

## **Transient tracers in the Fram Strait – Excess SF<sub>6</sub> and anthropogenic carbon transport**

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The determination of ventilation timescales and anthropogenic carbon contents of the Nordic Seas and the Arctic Ocean is a challenging field since the application of transient tracers and the Inverse Gaussian – Transit Time Distribution (IG-TTD) is much more difficult at high latitudes. The concentration ratio between transient tracers is shifted beyond reasonable limits of the model with increasing latitude. This feature can be observed in the northern and southern hemisphere, e.g. in the Nordics Seas and the Southern Ocean. Possible reasons are discussed in the literature and it is suggested that complicated mixing processes occur in such ocean areas which cannot be explained by the IG-TTD approach.

In contrast, we set the focus on saturation effects of transient tracers and, in case of SF<sub>6</sub> in the Fram Strait, additional anthropogenic sources by a tracer release experiment in the mid-1990s. We showed that the tracer concentration ratio of CFC-12 and SF<sub>6</sub> corresponds to the the shape of IG-TTD ratios although with a specific offset of CFC-12 under- and SF<sub>6</sub> supersaturation. This unusual coexistence of two different saturation states can be explained by the different sensitivity of the tracers to bubble induced supersaturation and, additionally, excess SF<sub>6</sub> by the deliberate tracer release experiment in the Greenland Sea. The total amount of excess SF<sub>6</sub> can be estimated by back-calculating the ideal concentration of SF<sub>6</sub> using saturation corrected CFC-12 data and the IG-TTD with standard parameterisation. The difference between the ideal concentrations and the measured values then yield the total excess SF<sub>6</sub> in the Fram Strait.

Furthermore, the saturation corrected CFC-12 data can be used to determine the anthropogenic carbon content in the water column. The net flux of anthropogenic carbon through the Fram Strait was estimated using a mean velocity field (2002-2010) which was obtained by a mooring array located at the same section at 78°50'N. This estimate indicates a net outflow of anthropogenic carbon through the Fram Strait. However, according to the mass balance of the Arctic Ocean and the higher concentrations of anthropogenic carbon in poleward propagating water masses in all major gateways, a net inflow of anthropogenic carbon can be observed.