**Introduction:** Fram Strait, located between Greenland and Svalbard, is a gateway for heat and nutrient transport to the Arctic Ocean and sea-ice export from the Arctic. Relatively warm Atlantic Water (AW) is transported northward in the eastern Fram Strait via the West Spitsbergen Current (WSC); in the western Fram Strait the East Greenland Current (EGC) transports colder, fresher water of Arctic origin (Arctic Atlantic Water, AAW and Polar Surface Water, PSW) southward. Part of the AW in eastern Fram Strait is not transported to the Arctic Ocean, but instead flows westward to join the EGC (it recirculates). Although crucial for understanding AW pathways to large outlet glaciers through two troughs (Westwind Trough and Norske Trough) on the East Greenland shelf, it is not known at what latitudes AW joins the EGC and how that changes the structure of the EGC. Further, dense waters formed in the Arctic Mediterranean (i.e. Denmark Strait Overflow Water) are transported in the EGC and contribute to NADW.

**Recirculation:** There are large differences between the time mean and the synoptic view of the recirculation in Fram Strait at 79°N, which appears to be in the form of an eddy field. A long-term average does not take into account processes on small scales such as eddies. These are important features however. Any synoptic measurement in Fram Strait will encounter the synoptic velocity field which does not necessarily look like the field expected from looking at the top panel in Figure 2. The small scale features mediate important physical processes such as heat transport into central Fram Strait and vertical exchange of mass, nutrients, salt, and heat. A model that wishes to produce realistic estimates of these parameters needs a high enough resolution to resolve eddies in Fram Strait.

**The EGC:** The East Greenland Current is believed to be a baroclinic boundary current following the shelf break southward. However, we only saw a clear boundary current south of 79.6°N. Further to the north the EGC appears as a broad region of southward transport between the Greenland shelf break and 0°E. This is corroborated by velocity fields in high resolution models e.g. in Wekerle et al. 2017 and Hattermann et al. 2016.

**Data:** In 2016 a high resolution summer synoptic survey was conducted in Fram Strait with FS Polarstern. We analysed CTD and ADCP data along five sections: 0°E, WT1, 79.6°N, 79°N (shown in Figure 2) and NT1. Absolute geostrophic velocities were computed from geostrophic shear and ADCP data.

**Fig. 1:** Map of Fram Strait between East Greenland and Svalbard. Station locations are shown in red. Bathymetry from Schaffer et al., 2016, map modified from Schaffer, pers. comm. 2017.

**Fig. 2:** Cross-sectional velocity at 79°N in Fram Strait from long-term mooring observations (top panel), a numerical model (FESOM, second and bottom panel) and a synoptic survey (third panel). The Greenland shelf is shown on the left, the Svalbard shelf on the right. Positive velocities are northward. Please note the different y-axis scaling in the panels.

**Fig. 4:** The circulation scheme in Fram Strait updated with our findings. Features we only speculate about (the location of the northern rim of the recirculation, the northern EGC between the shelf break and 0°E and EGC branches on the shelf are shown dashed and with a question mark.