OSNAP challenge

After completing my PhD in November 2016 at the University of Brest (France), I came to Edmonton in Canada to start a post-doc at the University of Alberta. I am working with Dr. Paul Myers and the ocean modelling group. My post-doc is part of the VITALS (Ventilation, Interactions and Transports Across the Labrador Sea) project.

My research focus is on the North Atlantic subpolar gyre and the Labrador Sea. The goal of my project is to analyze changes in Labrador Sea Water formation and how it could impact the meridional overturning circulation. For my investigation, I used simulations from the Nucleus for European Modelling of the Ocean (NEMO) numerical framework but I also complement my analyses by using data from observations.

Our group participated to the OSNAP challenge (http://www.o-snap.org/news-events/osnap-challenge/) and we have submitted our prediction for the Meridional Overturning Circulation (MOC) computed across the whole OSNAP line from September 2014 to August 2016 (Figure 1).

For this prediction, we used the NEMO numerical framework version 3.4 (Madec 2008), with an Arctic and Northern Hemisphere Atlantic (ANHA) configuration. This numerical model is coupled with the multi-layered sea-ice model LIM (Fichefet and Morales Maqueda, 1997), and with an Elastic Viscous Plastic (EVP) ice rheology (Hunke and Dukowicz, 1997). Horizontal resolution is 1/12 (ANHA12), and ranges from 9 km at the Equator, to 4 km in Northern Canada. The vertical grid contains 50 levels increasing from 1.02 m at the surface to 458.39 m for the last level. This configuration covers the Arctic and the North Atlantic ocean down to 20 degree S (Figure 2), with two open boundaries: one at Bering Strait ans the other at 20°S. The model is run from January 2002 onwards, with five day average output. The initial and open boundary conditions are provided by Global Ocean Reanalyses and Simulations (GLORYS) dataset (Ferry et al., 2010). The atmospheric forcing data, provided by Canadian Meteorological Centre's global deterministic prediction system reforcasts (CGRF) data set (Smith et al., 2014), has hourly, 33 km resolution for the following fields: 10 m surface wind, 2 m air temperature and humidity, downward shortwave and longwave radiation, and total precipitation.

The MOC in density space was computed using a potential density range (referenced to the surface) from 24 to 30 kg m^{-3} with step of 0.02 kg m^{-3}. The net transport integrated over the OSNAP array has been removed before computing the overturning stream function (Sv) from velocities across the OSNAP line (Figure 3).

We hope our estimate is close to MOC from the observational data!

