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Eddy Seeding in the Labrador Sea: a Submerged Autonomous Launching Platform (SALP) Application

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A simplified Submerged Autonomous Launch Platform (SALP) was used to release profiling floats into warm-core Irminger Rings (IRs) in order to investigate their vertical structure and evolution in the Labrador Sea from September 2007 – September 2009. IRs are thought to play an important role in restratification after convection in the Labrador Sea. The SALP is designed to release surface drifters or subsurface floats serially from a traditional ocean mooring, using real-time ocean measurements as criteria for launch. The original prototype instrument used properties measured at multiple depths, with information relayed to the SALP controller via acoustic modems. In our application, two SALP carousels were attached at 500 meters onto a heavily-instrumented deep water mooring, in the path of recently-shed IRs off the west Greenland shelf. A release algorithm was designed to use temperature and pressure measured at the SALP depth only to release one or two APEX profiling drifters each time an IR passed the mooring, using limited historical observations to set release thresholds.

Mechanically and electronically, the SALP worked well: out of eleven releases, there was only one malfunction when a float was caught in the cage after the burn-wire had triggered. However, getting floats trapped in eddies met with limited success due to problems with the release algorithm and float ballasting. Out of seven floats launched from the platform using oceanographic criteria, four were released during warm water events that were not related to passing IRs. Also, after float release, it took on average about 2.6 days for the APEX to adjust from its initial ballast depth, about 600 meters, to its park point of 300 meters, leaving the float below the trapped core of water in the IRs. The other mooring instruments (at depths of 100 to 3000 m), revealed that 12 IRs passed by the mooring in the 2-year monitoring period. With this independent information, we were able to assess and improve the release algorithm, still based on ocean conditions measured only at one depth. We found that much better performance could have been achieved with an algorithm that detected IRs based on a temperature difference from a long-term running mean rather than a fixed temperature threshold. This highlights the challenge of designing an appropriate release strategy with limited a priori information on the amplitude and time scales of the background variability.