



The evolution of the Southern Hemisphere climate within transient simulations of the Holocene

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The Southern Hemisphere Assessment of PaleoEnvironments (SHAPE) project aims to reconstruct and understand past changes in the atmospheric and oceanic circulation of the Southern Hemisphere. Within this context, climate modelling plays a critical role in testing the interpretation of the proxy data and exploring the underlying dynamical mechanisms.

Here, we analyse a suite of transient simulations of the Holocene climate. These are generated using state-of-the-art climate system models, and include simulations conducted by Phase Three of the Paleoclimate Modelling Intercomparison Project. We examine the changes in the atmospheric circulation and surface temperature.

The majority of the models simulate a progressive strengthening and poleward shift in the position of the Southern Hemisphere westerly winds (SHWW) during the Holocene. This trend is accompanied by cooling over Antarctica and the Southern Ocean, combined with a deepening and a poleward contraction of the circumpolar trough. The results are sensitive to the spatial resolution of the models and to the combination of forcings applied, with the lowest-resolution model simulating no changes in the location of the westerly wind belt.

There is strong seasonality in the simulated response of the SHWW to external forcings, and also in the relationship between the SHWW and local climate. This needs to be taken into account when using palaeoclimate proxies to reconstruct changes in the SHWW during the Holocene.