Exchange of water masses between the outer and inner branch of the Norwegian Atlantic current in the Svinøy section

Preliminary results from MICOM

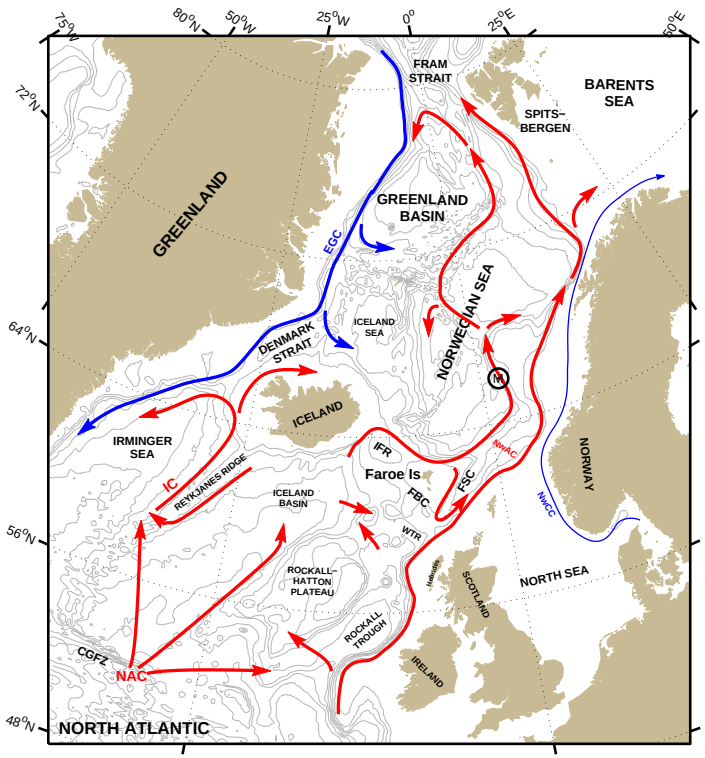
K. Richter

Geophysical Institute
University of Bergen

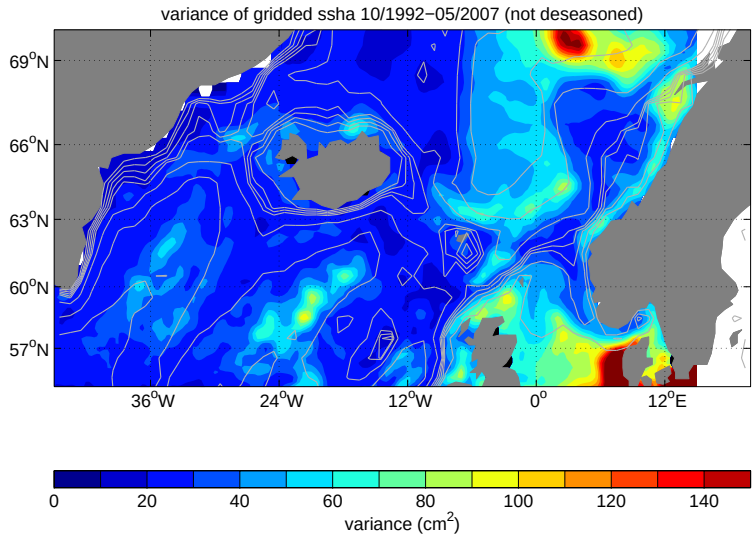
iAOOS workshop, 31 August - 2 September 2009

Outline

Motivation



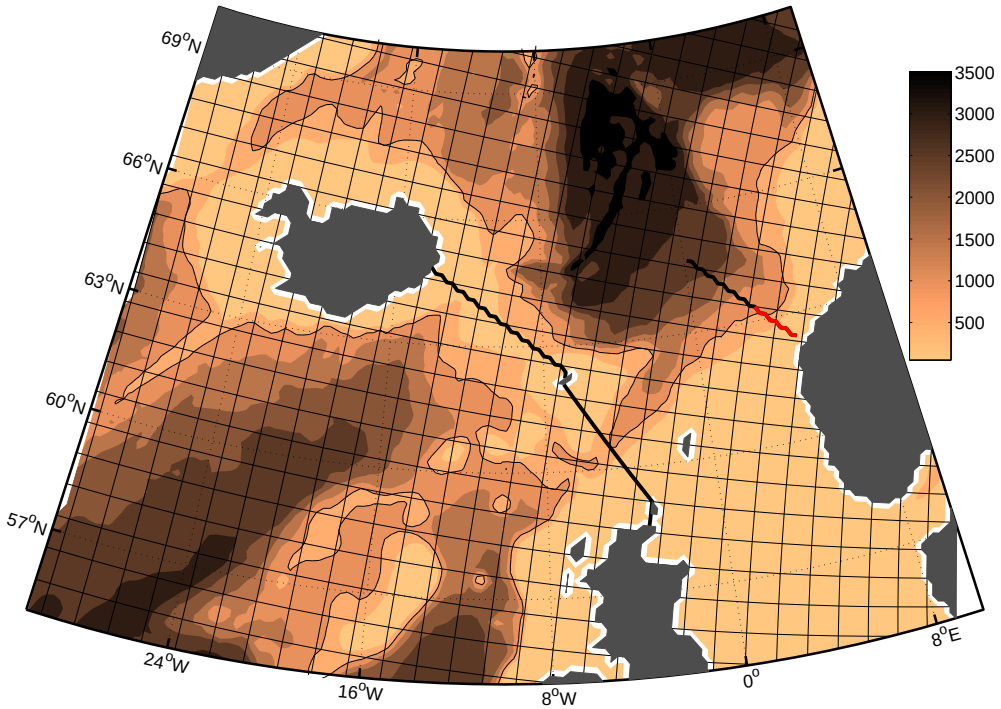
- NwAC: two distinct branches
- Atlantic water meets colder, less saline water in the Iceland Faroe Front



[Furevik and Nilsen, 2005]

MICOM CONF33

Grid, bathymetry and sections

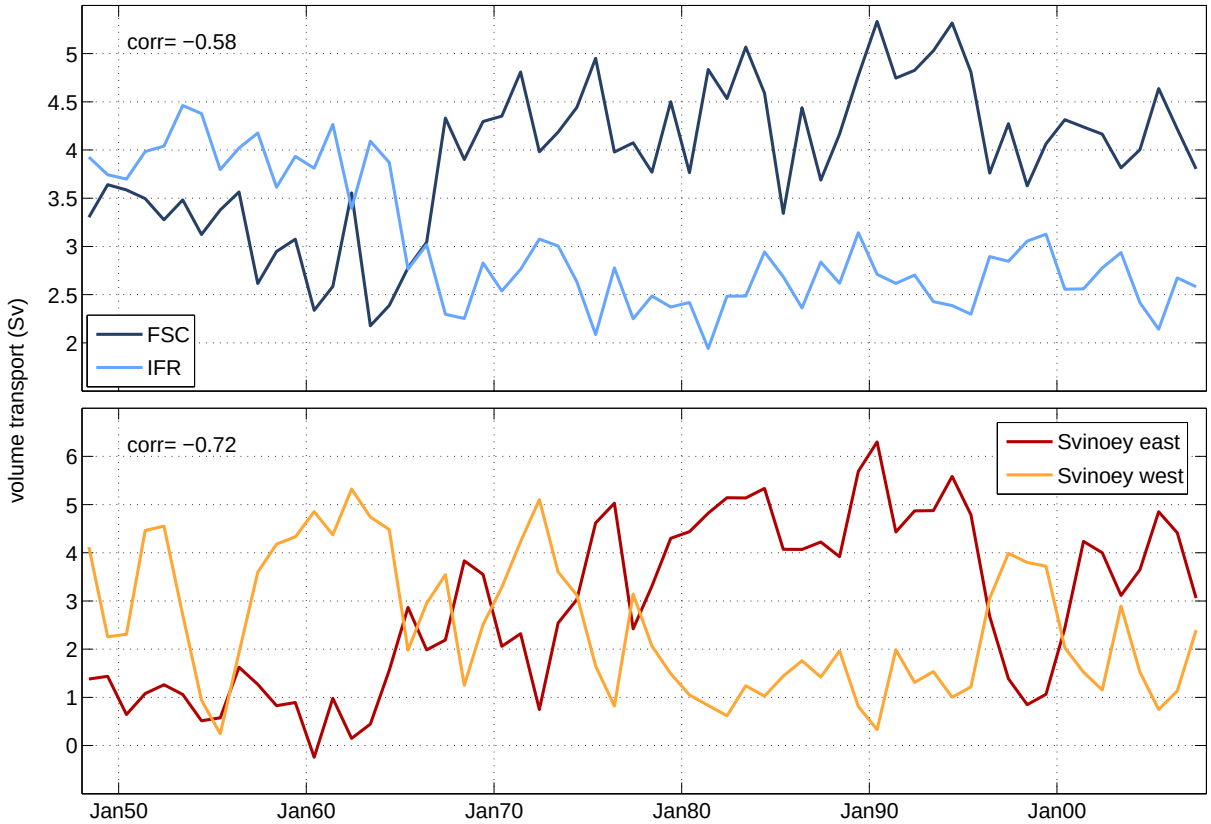


The model:

