Several discrepancies were identified with the original analysis of the samples from the Yukon freshet sampling in 2019; therefore, a second analysis was carried out on water samples from YK2019a that were stored frozen for approximately 2 years after collection in a different lab. The numbers from the later analysis were compared to the stations from the original measurements that were not compromised, and they agreed within 5%. However, there was still one station where there were no trustworthy concentrations measured. Consequently, another DOC analysis was carried out on the leftover CDOM samples from YK2019a that were stored at 4˚C and in the dark for approximately two years. Likely due to microbial degradation, these DOC concentrations measured from the leftover CDOM samples were all lower than the frozen DOC samples from the same stations that were run later. A linear relationship between these measurements was used to correct for the loss of DOC within this one CDOM sample. The sample in question was from station 8 (YK2019a) collected at the Emmonak Channel and the equation used to correct it was:

$$\mathrm{DOCcorr} = 0.956(\mathrm{CDOM}) - 0.16 \qquad (1)$$

where CDOM refers to the DOC concentration measured from the CDOM sample and DOCcorr is the corrected DOC concentration for that sample. The constants were derived from the linear fit to the relationship.

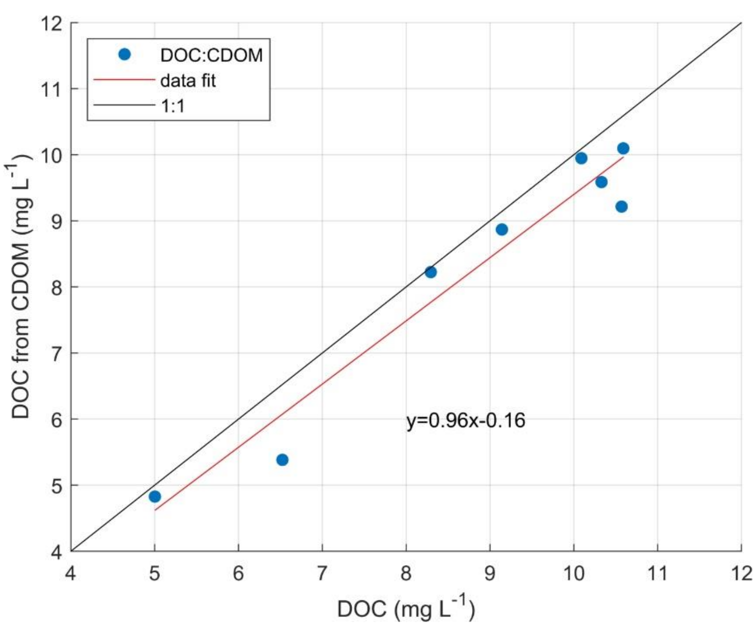

Figure 1. The relationship between DOC (mg L^{-1}) measured from frozen samples and DOC measured from CDOM samples stored cold (4˚C) and in the dark

Fluorescent Dissolved Organic Matter (FDOM) and Salinity data from the CTD profiles were used to generate the cross sections of interpolated FDOM and Salinity shown in **Figures 4A, B** of the main manuscript. The following figures show the actual data measured from the instrument package in order to clarify any artifacts that may have arisen due to the interpolation of the profiles. The concentration of FDOM increases at depth for each profile with the exception of KA1 where there is little variation between the surface and bottom waters. The rest of the profiles show an increase in FDOM concentration as the profiles approach the seafloor.

