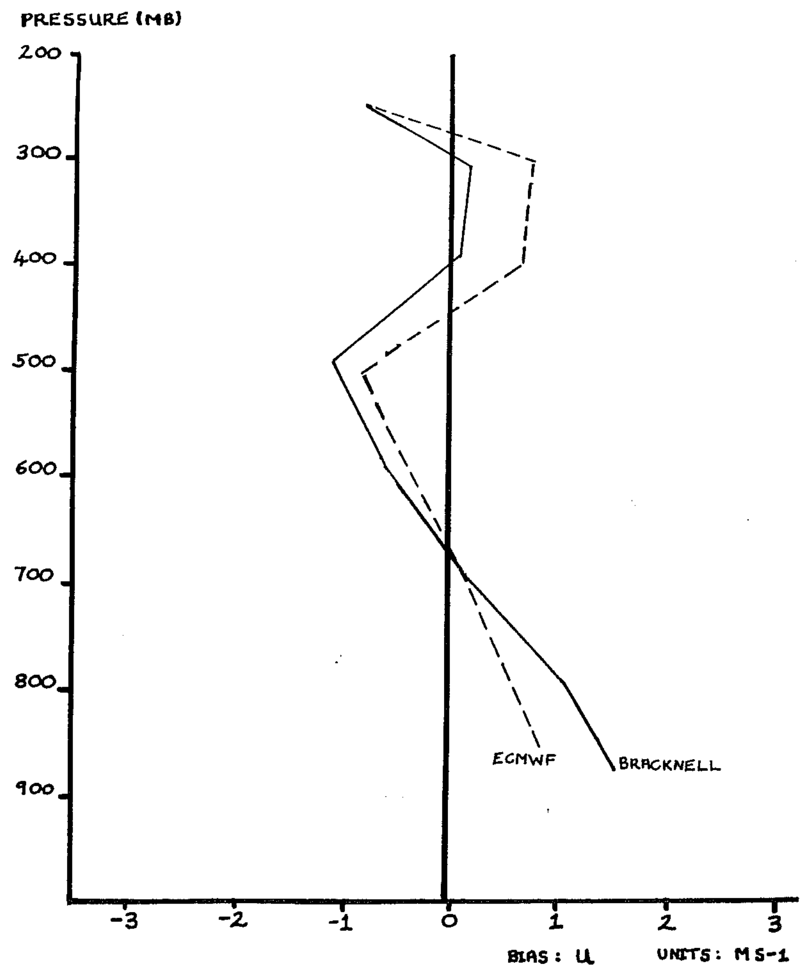


FIG. 1. BIAS OF OBSERVATION - BACKGROUND AT STATION 10338
ANALYSIS HOUR : OZ

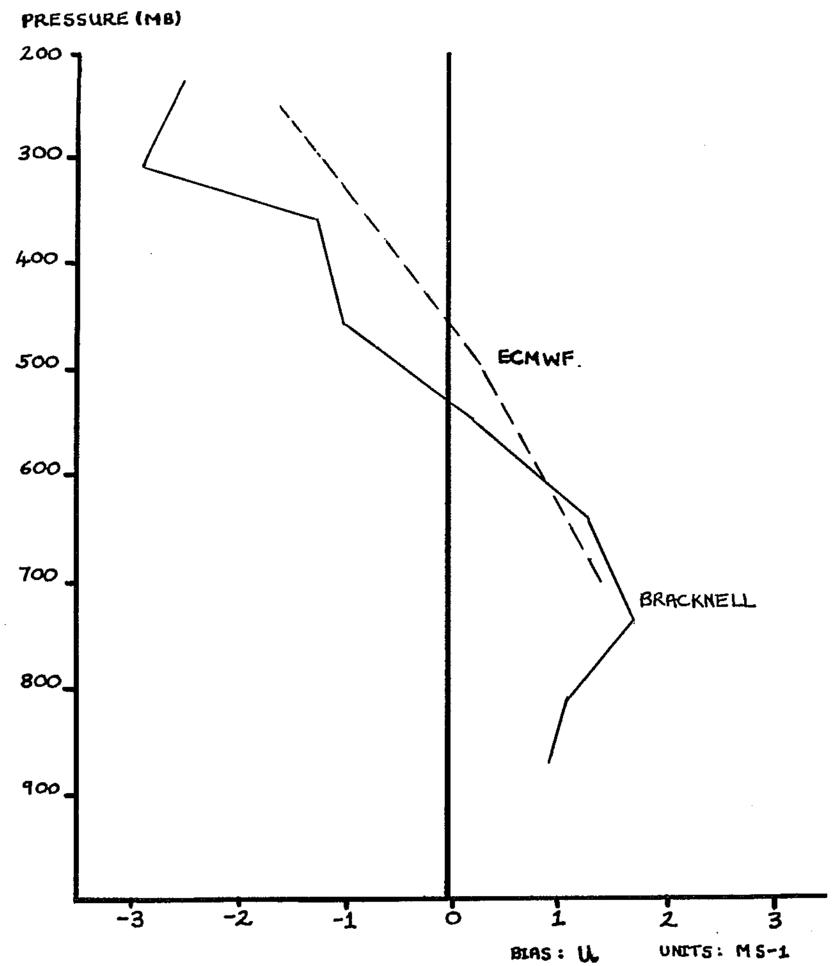


