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Geoscientific
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Interactive comment on "The HadGEM2 family of Met Office Unified Model Climate configurations" *by* The HadGEM2 Development Team: G. M. Martin et al.

Anonymous Referee #2

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The paper clearly describes the formulation of the HadGEM2 family of models, the rationale for forming the family, and the relationships among its members. Representative simulation results are presented, and the family is traced via references and brief descriptions of its evolution from HadGEM1. Publication is recommended with revisions and clarifications as discussed below.

Recommended Revisions:

1. On figures comparing models and observations, statistical summaries (bias, RMS difference, correlation) of the differences should be included, similar to those in the description papers for the GFDL CM3 (Donner et al., 2011, J. Climate; Griffies et al.,

2011, J. Climate) and the NCAR CCSM4 (Gent et al., 2011, J. Climate). Statistical summaries would be especially useful for Figs. 4, 6, 7, 11, surface fields of Fig. 12, and 19.

2. For the family members other than HadGEM2-ES, which includes tropospheric chemistry, summarize how emissions are related to sulfate concentrations. Is a simplified representation of the relevant chemistry used to relate DMS and sulfur dioxide emissions to concentrations of sulfate aerosol?

3. Summarize how cloud properties (e.g., drop sizes) depend on aerosols, if they do, i.e., how do the family members treat aerosol indirect effects?

4. On p. 773, briefly indicate the vertical co-ordinate system used. Fig. 2 could be clarified. The panel on the right presumably shows nominal thicknesses for locations without orography.

5. Regarding the precipitation diagnostics (p. 775), is the CMAP analysis the latest version (v. 2)? CMAP v. 2 differs substantially from v. 1. Yin et al. (2004, J. Hyrdometeor.) discuss the relative merits of GPCP and CMAP.

6. Although this paper focuses on the HadGEM2 family, it is interesting to note (p. 777) that HadGEM2-A is capable of producing a correlation of 0.76 between observed and modeled tropical cyclone variability in the North Atlantic, similar to the correlation obtained by Zhao et al. (2009, J. Climate) using a model with a much finer (50 km) horizontal resolution.

7. In Section 4.2.3, the aerosol optical depths on Fig. 7 should be compared with AERONET observations.

8. Regarding the discussion of ENSO metrics (p. 782), note that ENSO amplitudes and periods can vary appreciably over multiple decades (Wittenberg, 2009, Geophys. Res. Lett.). The robustness of the quoted spectrum analysis may depend on the length of the model integrations for which it has been calculated.

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9. The discussion of the terrestrial carbon cycle (pp. 785-786) states that the carbon cycle is included in HadGEM2-CC and HadGEM2-ES. Table 1 indicates that HadGEM2-CCS also includes terrestrial carbon.

10. In Section 4.2.9, the first paragraph states that the tropospheric chemistry scheme has improved the ozone distribution, while the second paragraph describes the interactive distribution as comparable to the prescribed distribution. In fact, Fig. 22 shows some large differences between the prescribed and interactive distributions.

Technical corrections:

p. 776, l. 26: "stratospheric" -> "stratosphere"

p. 783, l. 14: "Table 3" -> "Table 2"

p. 786, l. 26: Text refers to Panel 19c, but Fig. 19 does not have a,b,c,d labels.

p. 790, l. 11: "famiiy" -> "family"

Fig. 14: "contour interval" -> "shading interval"

Interactive comment on Geosci. Model Dev. Discuss., 4, 765, 2011.