OCEAN SCIENCE NEWS

LabSea2020 – A new international cooperative research program in the Labrador Sea.

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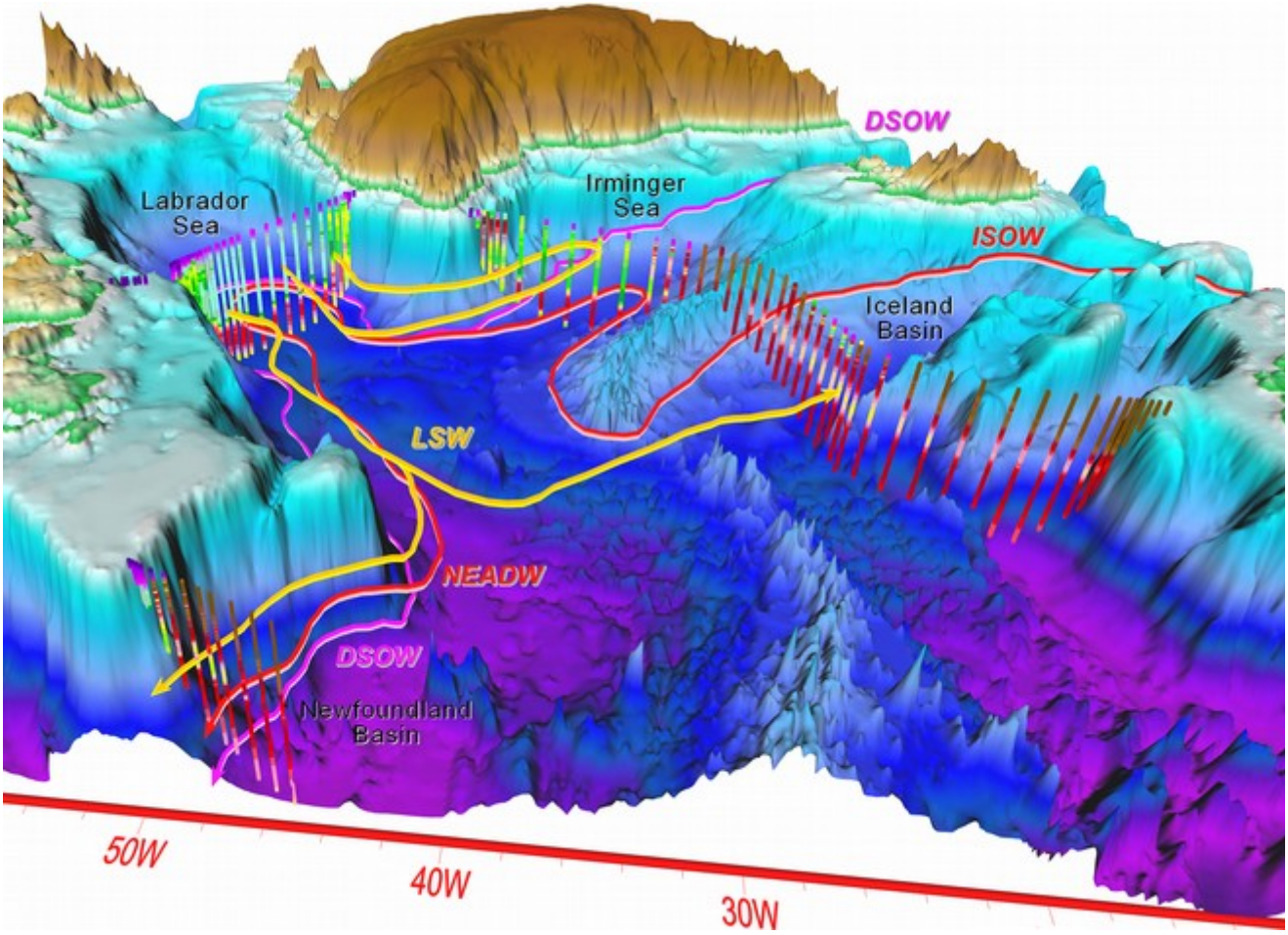
The Labrador Sea, off the east coast of Canada (see figure), is one of the few places where the deep ocean exchanges gases such as oxygen and carbon dioxide (CO_2) directly with the atmosphere. Localized deep convection releases large amounts of heat to the atmosphere and the resulting Labrador Sea Water contributes to the global ocean thermohaline circulation that redistributes heat from low latitudes to the poles. Transport out of the Labrador Sea carries oxygen and anthropogenic CO_2 into the North Atlantic interior, oxygenating subsurface layers and slowing the accumulation of CO_2 in the atmosphere, but exacerbating ocean acidification along Canada's sensitive eastern continental margin. The combined action of convection and horizontal circulation redistributes nutrients and contaminants (e.g. from future deepwater oil production along the deep Labrador slope) potentially affecting ocean productivity and marine ecosystem health.



