EGU21-14011
https://doi.org/10.5194/egusphere-egu21-14011
EGU General Assembly 2021

Pathways and timescales of connectivity around the Antarctic continental shelf

Hannah Dawson[1,2], Adele Morrison[3], Veronica Tamsitt[1,4], and Matthew England[5]
[1]Climate Change Research Centre, University of New South Wales, Sydney, Australia
[2]Australian Research Council Centre of Excellence for Climate Extremes, University of New South Wales, Sydney, Australia
[3]The Australian National University, Canberra, Australia
[4]Centre for Southern Hemisphere Ocean Research, CSIRO Oceans and Atmosphere, Hobart, Australia
[5]Australian Centre for Excellence in Antarctic Science, University of New South Wales, Sydney, Australia

The Antarctic margin is surrounded by two westward flowing currents: the Antarctic Slope Current and the Antarctic Coastal Current. The former influences key processes near the Antarctic margin by regulating the flow of heat and nutrients onto and off the continental shelf, while together they advect nutrients, biological organisms, and temperature and salinity anomalies around the coastline, providing a connective link between different shelf regions. However, the extent to which these currents transport water from one sector of the continental shelf to another, and the timescales over which this occurs, remain poorly understood. Concern that crucial water formation sites around the Antarctic coastline could respond to non-local freshwater forcing from ice shelf meltwater motivates a more thorough understanding of zonal connectivity around Antarctica. In this study, we use daily velocity fields from a global high-resolution ocean-sea ice model, combined with the Lagrangian tracking software Parcels, to investigate the pathways and timescales connecting different regions of the Antarctic continental shelf with a view to understanding the timescales of meltwater transport around the continent. Virtual particles are released over the continental shelf, poleward of the 1000 metre isobath, and are tracked for 20 years. Our results show a strong seasonal cycle connecting different sectors of the Antarctic continent, with more particles arriving further downstream during winter than during summer months. Strong advective links exist between West Antarctica and the Ross Sea while shelf geometry in some other regions acts as barriers to transport. We also highlight the varying importance of the Antarctic Slope Current and Antarctic Coastal Current in connecting different sectors of the coastline. Our results help to improve our understanding of circum-Antarctic connectivity and the timescales of meltwater transport from source regions to downstream shelf locations. Furthermore, the timescales and pathways we present provide a baseline from which to assess long-term changes in Antarctic coastal circulation due to local and remote forcing.