

# ***Interactive comment on “The Met Office Global Coupled model 2.0 (GC2) configuration” by K. D. Williams et al.***

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## **1 Reply to general comments**

We thank the referee for his/her review and helpful suggestions. We note the point that readers will need to consult several papers for a full description of GC2. As the referee notes, this is unavoidable for large models, however we intend to form a special issue of GMD containing the 4 papers which together provide this full description.

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## 2 Evidence for conclusion on ENSO

The referee raises a concern that insufficient evidence is given for the statements about ENSO being well simulated and also questions the reliability of the results given the length of simulation.

To address this, we have added a new table (Table 3) which contains 5 metrics: M1 and M2 are standard deviation of monthly SST anomaly for regions Nino3 (90W-150W, 5N-5S) and Nino4 (160E-150W, 5N-5S), M3 is the ratio of power in the 3-7 year range relative to 0-10 years for monthly Nino3 SST anomaly (%), M4 is a seasonality metric defined as the ratio of November to January and March to May standard deviation of Nino3 SST anomaly (Bellenger et al., 2014), M5 is the standard deviation of precipitation anomaly for Nino4 (mm day<sup>-1</sup>). We present these for the final 50 years of the CLIM experiment (as elsewhere in the paper), but also for the final 100 years of a second simulation which is equivalent to the CLIM experiment except for different initial conditions. The results are shown to be similar between the two. We have also added an extra panel to Fig. 15 showing the mean Pacific SST averaged 5N-5S.

The text on p537 lines15-21 has been revised as follows: *“As a result of the improved windstress, improved MJO (which can be the source of westerly wind bursts; e.g. Lengaigne et al., 2004) and higher horizontal resolution of the ocean, ENSO is well simulated in HadGEM3-GC2 with a good spatial pattern (Fig. 15c&d). When assessed against a range of metrics (Table 3) we see that variability in SST agrees well with observations in the central-east Pacific although is somewhat weaker than observed near the dateline. A power spectrum analysis shows the frequency lies within the observed range (3 to 7 years), with no dominant short (e.g. 2 year) or longer period peaks. The model seasonality is good, with maximum (minimum) variability in boreal winter (spring). The standard deviation of precipitation in the central Pacific gives a measure of model capability for regional climate impacts and although slightly underestimated, is good in comparison with other climate models which tend to underestimate this quan-*

tity. Overall, HadGEM3-CG2 compares favourably with a range of CMIP5 models (Belenger et al., 2014). The main observed ENSO teleconnections to remote precipitation anomalies (S. America, Sahel, India, E. Africa, etc.) are also present in the model (not shown).”

### 3 Responses to Minor concerns

#### 3.1 Clarity of experiment being used

As the referee suggests, the experiment being used (CLIM, SEAS, NWP) has been added to each of the figure and table captions.

#### 3.2 Conservation in the coupling

We have expanded the text to make the description of the conservative coupling clearer. p526 lines5-11 have now been replaced with: *“To ensure energy conservation, the coupling part of the NEMO name-list is set to ensure that in most cases there are separate coupling fields received in NEMO as relevant to ocean (solar and non-solar heat fluxes; evaporation) or sea ice (top and bottom conductive heat fluxes as calculated in the JULES land surface model; sublimation). These fields are converted to mean values over atmosphere grid boxes before being conservatively interpolated by OASIS, and once received by NEMO are applied to the ocean or sea ice component as appropriate. Where necessary, CICE can pass any excess heat or freshwater fluxes back to NEMO – this may be required if the interpolation of coupling fields produces sea ice fluxes in ocean grid boxes without sea ice, or if the sea ice melts either between coupling exchanges or within a CICE time-step. The wind stress components provided from the atmosphere model are currently mean values which are assumed to apply*

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*equivalently to ocean and sea ice.”*

### 3.3 Quantification of model drift

As the referee suggests, the following has been added to p528 line24: *“The largest global-mean ocean temperature drift over the 100 year simulation occurs at a depth of 563m with a rate of 0.11K/decade. Over the final 50 years this reduces to 0.08K/decade. Below 1000m the average drift is less than 0.02K/decade at all depths.”*

### 3.4 Figure 15

As the referee suggests, the longitude axes of the panels on Fig. 15 has been reformed to use the same tick interval to make comparison clear.

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Interactive comment on Geosci. Model Dev. Discuss., 8, 521, 2015.

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