Application and verification of ECMWF products 2008

Met Office, Exeter, UK – Simon.R.Fuller, Julian Heming

1. Summary of major highlights

2. Use and application of products

2.1 Post-processing of model output

2.1.1 Statistical adaptation

2.1.2 Physical adaptation

2.1.3 Derived fields

2.2 Use of products

3. Verification of products

3.1 Objective verification

3.1.1 Direct ECMWF model output (both deterministic and EPS)

(i) in the free atmosphere

ECMWF and Met Office forecast fields of PMSL, 500 hPa height and 250 hPa wind have been verified against observations. Monthly mean RMS errors for an area covering Western Europe, the North Atlantic and North America are plotted in ANNEX A, Figures 3.1.1(i)a,b,c.

The ECMWF lead over the Met Office was maintained up to March 2008. However, the Met Office results show a relative improvement in January and February 2008.

(ii) of local weather parameters verified for locations which are of interest to your service

(iii) of oceanic waves

The Met Office continues to contribute to the monthly verification exchange of global wave models.

3.1.2 ECMWF model output compared to other NWP models

Verification and Intercomparison of ECMWF Tropical Cyclone Forecasts

The Met Office has been carrying out verification of its own tropical cyclone (TC) forecast track errors since 1988 and of those from ECMWF since 1994. In addition, verification of the intensity tendency of TC forecasts has been carried out since 2001. The latter is done by a simple method which determines whether the model is forecasting weakening or strengthening over each 24 hour period based on model values of 850hPa relative vorticity at the TC centre. A skill score is produced to indicate whether the model is better than chance.

Results of an intercomparison between Met Office and ECMWF TC forecasts were presented in this report two years ago for the period 1994 to 2005 (for TC tracks) and 2001 to 2005 (for TC intensity). An update is included in this report to include the years 2006 and 2007. All comparisons are for homogeneous datasets.

Globally averaged track forecast errors for the Met Office global and ECMWF models can be seen in ANNEX A, Figure 3.1.2(a) (T+24, 48 and 72) and ANNEX A, Figure 3.1.2(b) (T+96 and 120). These firstly indicate a long term downward trend in track forecast errors for both the Met Office and ECMWF models, although the downward trend has been arrested for the Met Office model in the last two years. At short lead times (T+24 and T+48) Met Office track forecast errors have always been lower than ECMWF. However, in 2007 ECMWF T+48 errors were lower than the Met Office for the first time and the T+24 errors were very close. At T+72 the gap between ECMWF and the Met Office widened, with the former having significantly lower errors. At longer lead times (T+96 and T+120) the figures show a remarkable downward trend in ECMWF errors. In each the last four years errors were significantly below the previous year. The ECMWF T+120 track forecast error has reduced from 626 km in 2003 to 356 km in 2007 - a drop of 43%. The T+96 error saw a drop of 35% during this period. In the last

two years Met Office track forecast errors have shown a small increase. There is now a huge gap between the ECMWF and Met Office track forecast errors at longer lead times - primarily due to reduction in ECMWF errors.

Globally and lead-time averaged intensity skill scores for the Met Office and ECMWF models can be seen in ANNEX A, Figure 3.1.2(c) . In terms of overall intensity tendency there continues to be very little difference between the Met Office and ECMWF. Intensity tendency skill scores have been fairly stable at 20% or just above for both models in recent years. However, when this intensity tendency is broken down into strengthening and weakening skill, large differences between the two models appear. ECMWF show a much greater level of skill in predicting strengthening, with recent scores of near to 60%. The Met Office strengthening skill started from a base point almost 80% below ECMWF in 2001. However, strengthening skill has risen consistently and has attained a value of approximately 30% in the last two years. Met Office weakening skill has always been considerably higher than ECMWF. Both models showed a slight dip in weakening skill in the last two years. In 2007 the Met Office weakening skill was 25% higher than ECMWF.

In summary, ECMWF's track forecast errors have continued to drop at a faster rate that the Met Office - particularly at longer lead times, which have shown remarkable reductions. Both models show similar intensity tendency skill scores, but ECMWF is better at predicting strengthening, whilst the Met Office is better at predicting weakening.

