

Intrusion of Atlantic Water on an Arctic Shelf

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The rapid decline in Arctic sea ice is one of the most striking manifestations of climate change, and during recent decades, Svalbard fjords have experienced a substantial reduction in winter sea-ice extent. The reduced sea ice cover has been linked to an increased transport of warm Atlantic Water (AW) into the fjords. AW from the West Spitsbergen Current (WSC) can reach the upper shelf along western Spitsbergen and eventually flood into the fjords. Seasonal spatial hydrographic snapshots, combine with longer time series in strategic positions on the West Spitsbergen Shelf (WSS), reveal a circulation of AW in the troughs indenting the WSS, here named the Spitsbergen Trough Current (STC). From hydrographical and ocean current observations it is evident that the STC is primarily barotropic and driven by the sea surface height. A connection between the along-coast wind stress and the STC is established, and it is demonstrated how the increased occurrence of winter cyclones in Fram Strait during January–February accelerates and widens the WSC. Ultimately, this results in a strengthened STC and dominance of AW on the WSS. The STC represents a slower route of AW toward the Arctic Ocean and a large heat transport toward the West Spitsbergen fjords during winter (0.2–0.4TW toward Isfjorden). Sea ice production along West Spitsbergen has been reduced, or even nonexistent, in some fjords since 2006. Here, the authors argue that this is a consequence of the strong southerly wind periods along the WSS during winter.