- isopycnic coordinates
- 35 vertical layers
- forced with NCEP
- resolution: 10-20 km in northern North Atlantic

Atlantic inflow and Norwegian Atlantic current

Atlantic water masses: T>5°C, S>35



Inflow (Sv)

FSC: 3.9±1.4

IFR: 3.0±0.9

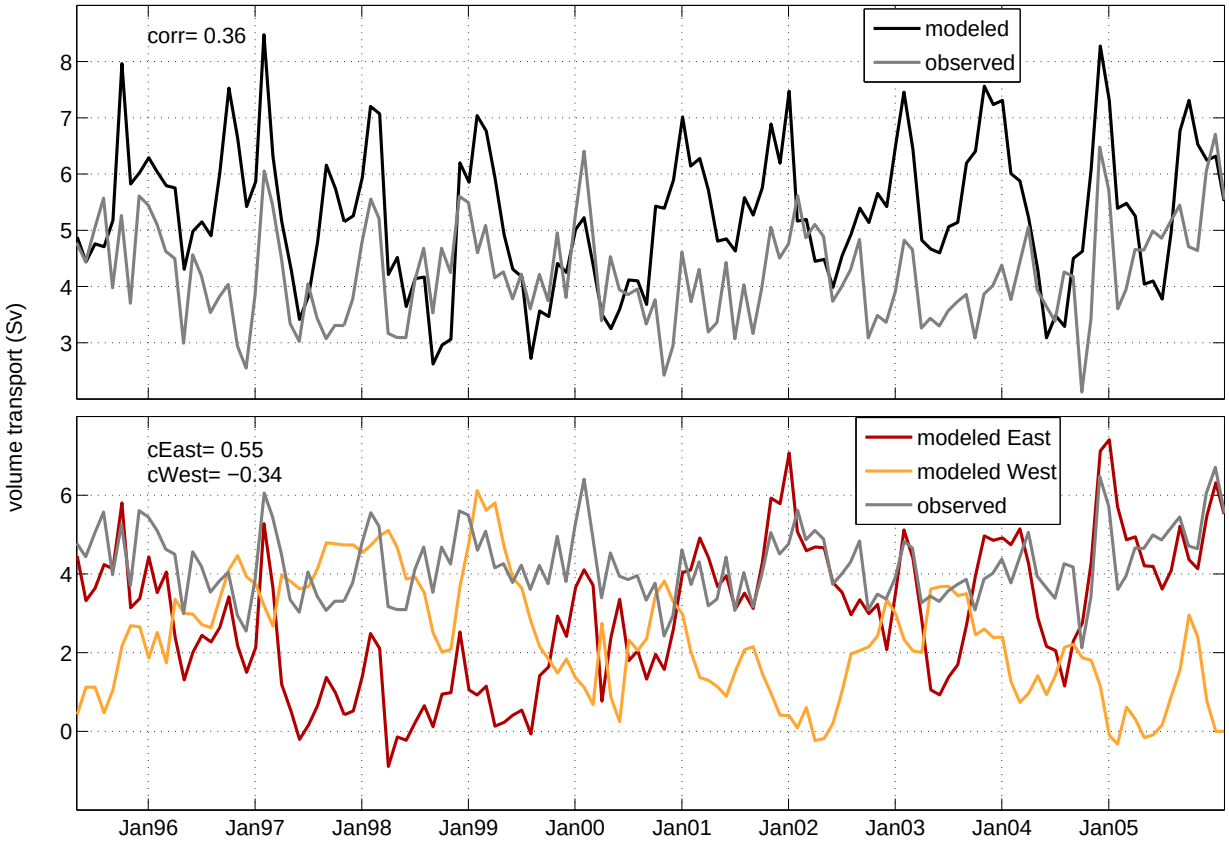
NwAC (Sv)

East: 2.9±2.1

West: 2.5±1.6

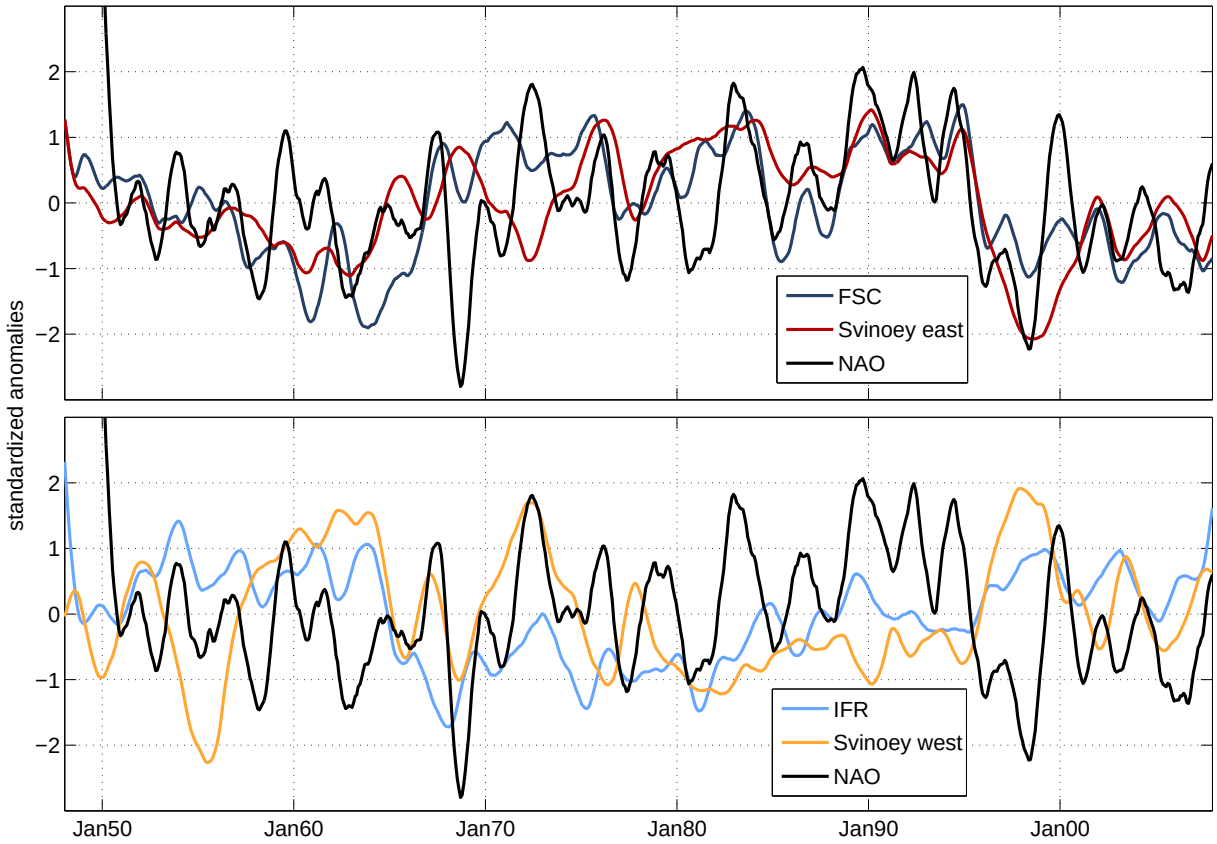
- large anticorrelation not caused by anticorrelation of inflow

Comparison with observations



- good agreement due to seasons

Relation to NAO



- relation between NAO and inflow is time-dependent

What causes positive and negative volume transport anomalies through the Svinøy section?

anomaly: deviation from the long term mean ($>$ 1std)

- Eastern branch (EB):
  - positive anomalies mainly in winter
  - seasonal amplitude $\approx$ 1.2 Sv
  - seasonal maximum in winter
- Western branch (WB):
  - anomalies evenly distributed through seasons
  - seasonal amplitude $\approx$ 0.5 Sv
  - seasonal maximum in autumn

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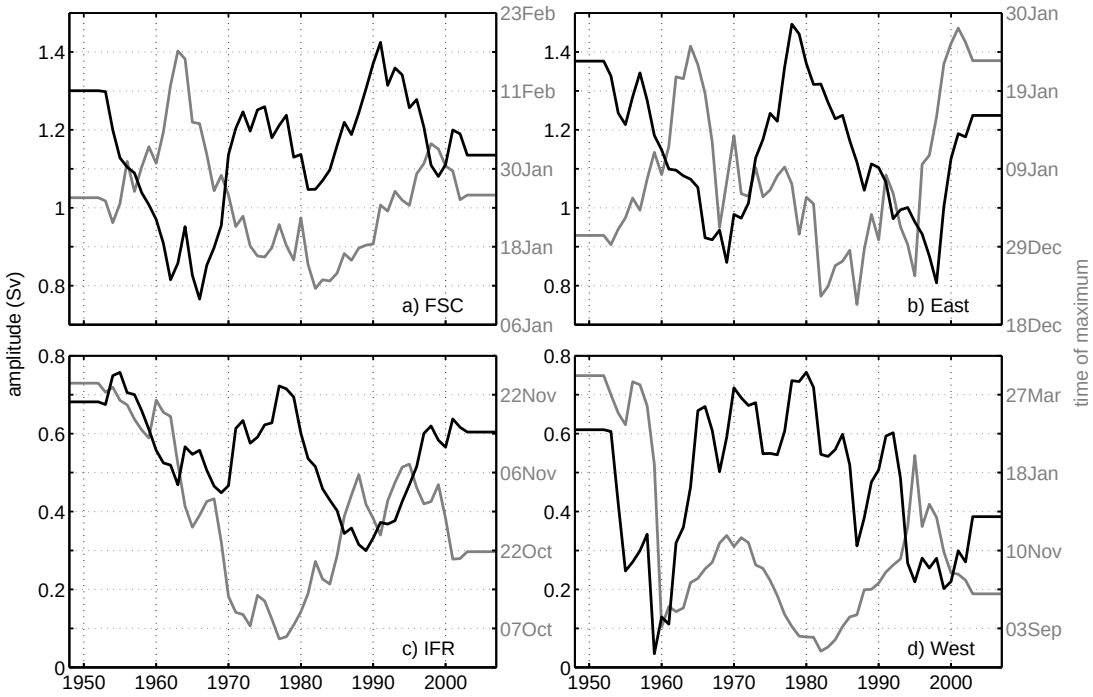
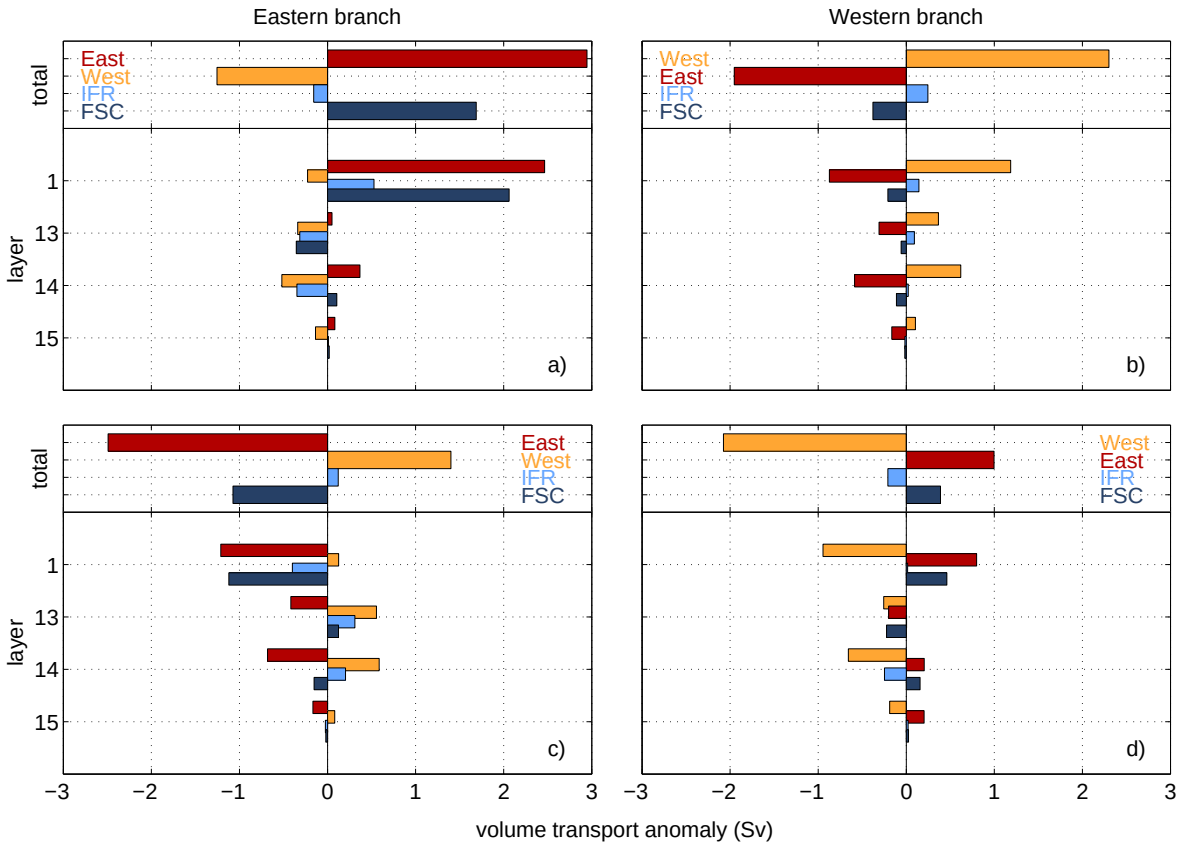
Seasonal amplitude and phase



Composites: volume transport anomalies (>1std) per layer

positive EB:
- increase in FSC
- decrease in WB

negative EB:
- decrease in FSC
- increase in WB



positive WB:
- decrease in EB

negative WB:
- increase in EB:
- Atl. water passes outside the SS

- variability due to variability of inflow (mainly FSC) and exchange of water masses within the NwAC

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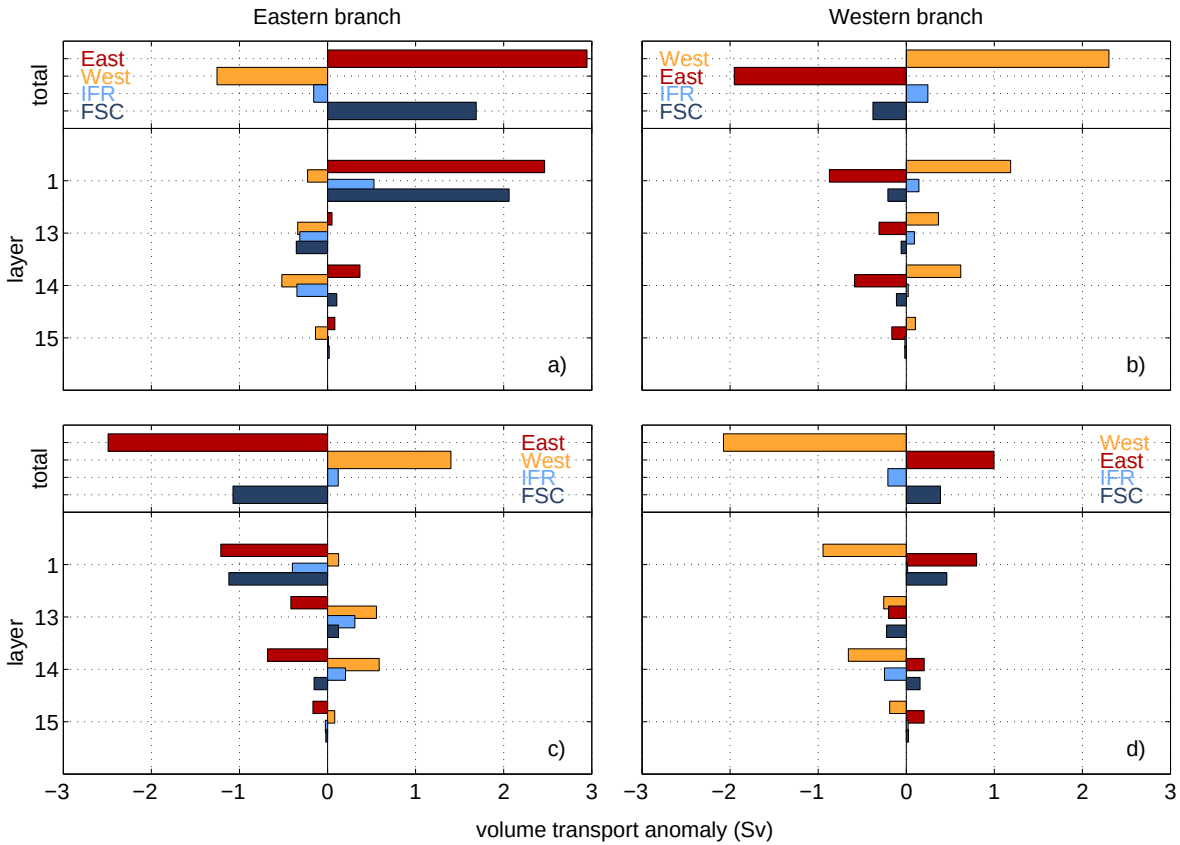

