

Comment on ‘Predictability of winter climate over the North Atlantic European region during ENSO events’ by P.-P. Mathieu, R. T. Sutton, B. Dong and M. Collins

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Linear teleconnections to winter climate in Europe are known to be very small (Kiladis and Diaz, 1989; van Oldenborgh et al., 2000), much smaller than in spring and fall. In Dec–Feb, of the 168 ECD (Klein Tank et al., 2002) precipitation stations (average record length 80 years), only 4 have a significant correlation with the Niño3 index (SST anomalies in 5°S–5°N, 150–90°W) at the 95% level, even less than expected by chance alone. Of the 167 ECD temperature stations, only 2 show significant correlations. The correlations with 500mb geopotential height from the ERA-40 reanalysis (Gibson et al., 1997), which is less noisy, are also less than 0.2 over the whole area 30–80°N, 50°W–60°E except over northern Africa and southern Spain (Fig. 1a). These results suggest that the teleconnections noted in some of the earlier literature are mostly artifacts caused by lack of data.

Mathieu et al. (2004) argue that ‘ENSO events have a significant influence on the climate of the North Atlantic European region’ (in winter). They claim that the details of the SST anomalies determine the shape of the teleconnection, which can therefore not be described by linear correlations. This statement is supported by model experiments, in which an ensemble of 10 atmospheric GCMs (HadAM3) forced by observed SST shows good predictability of the 500mb geopotential height patterns in this region during most of the 3 El Niño and 3 La Niña events in 1987–2000 that they analyze. However, their evidence also allows another conclusion: that their model atmosphere reacts strongly to the prescribed SST (Rodwell et al., 1999), whereas in the coupled system SST is also to a large extent forced by the atmosphere (Barsugli and Battisti, 1998). Prescribing SST overestimates the heat flux from the ocean into the atmosphere, possibly leading to an overestimation of the predictability.

This hypothesis can be tested by considering the performance of a similar coupled GCM in forecasting the winter climate of the North Atlantic European region, and noting the dependence of this skill on the presence or absence of El Niño or La Niña. A coupled version of the Met Office model that Mathieu

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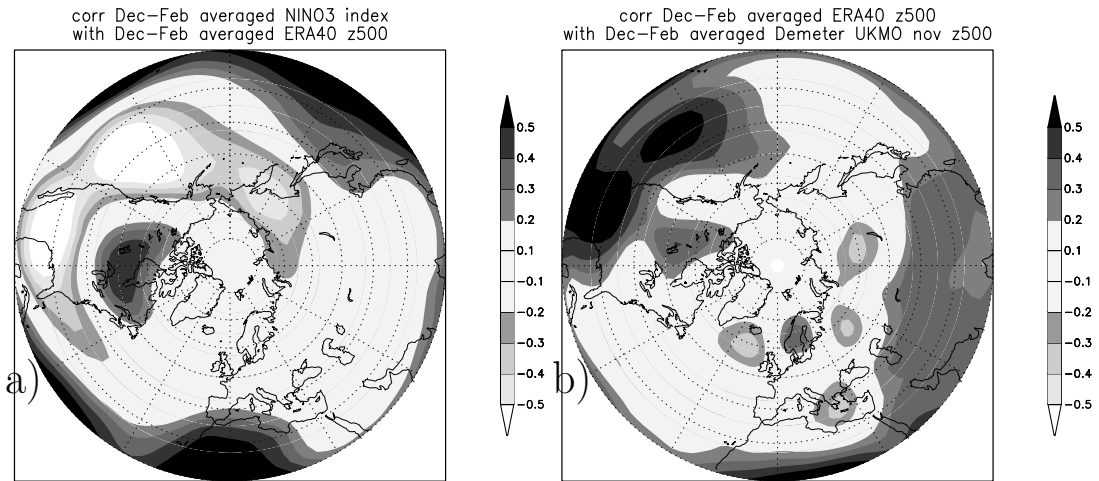


Figure 1: (a) The linear correlations of ERA40 500mb geopotential height with the Niño3 index. (b) The pointwise correlation skill in forecasting the 500mb geopotential height of the ensemble mean of the GloSea Demeter model over 1959–2001.

et al. (2004) use, GloSea, is used in the Demeter project (Palmer et al., 2004) with 9 ensemble members over the period 1959–2001. The hindcast data are publicly available and can be analyzed at climexp.knmi.nl. The skill in ENSO forecasts is very good for the November starts considered here.

