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TITLE: Distribution of the Northern Water Mass Formation completing the Atlantic Meridional Overturning Circulation

PRESENTATION TYPE: Assigned by Committee (Oral or Poster)

CURRENT SECTION/FOCUS GROUP: Global Environmental Change (GC)

CURRENT SESSION: GC25. Decadal-scale Arctic Climate Variability: Observations and Modeling

AUTHORS (FIRST NAME, LAST NAME): Helene R. Langehaug[1, 2], Peter B Rhines[3], Tor Eldevik[4, 2], Cecilia M Bitz[5]

INSTITUTIONS (ALL): 1. Nansen Environmental and Remote Sensing Center, Bergen, Norway.
2. Bjerknes Centre for Climate Research, Bergen, Norway.
3. School of Oceanography, University of Washington, Seattle, WA, United States.
4. Geophysical Institute, University of Bergen, Bergen, Norway.
5. Department of Atmospheric Sciences, University of Washington, Seattle, WA, United States.

Title of Team:

ABSTRACT BODY: The transport of cold dense water that constitutes the lower limb of the Atlantic Meridional Overturning Circulation has been identified as a key indicator for climate change. The decadal water mass formation in the Subpolar North Atlantic and the Nordic Seas have been localized and quantified in a pre-industrial multi-century (700 years) simulation with the Bergen Climate Model (BCM2). The BCM2 has a well-represented Nordic Seas Overflow, and it is therefore an adequate model for quantitatively assessing the relative contributions from these dense overflows and from air-sea interaction driven water mass formation in the Subpolar North Atlantic. The assessment is done following the method introduced by Walin (1982); here the transformation in water mass outcrop areas is estimated from the winter heat and freshwater fluxes into the ocean. The results are compared and contrasted with a 1000 years run based on the 1990s from the Community Climate System Model (CCSM3). The deep-water pathways are traced by analysis of tracers (ideal age) and transport of mass, heat and salt on the theta-S plane (Figure 1), similar to what is applied to observations from the real ocean, in different sections downstream of the deep-water formation regions. Such consistent evaluation of model performance has largely not been pursued to date. In the BCM2 simulation open-ocean deep convection in the Greenland Sea does not appear as a source for the Nordic Seas Overflow. Rather the densification of the Atlantic Boundary Current in the Nordic Seas, especially west of Svalbard, seems to be important for the northern dense water formation. Further downstream, east of Newfoundland, the amount of Labrador Sea Water and Overflow Water originating in the Denmark Strait is of comparable size; 4 Sv and 5 Sv, respectively.

Walin, G., 1982: On the relation between sea-surface heat flow and thermal circulation in the ocean. Tellus 34, 187–195.

INDEX TERMS: [4513] OCEANOGRAPHY: PHYSICAL / Decadal ocean variability, [4504] OCEANOGRAPHY: PHYSICAL / Air/sea interactions, [4283] OCEANOGRAPHY: GENERAL / Water masses.

(No Table Selected)

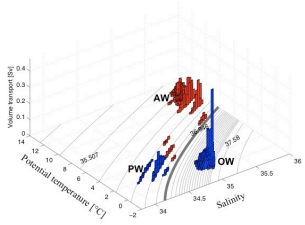

Figure 1: Volumetric TS-diagram of the water mass exchange across the Greenland-Scotland Ridge in BCM2. Three distinct water masses are evident and have the following integrated transport: warm and saline Atlantic Water (AW, 7 Sv), fresh and cold Polar Water (PW, 2 Sv), and cold and dense Overflow Water (OW, 6 Sv).

Additional Details

Previously Presented Material:

Scheduling Request:
