Variability in Circulation and Hydrography in the Denmark Strait
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Abstract
A great portion of the dense and cold Arctic water that reaches the subpolar North Atlantic flows through the Denmark Strait. Thus, the dynamics that occur around the strait are important for the maintenance and variability of the Atlantic Meridional Overturning Circulation. Therefore, we have set up a high-resolution (2 km) realistic model centered on the east Greenland shelf, the Iceland and Látrabjarg Sess to interpret the sparse observations available for this area. Our analysis focuses on the Látrabjarg hydrographic section across the Denmark Strait. Model hydrography and circulation show good agreement with available observational datasets. We analyze the variability of the Denmark Strait Overflow (DSO) by detecting and characterizing boluses and pulses, which are mesoscale features that increase the mean overflow transport by about 30%.

Model Configuration

Circulation in the Denmark Strait
Boluses are associated with a strengthening of the southward North Icelandic Jet (NIJ) in the center of the strait, which pushes the core of the northward flow at the Iceland shelfbreak slightly eastward.

Conclusions
- Model hydrography and circulation in the Denmark Strait are realistic.
- Boluses and pulses can be detected by looking at hydrographic fields.
- Pulses are associated with a strengthening of the velocity fields within the overflow layer, while the passage of boluses coincides with anomalies in the circulation of the whole water column.

References

Model outputs compare well with:
- (i) a 20-year hydrographic dataset (Mastropole et al., 2017)
- (ii) a velocity survey carried out in October 2008 (Våge et al., 2011)

As the pulse (bolus) arrives to the Denmark Strait, the overflow interface height deepens (rises). When the pulse crosses the strait, the magnitude of the tangential velocity increases.

NIJ
(a)

Normal Velocity Anomaly [cm/s]
−150 −100 −50 0 50 100
Distance from sill [km]
Depth [m]
(b)
Pulses

NIJ
(a)

Normal Velocity Anomaly [cm/s]
−150 −100 −50 0 50 100
Distance from sill [km]
Depth [m] (b)
Boluses

NIJ
(a)

Normal Velocity Anomaly [cm/s]
−150 −100 −50 0 50 100
Distance from sill [km]
Depth [m]
(b)
Conclusions

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