



Postglacial changes of the Southern Hemispheric Westerly Wind belt

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Postglacial changes in the latitudinal pattern and intensity of the Southern Hemispheric Westerly Wind Belt (SHW) are still poorly constrained and discussed controversially. Here we address the postglacial SHW evolution based on new and also published data from the southwest coast of South America between 33 and 54°S. Three marine and one lacustrine sediment core from different sites along the fjord system near the westernmost Strait of Magellanes (53°S) show low accumulation rates of biogenic carbonate and high accumulation of minerogenic and organic terrestrial components between 12 and 8.4 kyr BP. These proxies indicate relatively strong precipitation and related low salinities of superficial coastal water and point to strong winds in this central zone of the SHW during this warmest postglacial period in the early Holocene. At the northern margin of the SHW, marine and lacustrine sediment cores and pollen records from the coastal zone off Chile between 33-40°S suggest reduced precipitation and weak westerlies for this period. Taken together, these data are consistent with a southward displacement of the SHW after the Late Glacial and an intensification in its central sector. Our results are apparently in contrast with recently published pollen records from the eastern flank of the Andes between 51-53°S indicating a westward migration of the forest-steppe transition due to reduced westerly rainfall (Villa-Martinez & Moreno 2007; Mayr et al. 2007). We suggest, however, that this vegetation retreat can be explained by increased foehn-induced drought stress on the lee-side of the Andes due to stronger westerly winds. Between 8.4 and 7.9 kyr BP, the Magellanes cores suggest a sudden and strong weakening of the SHW, which could be related to the pronounced 8.2 kyr cold event in the Northern Hemisphere, associated also with a southward migration of the ITCZ. Between 7.9 and 5.5 kyr BP our southern records indicate again stronger westerlies. After around 5.5 kyr BP and during the Neoglacial, the Magellanes sediment cores and new stalagmite records from this area indicate a weakened, but also much more variable SHW, while at that time pollen records from east of the Andes suggest forest expansion towards the steppe, probably caused by less wind-induced drought stress. At the northern SHW margin, various records document increased rainfall, indicating a general northward displacement of the SHW during the late Holocene. Sediment and stalagmite proxies from the Andes between 50-53°S indicate that the coldest and driest Neoglacial phase occurred between 3.5 to 2.5 kyr BP, while at the same time stronger westerlies are recorded from the northern SHW margin. At around 2 kyr BP and during the Medieval Warm Period stalagmite records indicate relatively strong SHW, while the records at the northern SHW margin indicate less SHW influence. Our comparison of SHW records from the northern margin and the central part of the westerlies show that northward (southward) latitudinal displacements of the margin are coupled to reduced (intensified) westerly activity in the center over southernmost South America. Changes in both regions occurred simultaneously on both orbital (insolation-controlled) and millennial (solar variability?) time-scales.