3.1.3 Post-processed products

3.1.4 End products delivered to users

3.2 Subjective verification

3.2.1 Subjective scores

3.2.2 Synoptic studies

4. References to relevant publications

Chan, J.C.L. and **Kwok, R.H.F.** (1997). A diagnostic study on the improvement in tropical cyclone motion prediction by the UK Meteorological Office Global Model. Met. Apps. Vol.4 pp.1-9.

Jolliffe, I.T. and **Stephenson D.B.** (Editors), 2003. Forecast Verification: A Practitioner's Guide in Atmospheric Sciences. Wiley, 240 pp

ANNEX A

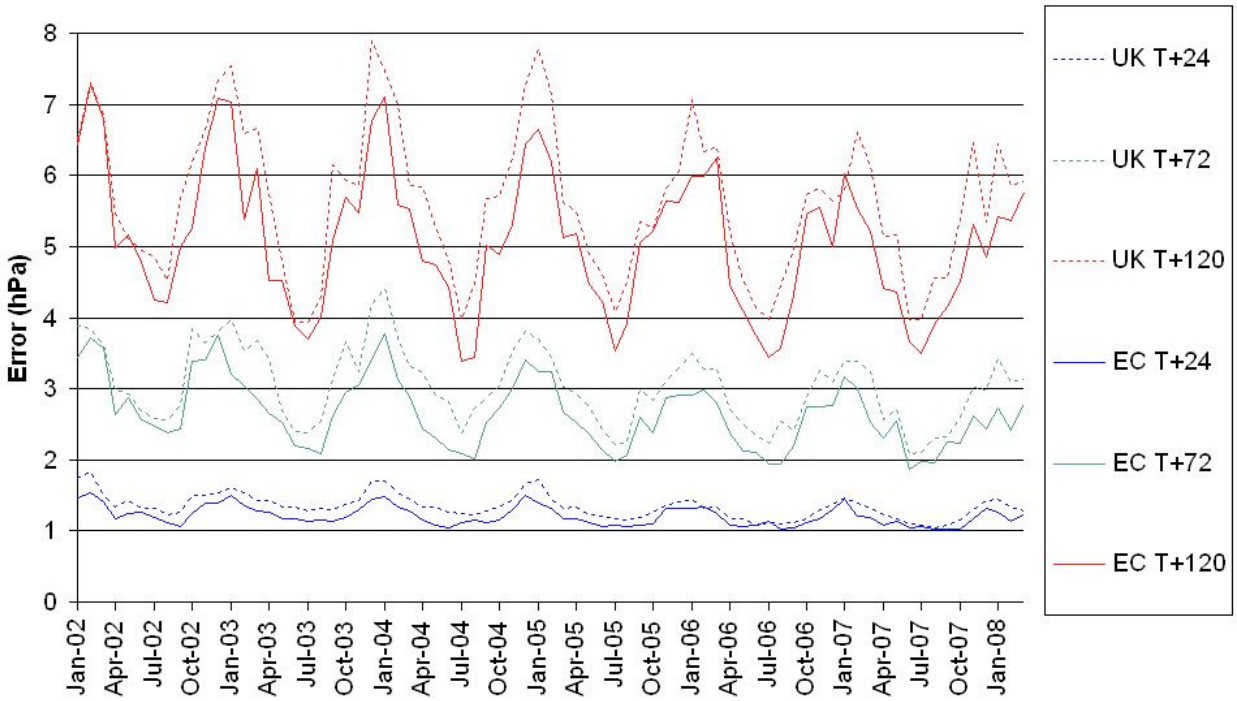

Fig. 3.1.1(i)a RMS errors of PMSL, verified against observations over W.Europe, N.Atlantic, N.America: Jan 2001 - Mar 2007, Met Office (dashed line) and ECMWF (solid line).

