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Interactive comment on "MetUM-GOML: a near-globally coupled atmosphere–ocean-mixed-layer model" *by* L. C. Hirons et al.

Anonymous Referee #2

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Title: MetUM-GOML: A near-globally coupled atmosphere–ocean-mixed-layer model

Author(s): L. C. Hirons et al.

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The paper introduces a new U.K. Met Office coupled model framework (MetUM-GOML), which is comprised of a full atmospheric general circulation model and 1-D multi-layer ocean mixed layer model without ocean dynamics. Some preliminary anal-

yses of the mean and variability of the simulated climate are presented to demonstrate the usefulness of the MetUM-GOML. Improved eastward propagation of MJO signal and the North Atlantic spring blocking frequency from the MetUM-GOML compared to the atmosphere only simulations are impressive. The paper is very clearly written, and the MetUM-GOML will be a very useful tool for the climate science community as a whole for investigating the role of air-sea interaction in various aspects of climate and weather.

One aspect, in which the paper can be improved significantly, would be additional comparison with a simulation using the AGCM coupled to a slab mixed layer ocean model, in addition to the comparisons with the atmosphere only simulations. As the authors discussed in the introduction, the AGCM-slab ocean configuration is the most often used experimental design as the intermediate step between the AGCM-only and fully coupled configurations, and the most relevant one to the new MetUM-GOML. Therefore, it would be helpful for the future potential users to demonstrate the advantage of using MetUM-GOML over the AGCM-slab ocean.

Overall, I recommend a minor revision of the manuscript. Additional comments are included below.

1. L.179-185, L6, L789: While the MetUM-GOML configuration is not one of the most commonly used types in climate modeling, it is not the first model with the full AGCM coupled to the 1-D multi-layer ocean mixed layer model. Please refer to the following papers for the similar previous experiments:

Bhatt, U.S., M.A. Alexander, D.S. Battisti, D.D. Houghton, and L.M. Keller, 1998: Atmosphere–Ocean Interaction in the North Atlantic: Near-Surface Climate Variability. J. Climate, 11, 1615–1632.

Alexander, M. A., J. D. Scott, and C. Deser, 2000: Processes that influence sea surface temperature and ocean mixed layer depth variability in a coupled model. J. Geophys. Res., 105, 16823–16842.

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Alexander, M.A., I. Bladé, M. Newman, J.R. Lanzante, N.-C. Lau, and J.D. Scott, 2002: The Atmospheric Bridge: The Influence of ENSO Teleconnections on Air–Sea Interaction over the Global Oceans. J. Climate, 15, 2205–2231.

Cassou, C., C. Deser, and M.A. Alexander, 2007: Investigating the Impact of Reemerging Sea Surface Temperature Anomalies on the Winter Atmospheric Circulation over the North Atlantic. J. Climate, 20, 3510–3526.

Kwon, Y.-O., C. Deser, and C. Cassou, 2011: Coupled atmosphere–mixed layer ocean response to ocean heat flux convergence along the Kuroshio Current Extension. Climate Dyn., 36:11-12, 2295-2312.

2. Figure 1 caption: Please explain which observational dataset is used to calculate the model biases.

3. L388-391: Please discuss a bit more detail on the sensitivity of the model simulation to the choice of the relaxation time scale, e.g. how the results change from 5-day to 90-day time scale, or what objective measure is used to determine the time scale.

4. L423-424: Please briefly explain why the 31-day smoothing is applied.

5. Figures 3-5: It would be worth adding one more panel showing the MetUM-fully dynamical ocean (used in Fig. 1a) minus observation to compare with A-K31 minus observation, which will show the typical biases in a fully coupled model.

6. Figures 3-5, 7-9: Please test the statistical significance of the anomalies and discuss only when they are statistically significant.

7. Figure 6 caption: “interio-gravity” -> “inertio-gravity”

8. Figure 8 caption: “130deg” -> “130degE”

Interactive comment on Geosci. Model Dev. Discuss., 7, 6173, 2014.