

Long-term Correlations in the Trans-Polar Index

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Abstract. Extratropical atmosphere circulation in the Southern Hemisphere is poorly understood because of the scarce climate data from these latitudes. The only pressure-based extratropical Southern Hemisphere circulation index in regular use is the Trans-Polar Index (TPI). TPI measures the eccentricity of the polar vortex around the South Pole. It is defined as the normalized pressure difference between Hobart, Australia and Port Stanley, Southern Atlantic Ocean.

We study long-term correlations in a monthly record of the TPI over a period of 120 years (from January 1895 to December 2014). We apply the detrended fluctuation analysis (DFA) method to quantify correlations. We observe weak persistence in the TPI on time scales up to several years. We find that the scaling properties of the TPI are not temporally invariant but change in time. Specifically, in the middle of the 20th century (the time period 1930-1965) TPI exhibits long-term correlations up to at least 9 years, while for the preceding and following periods of the 20th century long-term correlations are observed only up to much lower time scales.

We compare the scaling properties of TPI with scaling properties of other indices of climate variability. Interestingly, we observe that the temporal change in the scaling properties of TPI resembles that for the North Atlantic Oscillation (NAO) index. This finding indicates (i) possible relation between the southern extratropical atmospheric dynamics and the Northern Atlantic atmospheric dynamics or (ii) possible common mechanisms controlling TPI and NAO variability.