I. Yashayaev -2017

The Labrador Sea and adjacent seas, the atmosphere, surface ocean, and deep ocean interact in complex ways involving the interplay of physical, chemical, and biological processes that has global-scale impacts. The southwards transport of the Labrador Current, and associated water masses, is also part of an alongshore boundary current that connects outflow from the Arctic to the highly productive ecosystems of the eastern seaboard of North America. The Labrador Sea

has been the subject of several different focussed studies over the past forty years. In the 1980's, the first full convection studies were conducted by researchers from the Bedford Institute of Oceanography followed in the late 1990s by the Labrador Sea Deep Convection Experiment. While much has been learned about convection, transports and water property formation in this region, many fundamental questions remain unanswered.

These globally significant processes are regionally localized, temporally variable, and sensitive to the effects of ongoing climate changes. Gas uptake and redistribution processes are expected to respond to and feedback on climate change, as the high latitude warming surrounding the Labrador Sea increases stratification. Stratification changes may come from direct surface warming as well as the enhanced freshwater input from the melting of snow, multi-year sea ice and glaciers in Greenland and Canada. In either case, enhanced stratification will likely lead to a decline in deep water oxygen and anthropogenic CO_2 sequestration. With the accelerating rate of warming in the high North, multiple sources of freshwater now converge on the Labrador Sea, with the potential to disrupt deep convection, meridional ocean heat transport, climate, and ocean biogeochemistry at regional and global scales. The slowdown in deep water formation or of the Meridional Overturning Circulation may cut off the source of oxygen and "suffocate" the deep ocean, and reduce a critical sink of anthropogenic CO_2. In addition to impacts on gas budgets, changing stratification and far-field changes to ice-cover and biological productivity in the Arctic regions have the potential to alter nutrient concentrations and transports with potential consequences for biological productivity over large regions of the western Atlantic Ocean.

Thus, key open questions include: What is the relationship between convection and the Meridional Overturning Circulation (MOC)? How is the uptake of CO_2 changing with the possible slowdown of the MOC? Why is there a decline in nutrient concentrations and what are the implications? How will the Labrador Sea respond to changes in the cryosphere (e.g. Greenland and other high latitude glaciers) and changing sea-ice conditions in the Arctic Ocean?

We propose that these and other questions become the focus of a cooperative, multidisciplinary and international study focussed on the Labrador Sea and its surroundings in 2020. The initiative is intended to be "bottom-up" and link researchers and research initiatives with shared interest in the region. This year of research will address fundamental science questions which would initiate the Decade of the Ocean for Sustainable Development (2021-2030) coordinated by the International Oceanographic Commission and just approved by the United Nations. We are looking for partners who would like to contribute or be involved and invite them to contact either Doug Wallace (Douglas.Wallace@dal.ca) from Dalhousie University or Brad deYoung (bdeyoung@mun.ca) from Memorial University. We have a website and Facebook page in preparation and will hold webinars as well as a discussion at the Ocean Sciences Meeting in Portland in February. So keep your eyes open!

Labrador Sea Christopher Pratt 1980