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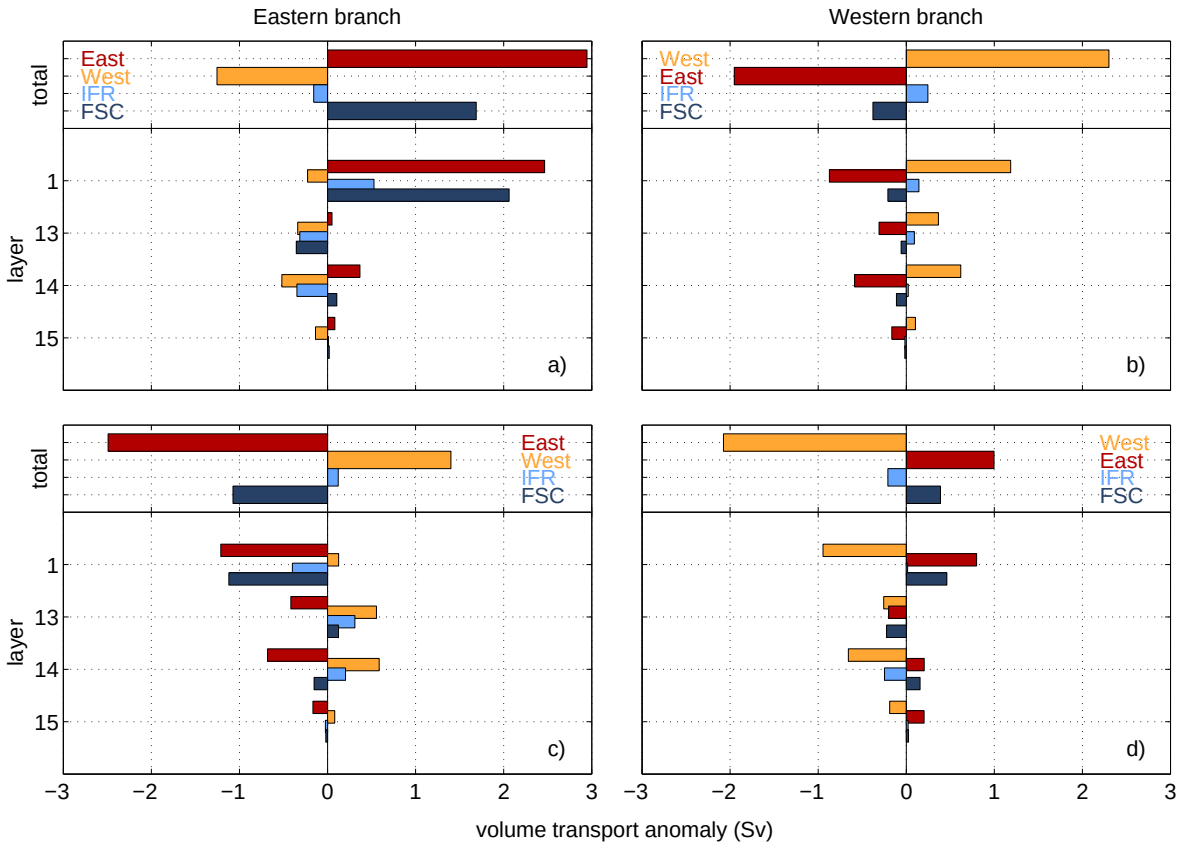

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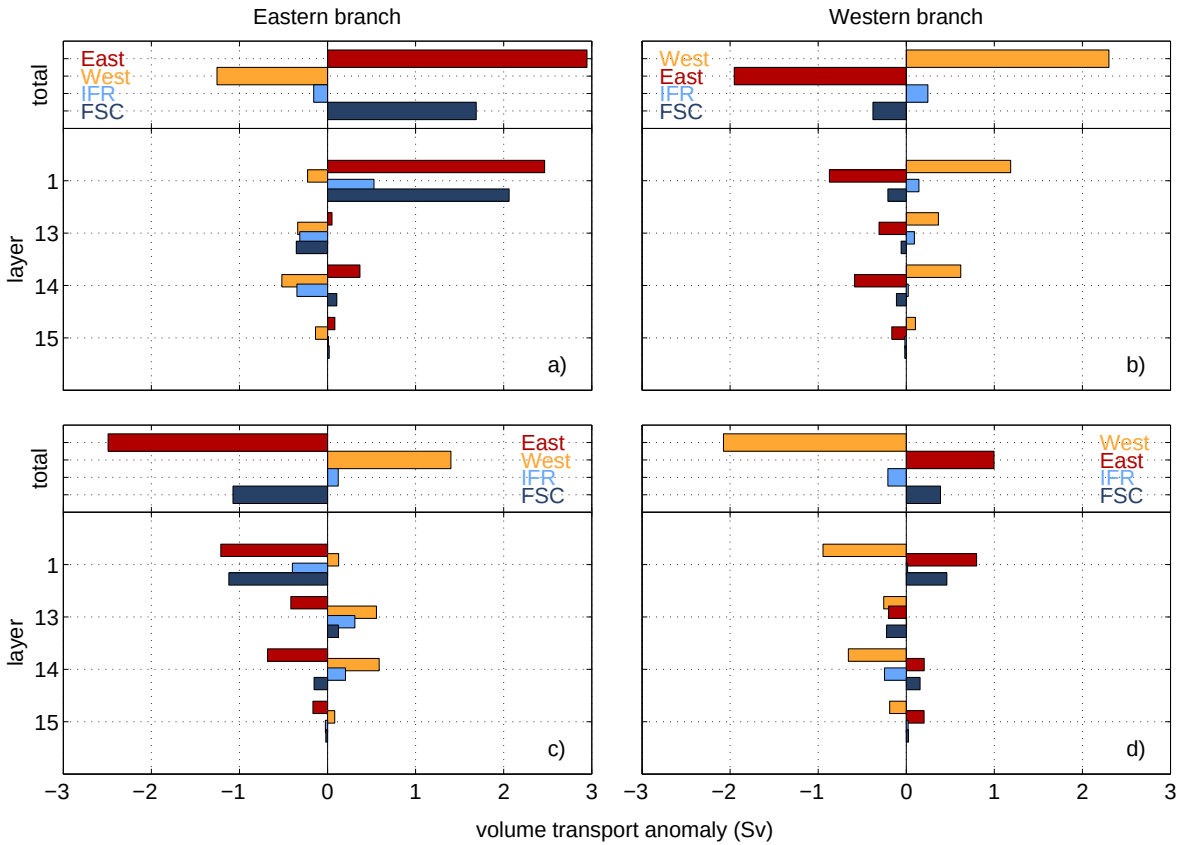