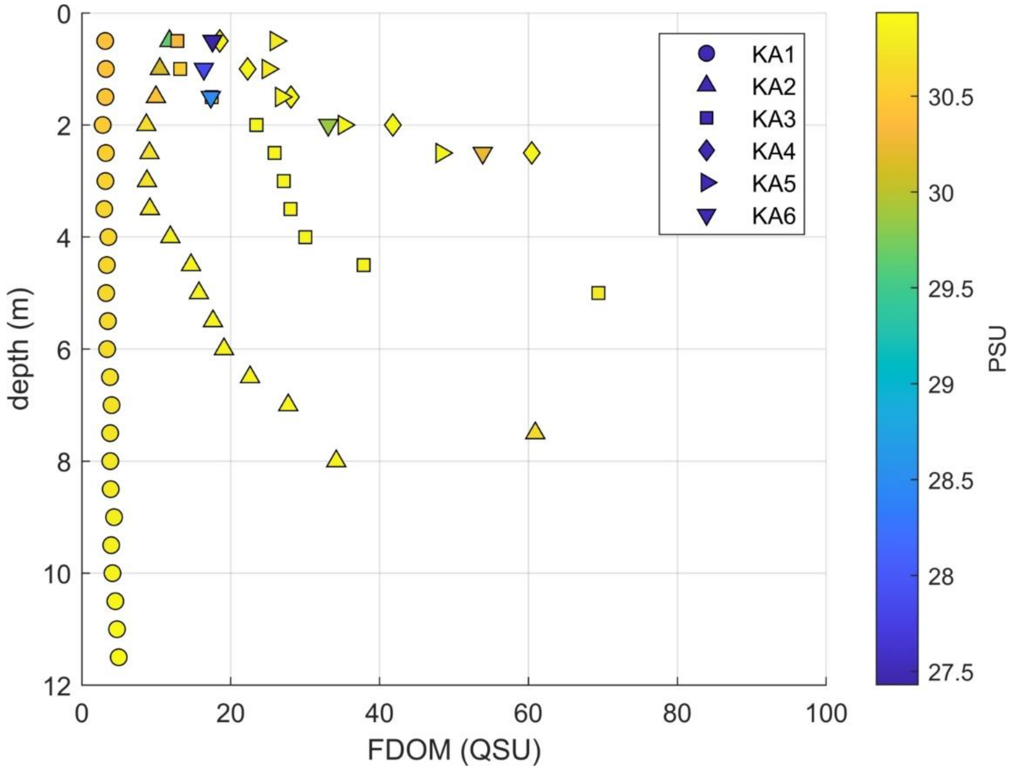

Figure 2. CTD profiles of FDOM concentration (ppb quinine sulfate) measured during the Jago River transect. The symbol color represents salinity concentration as defined in the colorbar legend.

