Geoscientific Model Development Discussions

Interactive comment on "A description of the FAMOUS (version XDBUA) climate model and control run" *by* R. S. Smith et al.

Anonymous Referee #3

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This paper describes a new version (XDBUA) of the low-resolution version of the Hadley centre coupled ocean-atmosphere model, FAMOUS. The basic model FAMOUS is initially described. The manuscript then goes on to outline scientific and technical improvements made from the previous version, ADTAN. The control run from XDBUA is compared to ADTAN, as well as a HadCM3 control climatology and observations.

The focus of the manuscript is ideal for the chosen journal. It is clearly structured, and the descriptions of model changes are well-written and detailed. The introduction explains, albeit briefly, the usefulness of models such as FAMOUS for experiments that examine centennial/millennial scale climate change, or large ensembles, in either case requiring thousands of years of simulation time. Several of the changes made

from the previous version of FAMOUS have been to facilitate long simulations, with transient boundary conditions. Other modifications have been made to improve the climatology with respect to HadCM3 (e.g. the cold bias at high northern latitudes and long term salinity drift), which appear to have appropriate scientific bases. I believe the manuscript makes substantial progress in the development of the FAMOUS model, and should be published and benchmarked. There are several questions and minor corrections I have suggested, which are listed below.

Page 148/9, Introduction. It may be useful to provide some background to allow comparison of FAMOUS with other similar models currently in the literature, and perhaps some more background on current scientific questions that are

Page 151, line 11. Abbreviations such as HadOCC, NPZD etc. are not defined when they are first used. These and other acronyms used in the manuscript should be explained.

Page 152 Line 12. It is not clear to me from the text what the new solution to atmospheric instability was used in XDBUA instead of the additional smoothing applied in ADTAN.

Page 152 Line 20+. The use of a simple iceberg parameterisation is well explained, and it is useful to note that for running different simulations that may have drastically different snow accumulation, this may need rescaling. Is there anything published on this parameterisation for HadCM3 or FAMOUS that could be referred to in this section? Is the model sensitive at all to the location of the water flux?

Page 155 sea ice parameters. The changes to the sea ice parameters seem to have improved the temperatures in the high northern latitudes, and improved Arctic sea ice extent. The Antarctic ice distribution is over estimated, and more so than ADTAN. This doesn't seem to have adversely affected the annual surface air temperatures (Figure 6), but does it affect AABW or seasonal climate?

Figure 4, sea ice plots. The left hand plots give seasonal sea-ice averages. Would it be possible to plot instead the monthly average sea-ice for Arctic and Antarctic? It would be nice to be able to tell if the max and min extents are correctly represented, for example.

Section 4. There is little information about the HadCM3 simulation (and in turn the HadCM3L one too) that is used to compare with XDBUA and ADTAN. Is this simulation published anywhere? If so can the reference be given at the start of section 4? If not, could this section include a few more details about the simulation, such as the length of simulation, and length of averaging performed to get a climatology?

Table 3. In this table the first two columns give differences of ADTAN and XDBUA from HadCM3 regional temperatures. They are all positive values. I assume these are magnitudes rather than giving the direction of anomaly (warmer or cooler), since in Fig. 6 there seem to be both cooler and warmer regions. If this is the case, why not put in whether the anomalies are plus or minus ? this would be more informative.

Figure 13. Is it possible to plot the AMOC for ADTAN, as well as ADBUA and HadCM3? It would be useful to compare the AABW and NADW. The manuscript relating to Figure 14, states that XDBUA has more AABW than ADTAN, is this a consequence of having a larger seasonal cycle and overestimate of sea-ice in this region, out of interest?

Figure 14. There are a couple of questions about this figure, since not all the sub-plots contain data from the same simulations for comparison with XDBUA. Were tracers not included in ADTAN and so are not included in this plot? And why do the middle plots contain data from both HadCM3 and HadCM3L, but the bottom plots of DIC only contain HadCM3L?

Page 163 line 14. There is a small mistake in the sentence: the word 'are' should be deleted.

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