Arctic fjords are particularly sensitive to climate change and global warming and play a crucial role in regulating carbon cycle over time. West Spitsbergen fjords are located in a critical area where warm and salt Atlantic Water (AW) carried by West Spitsbergen Current (WSC) mixes with, rich in macro-nutrients, iron, organic matter, sediments, and pollutants, Polar Water (PW) carried by Transpolar Drift. Warm WSC is naturally separated from the fjords by the cold Arctic Water mass (ArW) of the Sørcapp Current (SC) which flows from Barents Sea along the West Spitsbergen Shelf (WSS). This invisible barrier preventing West Spitsbergen Current from intruding into West Spitsbergen fjords is called Polar Front. WSC and SC water masses mix along Polar Front, during passage northward. That mixing, together with atmospheric heating and cooling, ice freezing and melting, precipitation and evaporation, cools WSC. In result, water mass entering the West Spitsbergen fjords is no longer WSC or SC but Transformed Atlantic Water (TAW) with temperature and salinity values between those of parent currents. During summer, glacial melting, river run-off and precipitation, create an additional surface water mass (SW) characterized by low salinity. Apart from different salinity and temperature values, listed above water masses (AW, ArW, SW and TAW), have also different proportion of dissolved organic matter (DOM) of different origin (melting glaciers, river run-off, leaching from thawing permafrost, marine production). DOM in AW has predominantly autochthonous origin, and DOM contained in ArW has high proportion of terrestrial DOM. The balance between those sources of DOM, determines physical and optical conditions of the west Spitsbergen fjords waters To date there is very limited information on DOM sources, transformation and fate in those Arctic fjord. The three fjords, that will be studied, are located at west Spitsbergen coast: Kongsfjorden, Isfjorden and Hornsund, have one common feature: they do not have distinct sill which facilitates AW intrusions into fjords. The variability of temperature and salinity in three considered fjords is dependent on mutual interaction and strength of the SC and WSC. As a result, Hornsund located southernmost of the West Spitsbergen coast, were the Sørkapp Current meets West Spitsbergen Current, has more Arctic-type characteristics compared to Isfjorden (located in the middle of Spitsbergen) and northernmost Kongsfjorden.

The main goal of the project is to describe quantitative and qualitative properties of dissolved organic matter (DOM) in Kongsfjorden, Isfjorden and Hornsund. Our main hypothesis is that, relative contribution of main water masses: Atlantic Water (AW), Arctic Water (ArW), Glacial Water (GW), have significant impact on the quantitative and qualitative properties of DOM. Those properties can be investigated with use of optical methods, as significant fraction of DOM exhibits optical properties: absorbs and fluorescence light. Such methods are easy to apply and cost effective. To be able to distinguish between different sources of DOM, PARAFAC model will be executed followed by measurements of the concentration of the lignin phenols, which presence indicates the terrestrial DOM originating from decay of land plants. Additionally, supporting physical (temperature, salinity), chemical (concentration of dissolved organic carbon, DOC, concentration of dissolved oxygen, DO) and biogeochemical (concentration of chlorophyll a) measurements will be done.

Results of pilot studies have shown, that composition of DOM in investigated fjords is dominated by *protein-like* fluorophores, although we found a significant differences in both quantitative and qualitative properties of DOM in those fjords. The contribution of fluorescence intensity of the *protein-like* components to the total fluorescence intensity, was the highest in Hornsund and the lowest in Kongsfjorden. The proportion of *protein-like* components to the total fluorescence intensity in the surface waters of Hornsund may be the result of the discharge of the glacier melt water or the result of the biological activity in the fjord (autochthonous production). This observation needs further investigations. This initial findings suggest also that a number of local scale and mesoscale process could impact effectively DOM composition in the study area. To answer those question we propose a project to intensive study on DOM qualitative and quantitative properties in Arctic fjords in West Spitsbergen.

This project will be executed through the field and laboratory work campaigns undertaken during research cruises on board of r/v Oceania organized to Spitsbergen by Institute of Oceanology Polish Academy of Sciences Sopot, Poland, within annual AREX cruises. There will be also a collaboration with dr Colin A. Stedmon from DTU Aqua (Technical University of Denmark), Denmark.