

Glacial and urban river's role in the fate of Contaminants of Emerging Concern in Arctic coastal waters

Background

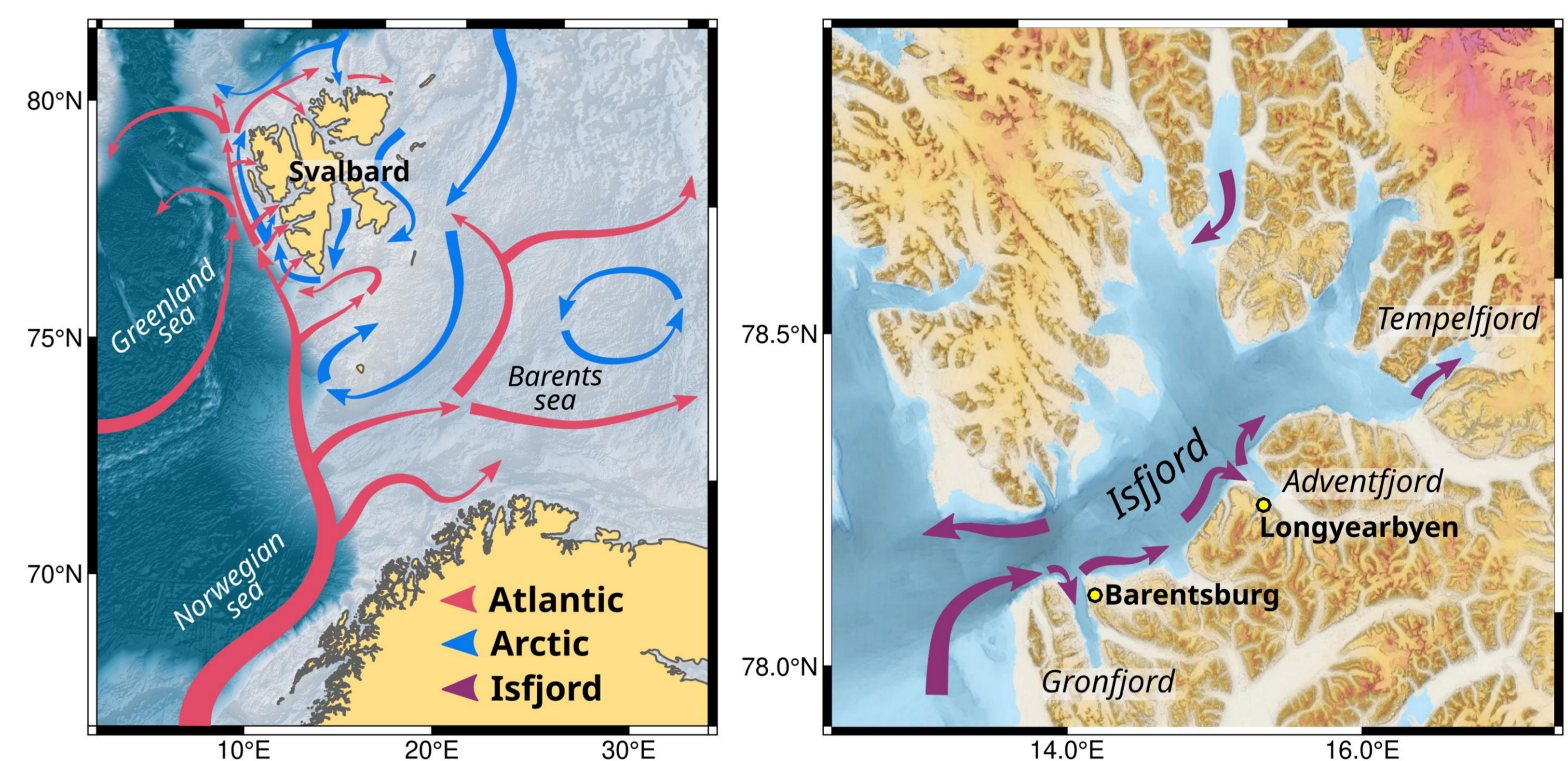
Arctic coastal waters have been subject to high levels of pollution with a wide list of contaminants that can be either delivered with ocean currents and by atmospheric transport from distant regions or may originate from local sources. Terrestrial freshwater input can alter concentration and composition of pollutants in marine water in the coastal zone. Freshwater plumes propagation, driven by local winds and waves, can affect different regions of the fjord, and shape the frontal zones by interacting with saline waters. The aim of this work is to assess the role of the freshwater plumes of glacial and urban rivers in the pattern of pollution in Arctic coastal waters by example of Svalbard fjords.

