1 A look at the first two weeks of Moored Profiler data

To verify data quality, the MP was recovered on May 5 with divers from the APL jetboat (Figures 1, 2). The divers plucked the profiler off the wire, allowing us to download the data, check it for integrity, and re-install it. We also equipped the profiler with an acoustic transponder, allowing us to verify proper profiling and to find it in the event of a mooring-line cut. The profiler was out of the water for a total of only 4 hours.

Figure 1: Alford and the Moored Profiler aboard the APL jet boat at Hoodsport marina, 5/5/2005.

Figure 2: Diver preparing to recover the profiler, May 2005.

The first two weeks of data are shown in Figure 3. Each panel shows the depth-time dependence of measured quantities, together with the sea-level height (top). We can see that the profiler measured
Figure 3: Time-depth series plot of sealevel, temperature, salinity, oxygen, and velocity for the first two weeks (4/22/05-5/5/05).

from 8-119 m twice an hour as programmed. An ADCP is measuring velocity in the upper layer not reached by the profiler, but these data will be presented later.

Tidal velocities of about 10 cm/s are seen - together with significant variability in temperature and oxygen. In particular, oxygen at mid-depths increases and then decreases again, closely related to temperature changes. What leads to this variability? This ability to measure velocity is an important aspect of the moored-profiler measurements - with this we can directly measure the lateral supply of oxygen to the southern end of Hood Canal. (We can also estimate the vertical diffusive supply - but this analysis is more detailed and is ongoing!)
Figure 4: T, S, potential density and dissolved oxygen along the Hood Canal. The moored profiler is located at about km 70. Based on citizen monitoring data, the oxygen data were calibrated by adding 0.44 mg/l.

We illustrate this with an example. A CTD section (Figure 4) taken at the time of the mooring deployment shows a “tongue” of cool, high-oxygen water near 40-50 m depth that extends southward just past Sund Rocks. This is the normal resupply of oxygen associated with inflows from Admiralty Inlet. At the time of the deployment, it does not extend quite to the location of the mooring.

Profiles of mean velocity, oxygen and temperature from the mooring are shown in Figure 5. We can see the southward velocity in a 30-60-m depth range associated with this inflow (panel a). But at the
beginning, the cool, oxygenated water to the north has not yet reached the mooring (blue curves). As time progresses and water in this depth range flows southward, the mooring shows cooler water and higher oxygen. Profiles five days later (red) agree well with the original CTD cast at Sund rocks (heavy black curves), indicating that the water has flowed from there to the mooring. Note that the water “shoaled” as it travelled. This is because water likes to flow along constant-density surfaces rather than at constant depth. The data indicated that these surfaces rose as time progressed (not shown here), which this preliminary analysis didn’t factor in.

Figure 5: The temperature profiles at deployment at the mooring site and at the Sund Rock CTD site are shown in heavy black, with temperature each 2 hours plotted with time going from blue to red. We see the cold intrusion arriving in the 40-m depth range. Time spanned is about 5 days. At the observed velocity of about 0.5 c/ms, the intrusion would have gone 2.2 km.

This initial look shows the importance of monitoring not only the level of oxygen, but also the FLOW and MECHANISMS that influence its variability. We hope that these ongoing measurements will help us understand the physical factors that influence hypoxia in the southern end of the canal.