EGU21-2746, updated on 16 May 2021
https://doi.org/10.5194/egusphere-egu21-2746
EGU General Assembly 2021

Sources and transport of glacial meltwater in the Bellingshausen Sea, Antarctica

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Quantifying meltwater content and describing transport pathways is important for understanding the impact of a warming, melting Antarctica on ocean circulation. Meltwater fluxes can affect density-driven, on-shelf flows around the continent, and the formation of the dense water masses that ventilate abyssal regions of the world ocean. We present observations collected from two ocean gliders that were deployed in the Bellingshausen Sea for a period of 10 weeks between January and March of 2020. Using multiple high-resolution sections, we quantify both the distribution of meltwater concentrations and lateral meltwater fluxes within the Belgica Trough in the Bellingshausen Sea. We observe a cyclonic circulation in the trough, in agreement with previous studies. A meltwater flux of 0.46 mSv is observed flowing northwards in the western limb of the cyclonic circulation. A newly identified meltwater re-circulation (0.88 mSv) is observed flowing back towards the ice front (i.e. southwards) with the eastern limb of the cyclonic circulation. In addition, 1.16 mSv of meltwater is observed flowing northeastward, parallel to the shelf break, with the northern limb of the cyclonic circulation. Peak meltwater is concentrated into two layers associated with different density surfaces: one approximately 150 m deep (27.4 kg m^{-3}) and one approximately 200 m deep (27.6 kg m^{-3}}). The deeper of these layers is characterised by an elevated optical backscatter, which indicates a more turbid water mass. The shallower layer is less turbid, and is more prominent closer to the shelf break and in the eastern part of the Belgica Trough. We hypothesise that the deeper, turbid meltwater layer originates locally from the Venables Ice Shelf, whereas the shallower, less turbid meltwater layer, comprises meltwater from ice shelves in the eastern Bellingshausen Sea. The broad distribution of meltwater from multiple sources suggests the potential for remote interactions and feedbacks between the various ice shelves that abut the Bellingshausen Sea.