Century Length Seasonal Southern Annular Mode Reconstructions

Julie Jones (1), Ryan Fogt (2), Martin Widmann (3), Gareth Marshall (4), Phil Jones (5), and Martin Visbeck (6)

(1) Department of Geography, the University of Sheffield, Sheffield, UK (julie.jones@sheffield.ac.uk), (2) Department of Geography, Ohio University, Athens, Ohio, USA (fogtr@ohio.edu), (3) School of Geography, Earth and Environmental Sciences, University of Birmingham, Birmingham, UK (m.widmann@bham.ac.uk), (4) British Antarctic Survey, Cambridge, UK (gjma@bas.ac.uk), (5) Climatic Research Unit, University of East Anglia, Norwich, UK (p.jones@uea.ac.uk), (6) Leibniz Institute for Marine Sciences (IFM-Geomar), Kiel, Germany (mvisbeck@ifm-geomar.de)

Seasonal reconstructions of the Southern Hemisphere Annular Mode (SAM) index are derived to extend the record before the reanalysis period, using station sea level pressure (SLP) data as predictors. Two reconstructions using different predictands are obtained, one (JW) based on the first principal component (PC) of extratropical SLP and the other (Fogt) on the index of Marshall (2003). A regional-based SAM index (Visbeck 2009) is also considered.

These predictands agree well post 1979; correlations fall in all seasons except austral summer for the full series starting in 1958. Predictand agreement is strongest in spring and summer; hence agreement between the reconstructions is highest in these seasons. The less zonally symmetric SAM structure in winter and spring influences the strength of the SAM signal over land areas, hence the number of stations included in the reconstructions. Reconstructions from 1865 were therefore derived in summer and autumn, and from 1905 in winter and spring.

The skill of each reconstruction is investigated by comparison with observations and reanalysis data. Some of the individual peaks in the reconstructions, such as the most recent in austral summer, represent a full hemispheric SAM pattern, while others are caused by regional SLP anomalies over the locations of the predictors. The JW and Fogt reconstructions are of similar quality in summer and autumn, while in winter and spring the Marshall index is better reconstructed by Fogt than the PC index is by JW. In spring and autumn the SAM shows considerable variability prior to recent decades.