^{129}I and ^{236}U Transit Time Distributions of Atlantic waters in the Arctic Ocean and Fram Strait

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Anthropogenic chemical tracers such as $\Delta^{14}C$, ^{3}H or CFC-11 are powerful tools to study ocean circulation time scales, ventilation processes and to infer, for instance, the concentration of anthropogenic carbon in the ocean. Among these transient tracers, the long-lived radionuclides ^{129}I ($T_{1/2}$ = 15.7 My) and ^{236}U ($T_{1/2}$ = 23.5 My) proved to act as suitable water mass tracers, in particular for the study of Atlantic water circulation in the Arctic Ocean. Their different historical releases, mainly from the two European Nuclear Reprocessing Plants (RP) of Sellafield and La Hague, can be used to extract valuable information about the sources and circulation patterns of waters in the Arctic Ocean and beyond.

Here we explore the strenghts and weaknesses of using ^{129}I, also in combination with ^{236}U, to study transit times of Atlantic origin waters in the Arctic Ocean and Fram Strait. We use ^{129}I and ^{236}U data from samples collected during several expeditions. (2011, 2012 and 2015 in the Arctic Ocean; 2016 and 2018 in Fram Strait). In particular, we focus on the transit-time distribution (TTD) approach, which accounts for interannual mixing along the flow path. This approach has been previously used mainly with CFCs and SF_6 to estimate ocean ventilation times, but has also been applied to ^{129}I, ^{137}Cs and CFC-11 in the Arctic Ocean.

We will discuss this method and apply it to estimate mean ages of waters in the Arctic Atlantic Layer (about 300-1000 m depth) and surface waters in the Polar Mixed Layer, both in the Arctic Ocean and Fram Strait, using ^{129}I, ^{236}U and potentially CFC-11.