Clim. Past Discuss., 3, S779–S782, 2008
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Climate of the Past Discussions

CPD

3, S779–S782, 2008

Interactive Comment

Interactive comment on "Modeling a strong East Asian summer monsoon in a globally cool Earth, the MIS-13 case" *by* Q. Z. Yin et al.

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Received and published: 16 January 2008

We appreciate the referee for her/his comments. We answer and discuss these comments as following.

1. "The 495 ka climate is significantly different from the control as in previous literatures".

Many experiments have indeed been made for understanding the climate response to the astronomical forcing. Most of them are however related to:

(1) glacials (mostly the LGM) as for example in Kutzbach J.E. and Guetter P.J., 1986. J. Atm. Sc., 43(16), 1722-1758; Masson V. et al., 2000. Geophys. Res. Letters, 27(2), 1747-1750; Yanase W. and Abe-Ouchi A., 2007. Climate of the Past Discc., 3, 655-678.

(2) Holocene as in Kutzbach J.E., 1981, Science, 214, 59-61; De Menocal P.B. and D. Rind, 1993. J. Geophys. Res., 98(D4), 7265-7287; Ohgaito R. and Abe-Ouchi A., 2007. Clim. Dyn., 29, 39-50.

(3) both glacial and Holicene in Braconnot P. et al., 2007. Climate of the Past, 3, 261-277.

(4) the whole last glacial-interglacial cycle, as in Prell W. and Kutzbach J.E., 1987. J. Geophys. Res., 93(D7), 8411-8425.

(5) the Eemian in Duplessy et al., 2007. Science, 316, 89-91.

As far as we know, nothing has been done yet for older interglacials, in particular testing the response of the climate model to two opposite astronomical forcings under the same boundary conditions (495 versus 506 and 529 ka BP).

2. "Small region of eastern China"

The analysis presented here focus indeed over East China because we would like to understand primarily the Chinese paleoclimate records that are related to the EASM (Yin and Guo, 2007, Climate of the Past Discuss., 3, 1119-1137). Although the different monsoon regions of the EASM are not unambiguously defined, we used Wang et al., 2003 (Marine Geology, 201, 5-21) as a reference for the East Asia subtropical Monsoon (22.5-45°N, 105-140°E). This does not prevent us to show a global view of our results in figure 2. Although we have restricted our study to Eastern China, a more complete analysis shows many regions with significant changes in response to the different forcings of Table 1(Yin, 2007. FNRS report and Inst. of Astr. And Geophysics G. Lemaître, UCL, Louvain-la-Neuve, Sc. Report, Sept. 2007). It would be interesting to analyse these anomalies also (we show some in our paper) but it is out of the scope of our present discussion.

3. (i)"Presumably insignificant responses". (ii) page 1268 "it is not anticipated8230; anomalies are significant".(iii) page 1269 "different models.....different conclusions".

(iv) page 1273 "regional scale responses very sensitive ......"

The reviewer raises here a fundamental question related to the significance of our results. An answer to this problem is not trivial and deserves a few explanations depending what you are looking for in a simulation experiment. The reviewers doubt of the significance of the effect of the ice sheet on South-East Asian monsoon precipitation.

First, it is useful to define what is meant by "significance". Significant may mean: statistical significance. Clearly, we have shown that the effect of the ice sheets on East-Asian China precipitation is much larger than the interdecadal variability. Remember that we use 100-yr averages, and that we checked that the signal was robust across different choices of the averaging period, or to slight changes in the boundary conditions. Clearly, the signal is statistically significant.

The second question is whether the signal is, or is not, model dependent. Here we would like to re-emphasise the overall idea of this paper. The wave train is an expected solution of the beta-plane quasi-geostrophic atmosphere (barotropic or baroclinic), as emphasised in the works of Hoskins. In fact, we should have been surprised not to see it. It happens in LOVECLIM that this wave-train positions itself such as to reinforce both summer and winter EA monsoons. This surprising result attracted our attention. We explored the mechanisms of the wave-train phase locking (see in particular the discussion about the role of the Tibetan Plateau) and found an overall plausible explanation to it. This is the message we wanted to convey to the scientific community. We are now impatiently waiting if other models will confirm these first results.

4. Page 1264 "Control Climate"

The control climate is indeed important in any sensitivity experiment. LOVECLIM has already been used in many sensitivity experiments and the control climate been shown and discussed. For example, temperature and precipitation maps for LOVECLIM and reanalysis are in Renssen et al., 2002 (Paleoceanography,17(2), 1020, 10.1029/2001 PA000649). In these maps, the data and model results are in good qualitative agree-

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ment, although the model generates a too high temperature in East Asia and precipitations are underestimated in the tropics. In addition to this kind of information, we have also discussed the Pre-Industrial and present-day simulations for the geopotential and wind fields for both January and July. In LOVECLIM, the surface temperature in January is pretty well reproduced with two main centres of low temperature located over eastern Siberian and the Tibetan Plateau. In both the simulation and the observations, temperature extends from -40°C in the north over Siberia to 18°C south of China. In July, the main discrepancy is a too warm climate over eastern China. The seasonal character of the precipitation over East Asia is well simulated, but July precipitation is underestimated over South China, and the main rain belt is located more south as compared to NCEP data. The seasonal characteristics of the 800hPa geopotential height over East Asia is well simulated in LOVECLIM. In January, LOVECLIM simulates a high pressure over land centred over the Tibetan Plateau. In July a low pressure is simulated over continental East Asia and a high pressure over the North Pacific. Consistently, the northwesterly wind in January and the southeasterly and southwesterly winds in July (shown by the NCEP data) are well simulated.

Interactive comment on Clim. Past Discuss., 3, 1261, 2007.