The West Spitsbergen Current in Fram Strait

Insight from a model-observation analysis

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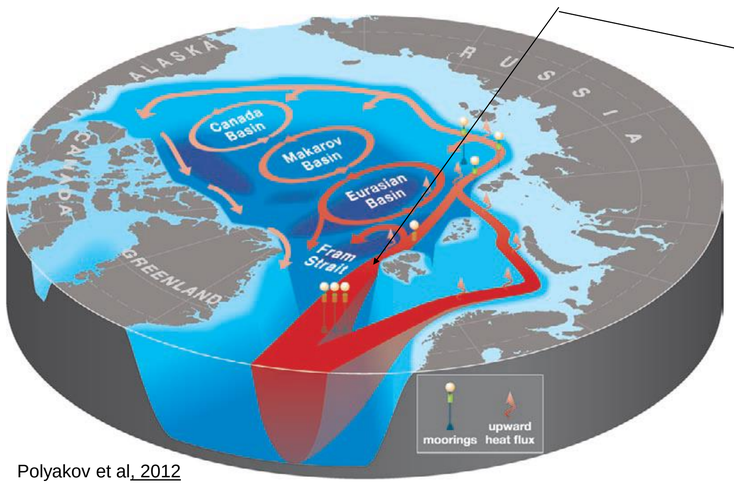
Abstract: Two quasi-synoptic glider transects have been carried out in summer 2017 across eastern Fram Strait in the context of the INTAROS project. The repeat sections revealed contrasted cross-slope structure of the West Spitsbergen Current between 78° N and 78°40' N, with possible implications for the Atlantic Water recirculation in the strait. The relevance of this summer snapshot to characterizing the circulation in eastern Fram Strait is analyzed in the context of the wider picture provided by a high resolution model simulation of the area.

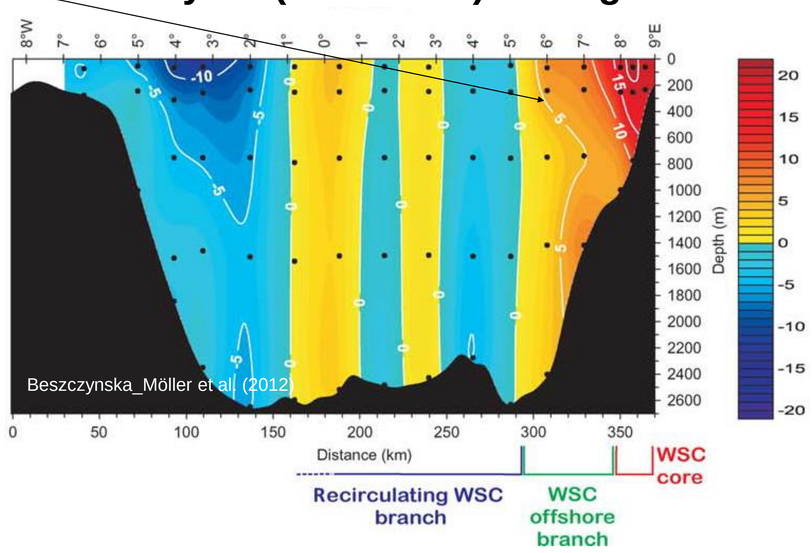
1 The West Spitsbergen Current : The Atlantic water route to the Arctic Ocean through Fram Strait

West Spitsbergen Current (WSC)

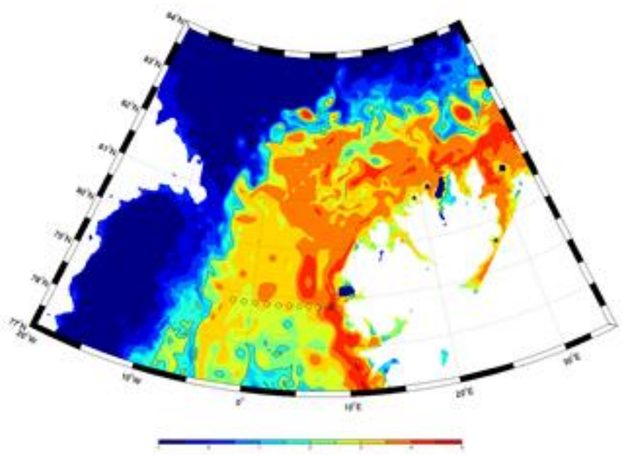


Polyakov et al, 2012

Long-term monitoring at 78°50'N
Northward current velocity
Multi-year (1997-2010) average