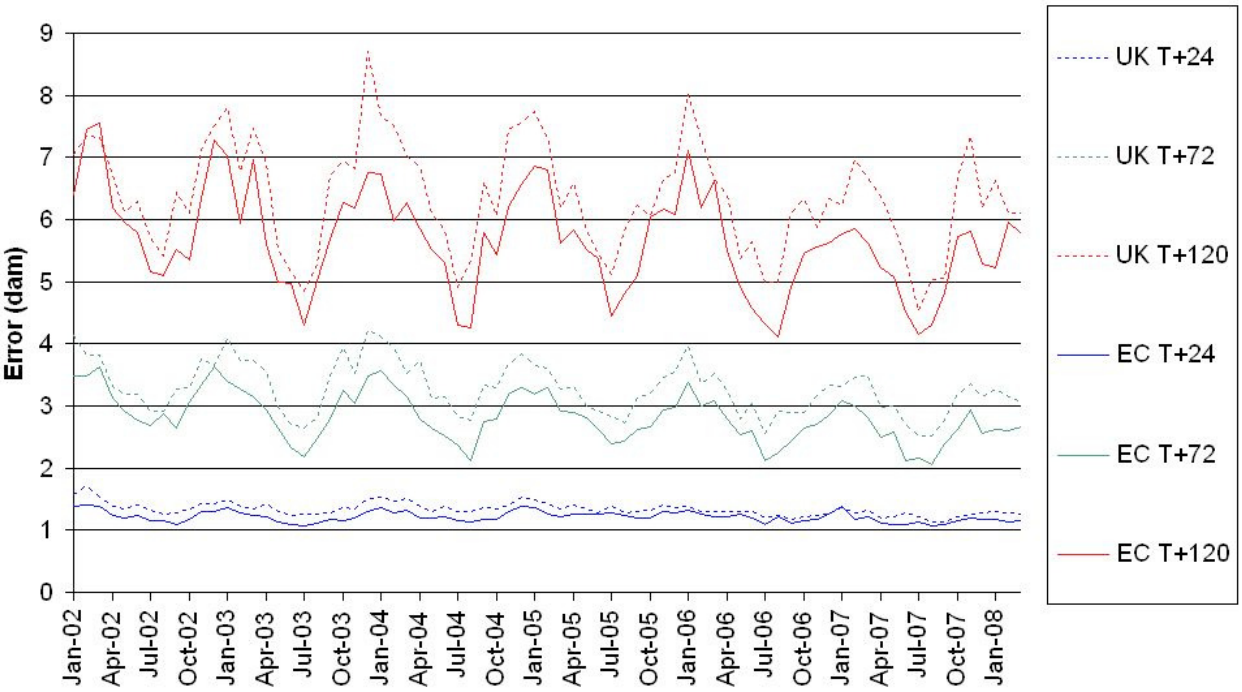

Fig. 3.1.1(i)b RMS errors of 500hPa height, verified against observations over W.Europe, N.Atlantic, N.America: Jan 2001 - Mar 2007, Met Office (dashed line) and ECMWF (solid line).

