Geophysical Research Abstracts
Vol. 19, EGU2017-11938, 2017
EGU General Assembly 2017

Basal melt, seasonal water mass transformation, ocean current variability, and deep convection processes along the Amery Ice Shelf calving front, East Antarctica

Laura Herraiz Borreguero (1,2), John A. Church (3), Ian Alison (1), Beatriz Peña Molino (1), Richard Coleman (4,1), Mathias Tomczak (5), and Mike Craven (1)

(1) Antarctic Climate and Ecosystem Cooperative Research Centre, University of Tasmania, Hobart, Tasmania, Australia , (2) Centre for Ice and Climate—Niels Bohr Institute, University of Copenhagen, Copenhagen, Denmark, (3) CSIRO Oceans and Atmosphere Flagship, Hobart, Tasmania, Australia , (4) Institute for Marine and Antarctic Studies, University of Tasmania, Hobart, Tasmania, Australia, (5) School of the Environment, Flinders University of South Australia, Adelaide, South Australia, Australia

Despite the Amery Ice Shelf (AIS) being the third largest ice shelf in Antarctica, the seasonal variability of the physical processes involved in the AIS-ocean interaction remains undocumented and a robust observational, oceanographic-based basal melt rate estimate has been lacking. Here we use year-long time series of water column temperature, salinity, and horizontal velocities measured along the ice shelf front from 2001 to 2002. Our results show strong zonal variations in the distribution of water masses along the ice shelf front: modified Circumpolar Deep Water (mCDW) arrives in the east, while in the west, Ice Shelf Water (ISW) and Dense Shelf Water (DSW) formed in the Mackenzie polynya dominate the water column. Baroclinic eddies, formed during winter deep convection (down to 1100 m), drive the inflow of DSW into the ice shelf cavity. Our net basal melt rate estimate is 57.4±25.3 Gt yr?^{1} (1±0.4 m yr?^{1}), larger than previous modeling-based and glaciological-based estimates, and results from the inflow of DSW (0.52±0.38 Sv; 1 Sv=106 m^{3} s?^{1}) and mCDW (0.22±0.06 Sv) into the cavity. Our results highlight the role of the Mackenzie polynya in the seasonal exchange of water masses across the ice shelf front, and the role of the ISW in controlling the formation rate and thermohaline properties of DSW. These two processes directly impact on the ice shelf mass balance, and on the contribution of DSW/ISW to the formation of Antarctic Bottom Water.