Response to Reviewers of GMDD-8-7983-2015, 'Impact of ocean coupling strategy on extremes in high-resolution atmospheric simulations'

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Response to Reviewer #2

This paper is a short study that points out some spurious effects when the surface fluxes in an atmospheric GCM are computed on a coarser grid. In particular, this leads to wind stress vectors that are not always aligned with the surface wind, leading to a mis-representation of extreme events. The problem is demonstrated here with an atmosphere-only GCM, but it should remain present in coupled mode. This problem may not occur very frequently in practice : not all atmospheric models compute surface fluxes on the ocean grid, and it is probably relatively rare to have a coarser ocean resolution, especially now that surface datasets at 0.25? exist. Still, it is something to be aware of when designing the interface of a GCM (along with the converse issues for the ocean with a coarse atmospheric grid). The problem pointed out may not be immediately apparent as the mean state is not impacted, and the paper shows it in a clear and pedagogic way. It should therefore be a valuable addition to the literature on model development.

Reply: Thank you for your positive feedback.

Title could be more specific (fluxes on coarse surface grid... rather than "coupling strategy" when imposed SSTs are used here).

Reply: We have chosen to change the title to 'Impact of surface coupling grids on tropical cyclone extremes in high-resolution atmospheric simulations' in response to both this comment and one from Reviewer #1.

Maybe a comment could be made in the intro or model section on why the fluxes are computed on the surface model grid in the first place ? (History of higher-resolution surface grid presumably). This would fit with the conclusion that fluxes should always be computed on the finest grid.

Reply: We agree. The first paragraph within the coupling section now reads 'Historically, this has not been the case, with the surface model (land, ocean, ice) grids being finer than their (more computationally-intensive) atmospheric counterparts. As computing capabilities improve, and smaller atmospheric grid spacings become more common in simulations utilizing prescribed SSTs and ice data forcing, it's no longer typical for the ocean resolution to be similar or finer in resolution in such setups. Therefore, having the atmospheric grid be the finest in the climate system is the default setup for many high-resolution configurations in CESM.'

***Conclusion, first line**: "atmospheric extreme climatology" is a bit awkward: distribution of extremes in atmospheric circulation ? Or just "strength of tropical cyclones"?*

Reply: To address this, we have changed the passage to read 'This manuscript describes biases in the distribution of atmospheric extremes which arise from choice of ocean grid and coupling strategy in CESM.'

***Figure 5**: Legend does not explain panels (c,f) type of simulation. Note that there are few differences between the (e,f) panels only because the SST used has no smallscale structure; there would presumably be more impacts in the presence of oceanic front or eddies.*

Reply: We have amended the caption to read '... Right panels (c,f) show version of 1° ocean grid where calculations are instead carried out on the finer atmospheric grid. ...' We have also added 'It should be noted that, as discussed earlier, the resolution of the SST forcing data set is 1°, which provides identical spatial forcing across all configurations. If SSTs were provided at the native resolution of each ocean grid, larger differences would be expected between the ne240_ne240 and ne240_gx1v6_reverse configurations due to additional small-scale forcing (such as ocean fronts and eddies) in the ne240_ne240 experiment.' to emphasize the second point.