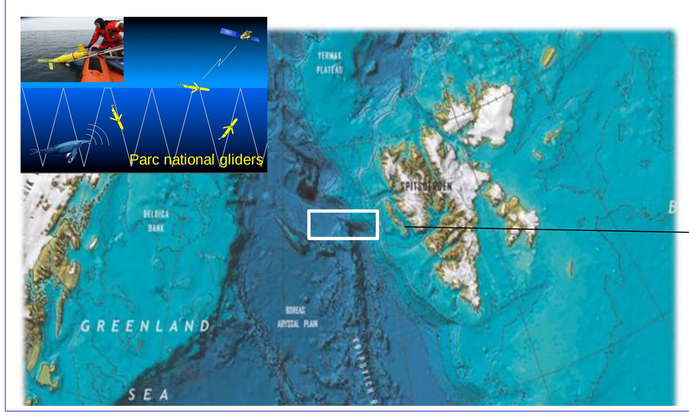


Sea ice ocean model 1/24°
Model climatology: temperature at 100 m



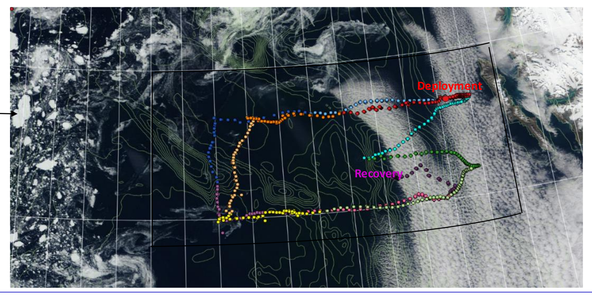
What can we learn about the WSC from summer glider observations and a hindcast sea ice-ocean simulation?

2 Glider sections in eastern Fram Strait: July-September 2017



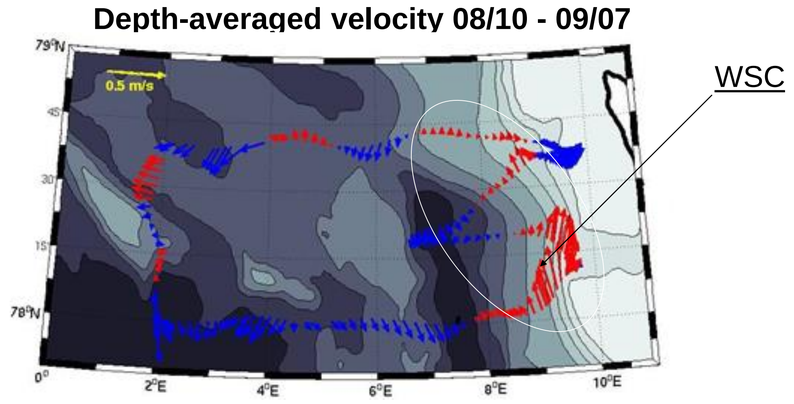
Two repeat quadrangles

- **Leg 1** : 07/25 - 08/30, 2017
- **Leg 2** : 08/30 - 09/22, 2017



3 Depth-averaged (0-1000 m) velocities and transports

Depth-averaged velocity 08/10 - 09/07

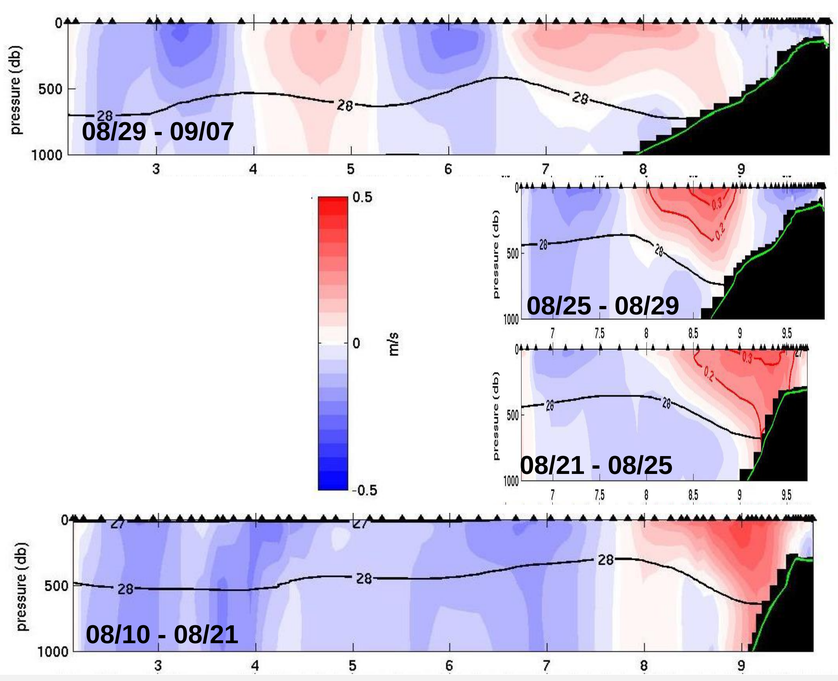


northward
southward

Transport 4-10°E (Sv)	Northward (recirculated)	Southward Offshore | shelf	Net
78°40'N	2.3	1.8 | 0.4	0.2
78°30'N	2.8 (0.5)	2.7 | 0.4	-0.4
78°20'N	3.2 (0.4)	2.0 | 0	1.2
78°N	5.7 (2.5)	9.0 | 0.1	3.4

