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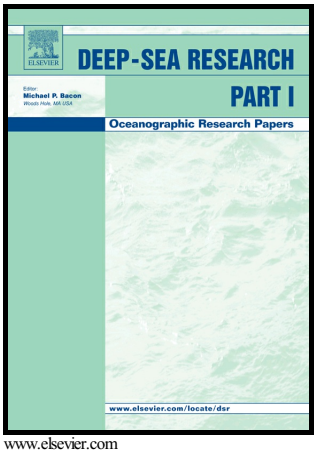
Sources, variability and fate of freshwater in the Bellingshausen Sea, Antarctica

Heather C. Regan, Paul R. Holland, Michael P. Meredith, Jennifer Pike



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Sources, variability and fate of freshwater in the Bellingshausen Sea, Antarctica

Heather C. Regan[a,b], Paul R. Holland[a], Michael P. Meredith[a], Jennifer Pike[b]

[a] *British Antarctic Survey, Cambridge, United Kingdom.*
[b] *School of Earth and Ocean Sciences, Cardiff University, United Kingdom.*

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Abstract

During the second half of the twentieth century, the Antarctic Peninsula was subjected to a rapid increase in air temperatures. This was accompanied by a reduction in sea ice extent, increased precipitation and a dramatic retreat of glaciers associated with an increase in heat flux from deep ocean water masses. Isotopic tracers have been used previously to investigate the relative importance of the different freshwater sources to the adjacent Bellingshausen Sea (BS), but the data coverage is strongly biased toward summer. Here we use a regional model to investigate the ocean's response to the observed changes in its different freshwater inputs (sea ice melt/freeze, precipitation, evaporation, iceberg/glacier melt, and ice shelf melt). The model successfully recreates BS water masses and performs well against available freshwater data. By tracing the sources and pathways of the individual components of the freshwater budget, we find that sea ice dominates seasonal changes in the total freshwater content and flux, but all sources make a comparable contribution to the annual-mean. Interannual variability is dominated by sea ice and precipitation. Decadal trends in the salinity and stratification of the ocean are investigated, and a 20-year surface freshening from 1992-2011

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