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Formation and export of deep-water in the Labrador and Irminger Seas in a GCM

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We use a realistic simulation of the circulation in the North Atlantic to determine where deep-water is formed and investigate its influence on the variability of the deep western boundary current (hereafter DWBC). In the simulation, deep-water formation happens in the Irminger Sea, in the interior of the Labrador Sea and in the Labrador Current. In the Irminger Sea, deep-water is formed close to the boundary currents. It is rapidly exported out of the Irminger Sea via an increase of the East Greenland Current, and out of the Labrador Sea via an increase of the southward current in its interior. Water masses that are formed in the Irminger Sea reach the Flemish Cap approximately one year after convection. The water masses that are formed in the interior of the Labrador Sea tend to accumulate and recirculate in the basin. Hence, they are only slowly exported northeastward to the Irminger Sea and southeastward to the subtropical North Atlantic, reaching the Flemish Cap in 1 to 3 years. As a result, the transport in the DWBC is mostly correlated with convection in the Irminger Sea. Finally, the deep-water produced in the Labrador Current is lighter and is rapidly exported out of the Labrador Basin, reaching the Flemish Cap in few months. Boundary production of deep-water in the Labrador Sea is shown to be minimum (respectively maximum) when convection is deep (shallow) in the interior, so that the correlation between the net export in the DWBC and convection in the interior is low.