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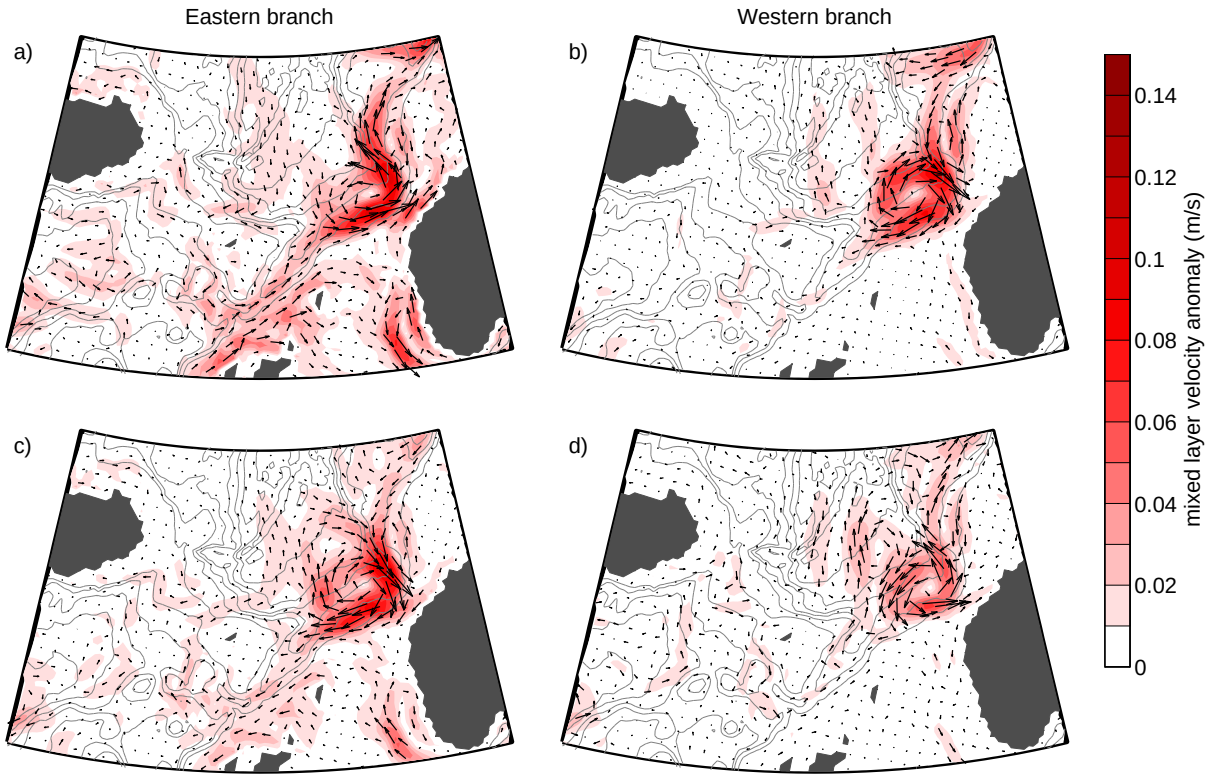
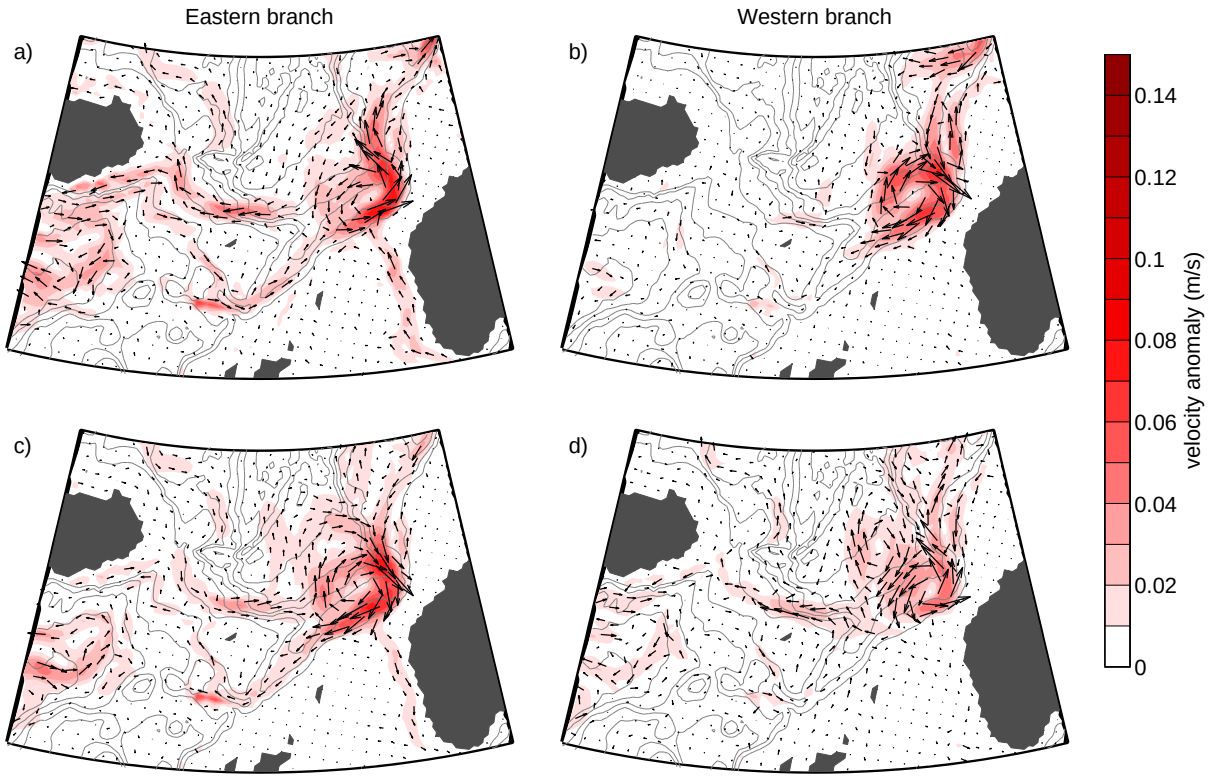
Composites: mixed layer velocity anomaly



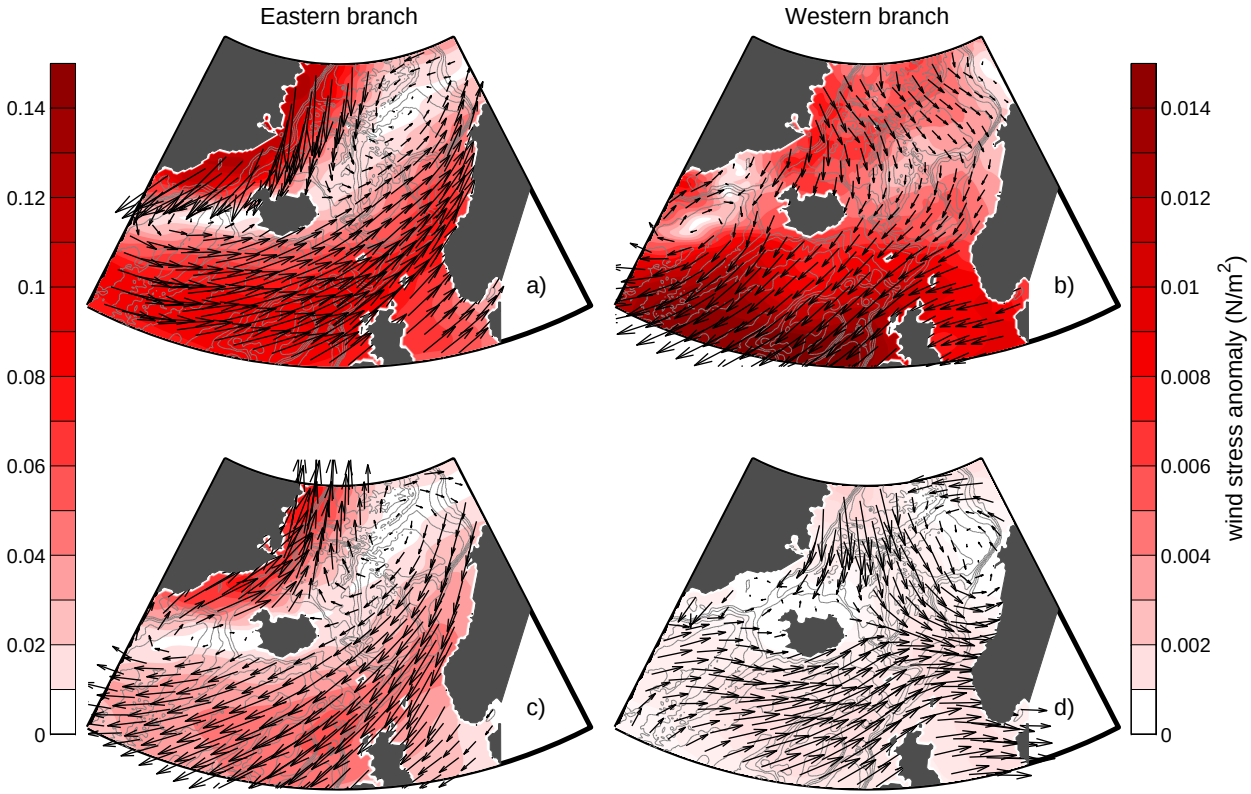
- exchange of water masses between the two branches in the area of the Svinøy section
- increased/decreased strength of the inflowing slope current through the FSC