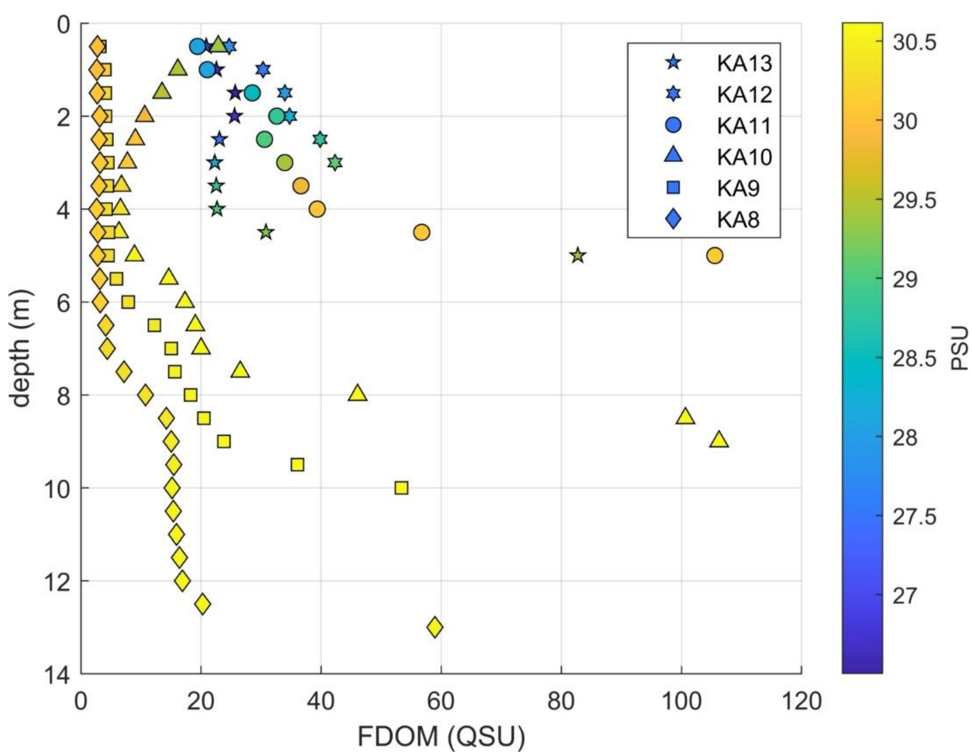

Figure 3. CTD profiles of FDOM concentration (ppb quinine sulfate) measured during the Hulahula River transect. The symbol color represents salinity concentration as defined in the colorbar legend.

There were beam attenuation (beam-c) measurements from a WETLabs ac-s instrument deployed with the FDOM fluorometer. The profiles at the Jago River and Hulahula River transect stations show that there was an increase in attenuation when approaching the bottom from either higher particle loads, increased CDOM absorption, or a combination of both. This was likely due to sediment resuspension and subsequent mixing of pore water near the bottom of the water column.

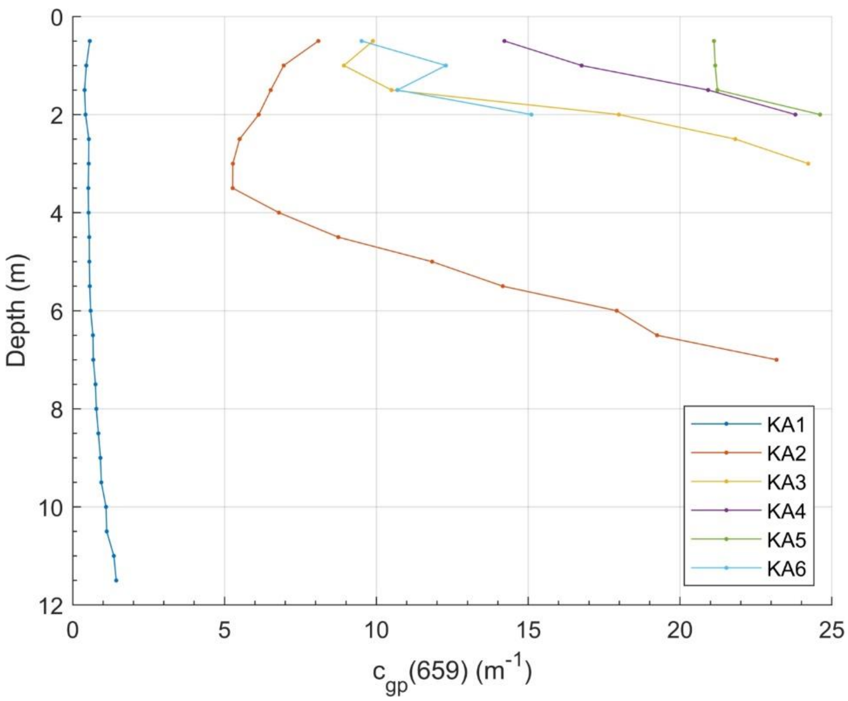

Figure 4. Attenuation profiles at 659 nm measured by a Wetlabs ac-s meter. These 6 stations were measured on the North Slope near Kaktovik Ak during the Jago River transect (KA2018).

