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# Decadal variability in the transient tracer distribution in the upper Arctic Ocean

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The Arctic is warming stronger and faster than other regions during the climate change. Within this development, the Arctic Ocean's water masses and ventilation processes are changing as well. Transient anthropogenic tracers can be used to track water masses and to investigate ventilation and mixing processes. For these tracers, e.g. chlorofluorocarbons (CFCs), the atmosphere is the only source to the ocean and they are conservative in the water. In this study, we analyse CFC-12 ($CCl_2F_2$) along two transects in the Canadian basin of the central Arctic Ocean covered in different decades (T1: 1994 and 2015, T2: 2005 and 2015), with additional hydrographic data for context. We find differences in both the tracer concentration and the hydrographic properties between the years and transects. Along the first transect (located at ~180°W), the difference in saturation between 2015 and 1994 is largest in the layer of the Atlantic Water at high latitudes (> 82°N). A similar strong increase in CFC-12 saturation is observed along the second transect (located at 150°W). In contrast to the saturation increase in the Atlantic Water layer, we find a decrease close to the surface, which is correlated to oversaturations in 2005 in this region. At the same time, the surface waters were more saline in 2005 indicating a mixing event. Oversaturation is present in all years, except in 1994. Existence of oversaturation can be caused by special events, either inside the ocean (by mixing processes) or at the sea ice-ocean-atmosphere interface (by the occurrence of changes in the sea ice concentration or atmospheric forcing). We compare the tracer results with hydrographic properties, as well as with wind and ice conditions present during the time of measurements, to investigate the causes of the observed changes. Further, the time dependent atmospheric concentrations of CFCs are used to determine the age of water masses. Here, we use the simplest possible approach of age determination to identify the age of the Atlantic Water along the transects, assuming no interaction or exchange with the surrounding water masses after the Atlantic Water left the surface in Fram Strait. Due to the decreasing CFC-12 atmospheric concentration after 2003/04, it is necessary to use sulfur hexafluoride ($SF_6$) as an additional tracer for 2015. Along the first transect, the tracer age of CFC-12 for 1994 is compared to the tracer age of $SF_6$ in 2015. In 2015 the tracer age is much higher in the region south of 80°N compared to 1994, while the ages are quite similar at higher latitudes. The higher age in the southern part of the transect indicates a water mass, that is much older in 2015 than it was in 1994, a sign of a possible circulation change. A similar result is found along the second transect, where the new tracer $SF_6$ is available in both years. Along this transect, the water is also older in 2015 than in 2005.