Composites: layer14 velocity anomaly



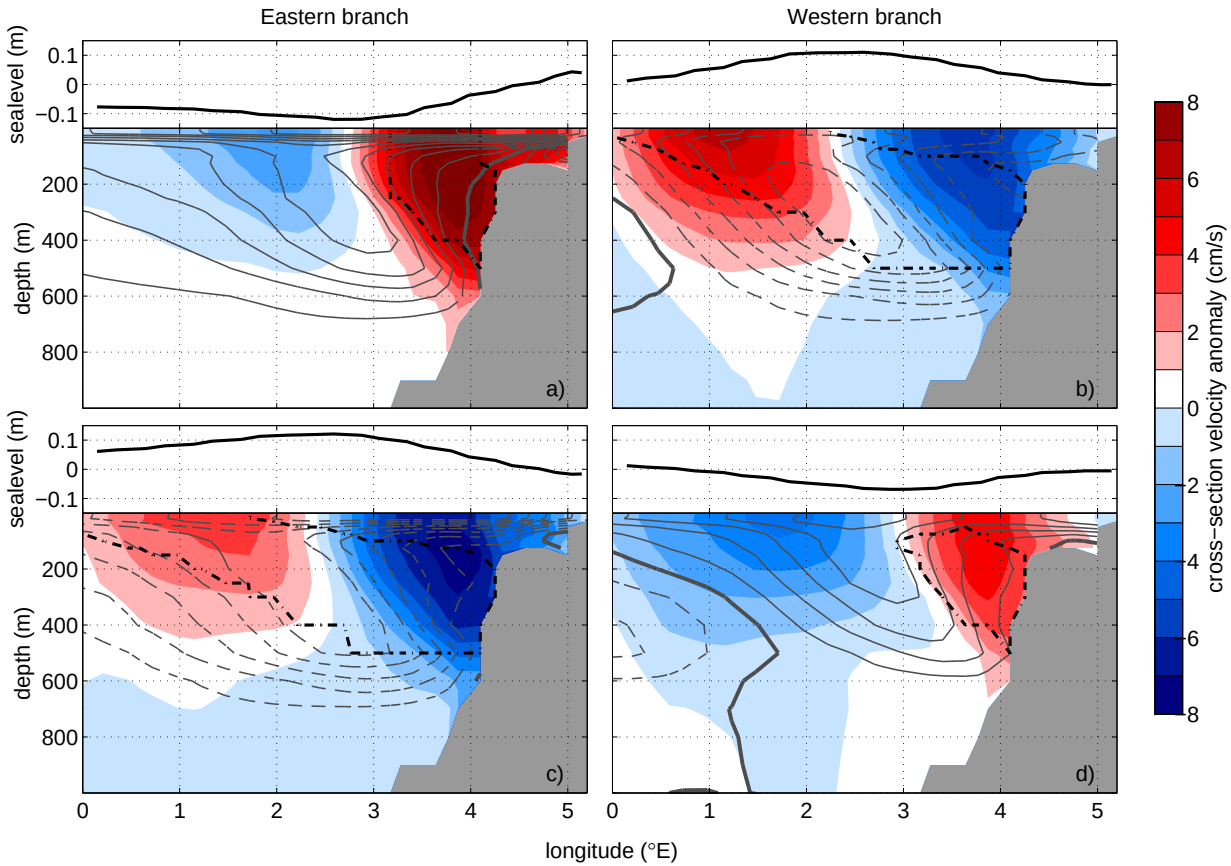
- exchange of water masses between the two branches in the area of the Svinøy section
- increased/decreased strength of the inflowing current over the IFR

Composites: wind stress anomaly



- strength of westerlies controls slope current
- northeasterly winds favor Western branch

Composites: cross-section velocity and density anomaly, and ssh anomaly



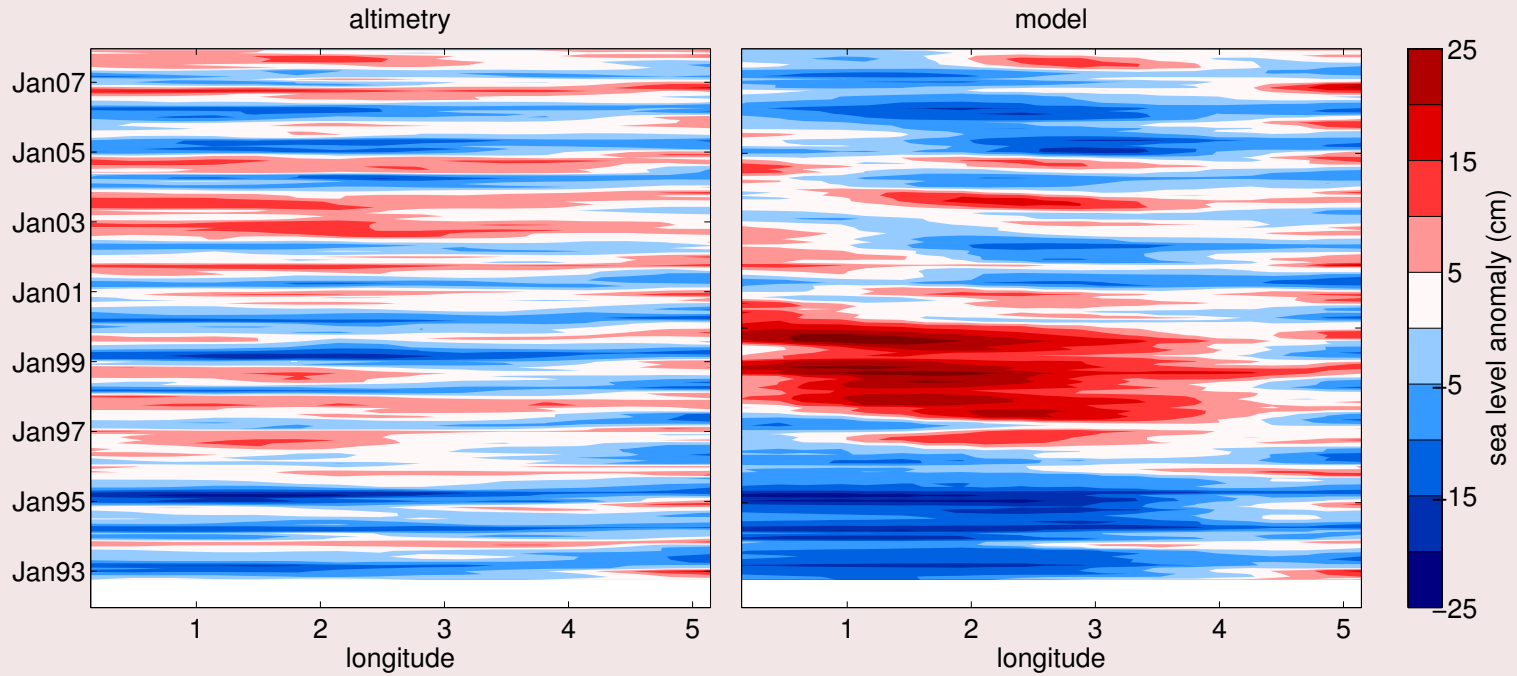
- domain occupied by Atlantic water varies considerably
- variability of currents reflected in sea level anomaly

Summary

- relation with NAO (i.e. wind stress curl) seems time dependent
- Volume flux variability through the Svinøy section governed by variability of the inflow and exchange processes between the two branches of the NwAC
- related to the bifurcation of Faroe branch? Model does not show significant link to recirculation of FB in the FSC
- monitoring the two branches by means of sea level observations?

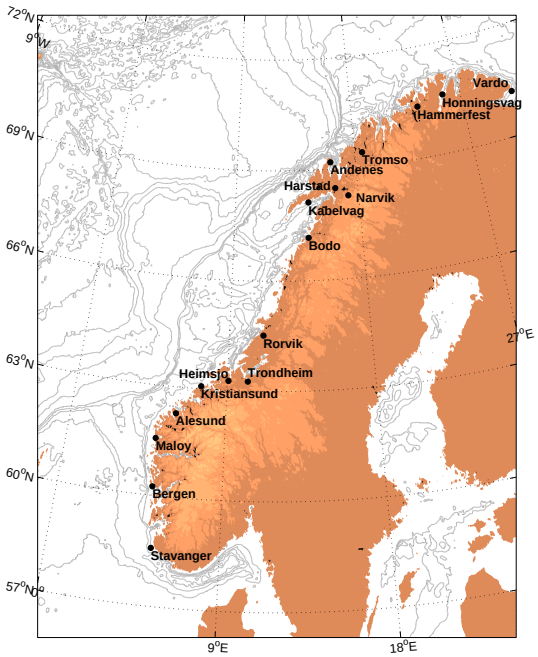
Volume transport from sea level observations?