As illustrative Contaminants (iC) in this study, we select polyfluoroalkyl substances (PFAS), microplastics (MPs), and mercury (Hg). PFAS and MPs belong to the group of Contaminants of Emerging Concern (CECs), and Hg to the group of Priority Hazardous Substances. Hg can become a new challenge regarding climate change due to its release from the thawing permafrost and the change in the sea ice regime. All illustrative contaminants can be transported both by water and by air.

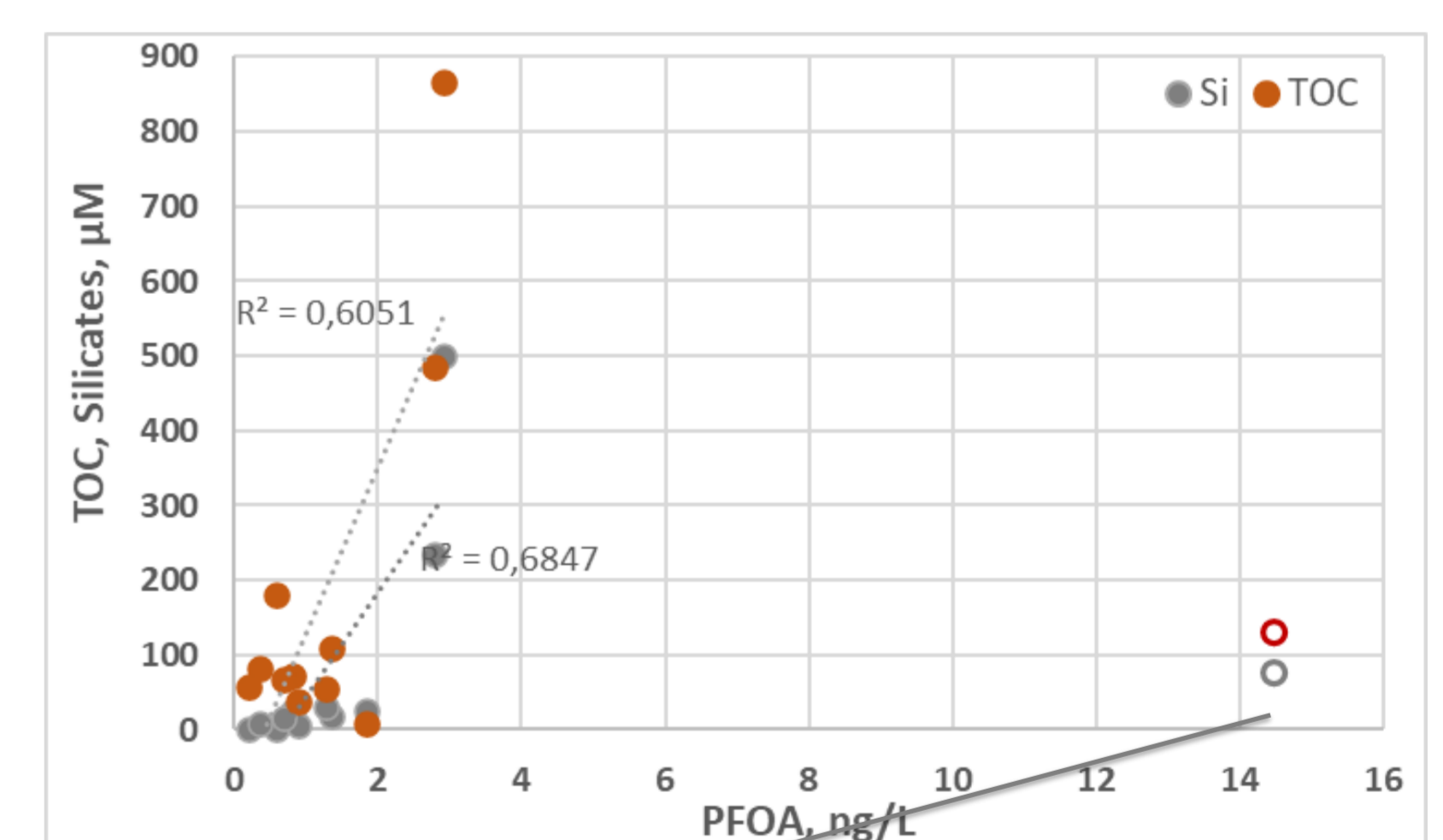
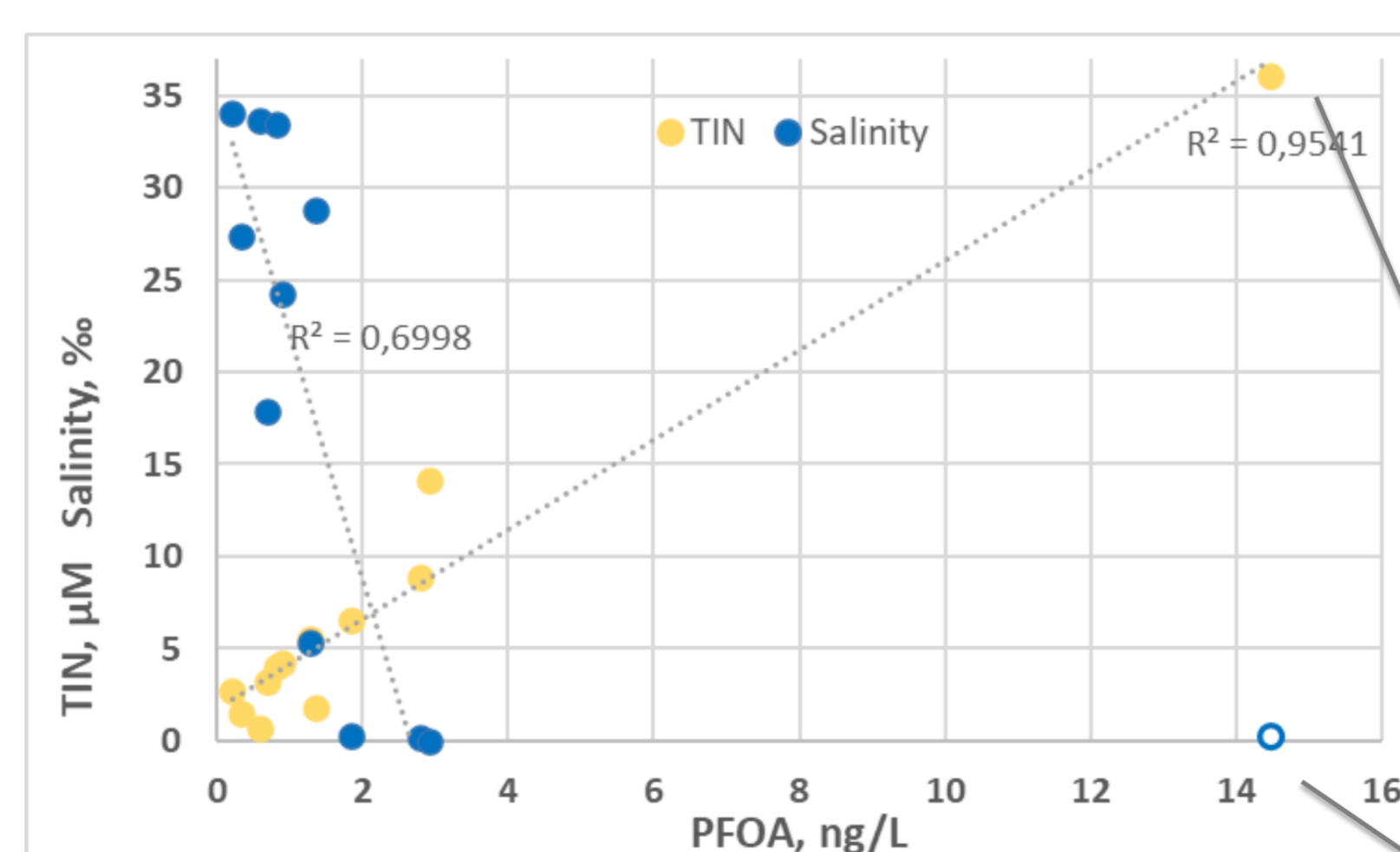
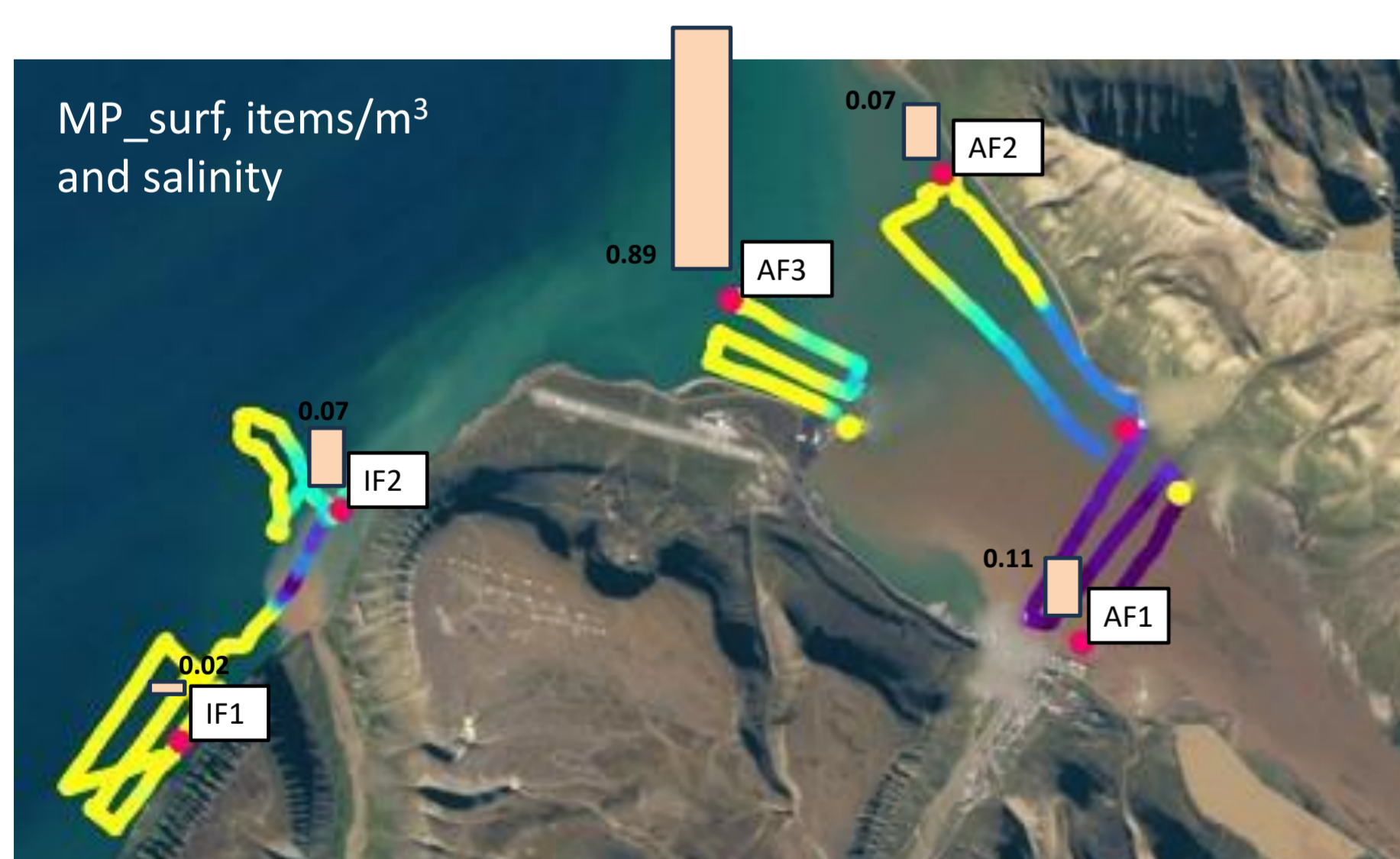
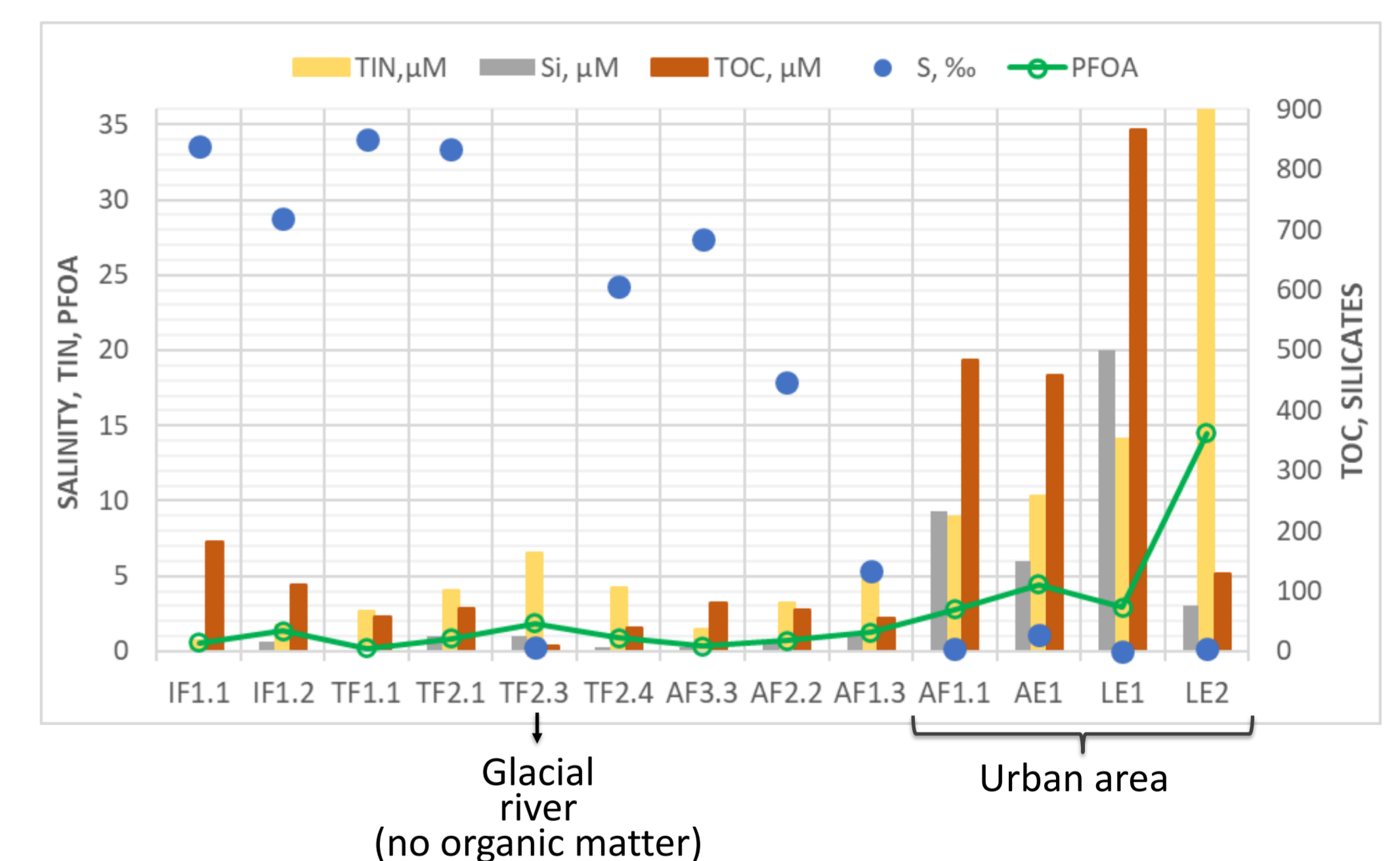
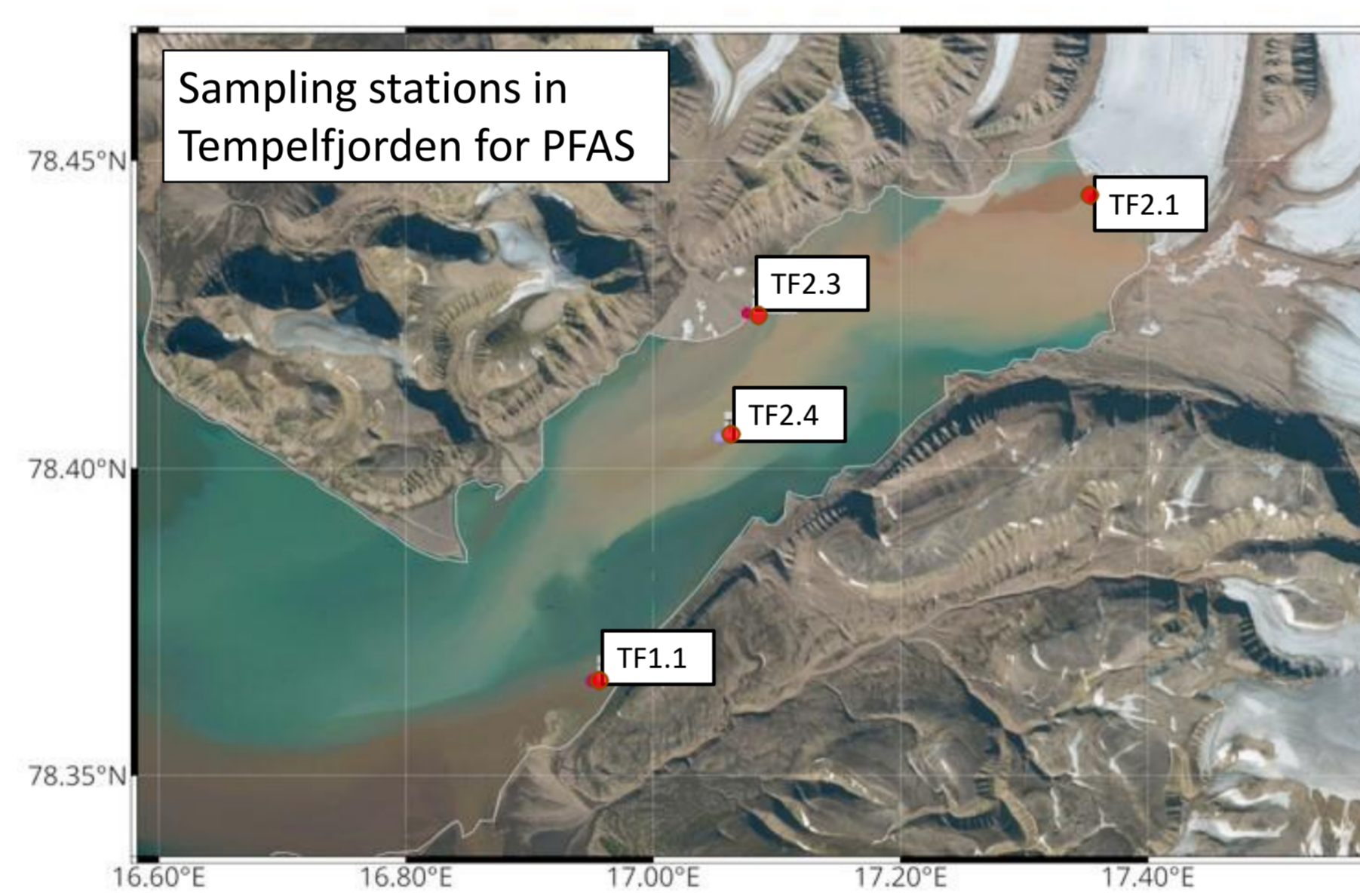
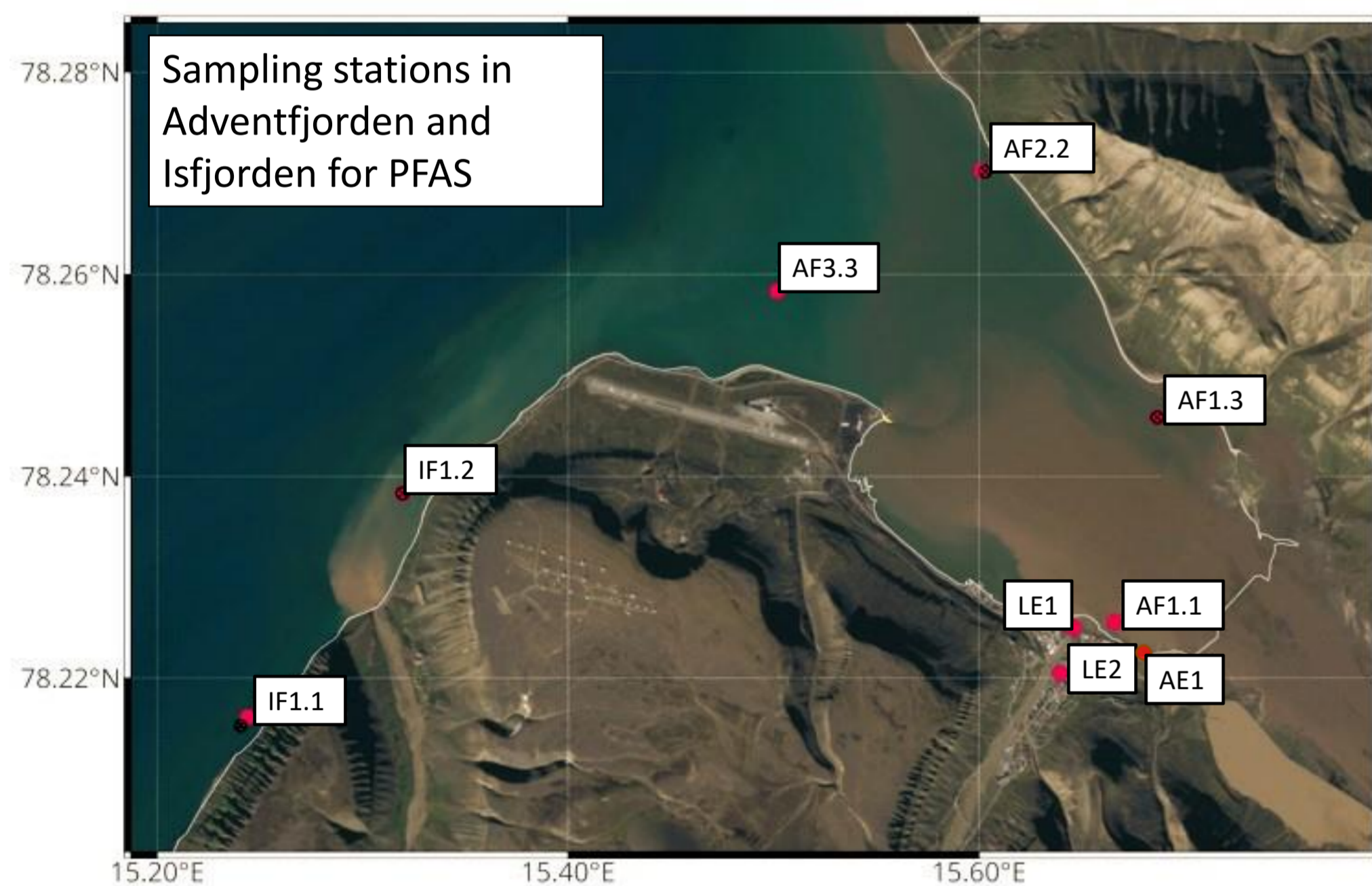
Approach

Field studies were performed in populated and unpopulated branches of Isfjorden in July 2023. Adventfjorden, and Tempelfjorden branch out one after another from the larger Isfjorden on the west coast of Spitsbergen.