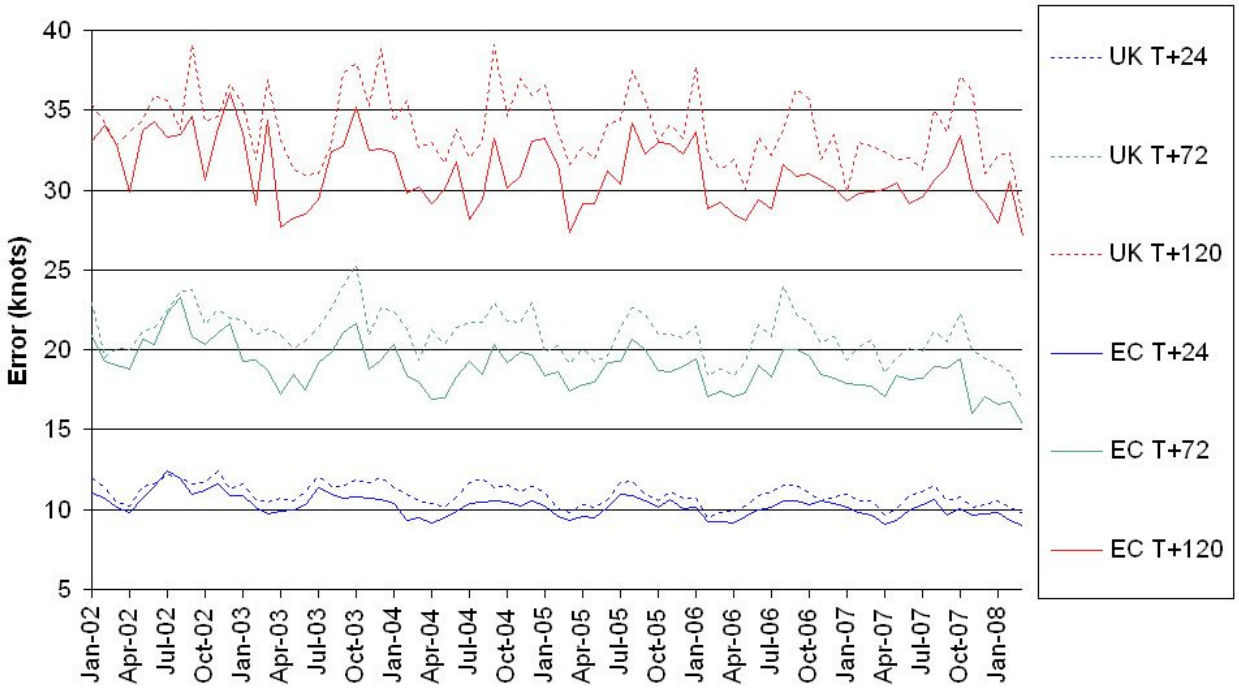

Fig. 3.1.1(i)c RMS vector wind errors at 250hPa, verified against observations over W.Europe, N.Atlantic, N.America: Jan 2001 - Mar 2007, Met Office (dashed line) and ECMWF (solid line).

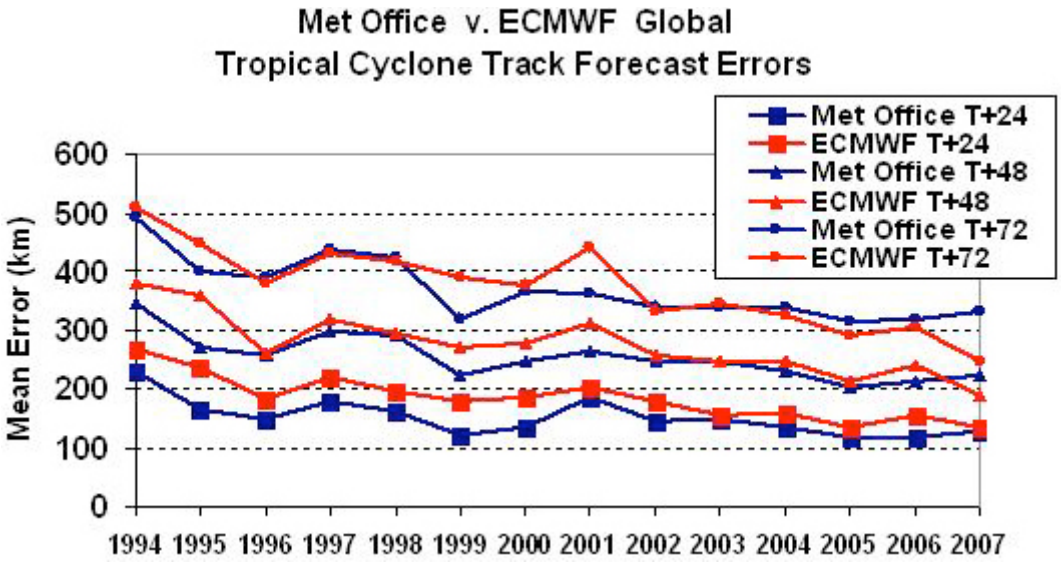

Fig. 3.1.2(a)