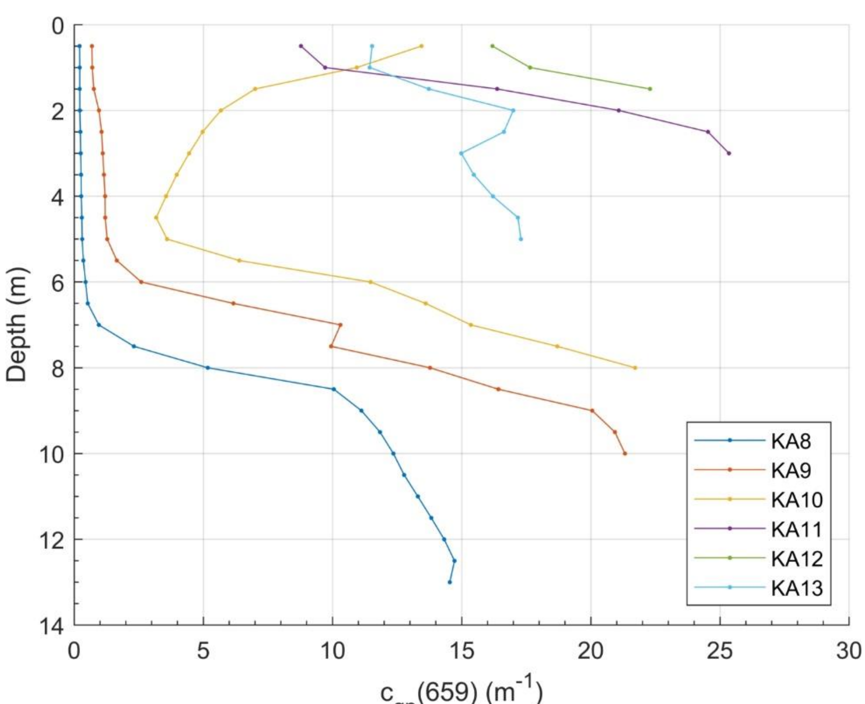

Figure 5. Attenuation profiles at 659 nm measured by a Wetlabs ac-s meter. These 6 stations were measured on the North Slope near Kaktovik Ak during the Hulahula River transect (KA2018).

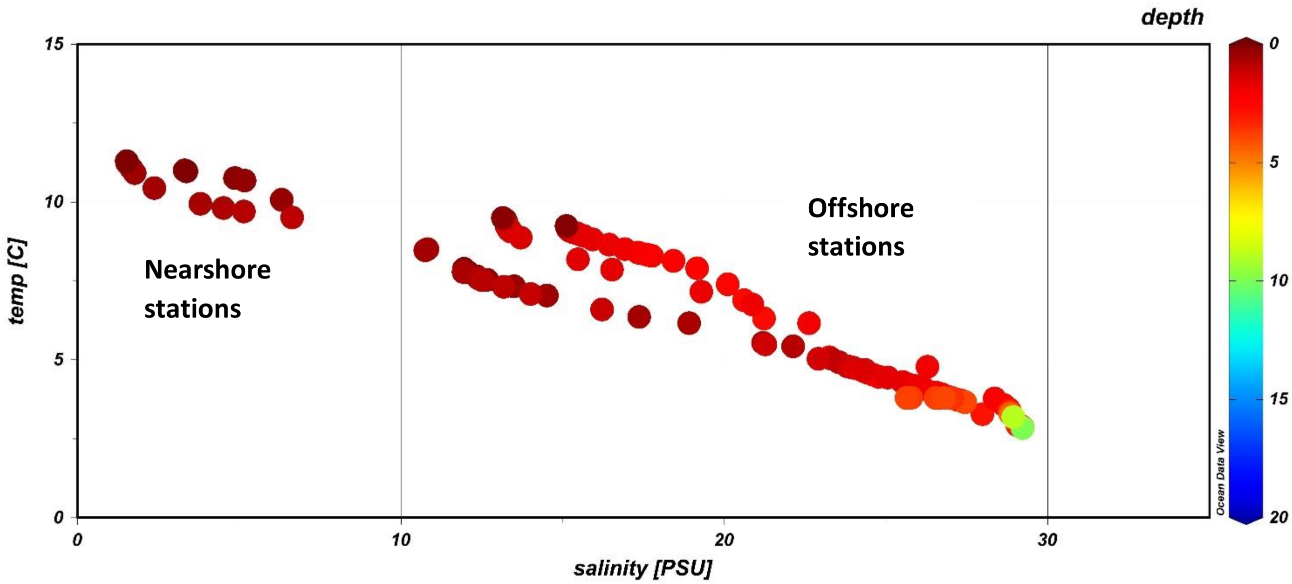

Figure 6. Temperature salinity diagrams for the Yukon River Transect during the ascending limb of the freshet. Marker color refers to the depth of the measurements in meters.

