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Solar-induced shifts of the Southern Hemisphere westerly wind belt

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The Southern Hemisphere westerlies constitute an important zonal circulation system that influences large-scale precipitation patterns and the global ocean circulation. Understanding the variability and forcing of the westerly wind belt on interdecadal–to-millennial timescales is therefore of great importance. A high-accumulation rate marine sediment core from the Chilean continental slope provides a mid-to-late Holocene record of rainfall variability in southern Chile related to the position of the southern westerlies (Lamy et al. 2001). A correlation analysis reveals that shifts in the westerlies are strongly related to changes in solar activity on a multi-centennial timescale during the last 3000 years. Depending on the solar activity reconstruction used, linear correlation coefficients vary between 0.49 and 0.60. To study the influence of solar activity on Southern Hemisphere westerly wind shift in a state-of-the-art global climate model, experiments with the Community Climate System Model CCSM3 were carried out with pre-industrial boundary conditions along with different solar irradiance values (1365 W/m$\hat{2}$ and 1363 W/m$\hat{2}$). The model results support the northward shift of south westerly winds postulated for lower solar activity. Based on these results we infer that enhanced solar activity may have contributed to the observed southward movement of the Southern Hemisphere westerlies during the past decades, albeit to a much lesser degree than global warming and/or the Antarctic ozone hole.