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The impact of water column mixing in a salt wedge estuary

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Introduction

The Snohomish River flows into the North Whidbey Basin of the Possession Sound. Here, a salt-wedge type estuary is formed by density differences between the fresh water of the Snohomish River and the higher salinity water of the Possession Sound. This salt-wedge causes stratification in the form of a pycnocline and varies with both the tidal cycle and Snohomish River outflow. The amount of stratification occurring in the estuary can be quantified in terms of the vertical an and the higher salinity water of the Possession Sound. This salt

Methods

This study utilized ADCP and CTD data collected from September 2017 to November 2017 at a centralized location near the mouth of the Snohomish River. Deployment of these instruments was achieved in cooperation with Gravity Marine Consulting. The ADCP data was recorded by a 1 mhz Nortek Aquadopp deployed on the seafloor at 10 minute intervals. CTD data was collected by a Seabird CTD, on loan from the Department of Ecology, deployed on a 3-meter pivot off of a floating dock. Analysis was conducted using MATLAB. Snohomish River outflow data was obtained from the United States Geographical Survey.

Conclusions

Overall, this study was able to build a picture of how Snohomish river outflow, tidal cycle, velocities, and various biological factors interact over a month period. The initial hypothesis was partially supported. In terms of velocities, the time of peak outflow and ebb tide saw large negative vertical values, as predicted. This same trend was not as clear in the East/West velocities, but more mixing appeared to occur during peak outflow as indicated by higher overall velocity values. There did not appear to be any correlation with tidal cycle in these East/West velocities. In terms of biological products, the hypothesis was flawed. Instead of decreasing in turbidity and chlorophyll after a large outflow event, as predicted, turbidity and chlorophyll values saw higher peaks that were sustained for a longer period of time. This is likely because the Snohomish River outputs both nutrients and sediment into the water, affecting the two primary biological products of this study. Instead of looking at two isolated time spans, velocity values could be evaluated over a multi-month period to see how mixing affects these biological values outside of river influence. In addition, quantification of bottom shear stress, which correlates with sediment transport, and suspended sediment concentrations would provide a clearer picture of the interaction between velocity and turbidity.