

Interactive comment on “Climate model boundary conditions for four Cretaceous time slices” by J. O. Sewall et al.

Anonymous Referee #2

Received and published: 15 July 2007

Most paleoclimate modelers develop boundary conditions using published references and publish these data sets in the context of their model results. Here, Sewall et al. aim to provide a suite of boundary conditions for four Cretaceous time slices that might serve as a standard for the paleoclimate community. This is a worthwhile and valuable endeavor. However, this contribution fails to: 1) adequately explain the procedures used for modifying the geologic/oceanographic data sets, 2) provide new geological data compilations or geological insights, and 3) provide data sets at a resolution that could be easily used in future studies. All of these shortcomings can be overcome but require extensive modification of the present manuscript.

Major comments: 1. p. 795. paragraph 1. The authors state that the datasets were “manipulated” and then describe these modifications in very general terms. My guess

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is that the authors actually used systematic rules to develop their boundary conditions. These rules should be described in detail. For example, the authors list the expansion of narrow ocean gateways as one alteration. To what width were the gateways altered? How exactly was internal drainage modified? What are the exact numerical difficulties with narrow gateways and internal drainage? These boundary conditions should be reproducible. As written, this is not possible. The authors should also reference previous publications that have described the development of boundary conditions (e.g. see Tectonic Boundary Conditions for Climate Reconstructions and references therein).

2. p. 795, paragraph 2. Describe the pole problem. Climate modelers will be familiar with this problem, but the general reader (geologist, oceanographer) may not be.

3. p. 796, paragraph 1. The authors chose to systematically vary the presence/size of the Cretaceous Interior Seaway from the early to late Cretaceous, and suggest that this will allow for sensitivity experiments that capture the response to geographic changes. I don't entirely agree with this logic. To capture the sensitivity to the presence/absence of the Cretaceous Interior Seaway, all other geographic conditions should remain constant and only the seaway should change. I would suggest publishing multiple versions of each time slice within different seaway constructions with some indication of the "best" or "most likely" boundary conditions.

4. p. 797, p. 1. The boundary conditions are provided as a 2.8 x 2.8 gridded data set. This may be relatively high resolution today, but doesn't reflect the resolutions that will be used in the future (even the very near future). If this is truly a resource for the paleoclimate community, I would suggest that the authors provide Cretaceous data sets at a higher resolution (1.0 x 1.0) that could then be easily interpolated to lower resolutions. The authors might also indicate what the limit on resolution is. For example, would any geologist believe a data set gridded at 0.1 x 0.1?

5. p. 798, p. 2. "based on expected, large-scale climate patterns" Again (see comment 1), specific rules should be described in detail. This should be reproducible!

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6. p. 796, p. 2. In this paragraph, the authors describe their decision to limit the Cretaceous Interior Seaway since Blakey and Scotese disagree and their Turoonian/Cenomanian reconstruction has an open seaway. I am a bit alarmed by this logic. Shouldn't it be based on geologic evidence (e.g. White et al., 2000)? In general, I find this contribution to offer little new data or data compilation. Most of the boundary conditions (particularly paleogeography) are based on global data sets that already exist and are currently used and referenced by the paleoclimate community.

Minor comments: 1. p. 793, paragraph 1. The choice of references in the first sentence is peculiar. I would recommend either citing the early pioneers of paleoclimate modeling (especially Barron, Kutzbach, Crowley, but also including Otto-Bliesner, Valdes) or, since this manuscript focuses on the Cretaceous, those researchers that have published Cretaceous paleoclimate studies (Barron, Valdes, Brady, Poulsen, Bice, DeConto, etc.).

2. p. 793, paragraph 2. The development of boundary conditions is a non-trivial task for anyone. The phrasing of this section seems to imply that geological or paleontological training is required. Yet, in this paper, the development of the boundary conditions relies completely on published references. I would edit this section so that it doesn't seem to slight non-geologists.

3. p. 796, paragraph 1. The sinking of islands is justified on the basis of computational expense. It would be useful to give the reader (i.e. the non-modeler) an idea of how expensive the islands are and how long simulations usually run.

4. p. 793, paragraph 2. "In the AlbianĚ" This is a typographical error. Blakey created his boundary conditions in the present day, not the Albian.

5. p. 798, paragraph 2. Could the biomes be summarized in a table? The authors might also consider including additional information, such as the albedo, roughness, etc., that they think is appropriate for each biome.

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6. p. 799, paragraph 1. “Expert commentary was then integrated into the final paleovegetation distribution.” What does this mean? Please describe the decisions/suggestions made by the experts.

Interactive comment on Clim. Past Discuss., 3, 791, 2007.

CPD

3, S452–S455, 2007

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