The linear correlation skill of this model is essentially zero over the North Atlantic and European region (Fig. 1). Even the full multi-model Demeter ensemble mean (7 models, 9 ensemble members per model) shows very little linear skill in the North Atlantic and European region. Higher order moments of the probability density function have not been considered.

The forecasts of the coupled model ensemble mean 500mb geopotential for the El Niño and La Niña winters considered by Mathieu et al. (2004) are indeed qualitatively different from the ones of the GloSea coupled forecasts started on November 1. To investigate whether the skill of the coupled forecasts is also higher during ENSO events, the skill per year has been estimated as the spatial anomaly correlation coefficient over the North Atlantic–European region for Dec–Feb averaged fields. We take a smaller region than Mathieu et al. (2004), $50^{\circ}\text{W}–60^{\circ}\text{E}$ $30–80^{\circ}\text{N}$, in order to exclude the linear North–American and tropical teleconnections shown in Fig. 1a. The correlation coefficients for the GloSea ensemble mean are plotted against the absolute value of the Niño3 index in Fig. 2. . This coupled model does not show significantly more skill in El Niño or La Niña years than in neutral years. During the nine winters with Niño3 index smaller than -1.25 K or larger than $+1.25$ K the median skill was $r = 0.21$ with a 95%

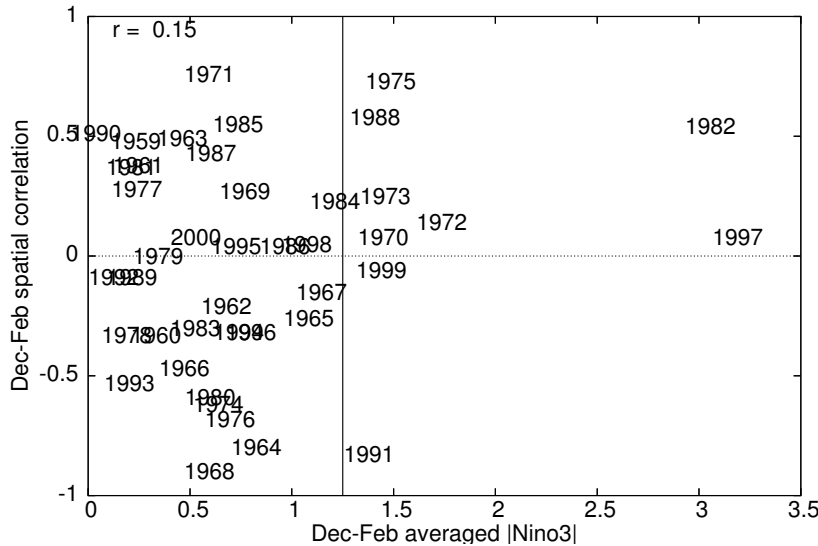


Figure 2: The skill in forecasting the 500mb geopotential height in the North-Atlantic–Europe region as estimated by a spatial anomaly correlation coefficient of the ensemble mean of the GloSea Demeter model over 30–80°N, 50°W–60°E, as a function of the absolute value of the Niño3 index. The year refers to the beginning of the winter season.

confidence interval of $-0.11 < r < 0.45$ (estimated via a bootstrap method).

We conclude that the results of Mathieu et al. (2004) are most likely due to the effects of prescribing SST in this model and do not support the hypothesis that there is predictability in the coupled system in the North Atlantic–European region in winter during large ENSO events, except for the western Atlantic extensions of the well-known teleconnections to North America.

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