Introduction

A targeted analysis of long time series of satellite data sets over the Atlantic Ocean are being conducted to lay the foundation for the identification of signatures of changes in the AMOC. The satellite data sets are multi-decadal time series of sea surface temperature from infrared radiometers, surface wind speeds and the ice edge. During the period spanned by these measurements there have been several generations of satellite sensors, but recently reprocessed data sets are believed to minimize, as far as possible, the artifacts that result from changing sensors and orbital drift: Additional shorter data sets, such as vector winds and microwave sea surface temperatures, as well as modeled NWP fields as necessary, are being used to enhance the scientific merit of the analyses. Focus is being directed to areas of deep water formation in the North Atlantic.

AVHRR Pathfinder SSTs

A five year time series of weekly SSTs over the Labrador Sea area (blue in the bottom right panel to the right) from the latest version (V5) of the global SST fields from AVHRR on the NOAA Polar Orbiters is shown below. The upper panel is mean SST (± one standard deviation) and the lower panel is the minimum temperature in the area in each week. These are derived from the highest quality flagged night-time data. When data from later years become available (see below), this analysis will be extended to cover the more recent years when a stronger SST appears to be present.

Sea Surface Temperature and Convection in the Labrador Sea.

Part of our focused analyses of satellite data sets is to determine variability of surface conditions that might be sensitive to MOC fluctuations. Using data from the AVHRR Pathfinder v5 global SST climatology in conjunction with profiles from the ARGO array, the characteristics of the upper water column in the Labrador Sea area are being studied in relation to the time-series of multi-year satellite data.

The figures (left) show time series of the ARGO measurements in the Labrador Sea (blue area, bottom right). Top left is Temperature, which is not a strong controller of density, but which can be measured from space, and top right is salinity, which is a strong controller of temperature, but which cannot be measured from space. Bottom left is derived density (γ). Even though there is over a decade of ARGO data, the sampling in critical areas is quite sparse and spatially and temporally irregular. Are we capable of capturing accurately the deep convection?

Because of cloud cover, sampling of SST by infrared sensors is irregular. How does this influence our description of interannual variability?

Problems and concerns

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Next steps

• Identify a better metric for winter convection in the ARGO data in the Labrador Sea.
• Extend analysis of AVHRR Pathfinder SST time series, varying averaging areas.
• Include MODIS and AMSR-E SSTs into the analysis.
• Study wind signals in the wintertime Labrador Sea area.
• Extend analysis to the West Greenland Sea.

Wind fields in AMOC critical areas

The emphasis of the analysis of the surface wind fields will be on the wintertime features in the areas of deep water formation. An example of a high wind speed event is the Greenland Tip Jet, which occurs to the south of Greenland from November to April, when low-pressure systems cross the south of Greenland where mountains divert the winds, accelerating them around the Southern tip of Greenland. Peak wind speeds reach well in excess of 20 ms⁻¹, but last for relatively short periods of a day or so.

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