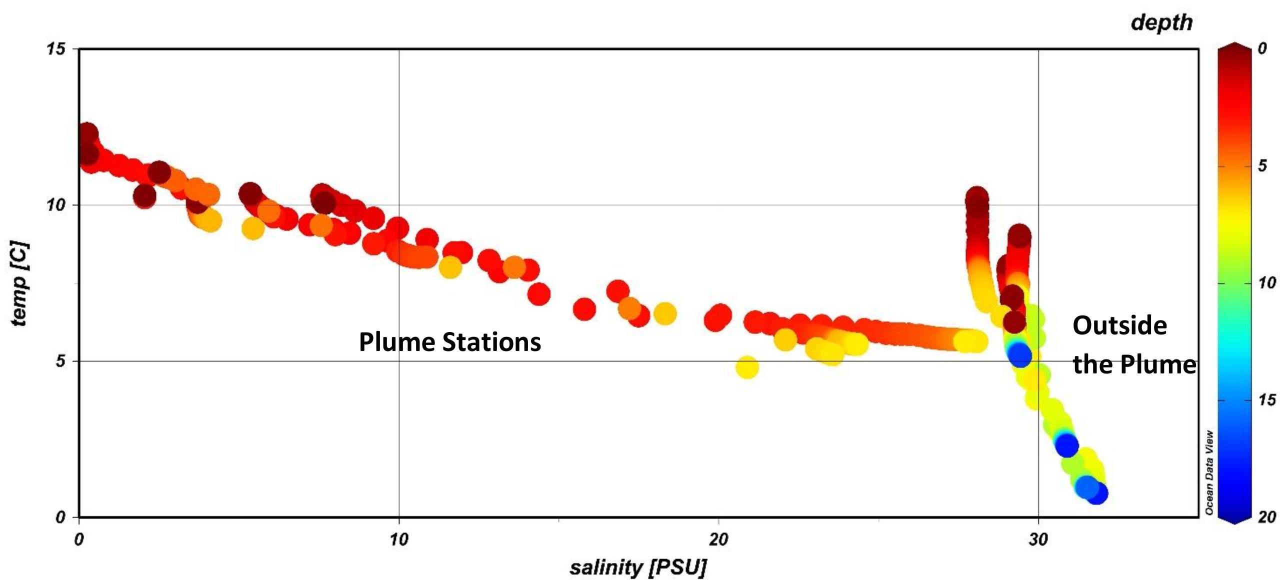

Figure 7. Temperature salinity diagrams for the Norton Sound Transect during the ascending limb of the freshet. Marker color refers to the depth of the measurements in meters

