

EGU21-13461

<https://doi.org/10.5194/egusphere-egu21-13461>

EGU General Assembly 2021

© Author(s) 2021. This work is distributed under the Creative Commons Attribution 4.0 License.



Sensitivity of convective overturning and turbulent mixing of dissolved gases in the Labrador Sea to atmospheric forcing

Romina Piunno and Kent Moore

University of Toronto, Toronto, Canada (romina.piunno@mail.utoronto.ca)

Deep oceanic convection occurs in few locations around the globe. One such location is found in the Labrador Sea where dense waters can subside to depths in excess of 2km below the surface. The weak stratification preconditions the water column for deep convection, triggered by wintertime surface cooling associated with high wind speed events. The convected water brings with it dissolved gases, such as Carbon Dioxide, which are in constant flux between ocean and atmosphere. It is thought that this process of turbulent boundary layer interactions coupled with deep convection is responsible for mixing these gases into the deep ocean, making the ocean the largest sink of anthropogenic carbon.

The convective overturning process depends on the temperature and salinity profiles which, together dictate density and thus the static stability of the water column. We have adapted a widely used one-dimensional mixed-layer model, referred to as PWP, to include a parameterization of the air-sea flux of gases such as Oxygen and Carbon Dioxide. The model is forced with surface meteorological fields from the ERA5 reanalysis as well as the higher resolution operational reanalysis from the ECMWF.

With the model, we investigate the sensitivity of deep-water formation and the vertical profile of these gases to various atmospheric forcing scenarios. Overturning in the Labrador Sea is most active during the winter months when heat flux out of the ocean is at its maximum. It is found that overturning is far more sensitive to thermal forcing than it is to freshwater forcing within the range of forcings typical to the Labrador Sea. We explore the impact of this sensitivity, including the dependence of the atmospheric forcing on modes of climate variability such as the NAO, has on the role that the Labrador Sea plays as a marine sink for anthropogenic carbon.