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Climate of the Past Discussions

Interactive comment on "The Aptian evaporites of the South Atlantic: a climatic paradox?" *by* A.-C. Chaboureau et al.

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1 General Comments

The MS by Chaboureau et al. aims to explain the mineralogical difference between evaporite salts found in the northern part of the opening South Atlantic and the more southern latitudes of this basin. They content that the northern evaporites have been deposited under wet humid conditions, and are likely of hydrothermal origin. As such, they caution that evaporites are not necessarily a good climate indicator. Their argument is primarily supported by the results of a climate model.

The overall argument is believable, bur there are several shortcomings in the MS, which

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should be addressed in order to strengthen their argument:

- The occurrence of the mineralogical distinct evaporites is not well presented.
- The mineralogical differences and their significance is only touched upon. This requires a more substantial discussion which also incorporates more modern ideas about the origin of calcium chloride brines (e.g., Lowenstein et al. 2003).
- Ground truthing a climate model is always difficult, but the authors should at least attempt to compare their results to other published models (e.g., Wold or Barron). I also miss some general benchmark values, e.g., the latitudinal temperature profile, or the resulting sea surface temperature. A discussion of these parameters (see e.g., Hay 2008, and much of Barrons work) would provide a useful context to judge the validity of their model.
- The northern part of the basin was rather small, and indeed smaller than the grid resolution of the model used by the authors. How will this affect the validity of their results?
- Most importantly however, the authors reasoning depends critically on their choice of paleogeographical model. In most published paleogeographic reconstructions, the bulk of the evaporites was deposited between 10 and 40S, whereas Chaboureau et al. use the model by Moulin et al. 2010, which proposes paleolatitudes between 0 to 20S for the Aptian Salt basins. While it is beyond my abilities to judge the validity of Moulin et al. 2010 paleolatitudes, it must be mentioned that paleolatitude estimates are particularly difficult and error prone. Since the main point of the MS, i.e., how to create evaporite deposits under tropical conditions, may not even exists if we choose another paleogeographical reference frame, the authors should provide a discussion, of why this particular paleogeographical model was chosen, what kind of confidence interval

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one can assign to the latitudinal values given in the model, and how that would affect their modeling efforts. In my view the authors should also supply model results for an alternative paleo-latitudinal model, and frame the discussion of their results accordingly.

2 Specific Comments

1. p123 l23: To my knowledge, the bulk of the evaporites have been deposited during the Early Aptian (see e.g., Wortmann & Chernyavsky 2007). What is the relevance of the Mid-Cretaceous climate here?

2. p 123 l 29, this is indeed interesting, and a location map would be really useful to support this point.

3. p 124 l 23, why the upper Aptian? The majority of the salt extraction happened during the lower Aptian?

4. p 125 l 6, the longitudinal resolution of the atmospheric model is smaller than or equal to the basin with. How will this affect the modeling of evaporation rates?

5. p 125 l 14ff: If understand this correctly, the authors propose several important changes to the topographic model of Sewall 2007, and provide only scant justification why. More importantly, they do not provide model results based on the original Sewall 2007 model, so it is difficult to understand how these changes affect their model.

6. p 128 l 15: Is the model resolution really sufficient to evaluate whether local moisture uptake over the rift basin is sufficient to create substantial orographic rain at the rift shoulders? The comparison with India is not valid here, as the Indian monsoon has the whole Indian Ocean to fetch moisture, and a strong driving

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force (i.e., the trade winds). Furthermore, the moisture balance over land is critically controlled by vegetation. What kind of biomes where used in the model, and is there any evidence for comparable Aptian vegetation at these locations?

7. p 131, l 6: why are clastic rocks a proxy for humid conditions? can this be substantiated?

8. p 132 l 3: I miss a discussion of Lowenstein 2003?

9. p 132, l23: The rift shoulders around the Red Sea exceed 2.5km in elevation in many places – and this is under arid conditions. Intense rainfall would result in erosion and accelerated uplift. So why is 3km an extreme value?

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