Verification of Quantitative Precipitation Forecast from Operational Numerical Weather Prediction Models over Japan (WGNE precipitation forecast intercomparison project)

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1. Introduction

In 1995 the WGNE initiated the verification of quantitative precipitation forecasts (QPFs) from operational NWP models over different areas of the globe. A number of results of this project have been already reported (e.g., Goeber et al. 2002; Ebert et al. 2003). We also undertook the QPFs verification over Japan last year (2002). This paper reports the findings of our verification results until September 2003.

2. Verification Methods

Table 1 indicates the specifications of the QPFs data sent by each NWP centers as of December 2003. The observational precipitation data are referred to the operational high-dense (17 $\times$ 17 km) rain gauge observation network. Both the observation data and the model forecasts data are interpolated into the verification grid, whose resolution is 80km.

3. Verification Results

(1) 24-h QPFs Verification Results

Figure1 shows the frequency bias score (BS) for 24-h precipitation in day 3 (FT48~72) in summer of 2003. All models tend to overestimate the frequency of light precipitation, though there are differences in degree. Similar features are also reported in other regions (Goeber et al. 2002; Ebert et al. 2003). Most models underestimate the frequency of moderate or intense (>20mm/24h) precipitation.

Monthly time series of BS and the equitable threat score (ETS) for 24-h precipitation in day 3 (FT48~72) are shown in Figure 2. BS for the threshold of 1mm/24h is larger than 1.0 in most models all year around. Since meso-scale convective systems are dominant in precipitation associated with Asian summer monsoon in Japan region, all models tend to decrease ETS in summer. It is also found that some models show low ETS in winter monsoon season due to the overestimation of frequency (high BS).

(2) 6-h QPFs Verification Results

Although a number of investigations have been made on accuracy of 24-h precipitation forecasts, there is little report on precipitation forecasts in shorter timescale (6 or 12-h). It is expected that the verification of 6-h or 12-h QPFs reveals characteristics on diurnal variation.

Figure 3 indicates BS and ETS for 6-h forecasts in summer of 2003. BS for each model is larger in daytime (00~06UTC or 06~12UTC) than nighttime. BS for some models at FT00~06 is high despite nighttime (12~18UTC) indicating these models have so called spin-down problem at the beginning of forecast. ETSs for these models, therefore, are lower at FT00~06 than FT06~12.

References

Ebert, E. E., U. Damrath, W. Wergen and M. E.Baldwin, 2003: The WGNE assessment of Short-term Quantitative Precipitation Forecasts. Bull. Am. Meteorol. Soc., **84**, 481-492.

M. Goeber, S.F. Milton and C.A. Wilson, 2002: WGNE assessment of Quantitative Precipitation Forecasts from Operational Numerical Weather Prediction Models over the U.K. WMO/TD **No.1105**, WMO, 02-07 - 02-08.

Table 1. The specifications of the QPFs data sent by NWP centers as of December 2003.

NWP center	horizontal resolution of data(°)	forecast time (h)	verified since	
ABoM	1.25×1.25	12,24,36,…,120	Aug 2002	*1
DWD	0.75×0.75	24,48,72	Jul 2002	*2
ECMWF	0.50×0.50	6,12,18,…,72	Apr 2002	*3
NCEP	1.00×1.00	6,12,18,…,72	Aug 2002	*4
UKMO	0.83×0.56	6,12,18,…,96	Oct 2001	*5
JMA	0.56×0.56	3,6,9,12,…,72	Apr 2002	*6

*1: Australian Bureau of Meteorology
*2: Deutscher Wetterdienst
*3: European Centre for Medium-Range Weather Forecasts
*4: National Centers for Environment Prediction (Aviation model)
*5: United Kingdom Meteorological Office 12-h accumulated QPFs data received until Sep 2002.
*6: Japan Meteorological Agency

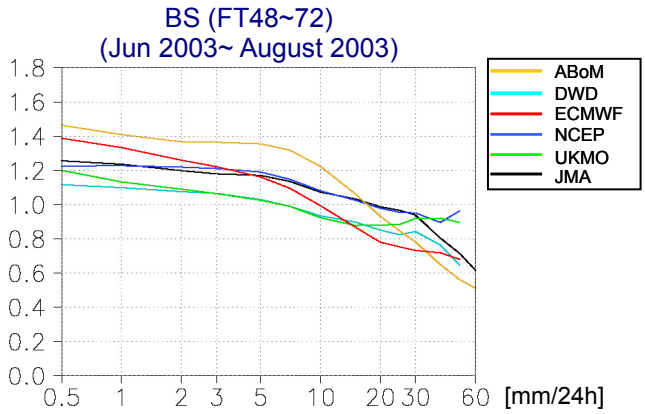

Fig. 1. Bias Score as a function of precipitation threshold for 24-h precipitation in day 3 (FT48~72) during June to August 2003. Initial time for each model is 12 UTC. The score is not plotted when the number of event in either observation or forecast is less than 450 in case of high threshold values.

