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# Interannual hydrographic variability beneath Thwaites Eastern Ice Shelf, West Antarctica

**Tiago Dotto**[1], Karen Heywood[1], Rob Hall[1], Ted Scambos[2], Yixi Zheng[1], Yoshihiro Nakayama[3], Tasha Snow[2], Anna Wåhlin[4], Christian Wild[5], Martin Truffer[6], Atsuhiro Muto[7], and Erin Pettit[5]

[1]University of East Anglia, School of Environmental Sciences, Centre for Ocean and Atmospheric Sciences, United Kingdom of Great Britain – England, Scotland, Wales (tiagosdotto@gmail.com)

[2]Earth Science and Observation Center, Cooperative Institute for Research in Environmental Sciences, University of Colorado Boulder, Boulder CO, USA

[3]Institute of Low Temperature Science, Hokkaido University, Sapporo, Japan

[4]Department of Marine Sciences, University of Gothenburg, Box 461, 405 30 Gothenburg, Sweden

[5]College of Earth, Ocean, and Atmospheric Sciences, Oregon State University, Weniger Hall 533, 103 SW Memorial Place, Corvallis, OR 97331, USA

[6]Geophysical Institute and Department of Physics, University of Alaska Fairbanks, Fairbanks AL, USA

[7]Department of Earth and Environmental Science, Temple University, Philadelphia PA, USA

Basal melting of the Amundsen Sea ice shelves is caused by relatively warm waters accessing the ice base through turbulent processes at the ice-ocean boundary layer. Here we report hydrographic variability in Thwaites Eastern Ice Shelf (TEIS) from January 2020 to March 2021 using novel subglacial mooring measurements and ocean modelling. The layers ~100 m beneath the ice base warmed considerably (~1 ˚C) in this period. The meltwater fraction doubled associated with basal melting due to the higher heat, leading to a freshening in the upper layers. The lighter layer contributed to the acceleration of the under-ice circulation, which led to higher basal melting through intensified temperature flux, creating positive feedback beneath the ice. The interannual variability of the water masses in the TEIS cavity is linked to the seasonal strengthening and weakening of the Pine Island Bay gyre. During periods that the sea-ice covers the bay, such as winter 2020 and the 2020-2021 summer season, the momentum transfer from the wind to the ocean surface is less effective and the gyre weakens. The deceleration of the gyre leads to relaxation and shoaling of the isopycnals beneath the TEIS, which brings warmer water upwards closer to the ice base. The results discussed in this work shows that the fate of the Amundsen Sea ice sheet is tightly controlled by adjacent small-scale gyres, which could prolongate warming periods beneath ice shelf cavities and lead to high basal melting rates.