Recent circulation changes at intermediate depths (Upper Polar Deep Water) in the Beaufort Gyre inferred from water column distribution of $^{230}$Th

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Mid-depth circulation

before 2004: splendid isolation of Alpha Ridge

The world’s record steepest $^{230}$Th profile was observed in 1983 under heavy ice above the Alpha Ridge, inferring a water column with very little exchange. The lack of ventilation was confirmed by low CFC concentrations and the pathway taken by reprocessing $^{129}$I.

2004

After 2004, surface- and Atlantic Layer-water circulation changed in relation to the change of the Arctic Oscillation (Karcher et al., 2012). In 2007, a $^{230}$Th profile taken on the Canada Basin side of the Alpha Ridge showed reduced $^{230}$Th activity below 500m depth.

In the southern Beaufort Sea, $^{230}$Th activities in the 500-1500m depth range increased progressively in the period 2007-2009

We hypothesize that both effects result from an anticyclonic circulation advecting the $^{230}$Th that had accumulated over decades to the south.

2008

In 2007, a $^{230}$Th profile taken on the Canada Basin side of the Alpha Ridge showed reduced $^{230}$Th activity below 500m depth.

New $^{230}$Th and $^{231}$Pa profiles were obtained during the International Polar Year 2007-2009

$^{230}$Th signals

At the Alpha Ridge, isolation under permanent ice cover allows $^{230}$Th to accumulate to record high activities

2000

$^{129}$I at 240m (10$^3$ at/L)


other tracers

The evolution of reprocessing-produced $^{129}$I was interpreted by Karcher et al. (2012) to infer a transition from cyclonic to anti-cyclonic circulation of the Canada Basin, in line with the spreading of the Warm Temperature Anomaly (McLaughlin et al., 2009)

$^{231}$Pa decreased in Makarov Basin (Scholten 1991 – Edmonds 1994) and at Alpha Ridge (Bacon 1983–1991, our data 2007)

References

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