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Dynamical properties of MOS forecasts. Analysis of the ECMWF operational forecasting system

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The dynamical properties of ECMWF operational forecasts corrected by a (linear) Model Output Statistics (MOS) technique are investigated,in the light of the analysis performed in the context of low-order chaotic systems (Vannitsem and Nicolis, 2008). On the basis of this work, the respective roles of the initial condition and model errors on the forecasts can be partly disentangled. For the temperature forecasted by the ECMWF model over Belgium, we have found that: (i) The error amplification arising from the presence of uncertainties in the initial conditions dominates the error dynamics of the 'free' atmosphere; (ii) The temperature at 2 meters can be partly corrected by the use of the (linear) MOS technique (as expected from earlier works), suggesting that model error (and possibly a systematic initial condition error) dominates at the surface; (iii) for a 2-observable MOS scheme, the best second predictor is the temperature predicted at 850 hPa in the central part of the country, while for the coastal zone, the best second predictor is rather the sensible heat flux entering in the evolution of the surface temperature. These differences between regions suggest that the model error sources are different, with a dominant problem of vertical temperature interpolation in the central and east parts of the country and a difficulty in assessing correctly the surface heat fluxes on the coastal zone. Potential corrections of these problems using higher resolution models are also discussed.