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Circulation in the region of the Reykjanes Ridge in June-July 2015

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The Reykjanes Ridge is a major topographic feature of the North-Atlantic Ocean lying south of Iceland that strongly influences the pathways of the upper and lower limbs of the meridional overturning cell. The circulation in the vicinity of the Reykjanes Ridge is anticyclonic and characterized by a southwestward flow (the East Reykjanes Ridge Current, ERRC) along the eastern flank and a northeastward flow (the Irminger Current, IC) along the western flank. Even if it is admitted that the ERRC feeds the IC through a cross-ridge flow, details and magnitude of this circulation remain unclear.

In this study, the circulation in the region of the Reykjanes Ridge was investigated based on ADCP and $CTDO_2$ measurements carried out from the R/V Thalassa during the RREX cruise, which provided a snapshot of the water mass distribution and circulation during summer 2015. One hydrographic section followed the top of the Reykjanes Ridge between Iceland and 50˚N and three other sections were carried out perpendicularly to the ridge at 62˚N, 58.5˚N and 56˚N. Geostrophic transports were estimated by combining ADCP and hydrographic data. Those observations were used to provide an estimate of the circulation around the Ridge and to discuss the meridional evolutions of the ERRC and IC transports along the Ridge and their connection to the cross-Ridge flows.

The section along the top of the Reykjanes Ridge allowed us to describe the cross ridge exchanges. A westward flow crossed the Ridge between Iceland and 53˚N. Its top to bottom integrated transport was estimated at 17.7 Sv. Two main passages were identified for the westward crossing. A first passage is located near 57˚N (Bight Fracture Zone, BFZ) in agreement with previous studies. More surprisingly, a second passage is located near 59˚N. The top-to-bottom transports of those two main flows were estimated at 6.5 and 8 Sv respectively.

The IC and ERRC top-to-bottom integrated transports were maximum at 58.5˚N and estimated at 24.7 Sv and 17.6 Sv respectively. At 58.5˚N, the IC was composed of two baroclinic branches while the ERRC was composed of one barotropic branch. The analysis also suggested that the IC was partly fed by the subpolar branch of the North Atlantic Current characterized by relatively low salinity and temperature. This subpolar branch would directly feed the IC without entering in the Iceland Basin. The northward increase in salinity and temperature of the IC core between 56˚N and 62˚N highlights the entrainment in the IC of saltier and warmer subtropical waters coming from the eastern side of the Ridge.