

Title: *Recent cooling of Atlantic Intermediate Waters in Kangertittivaq (Scoresby Sund) driven by large-scale advection and a glacial meltwater plume*

Authors: Torsten Kanzow et al.

The authors combine 2018–2022 moorings at the mouth (M) and at the entrance of Kangertertivarmît Kangertivat (KK1, KK2) with summer CTD/LADCP surveys (2016–2024), OMG airborne XCTDs, Argo, He/Ne meltwater fractions, the West Spitsbergen Current (WSC) record, a buoyant-plume model and FESOM2. They find an AIW cooling of about 0.5 °C at the mouth between 2018 and 2022, and an abrupt 0.3–0.5 °C drop at the KK entrance in 2019. They consider that this cooling results from the WSC cooling after 2016, transmitted along the East Greenland shelf with a lag of about 2 years. This is coherent with the 2018–2021 cooling at 79N Glacier. In addition they observe a summer-intensified, bottom-trapped inflow into KK (about 0.15 m/s) that they interpret as an estuarine response to entrainment into the Daugaard-Jensen subglacial plume.

The mooring records are a valuable contribution: year-round data from inside a major East Greenland fjord are rare, and the paper is clearly within the scope of journal. The large-scale advective interpretation is plausible and consistent with McPherson et al. (2024). My main concerns are that the paper's quantitative and causal claims rest on an ADCP record compromised by tidal aliasing, a weak physical and interannual link between plume entrainment and summer inflow, a purely visual assessment of the large-scale cooling advection pathway, and a lack of statistical uncertainty margins for the reported seasonal variations. Most of these can be addressed with additional analysis of the existing data. I suggest publication under major revision.

2. Major Comments

ADCP sampling at KK2

The authors report that after October 2018 the ADCP at the KK2 location changed its sampling rate (for unknown reasons) to one sample every 5.7 days. This can generate aliasing effects from fast tides in the long-term seasonal cycles. These effects can degrade the information content of the time series. In fact, the authors note near-bottom tidal amplitudes of about 4 cm/s before October 2018. That is comparable to the difference between the summer peaks (0.06–0.15 m/s) and the winter background (<0.04 m/s), and the 2020 peak (0.06 m/s) is within it. I would suggest the authors to clarify the exact sampling interval and use a tidal model to predict and subtract the tide's distortion. Subsampling the predicted tide at the actual sample times could quantify the aliased variance.

The link between plume entrainment and the summer inflow is weak

The argument is based on the observation that the inflow peaks about 30 days after the modelled entrainment peak in 2019–2021. Two seasonal signals always have some phase lag, so this alone does not establish causality. The authors should propose which mechanism produces this lag, give the along-fjord distance from the KK2 mooring to the glacier, and show that the lag is consistent with it. Does modelled entrainment in 2020 (weak observed inflow) differ from 2019 and 2021 in the same sense as the observations? An additional correspondence in interannual amplitude would be much more convincing. If modelled entrainment is similar in all years, that argues against the

mechanism. In addition, other competing seasonal drivers were not tested. This argument should be weakening in the abstract and conclusions unless a more profound analysis is carried out.

Quantitative support to the large-scale advective hypothesis

The interpretation of the advection of the WSC cooling after 2016 by the Fram Strait recirculation till the East Greenland Current and its inflow in the Kangertittivaq after about 2 years is plausible and it is the strongest part of the paper. However the arguments are mainly based on visual comparison. I would suggest to provide information about the resulting coefficients, significance and the range of lags with comparable correlation. Passive-tracer or Lagrangian experiments in FESOM2 could also test the pathway directly. On the other hand, a WSC cooling of about 1 °C (2016–2019) is followed by about 0.5 °C at the mouth and about 0.3 °C at the KK head. With summer snapshots and one four-year mooring, the observed lag can be resolved only to about one year. Please give the lag with an uncertainty, and the lag between 79N and Kangertittivaq. The statement that the basin-scale forcing “synchronises” the fiords would need a quantitative assessment.

Statistical information

Throughout, changes are given as single numbers without uncertainty: 0.5 °C cooling at M, 0.3 °C at KK, 0.5 °C in the XCTDs. Interannual differences from records with a 0.7–1.5 °C seasonal cycle should be computed from phase-matched periods or after removing a fitted seasonal cycle, with confidence intervals. The same applies to the summer inflow peaks and to the claimed damping of the signal from the mouth toward the glacier, which currently rests on three snapshot years.

3. Minor and Technical Corrections

Figure 1b: localize with a symbol the glacier. You can infer it from the white color tongue but it would be easier to the reader if it is explicitly marked.

Figure 1c: add on top the title KK entrance

Figure 1d: add head and mouth at 0 and 500 km respectively to indicate the orientation of the section.

Line 119: define what is ΔC (I guess generic gas concentration)

Line 131 Spelling of RACMO (Regional Atmospheric Climate Model?)

Line 220 What is the speed considered to estimate the total transit time?

Line 244-246 This is a result and I would include in the Result Section

Line 225 Typo “...flux. depending...”

Line 65 Argo period: March 2015–March 2022 but March 2015–March 2025 in the Figure 4 caption.

Figure 7a refers to a 600 m temperature record at KK2, whereas Table 1 lists the KK2 sensors at about 796–800 m and the 610 m sensor at KK1.

Table 1. The KK2 ADCP end date is 11/7/2022 and 7 July 2022 in Line 193.