



## **A data assimilation approach to reconstructing atmospheric circulation around Antarctica**

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The West Antarctic Ice Sheet has been rapidly retreating in recent decades, with the greatest mass loss occurring in the Amundsen Sea sector. Ice shelves in this region are thinning due to increased upwelling of warm Circumpolar Deep Water, which is likely a response to changes in regional atmospheric circulation including increased westerly wind stress. Climate in the Amundsen Sea can be influenced by the Southern Annular Mode (SAM), the Amundsen Sea Low, and the El Niño/ Southern Oscillation, making this region prone to large natural variations in climate. Reliable observational records in this region only start in 1979, making it difficult to infer whether atmospheric circulation of the past few decades is a result of anthropogenic forcing. Longer, spatially-complete climate records are needed to place recent climate and glaciological changes in the context of natural variability.

We present globally-gridded annual reconstructions of winds, temperature, and pressure fields over the last 200 years from a new paleoclimate data assimilation product. This data assimilation framework combines data from paleoclimate records with the physical constraints of climate models. Our reconstructions are derived from an extensive paleoclimate proxy database that includes the PAGES2k database plus additional ice core records from Antarctica. Information from the proxy records is spread using the covariance patterns from the isotope-enabled Community Earth System Model (CESM) Last Millennium Ensemble.

We also present analyses of these reconstructions including past atmospheric circulation trends around Antarctica and a reconstructed SAM Index. Preliminary results demonstrate that zonal winds in the Amundsen Sea have become more westerly since 1800, with strong westerly events becoming more common in the late 20th century. These spatially-complete, physically-consistent reconstructions enable us to better understand whether recent changes in the Amundsen Sea region are characteristic of natural modes of variability or perhaps part of a long-term trend related to greenhouse gas forcing.