

Early-nineteenth century southern African precipitation reconstructions from ships' logbooks

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Detailed investigations of past rainfall variability are essential for understanding how recent rainfall levels differ from long-term averages. Instrumental rainfall records in southern Africa, however, only become plentiful in the 1880s, and are absent over much of the continent until the early 1900s. This study presents a statistical methodology used to produce seasonal terrestrial rainfall reconstructions in southern Africa from early-nineteenth century marine wind data held within the CLIWOC database and digitised English East India Company logbook data (Hannaford et al. 2015). We obtained these reconstructions by first relating gridded 8° x 8° NCEP-DOE reanalysis seasonal mean wind vectors in the oceans surrounding southern Africa to station-based precipitation over a 30-year calibration period (1979-2008). This revealed significant correlations between southwest Indian Ocean zonal winds and summer precipitation at the stations of Mthatha (Eastern Cape) and Royal National Park (KwaZulu-Natal), and southeast Atlantic Ocean zonal winds and winter precipitation at Cape Town (Western Cape). We then derived the reconstructions using principal component regression with the reanalysis wind vectors as predictors, and applying the regression relationships to the equivalent gridded seasonal mean logbook data over the period 1796-1854. The reconstructions show good correspondence with other regional proxy-documentary reconstructions, while their integration into a southern African multi-proxy rainfall reconstruction suggests that summer precipitation has been declining progressively over the last 200 years (Nash et al. 2015). A westerly index produced from the oceanic areas with significant wind-rainfall correlations also reveals correspondence between documentary-derived reconstructions of El Niño events and increased westerliness, though these events did not always result in drier conditions in the subcontinent.

Hannaford, MJ, Jones, JM, Bigg, GR. 2015. Early-nineteenth century southern African precipitation reconstructions from ships' logbooks. *The Holocene*, 25, 379-390.

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