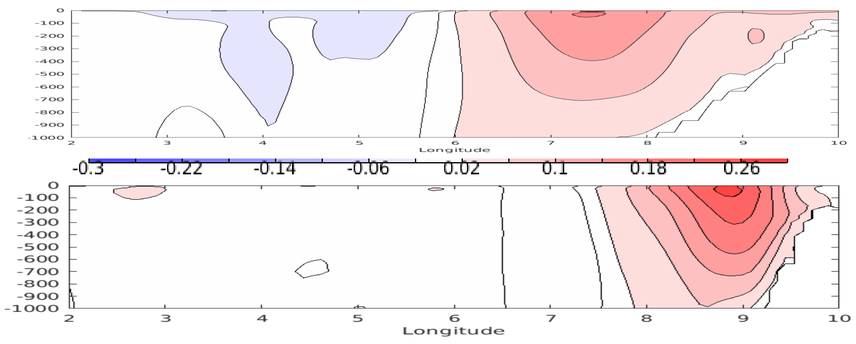
Strongest recirculation (2.5 Sv) between 78°N and 78°20'N
Large southward transport west of 8°E at 78°N

3 Geostrophic flow from glider observations Along slope evolution



- **Along-slope change of the WSC structure : weaker and downslope shift of the northward flow core at 78°40'N, compared with 78°N**
- **At 78°N, ca. 6 Sv of the southward transport is achieved by the inner part of the flow (between 6° and 7.5°E), also seen intermittently in model (part 5)**

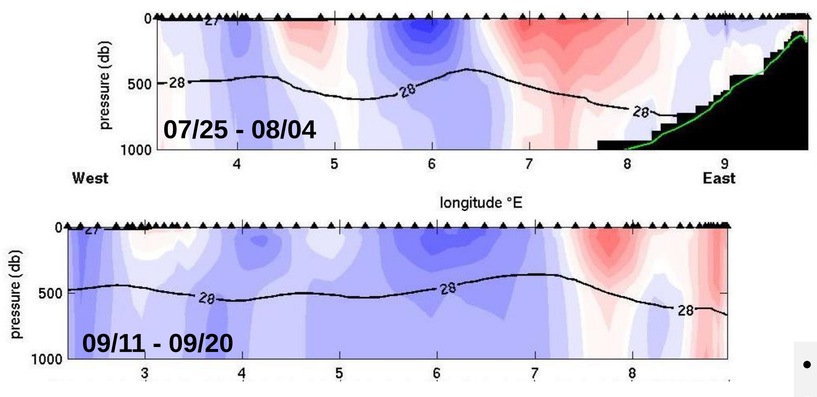
4 Model monthly climatology (August)



- **Overall zonal structure (incl. along-slope contrast) shows as a mean annual feature.**
- **Mean southward flow: weak at 78°N, more visible at 78°40'N**

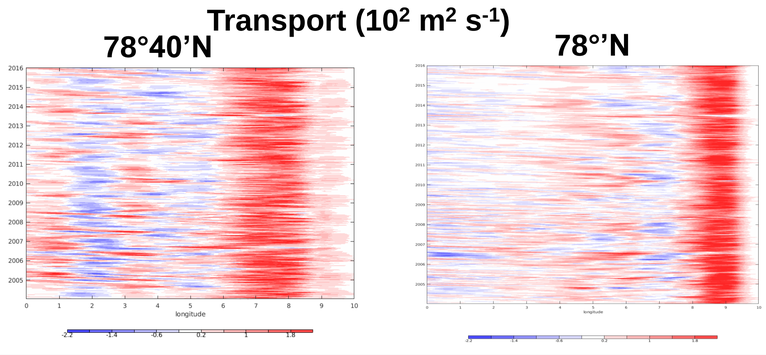
5 Temporal context from observations and model simulation

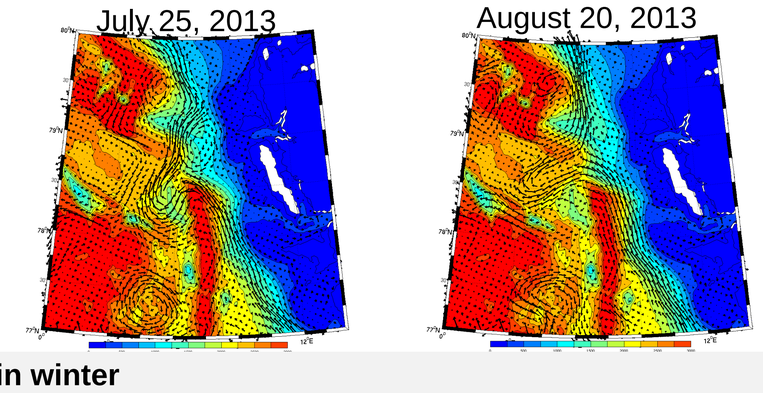
Glider : second realisation of the section



Persistent feature throughout the 2-month period

Transport (10^2 m^2 s^{-1})





- **Annual cycle : strengthening of the northward WSC core in winter**
- **Southward flow at 78°N may be a transient feature, outer part fed by a large scale meridional flow, inner part is a meander or eddy associated with the WSC ?**

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