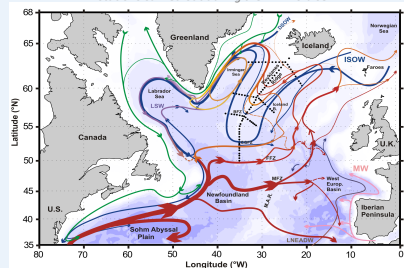


First direct estimates of volume and water mass transports across the Reykjanes Ridge

Outline

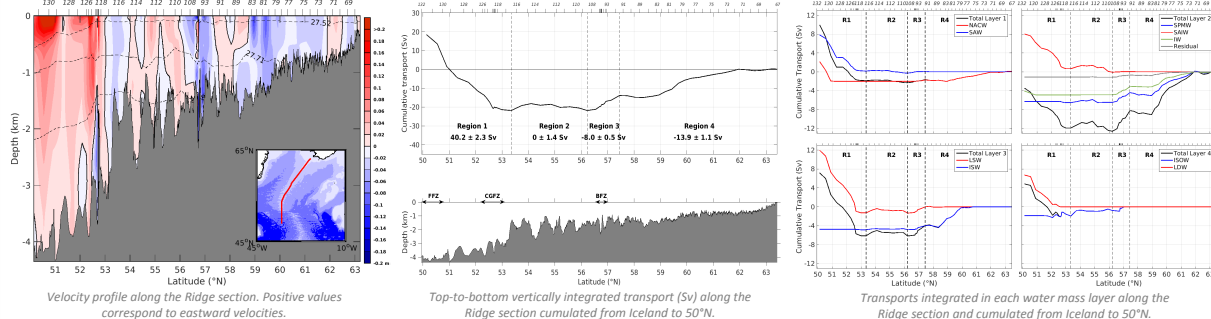
The Reykjanes Ridge is a major topographic feature of the North-Atlantic Ocean, lying south of Iceland, which strongly influences the pathways of the meridional overturning circulation. Until now, the cross-Ridge flow was only indirectly estimated such as results where subject to controversy. Combining ADCP and hydrographic data carried out from the RREX cruise during summer 2015, we computed the first direct geostrophic transports along the top of the Reykjanes Ridge from Iceland to 50°N in order to: Quantify the top to bottom and the north to the south cross-Ridge flow; Estimate the distribution and transport of the water masses over the Ridge section.

Schematic large scale circulation in the northern North Atlantic adapted from Danialt et al. (2016) with the locations of hydrographic stations carried out during the RREX cruise



- North of 53.35°N, the Subpolar Gyre intensity was 21.9 ± 2.5 Sv westward
- The westward flows were intensified at the Bight Fracture Zone (57°N) and at 59 – 61°N
- The water mass distribution over the Ridge was shaped by horizontal circulation and bathymetry

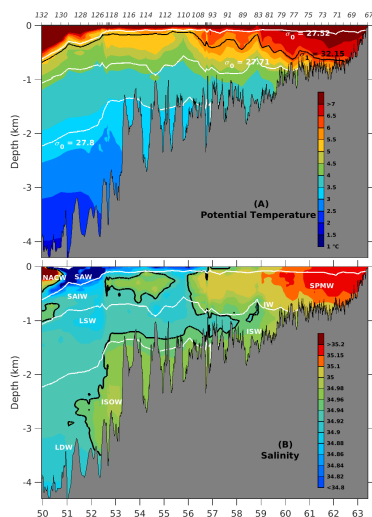
Volume and water mass transports above the Reykjanes Ridge



- Region 1 delimits the eastward flow of the NAC with 22.8 ± 1.1 Sv in the SAF and 17.4 ± 1.7 Sv in the northern branch.
- Region 2 is characterized by no net flow (0 ± 1.4 Sv).
- The westward flow is high in region 3 and 4 with an intensification at BZF (57.3 – 56.4°N) of -8 ± 0.5 Sv and at 59 – 61°N of -13.6 ± 0.8 Sv.
- The SAIW was mainly transported eastward by the NAC with 7.3 ± 0.6 Sv
- The SPMW followed the pathways at BZF (-2.1 ± 0.1 Sv) and at 59 – 61°N (-5 ± 0.4 Sv) as well as the IW whose the total transport was -4.9 ± 0.4 Sv
- The ISW was only transported between 58.5 and 60°N with -4.3 ± 0.3 Sv
- The ISOW crossed the Ridge through the CGFZ (-0.8 ± 0.8 Sv) and BZF (-1.1 ± 0.7 Sv)

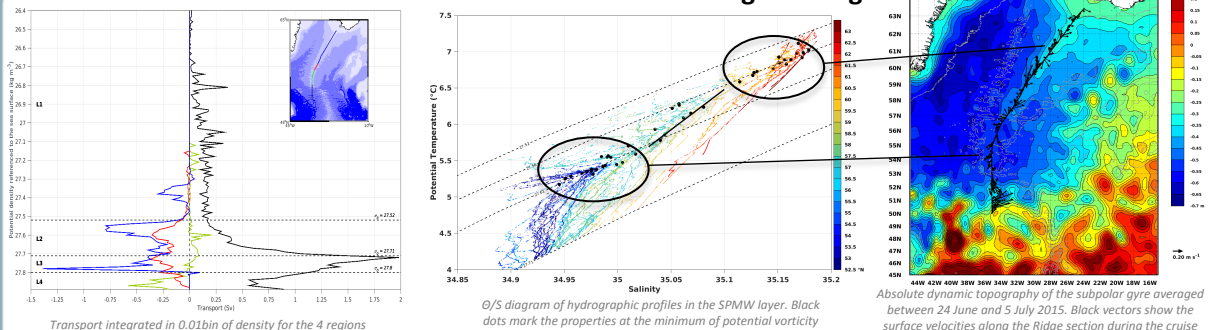
Water mass characterization

- North Atlantic Central Water (NACW)
- Sub-Arctic Water (SAW)
- Sub-Arctic Intermediate Water (SAIW)
- Intermediate Water (IW)
- Subpolar Mode Water (SPMW)
- Labrador Sea Water (LSW)
- Icelandic Slope Water (ISW)
- Lower Deep Water (LDW)
- Iceland-Scotland Overflow Water (ISOW)



(upper) Potential temperature (°C) and (lower) Salinity sections along the Reykjanes Ridge. The potential density anomalies 27.52, 27.71 and 27.8 are in white and are used to delimit the identified water masses. The potential density anomaly 32.15 and the isohaline 34.94 are in black. Bathymetry in grey is from the ship survey.

Evolution of water masses along the Ridge



- The northern branch of the NAC contains a larger proportion of subpolar waters (83.6%) than the SAF (61.4%)
- The comparison between outflow (region 2-3-4) and inflow (region 1) reflects the integral measurement of the mixing in the Iceland Basin and shows a densification of the water masses
- Two pools of SPMW are density compensated at 59 – 63°N (27.56) and at 53 – 55.5°N (27.61)
- The southward increase in density between 59°N and 55.5°N is related to the circulation and composition of the NAC branches in the Iceland Basin
- The southern pool of SPMW at 53 – 55.5°N is locally formed in the center of the Subpolar Gyre where the net flow is weak
- The SAF and the northern branch of the NAC are connected to the 59 – 61°N and BZF pathways respectively
- The northern branch of the NAC was north and strong enough to disturb the ISOW flow in the CGFZ
- A weak dynamic height gradient is located along the Ridge section between 53.35 and 56.4°N