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Subduction as Observed at a Submesoscale Front in the Marginal Ice Zone in Fram Strait

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The marginal ice zone in Fram Strait is a highly variable environment, in which dense Atlantic Water and lighter Polar Water meet and create numerous mesoscale and submesoscale fronts. This makes it a model region for researching ocean frontal dynamics in the Arctic, as the interaction between Atlantic Water and the marginal ice zone is becoming increasingly important in an "atlantifying" Arctic Ocean. Here we present the first results of a front study conducted near the ice edge in central Fram Strait, where Atlantic Water subducted below Polar Water. We posit that the frontal dynamics associated with the sea ice edge also apply beyond, both to the open and the ice-covered ocean in the vicinity. They, in turn, can affect the structure of the marginal ice zone. The study comprises a total of 54 high resolution transects, most of which were oriented across the front. They were taken over the course of a week during July 2020 and include current velocity measurements from a vessel-mounted ADCP. Most of the transects also include either temperature and salinity measurements from an underway CTD, or temperature and salinity measurements and various biogeochemical properties from a TRIAXUS towed vehicle. Additionally, 22 CTD stations were conducted, and 31 surface drifters were deployed. This wealth of measurements gives us the opportunity to follow the temporal and spatial development of the density fronts present at the time. We discuss the dynamics of the frontal development, including the associated geostrophic motion, and the induced secondary ageostrophic circulation with subsequent subduction of Atlantic Water and biological material in a highly stratified region. Beneath the stratified upper ocean, subduction is clearly visible in the biogeochemical properties, and water samples indicate a substantial vertical transport of smaller particles. Surface drifters accumulated in locations of subduction, where sea ice, if present, would likely also accumulate. Our study thus demonstrates the importance of frontal dynamics for the vertical transport of water properties and biological material, and the highly variable development of the marginal ice zone in Fram Strait.