

To the two ends of the Earth: Arctic and Antarctic sea ice variability and environmental change

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We examine the evolution of sea ice extent (SIE) over both polar regions for the 35-year period November 1978 to December 2013, as well as for the global total ice (Arctic plus Antarctic). Our examination confirms the ongoing loss of Arctic sea ice, and we find significant ($p < 0.001$) negative trends in all months, seasons and in the annual mean. The greatest rate of decrease occurs in September, and corresponds to a loss of $3 \times 10^6 \text{ km}^2$ over 34 years. The Antarctic shows positive trends in all seasons and for the annual mean ($p < 0.01$), with summer attaining a reduced significance ($p < 0.10$). Based on our longer record (which includes the remarkable year of 2013) the positive Antarctic ice trends can no longer be considered small and the positive trend in the annual mean of $15.29 \pm 3.85 \times 10^3 \text{ km}^2 \text{ year}^{-1}$ is almost one third of the magnitude of the Arctic annual mean decrease. The global annual mean SIE series exhibits a trend of $-35.29 \pm 5.75 \times 10^3 \text{ km}^2 \text{ year}^{-1}$ ($p < 0.01$). Finally we offer some thoughts as to why the SIE trends in the CMIP5 simulations differ from the observed Antarctic increases.