Abstract View

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On the Effect of Precipitation and Runoff on Coastal Circulation in the Gulf of Alaska

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ABSTRACT

Surface waters in the Gulf of Alaska undergo a net dilution throughout most of the. year since the regional precipitation exceeds evaporation. Recent hydrographic data give evidence that seasonal dynamic height fluctuations in the upper layers (<100 m) are well-correlated with the seasonal changes in precipitation and runoff. The precipitation effect is magnified by coastal mountain ranges which enhance the rainfall at or near the coast, contributing fresh water at the coast through runoff. Previous estimates of the offshore precipitation gradient appear to be smaller than those measured recently. Precipitation and runoff alter the dynamic height through salinity changes. This dependence of dynamic height on salinity is possible here because of the high precipitation (>130 cm year^{-1}), runoff, longshore accumulation of fresh water around the gyre, and the low water temperatures.

The coastal sea level is in phase and has nearly the same amplitude as the local dynamic height, though not in phase with heating and cooling. Both the seasonal cycles of sea level and precipitation and their anomalies are well-correlated. The majority of the seasonal sea level variations can be accounted for by the local steric property changes. The small difference between the dynamic height and sea level implies that the barotropic effects on sea level are small.

The dynamic height and longshore flow respond to the annual hydrologic cycle for the Alaska south coast area. This provides an important mechanism through which the atmosphere can affect the local ocean circulation. The dynamic height beneath 100 m responds to wind stress changes through Ekman pumping and coastal divergences and convergences. Thus precipitation, runoff and wind stress are all important to the coastal dynamics here.

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