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MODELLING THE CIRCULATION ON THE WEST ANTARCTIC PENINSULA: THE EFFECT OF BUOYANCY FORCING

J M Klinck, M S Dinniman, E E Hofmann

CCPO Old Dominion University, Norfolk, Virginia, United States

Observations on the west Antarctic Peninsula (WAP) shelf show a persistent decrease in salinity of about 1.0 psu from the ocean to the shelf. Some low salinity water is trapped near the surface (~50 m thickness), which is clearly due to surface ice melt, coastal runoff and precipitation. However, the deep salinity at the coast is lower than offshore indicating a deeper source of fresher water. Two possibilities are water from Bransfield Strait through Gerlache Strait, or deep melting of ice shelves.

A high resolution (5 km) regional circulation model (using the Rutgers/UCLA Regional Ocean Model System) creates reasonable flow in the offshore ocean and on the outer continental shelf, driven by winds and the oceanic flow (ACC). The near-shore model flow is only sometimes southward which is the flow direction indicated by surface drifters and moored current observations. Increasing model precipitation at the coast, due to the coastal mountains, creates a little better near-shore flow. Stronger flow into Bransfield Strait from the Weddell Sea (a model boundary condition) improves the southward flow on the WAP shelf indicating a dynamic connection through the Gerlache Strait.

Model salinity within and south of Marguerite Bay is higher than observations. Meltwater from the George VI Ice shelf onto Marguerite Bay is estimated at 16 km^3/yr and when this additional freshwater source is added, the circulation and salinity structure improve.

In summary, this model study indicates that circulation on the WAP shelf is influenced by the oceanic intrusions, flow along the shelf break, surface winds, precipitation, coastal runoff, sea ice freezing and melting, flow through Gerlache Strait and basal melt of ice shelves.