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Atmospheric and oceanic transport of multi-year ENSO signals to polar regions detected by MC-SSA and waveletcoherence methods

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We provide evidence of ENSO influence on the winter climate variability in NH during the last 150 years via signals in the 2.2, 3.5, 5.7 and 13.9 year bands. Using Monte-Carlo Singular Spectrum Analysis (MC- SSA) and Wavelet Transform (WT) we separate statistically significant components from time series and demonstrate significant co-variance and consistent phase differences between ice conditions and the Arctic Oscillation and Southern Oscillation indices (AO and SOI) at 2.2, 3.5, 5.7 and 13.9 year periods. The 2.2, 3.5 and 5.7 year signals detected in the Arctic are generated about three months earlier in the tropical Pacific Ocean. In contrast, we show that the 13.9 year signal propagates eastward from the western Pacific as equatorial coupled waves (ECW, 0.13-0.15 ms-1), and then as fast boundary waves (1-3 ms-1) along the western margins of the Americas, with a phase difference of about 1.8-2.1 years by the time they reach the Arctic. Our results provide evidence of dynamical connections between high latitude surface conditions, tropical ocean sea surface temperatures mediated by tropical wave propagation, the wintertime polar vortex and the AO.