$^{129}I/^{236}U$ and $^{236}U/^{238}U$ as a dual tracer for water mass circulation in the North Atlantic and Arctic Ocean

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Artificial radionuclides have been introduced to the oceans from nuclear weapons tests (1950's-1960's), nuclear accidents (e.g. Chernobyl, 1986) and nuclear reprocessing plants (Sellafield, and La Hague, from 1960s until today) and since then they are used as transient tracers for ocean circulation. Among these radionuclides, ^{129}I and ^{236}U have become of special interest in the last decade and the combination of $^{129}I/^{236}U$ to $^{236}U/^{238}U$ atom ratios has been suggested as a tool to determine transit times in the Arctic Ocean [1] and to constrain the source of the anthropogenic contamination [2]. The performance of this new dual tracer has now been tested as data from samples collected during several cruises performed in the North Atlantic and Arctic oceans.

Here we present the results of a number of expeditions to the Arctic Ocean (2011, 2012 and 2015) and the North Atlantic Ocean (2010, 2014). Atlantic waters entering the Arctic Ocean are tagged with high $^{129}I/^{236}U$ ratios (>100) and $^{236}U/^{238}U$ ratios (>1000 $x10^{-12}$), originating from more recent (<15 years) releases from reprocessing plants. Deep and bottom waters in the Arctic Ocean have much lower $^{129}I/^{236}U$ and $^{236}U/^{238}U$ ratios (supported by low ^{14}C concentrations), representing the isolation of these waters from anthropogenic signals. New data from Barents Sea Branch Waters indicate the presence of a stronger signal from waters tagged by La Hague while Fram Strait Branch Waters, show a mixture of both Sellafield and La Hague endmembers.

In order to better disentangle the sources and fate of ^{129}I and ^{236}U to the North Atlantic and Arctic oceans, results from a global ocean model will be presented and discussed in the context of the experimental data.

[1] Christl *et al*. (2015) *J. Geophys. Res. Oceans*, 120.
[2] Casacuberta *et al*. (2016) *Earth Planet. Sc. Lett*. 440.