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Annual variability of the long-lived anthropogenic radionuclides ^{129}I and ^{236}U in the Fram Strait and their use as water mass composition tracers

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Anthropogenic chemical tracers are powerful tools to study pathways, water mass provenance and mixing processes in the ocean. Releases of the long-lived anthropogenic radionuclides ^{129}I and ^{236}U from European nuclear reprocessing plants label Atlantic Water entering the Arctic Ocean with a distinct signal that can be used to track pathways and timescales of Atlantic Water circulation in the Arctic Ocean and Fram Strait. Apart from their application as transient tracers, the difference in anthropogenic radionuclide concentrations between Atlantic- and Pacific-origin water provides an instrument to distinguish the interface between both water masses. In contrast to classically used water mass tracers such as nitrate-phosphate (N:P) ratios, the two radionuclides are considered to behave conservatively in seawater and are not affected by biogeochemical processes occurring in particular in the broad shelf regions of the Arctic Ocean.

Here we present a time-series of ^{129}I and ^{236}U data across the Fram Strait, collected in 2016 (as part of the GEOTRACES program) and in 2018 and 2019 (by the Norwegian Polar Institute). While the overall spatial distribution of both radionuclides was similar among the three sampling years, significant differences were observed in the upper water column of the EGC, especially between 2016 and 2018. This study is the first attempt to investigate the potential of ^{129}I and ^{236}U as water mass composition tracers in the East Greenland Current (EGC). We discuss how the ^{129}I - ^{236}U tracer pair can be applied to estimate fractions of Atlantic and Pacific Water, especially considering their time-dependent input into the Arctic Ocean.