

Interactive comment on “Simulated climate variability in the region of Rapa Nui during the last millennium” by C. Junk and M. Claussen

Anonymous Referee #2

Received and published: 19 March 2011

Junk & Claussen use the output of two ocean-atmosphere general circulation models with time dependent forcings, including volcanic and solar variability, for the period ~800-1750 AD, as well as a control run with constant forcing, to evaluate whether climate may have been a contributing factor in the demise of civilization of Easter Island. None of the model runs produced temperature or rainfall changes in the vicinity of Easter Island that were statistically significant, or large enough to produce the change in vegetation from palm woodland to grassland that occurred between ~1200 AD and 1722 AD. The authors conclude that factors other than climate were most likely the cause of the alteration of the vegetation on Easter Island. This seems like a reasonable interpretation of their model results.

My main problems with the paper pertain to the models themselves, and their use in

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evaluating local climate changes on Easter Island, which is far smaller than a grid box in the models. One model produces about half the precipitation that occurs on Easter Island today, seemingly making it a rather poor tool even for a sensitivity analysis. The authors should show a map of the model precipitation in the tropical Pacific, akin to the climatological data in Fig. 1. Do either of the models reproduce the modern pattern of precipitation in the tropical Pacific? I.e., do they have an ITCZ, an SPCZ and an eastern Pacific dry zone? If they don't reproduce those primary features of the precipitation field in the modern climate it is hard to imagine them producing credible rainfall changes in a single grid box under a different climate forcing regime. Likewise with ENSO. Do the models demonstrate a true ENSO-like behavior? If not, why would the model Nino-3.4 SST time series be informative?

I do not know if these issues can be addressed in a revised paper. But if the authors attempt to do so, I would recommend that they consider the effect of a change in the position of the ITCZ during the Little Ice Age period. Several recent studies have indicated that the ITCZ was as much as 500 km closer to the equator during the LIA than it is today (Haug et al., 2001; Newton et al., 2006; Sachs et al., 2009; Tierney et al., 2010). If this were imposed in their models, what are the implications for even large-spatial scale rainfall patterns in the south Pacific? This is the type of “sledge hammer” forcing that might produce a model response in the region of Easter Island that is statistically significant. Obviously, what caused the ITCZ migrations is another question altogether.

Interactive comment on Clim. Past Discuss., 7, 381, 2011.

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