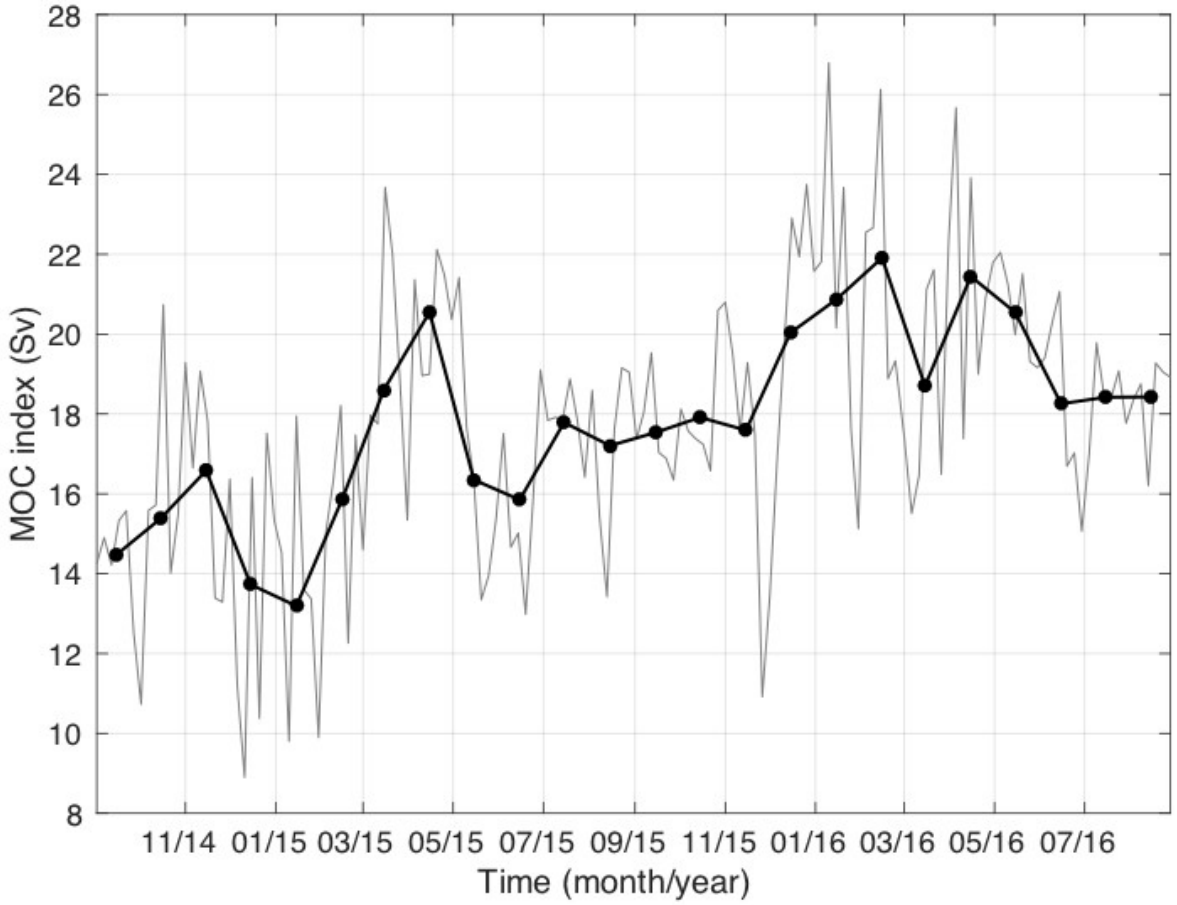

Figure 1: MOC prediction (in Sv) from September 2014 to August 2016. Grey line is 5-day values. Thick black line is montly average.

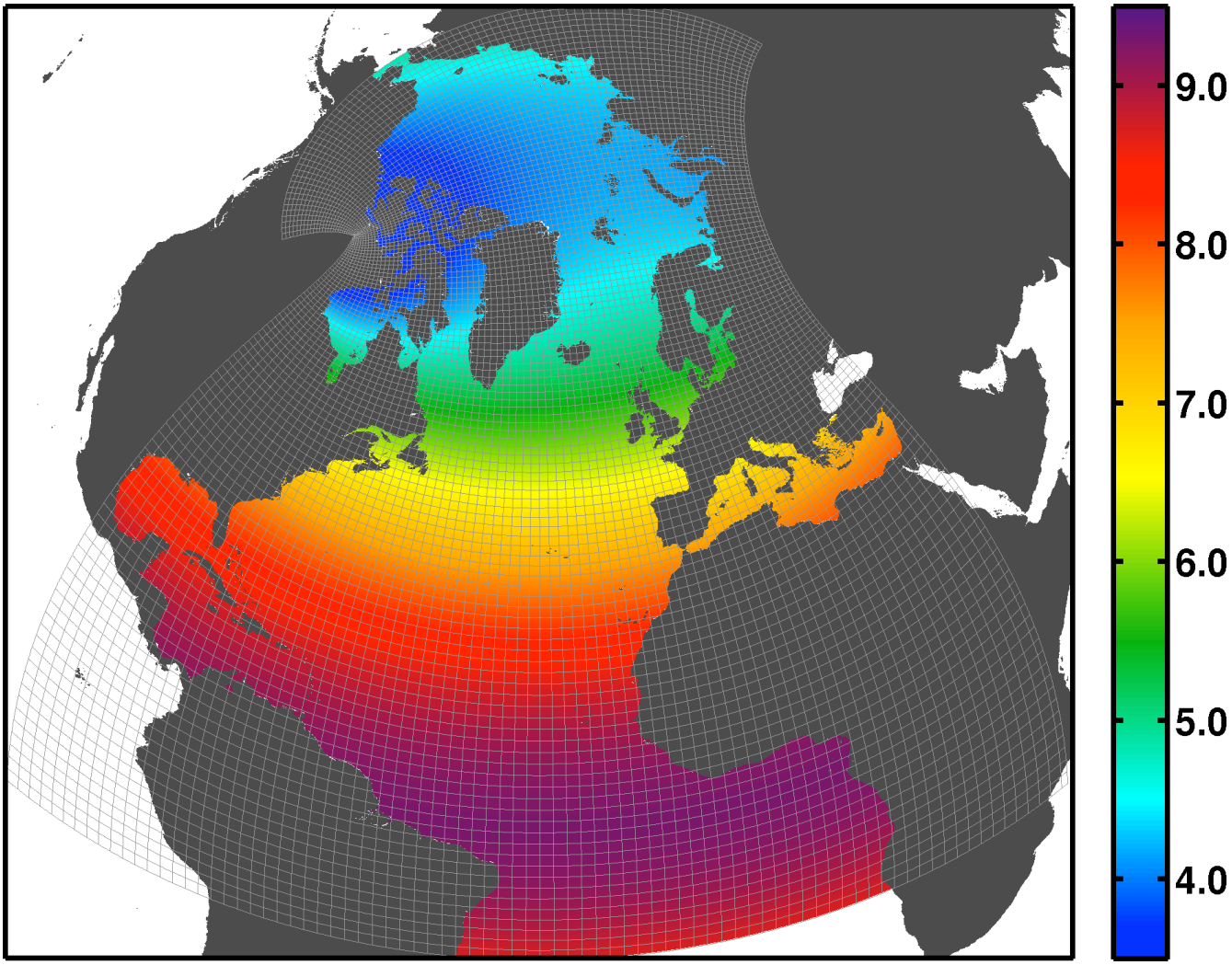

Figure 2: ANHA12 horizontal mesh (every 20 grids, color shows the resolution in kilometers).

