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Irminger Rings in the Labrador Sea: A heat pipe between the subsurface Western Boundary Current and the atmosphere?

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The life cycle of Irminger Rings (IRs) in the Labrador Sea is investigated over several seasonal cycles in model simulations carried out with a full primitive equation, eddy resolving (4 km resolution), regional model of the Labrador Sea, driven by realistic air-sea fluxes. Model IRs characteristics are found to compare very well with recent observations. The life cycle of IRs is investigated from several years of model outputs. It is found that topographic instability off Cape Desolation generates IRs, which are the source of high EKE levels seen north of about 60˚N in satellite altimetry. Like all ocean rings, their peculiar potential vorticity (PV) anomaly structure (a negative core surrounded by a positive ring) insulates them from surrounding waters, and eddies survive several winters. IRs properties primarily evolve through surface exchanges with the atmosphere, especially heat loss, as confirmed by recent observations. Lateral exchange of heat with ambient waters appears to be significantly smaller. Under the forcing conditions of our simulations, it takes about two winters to the atmosphere to extract the heat contained in the subsurface core of a ring and to bring it to a colder temperature comparable to that of the deep convection area. This ring usually collapses shortly after that. Therefore, the heat extracted by Irminger Rings from the boundary current is not given up to the interior ocean, but to the atmosphere. In that sense, Irminger Rings could be seen as acting as a pipe making the heat of the subsurface western boundary current available to the atmosphere.