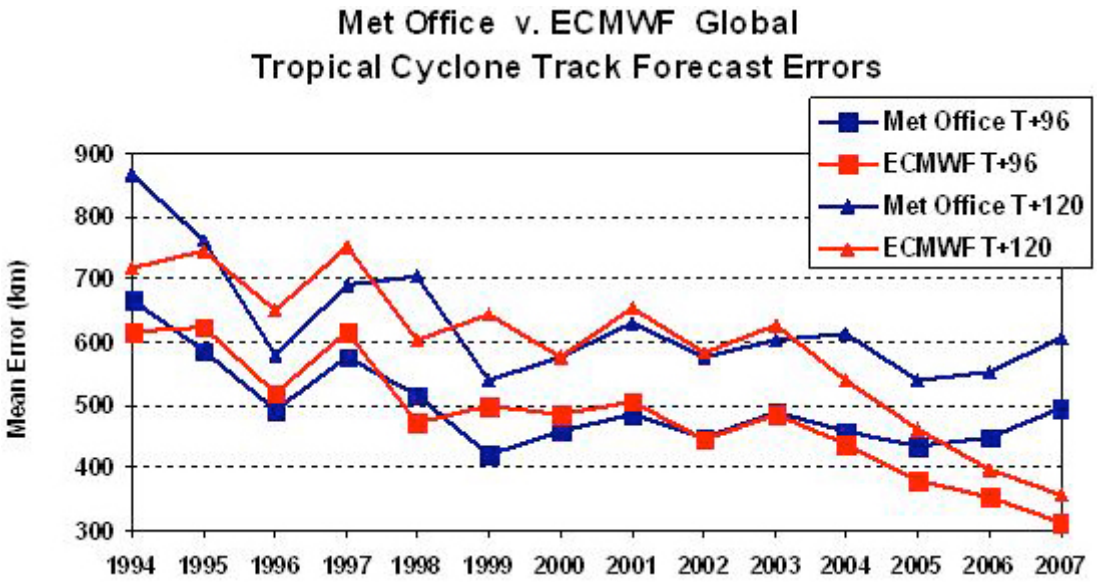

Fig. 3.1.2(b)

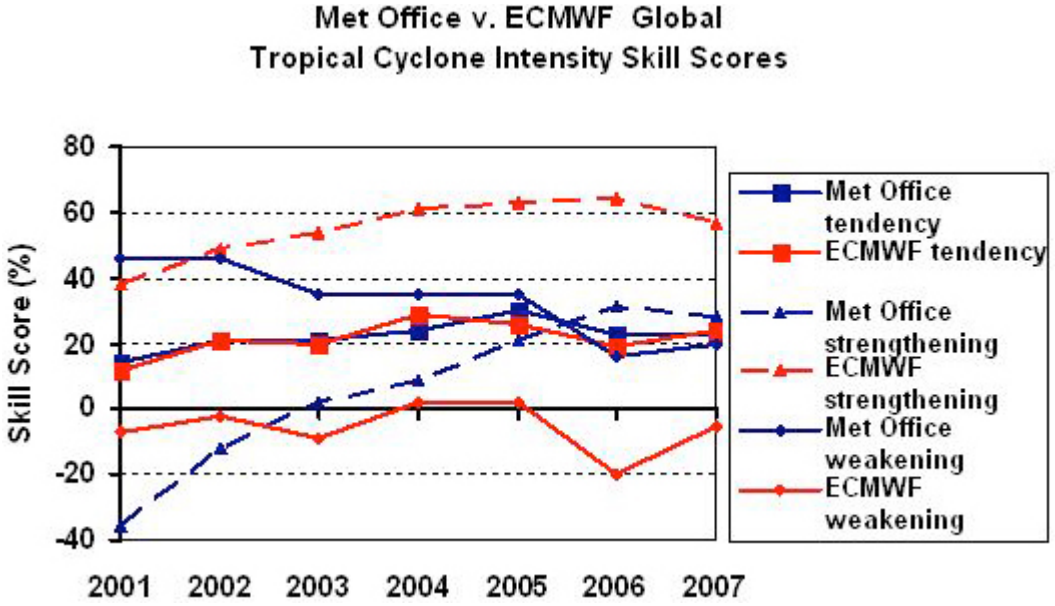

Fig. 3.1.2(c)