

The Southern Westerlies Since Fullglacial (LGM) Times

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Comparing pollen records from the southern Andes from latitudes 35 to 55°S changes in the latitudinal position and strength of the westerly stormtracks can be reconstructed. Apparently during LGM times the stormtracks were focused between latitudes 41 and 43°S, i.e. poleward of the present-day winter-rain region and equatorward of today's maximum precipitation region. Despite the focusing, precipitation was reduced by perhaps as much as 50%, probably related to the markedly colder South Pacific sea surface temperatures. In addition, Antarctic cold air outbreaks were more frequently reaching low latitudes, bringing moisture to the mid-latitudes (35 to 40°S) east of the Andes. In a step-wise fashion, first by 14,000 yr B.P. (16,500 cal yr B.P.) and then by 12,500 yr B.P. (14,500 cal yr B.P.), temperature and precipitation increased throughout the whole latitudinal band. Quantitatively, however, the precipitation increase was strongest at mid-latitudes (40 to 45°S), suggesting that the stormtracks continued to be focused in that region. By 9000 yr B.P. (10,000 cal yr B.P.) stormtracks had shifted poleward, where they focused between latitudes 45 and 50°S, reducing moisture at mid-latitudes. Only after 5000 yr B.P. did the present-day latitudinal shifting in the stormtracks develop, leading to the present-day latitudinal distribution of the precipitation.

Different Atmospheric General Circulation Models (AGCM) confirm the LGM poleward displacement of the zonal maximum of the westerly stormtracks (Kutzbach et al. 1993; Wyrwall et al. 2000). This behavior markedly contrasts the Northern Hemisphere westerly stormtracks, which at LGM times had shifted equatorwards of present-day winter-rain region. The differences in Northern and Southern Hemisphere behavior is related to the different influences; for the Northern Hemisphere the Laurentide Ice Sheet forced the stormtracks equatorwards, whereas for the Southern Hemisphere the extended Austral-Asian landmass was responsible for the focusing of the stormtracks and the relatively small latitudinal shift.