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Climate of the Past Discussions

Interactive comment on "Holocene evolution of the Southern Hemisphere westerly winds in transient simulations with global climate models" *by* V. Varma et al.

Anonymous Referee #1

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Varma et al. study the Holocene trend in the position and strength of the southern hemispheric westerlies using 3 AOGCMs and 2 EMICs. All the models generally agree with an annual strengthening and poleward shift of the westerlies during the Holocene. This change in the westerlies is associated with a cooling at high southern latitudes.

The paper shows a nice agreement between the different models, is generally well-written and displays informative and high quality figures. I would recommend it for publications in CP, but I would like the authors to again look closely at the analysis of the results.

The authors suggest that the strengthening and poleward shift of the westerlies is due

an enhanced temperature gradient in the southern hemisphere (p1807, L 26; p1808, L4).

I am a little confused as I would think that the strongest temperature gradient is obtained in the models in SON. This is the season that displays the strongest cooling at high latitude (fig7, blue) due to the insolation decrease. Therefore if you think that the strength of the westerlies depends on the temperature gradient, you would except the greatest westerly increase during the SON. On the contrary, as seen in figure 5, a weakening and equatorward shift of the westerlies is obtained during SON. Similarly, a warming is obtained at hight latitudes in MAM (fig7, red for CCSM3, ECBILT-CLIO), which would indicate the weakest temperature gradient. COSMOS also displays a weak temperature gradient for MAM. And on the contrary the westerlies are the strongest during MAM (fig5, red) in all the models (except CLIMBER).

In addition, temperature gradients driving changes in the westerlies do not apply for LGM conditions (Rojas et al. 2008). Despite a greater surface temperature gradient during the LGM, about half of the PMIP models show a weakening of the westerlies. Rojas et al. 2008 attributed this weakening to a decrease in the tropospheric temperature gradient. Maybe the authors could comment a little more onto why temperature gradient changes would drive SWW changes during the Holocene but not during the LGM.

Interactive comment on Clim. Past Discuss., 7, 1797, 2011.