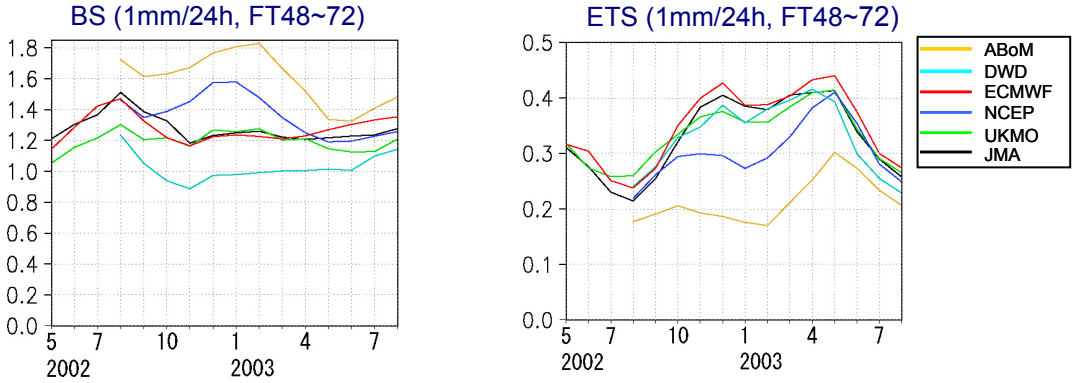

Fig. 2. Monthly time series of BS (left) and ETS (right) for 24-h precipitation in day 3 (FT48~72) from May 2002 to August 2003. The threshold is 1[mm/24h]. Scores are calculated for 3 consecutive months (from the previous month to the next).

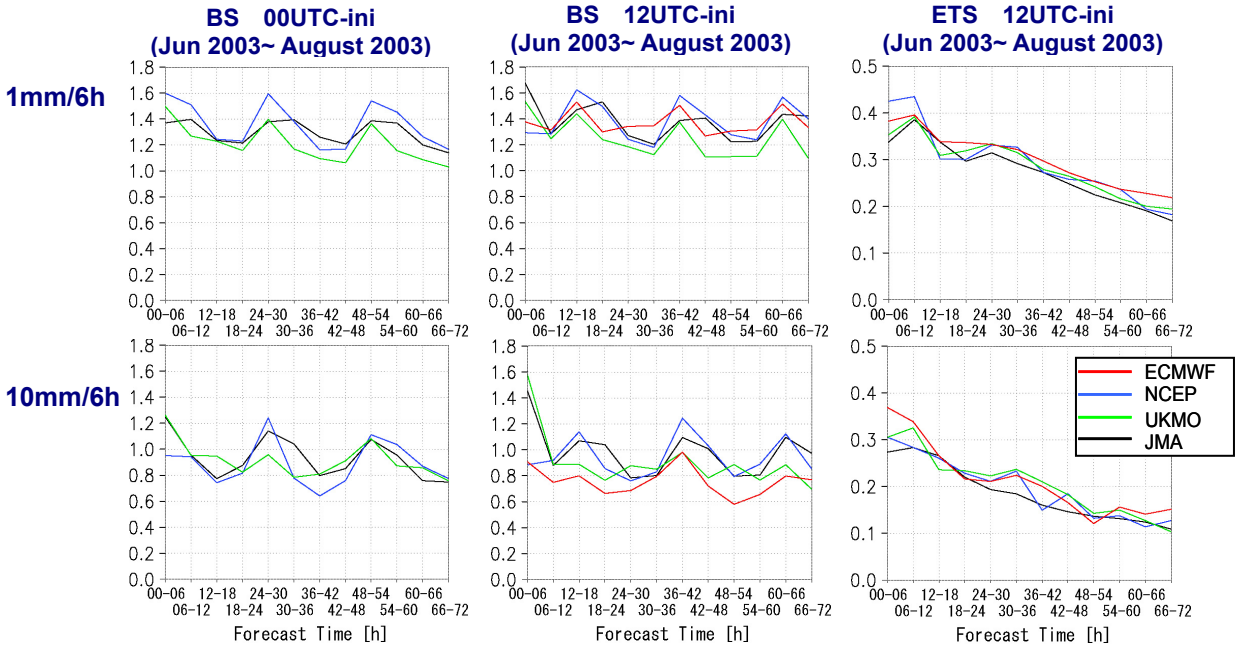

Fig. 3. Monthly time series of BS (left and middle) and ETS (right) during June 2003 to August 2003 as the functions of forecast time. Precipitation threshold is 1[mm/6h] (above) and 10[mm/6h] (below).