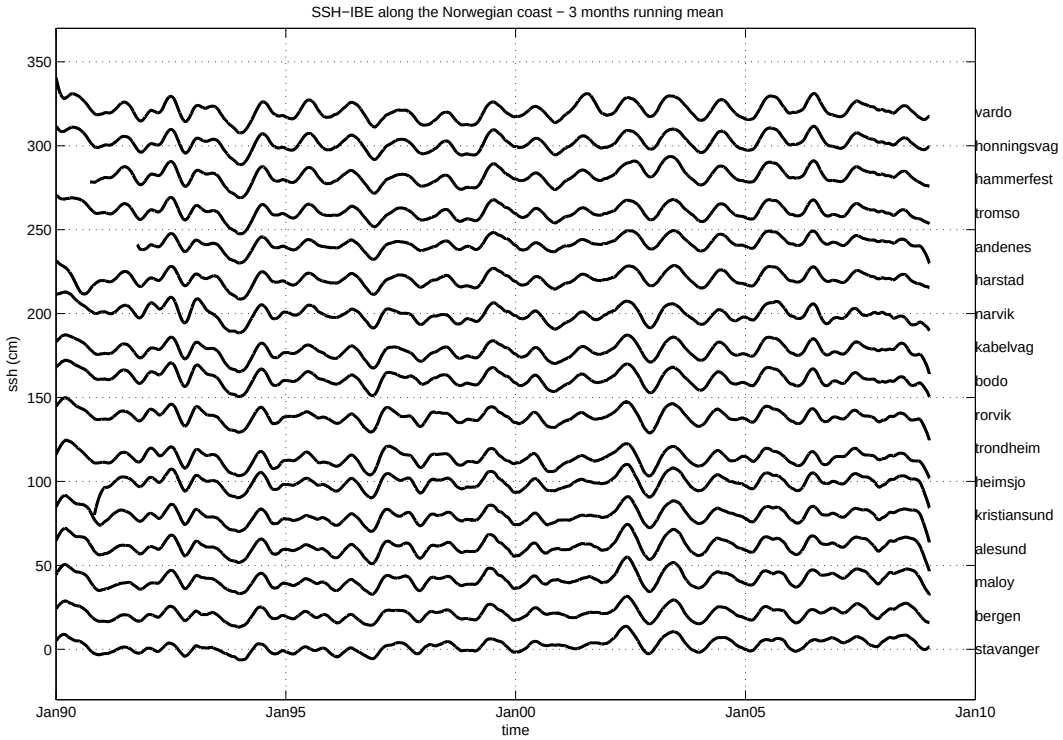
Comparison with altimetry 1992 - 2007



Volume transport from sea level observations?

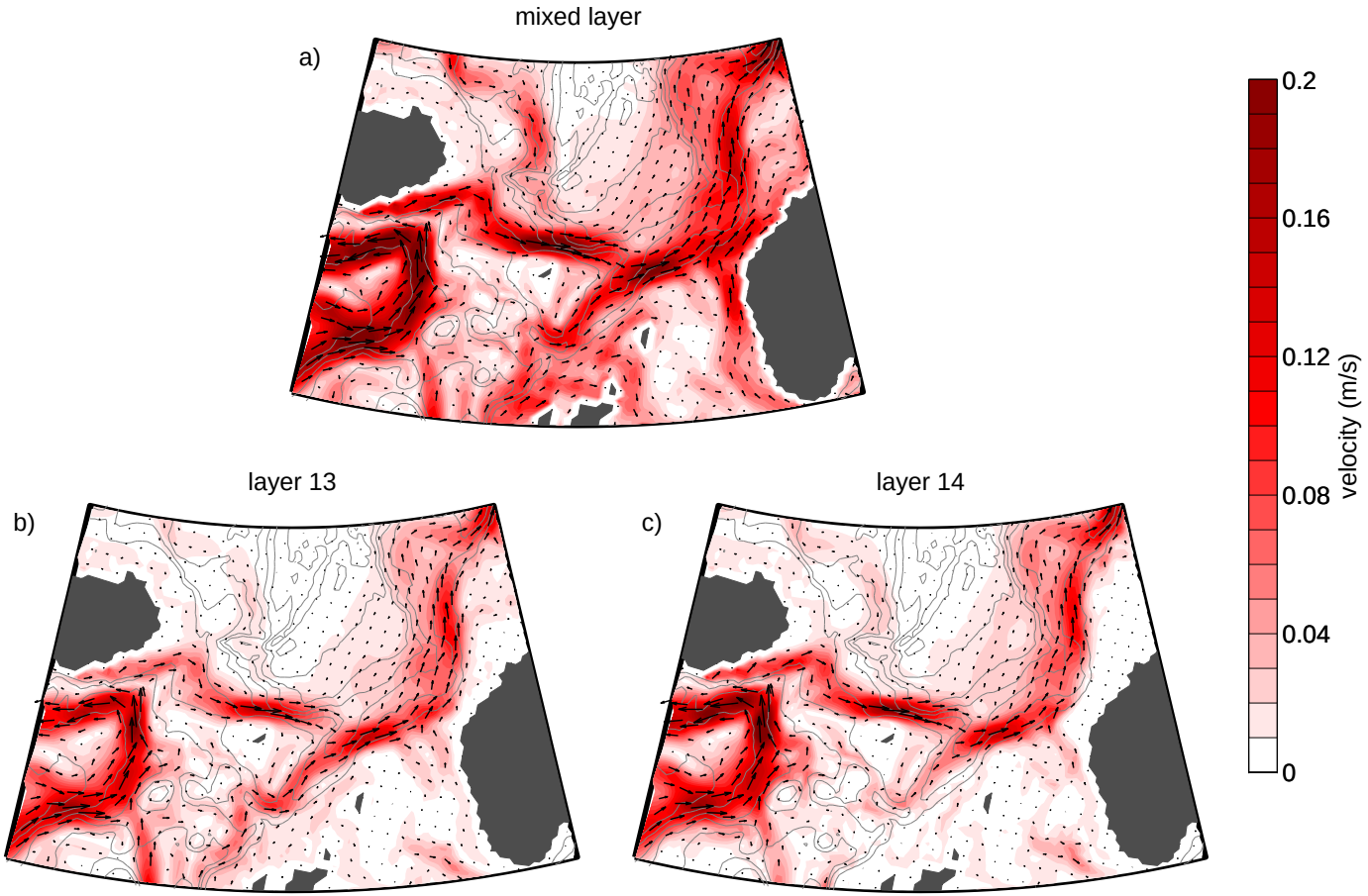
- 17 tidegauges along the norwegian coast



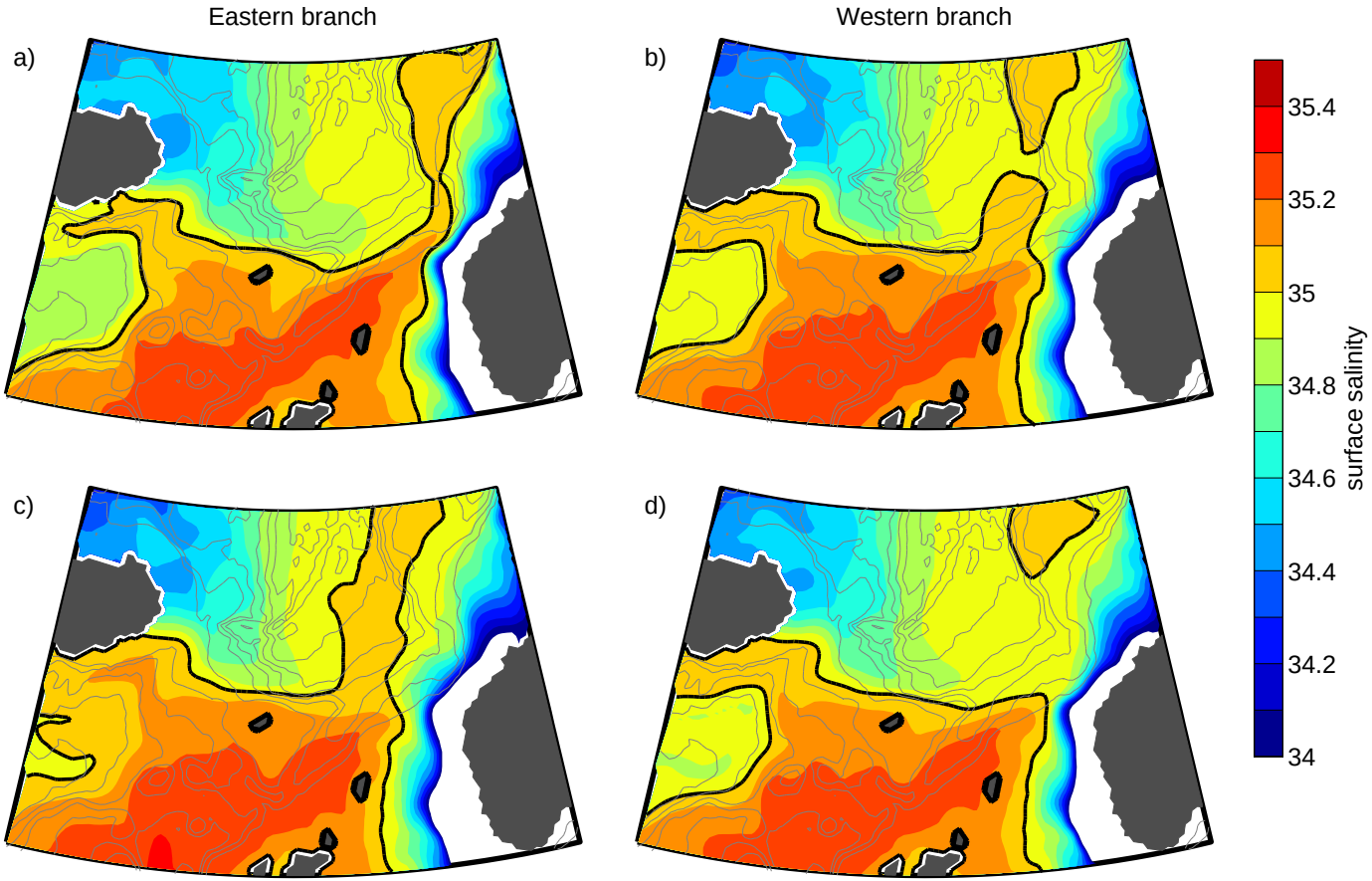


- sealevel $\eta = \eta_{BT} + \eta_{BC}$
- find propagating signals (baroclinic and barotropic) by means of Singular Spectrum Analysis?

