JGR Oceans

RESEARCH ARTICLE
10.1029/2021JC017524

Moored Observations of the Iceland-Scotland Overflow Plume Along the Eastern Flank of the Reykjanes Ridge

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Key Points:

- Dense waters overflowing the Iceland-Scotland ridge nearly double their volume transport through entrainment of lighter ambient waters
- The export of the Iceland-Scotland Overflow Water from the Iceland Basin is approximately 5.3 Sv net of interior recirculation
- The transport of the Iceland-Scotland Overflow plume found in this study is larger than most previously published estimates

Supporting Information:

Supporting Information may be found in the online version of this article.

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Citation:

Johns, W. E., Devana, M., Houk, A., & Zou, S. (2021). Moored observations of the Iceland-Scotland Overflow plume along the eastern flank of the Reykjanes Ridge. *Journal of Geophysical Research: Oceans*, *126*, e2021JC017524. https://doi.org/10.1029/2021JC017524

Received 28 APR 2021
Accepted 9 AUG 2021

Abstract Since 2014, an array of current meters deployed in the Iceland Basin as part of the Overturning in the Subpolar North Atlantic Program has provided new measurements of the southward flow of Iceland-Scotland Overflow Water (ISOW) along the eastern flank of the Reykjanes Ridge. The location of the array, near 58–59°N, captures the ISOW plume at the farthest downstream location in the Iceland Basin before significant amounts of ISOW can flow into the Irminger Basin through deep fractures in the Reykjanes Ridge. The net transport of the ISOW plume at this location—approximately 5.3 Sv based on the first 4 years of observations—is significantly larger than previous values obtained farther north in the Iceland Basin, suggesting that either previous measurements did not fully capture the plume transport or that additional entrainment into the ISOW plume occurs as it approaches the southern tip of the Reykjanes Ridge. A detailed water mass analysis of the plume from continuous temperature/salinity observations shows that about 50% of the plume transport (2.6 Sv) is derived from dense waters flowing over the Nordic Sea sills into the Iceland Basin, while the remainder is made up of nearly equal parts of entrained Atlantic thermocline water and modified Labrador Sea Water. The overall results from this study suggest that the ISOW plume approximately doubles its transport through entrainment, similar to that of the Denmark Strait overflow plume in the Irminger Sea that forms the other major overflow source of North Atlantic Deep Water.

Plain Language Summary This study reports new observations of an important branch of the Atlantic Meridional Overturning Circulation known as Iceland Scotland Overflow Water. It is formed from dense Nordic Sea waters that spill across the Iceland-Scotland Ridge and mix with ambient North Atlantic waters to form a bottom-intensified current along the eastern flank of the Mid-Atlantic Ridge south of Iceland. These new observations provide the most comprehensive measurements of this flow to date—in terms of both their spatial and temporal coverage—and show that the transport of this current and the overall formation rate of Iceland Scotland Overflow Water is much larger than previously