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Glacial Maximum climate in the SE Pacific sector as reconstructed by PMIP2 simulations

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Our objective is to understand the history of the Southern Hemisphere westerlies (SHW) and their influence at continental, hemispheric, and global scales. The SHW are a key component of the global climate system. Results from ocean-only and fully interactive ocean-atmosphere numerical models have led to the idea that variations in the SHW may have triggered changes in the amount of carbon dissolved in the Southern Ocean, the extent of Antarctic sea ice, and global thermohaline circulation. Furthermore, it has been proposed that changes in the latitudinal position and strength of the SHW may have exerted a positive feedback on glacial-interglacial transitions through changes in atmospheric CO2 (Imbrie et al., 1992; Toggweiler and Samuels, 1995, Toggweiler et al, 2005).

Here we present analyses of the Paleoclimate Modelling Intercomparison Project 2 (PMIP2) simulations for the Last Glacial Maximum (LGM, 21,000 years before present). We focused our analysis on three models (the UK Met. Office HadCM3, MIROC, and the NCAR CCSM) with respect to their simulations of the SHW, with special emphasis on the SE Pacific sector and adjacent South America (30-54S). All models produce a drop in surface temperatures over Patagonia, ranging from 2-10 degrees (depending on model and season), which is consistent with paleoclimate estimates of 6-8 degrees in mean annual temperature depression during the LGM (Heusser et al. 1999, Moreno et al. 1999, Moreno and Leon 2004, Kaiser et al. 2005). With respect to precipitation changes, the three models predict a drier southern tip of the continent. CCSM predicts almost no change over the rest of the region, whereas HadCM3 and MIROC predict a northward shift of the precipitation belt, especially during the

austral winter. The latter results are in broad agreement with paleoclimate estimates from western South America between 33-42S (eg. Heusser et al. 1999, Moreno et al. 1999, Moreno and Leon 2004, Lamy et al. 1999, Valero-Garces et al., 2005), which indicate a substantial increase in precipitation of westerly origin. Indicators of storm track activity show a narrowing of the band of maximum activity during the LGM, compared to present day.

Despite some inter-model differences, the PMIP2 simulations provide a clearer picture of large-scale climate and paleocirculation during the LGM when compared to previous GCM simulations, and offer the opportunity to examine the contribution of the SHW to continental, hemispheric, and global climate change during the last glacial-interglacial transition.