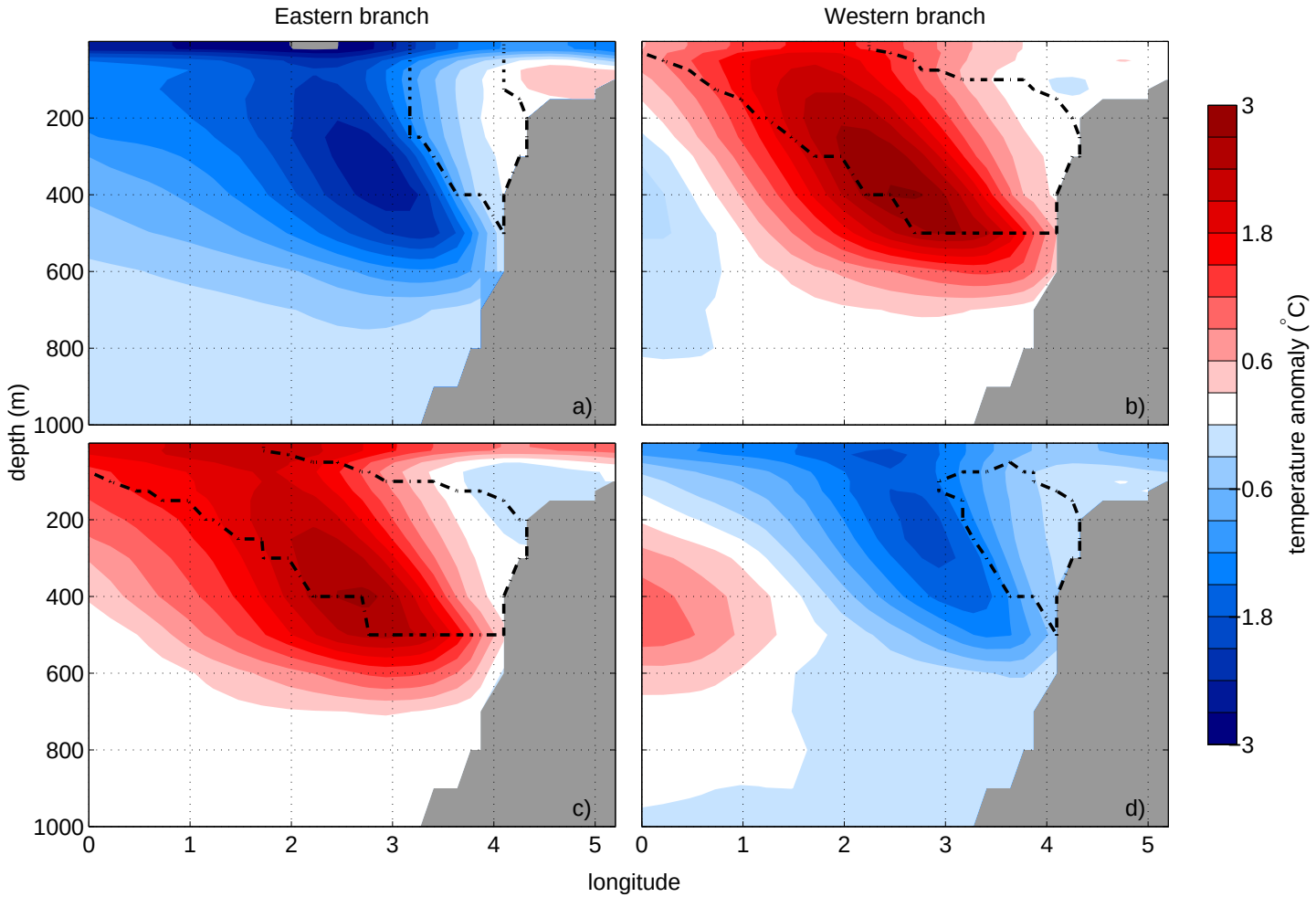
Mean velocity in Atlantic water layers



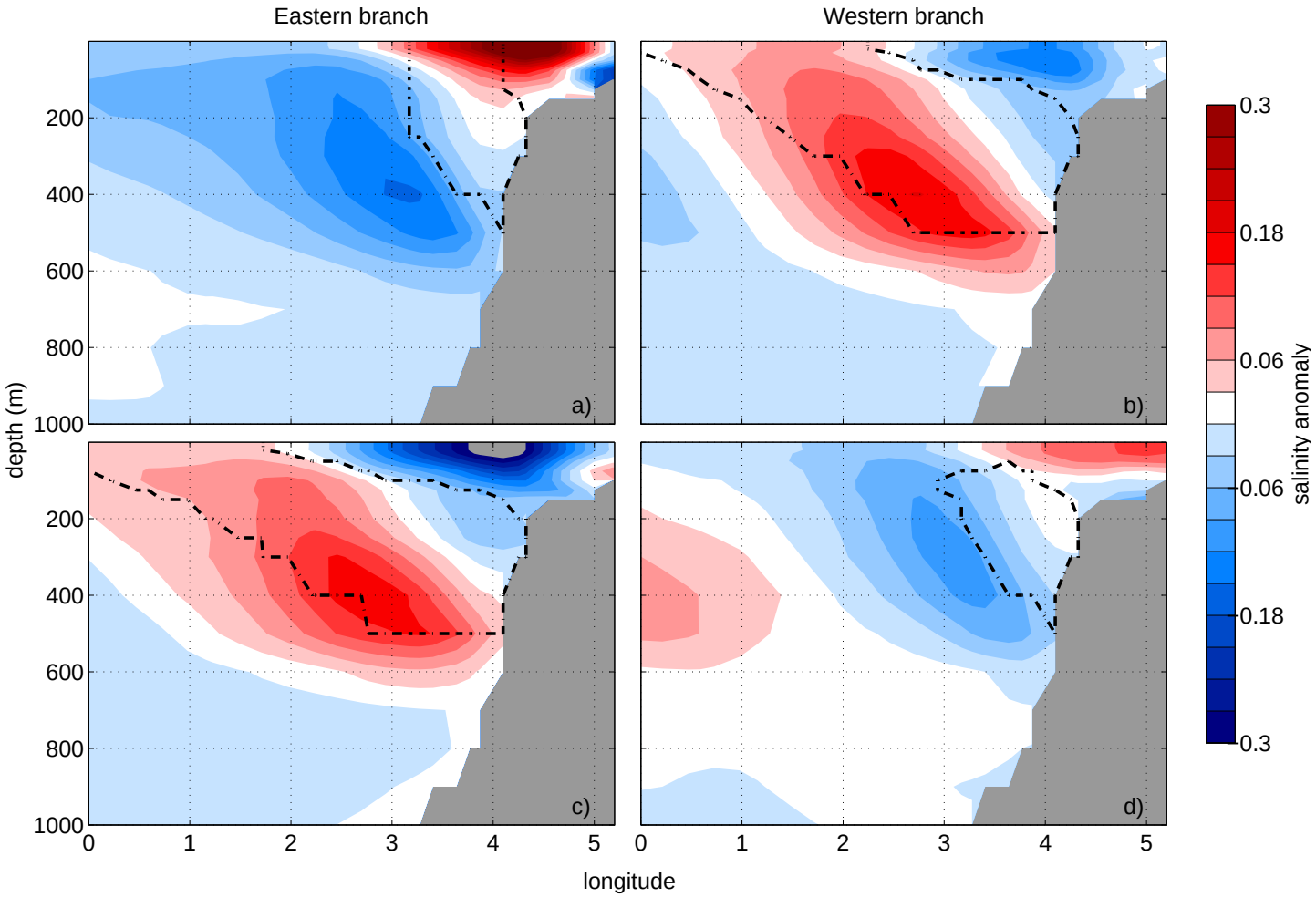
Sea surface salinity



Temperature anomalies



Salinity anomalies



EOF-analysis of cross-section velocity