Environmental variability and change during the Medieval Climate Anomaly (MCA; ~800 to 1300 - 1400 CE) in the Southern Hemisphere has been characterized by a La Nina-like mean climate state in the Pacific Basin, largely deduced from proxy records located in the equatorial and tropical Pacific Ocean. Little attention has been placed on the atmosphere/ocean circulation anomalies that forced the interpreted temperature and precipitation patterns seen across the Southwest Pacific region. In this paper, we reconstruct the circulation anomalies in the atmospheric planetary waves across the extra-tropical Australasian and Pacific sectors of the Southern Hemisphere. These circulation patterns are derived from a synoptic climate typology related to regional MCA climate anomalies, including: Eastern Australian wave climate; subtropical sea-surface temperature anomalies from corals; New Zealand precipitation from tree ring, speleothem and glaciosedimentary records; South Polynesian voyaging and migration routes; Southern Australian mega-lake hydrology; extratropical sea-level pressure anomalies derived from East and West Antarctic ice core glaciochemistry; and Antarctic lake hydrological balance and katabatic wind records.

The proxies define five intervals of different atmospheric circulation anomalies: (i) ~600 to 1000 CE, (ii) ~1000 to 1150 CE, (iii) 1150 to 1250 CE, (iv) 1250 to 1350 CE and (v) ~1350 to 1550 CE. The broadscale anomalies define a poleward and subsequent equatorward migration of the Hadley Cell, combined with a low-frequency progression in the phases of the dominant extratropical climate modes like the Pacific-South American (PSA) and the Southern Annular Mode, which generate regionally distinct atmospheric pressure anomalies across the mid-latitudes.