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Interactive comment on "Circulation changes in the Amundsen Basin from 1991 to 2015 revealed from distributions of dissolved ^{230}Th" *by* Ole Valk et al.

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The authors present a time-series study of seawater 230Th in the Arctic Ocean, which could potentially provide useful information to monitor changes in water circulation and particle dynamics in the Arctic Ocean under the impacts of climate change. The authors observed a decline in seawater 230Th in the Amundsen Basin from 1991 to 2015, which they considered to be due to the enhanced advection transporting more Atlantic water into the Arctic Ocean and increased particle scavenging during the transit. Overall, I think the study is novel and the discussion is thorough. However, I list a few issues below, which I think the authors should consider in their revision.

1. The authors suggest that the decline in seawater 230Th in the Amundsen Basin isdue to the enhanced advection of Atlantic water and the increased particle scavenging on the shelf in the Atlantic water pathway. I was wondering if the authors have any explanation why the scavenging only affects 230Th but not 232Th in the water pathway? Another related question, if the scavenging on the shelf were the dominant signal to explain the decline in 230Th over time, one would imagine that the terrestrial signal should increase and the salinity should decrease. Why is the salinity increasing instead of decreasing in this case?

Reply: We cannot say whether indeed the advection of Atlantic water has increased. Generally we intend to change the focus of the discussion from circulation change towards increased scavenging on water pathways. If there was a stronger influence of Atlantic water through Fram Strait we would observe increased salinity. We intend to change the abstract so it is not proposing a circulation change as the main cause of the dissolved 230Th reduction but a change in scavenging intensities along circulation pathways.

We agree that the increased scavenging may be related to an increased terrestrial signal. But if this signal is due to increased erosion and resuspension by the longer ice-free season, this does not require an increased runoff and corresponding decrease in salinity. The increased particle input can lead to increased input of 232Th, not 230Th, which may offset the removal of 232Th by increased scavenging.

2. It would be more useful if the authors could provide a quantitative analysis to determine the rate of decline in 230Th from 1991 to 2015, and then to use other tracers (e.g. salinity or 129I/236U) to distinguish the signal of water advection from particle scavenging, so that the authors can work out the change of particle scavenging fluxes on the shelf over this period. These calculations could provide more meaningful information for ocean modeling in the Arctic Ocean.

Reply: We agree, this kind of calculations should help to improve the discussion about processes decreasing the dissolved 230Th concentrations in the Amundsen Basin. We will provide rates of decrease of 230Th for the period between 1991 and 2007 and between 2007 and 2015. We use data of other tracers (129I/236U) to show that there is no reason to believe that the advection has increased over these time intervals.

3. I understand that the reversible exchange model used in section 2.4 and 4.5 (and Fig. 7) is cited from another reference. To help to clarify the model in this manuscript, please provide some details of the model either in the method section (if there is enough room) or in a supplementary document. In Fig.7, please add the measured data for comparison.

Reply: The basis of the model will be included at the end of the method section. Reviewer 2 made a similar suggestion.

Minor comments: Fig.8, the caption is wrong (the current version is a repeat of Fig.3). P3/L5, The Lomonosov Ridge into the: : : P7/L28, : : :then slightly increased towards 4500m.

Reply:This will be changed accordingly.

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