Water samples were taken in pristine and urban rivers, river plumes and high saline fjord waters for PFAS, MPs, Hg analysis as well as nutrients, organic carbon, and carbonate system. The collection of MPs floating on the sea surface (MP_surf) and MPs suspended in the water column at about 1.5 m (MP_wat) was carried out by net trawling and water pump system respectively. PFAS samples were taken from the sea surface and were filtered for analysis of both suspended and dissolved forms. Constant measurements of pH, oxygen, temperature and salinity were conducted in order to identify and assess the influence of freshwater influxes to the sampling locations.



Preliminary results



Abundance of MPs floating on the sea surface has maximum at mixing zones of freshwater and high saline sea water. The maximum surface MPs abundance was found at station AF3, where waters with MPs from local sources (Longyearbyen city) and from the North Atlantic meet. No surface MPs were found in Tempelfjorden.

Preliminary data for MPs distribution in water column shows maximum concentration in the urban river, Longyearelva (LE1 and LE2 stations) and minimum in Adventelva and Tempelfjorden.

Summary

- Local sources of PFOA and MPs in Longyearbyen play a significant role in pollution of Isfjorden coastal waters.
- Distribution and transfer of PFOA and MPs floating on sea surface depend on different factors and processes.
- Arctic rivers flowing through unpopulated regions diluted MP concentration in sea water.
- Higher PFOA concentrations were found in the rivers. Svalbard rivers are dominantly snow fed and therefore it can indicate to a possible airborne transport of PFAS compounds and their accumulation in the snow during the winter period.