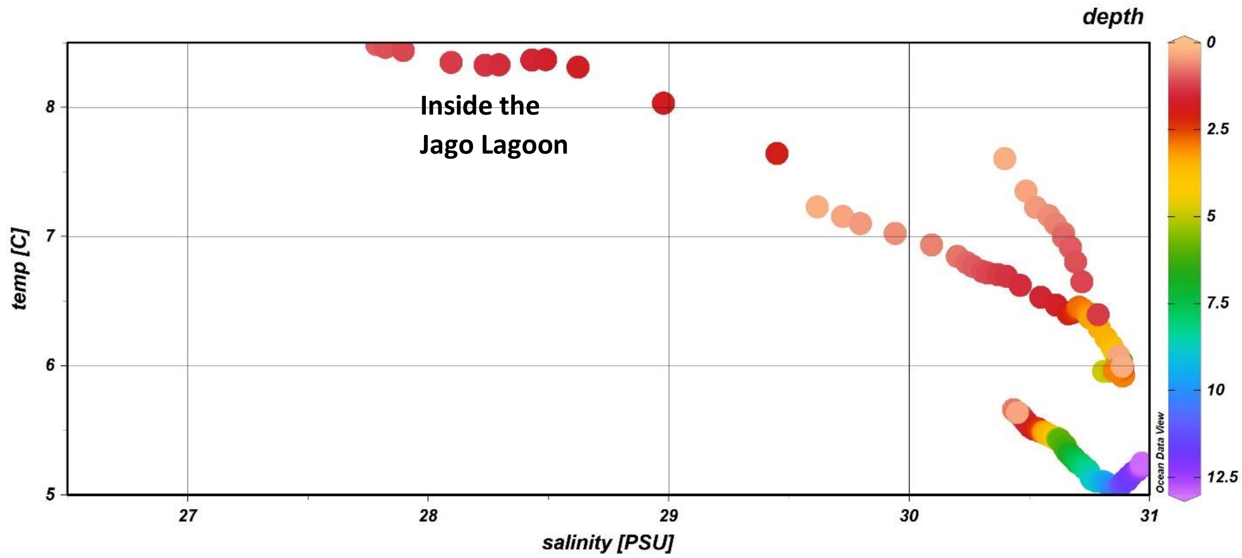

Figure 8. Temperature salinity diagrams for the Jago River Transect on the North Slope of Alaska near Kaktovik. Marker color refers to the depth of the measurements in meters.

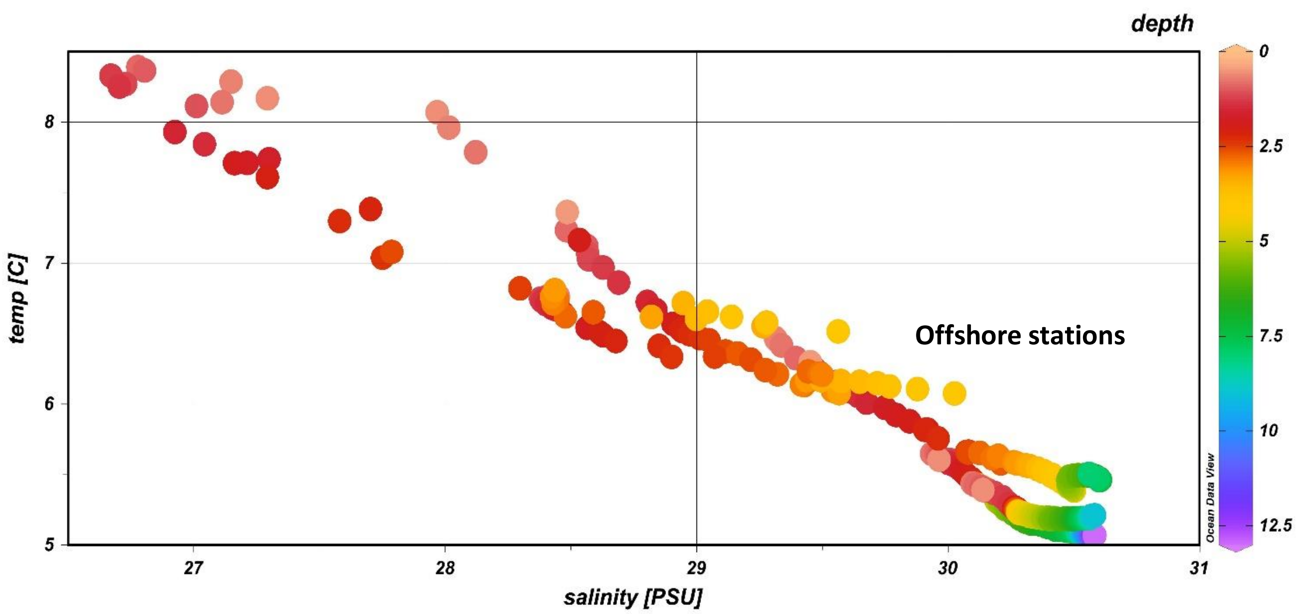

Figure 9. Temperature versus salinity diagrams for the Hulahula River transect on the North Slope of Alaska near Kaktovik. Marker color refers to the depth of the measurements in meters.