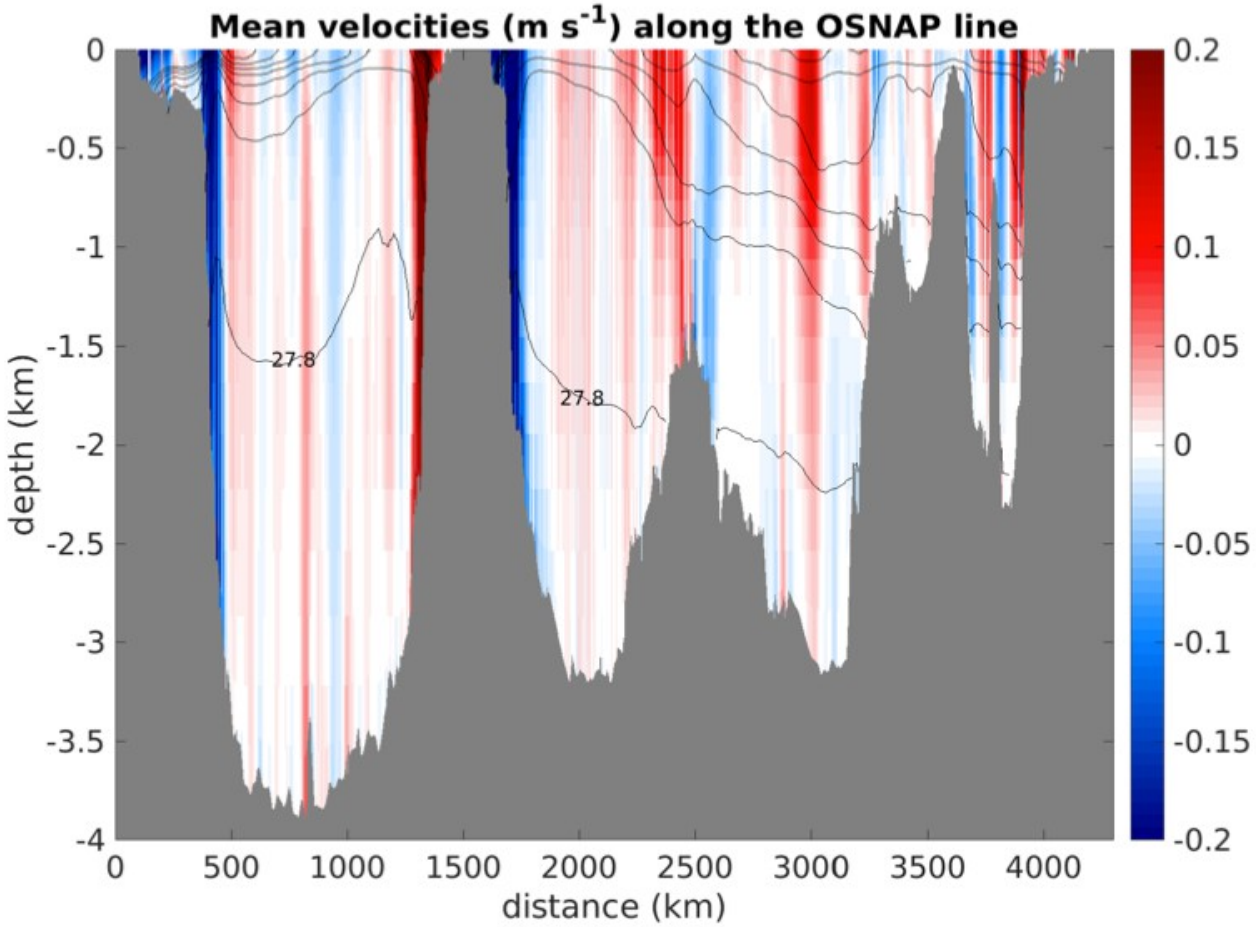

Figure 3: Mean circulation (September 2014-August 2016) along the OSNAP line. Northward (southward) flow is in red (blue). The black lines represent contours of constant potential density (contours every 0.01 kg m^{-3}).