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Climatology and recent change of westerly winds over the Amundsen Sea Embayment derived from six re-analyses

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The observed acceleration of glaciers from West Antarctica into the Amundsen Sea is estimated to be contributing 6% to current sea-level rise with the estimated potential to add 0.24 m to global sea level. Stronger westerly winds over the Amundsen Sea can divert relatively warm ocean currents to the base of ice shelves that flow from glaciers into the Amundsen Sea. Winds are therefore a potentially important factor in driving the observed acceleration of glaciers. However, the climatology of winds in the region has not been extensively studied due to a lack of in-situ observational long-term records. Here six different re-analysis datasets are assessed (CFSR, ERA-40, ERA-Interim, JRA-25, MERRA and NNR1) to determine a best estimate of variability and change since 1979 when the widespread monitoring of the atmosphere from satellites was introduced. A comparison with independent mean sea level pressure (MSLP) data from ice drifting buoys shows that ERA-Interim is clearly the most accurate at capturing the details of individual weather systems over the neighbouring Bellingshausen Sea, implying that it is also accurate over the Amundsen Sea. In terms of climatological means, the five recently-produced (after $\sim$2000) re-analysis datasets show only small differences. Decadal variations of westerly winds congruent with the observed changes in the southern annular mode (SAM) are a consistent feature across the re-analysis datasets. In particular the strong seasonal dependence of observed trends in the SAM (i.e. significant positive trends in the summer and autumn in recent decades) is also seen in the strength of westerly winds over the Amundsen Sea. In terms of year-to-year variability, the annual mean westerly winds over the Amundsen Sea were found to be weakly correlated with ENSO, with a correlation of 0.24 with the NINO3.4 index.