FIG 2. BIAS OF OBSERVATION - BACKGROUND AT STATION 10868
ANALYSIS HOUR : OZ

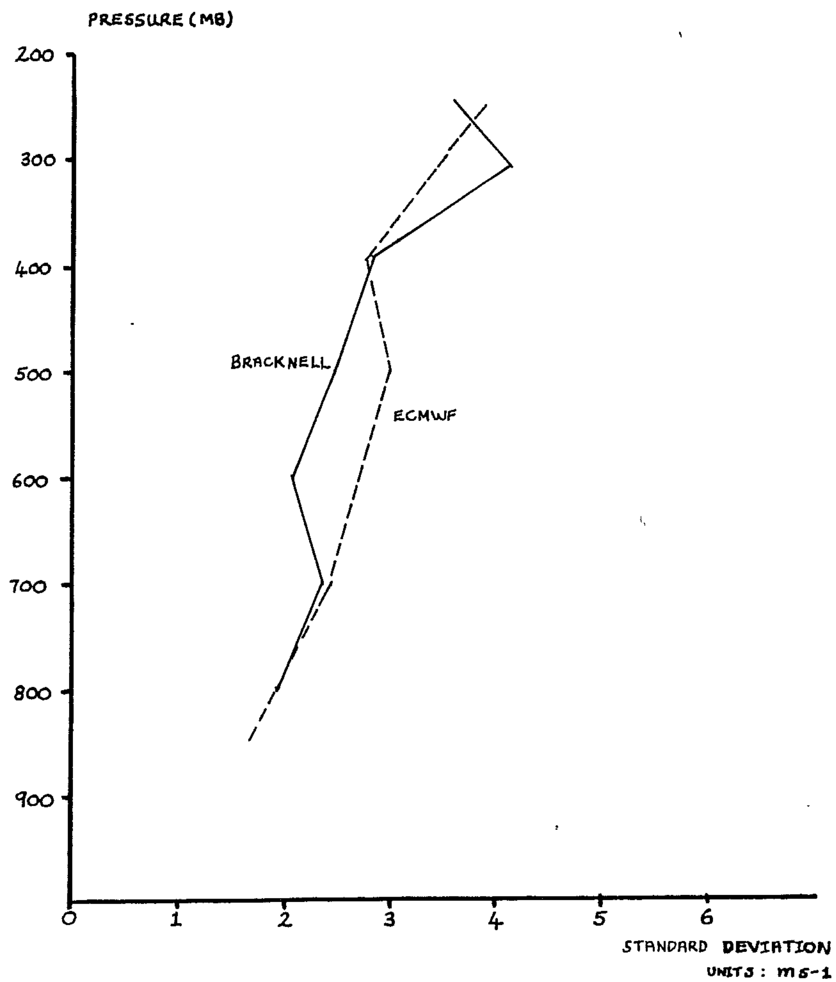


FIG. 3. STANDARD DEVIATION OF OBSERVATION-BACKGROUND AT STATION 10035. ANALYSIS HOUR : 12 Z