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Dynamics of the high-frequency variability in Denmark Strait

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The nature and dynamics of the mesoscale variability in Denmark Strait is investigated using a combination of mooring data, satellite data, and a numerical model. We describe a newly-indentified mesocale process in the strait whereby warm water from the Irminger Sea flows northward through the center of Denmark Strait, displacing the normal equatorward flow of dense overflow water. This process, which occurs roughly 10 times per year, is termed a flooding event. The satellite and model fields reveal that flooding events are associated with a westward propagation of the North Icelandic Irminger Current, which brings the warm water into the center of the strait. Two other types of mesoscale processes in Denmark Strait have been described previously in the literature, known as boluses and pulses. In the former case, a thick lens of dense water passes through the strait which raises the interface height of the overflow water. In the latter case, the interface height drops and the thin layer of overflow water accelerates. Our study reveals that flooding events occur in conjunction with pulses. Furthermore, the model reveals that all three mesoscale processes are dynamically related and tied to the behavior of the hydrographic front in the strait. The model also shows that the hydrographic front is maintained by a balance between frontogenesis by the large scale flow and frontolysis by baroclinic instability. Our study provides a general framework for understanding the dominant variability of Denmark Strait Overflow Water entering the Irminger Sea.