Ocean Indicators in the Tropical and South Atlantic Oceans

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Abstract

This effort supports the National Climate Assessment: Indicators System; and it is focused on providing in a coordinated fashion ocean indicators for ocean and climate state monitoring and numerical model evaluation. These indicators are focused on:

- The Meridional Overturning Circulation in the South Atlantic Ocean; and
- Variability in the state of the ocean, through key ocean currents and properties associated with the circulation in the South Atlantic Ocean.

This effort also supports the NOAA Next Generation Strategic Plan Long-term goal *Climate Adaptation and Mitigation: An informed society anticipating and responding to climate and its impacts*:

- Improved scientific understanding of the changing climate system and its impacts;
- Assessments of current and future states of the climate system that identify potential impacts and inform science, service, and stewardship decisions.

To accomplish this, we propose to utilize some of the longest ocean data sets in existence, including hydrographic and satellite observations, numerical model and reanalysis outputs, and theoretical efforts, many of which are currently being funded by NOAA/CPO. Integration of data and analysis of blended data will be key factors in this work, in order to maximize the value of the ocean observing system. Indicators distributed through this work will help improve scientific understanding of the ocean and climate system, and provide assessments of current states of the climate and ocean system for scientific analysis, numerical modeling comparisons, and identification of potential impacts to inform service, planning, and management decisions. The indicators proposed here will be provided with a summary analysis of their temporal and spatial variability, including maps showing assessments of their current states and uncertainties.

An important component of the proposed work is the monitoring of the Atlantic component of the Meridional Overturning Circulation (AMOC). The AMOC is characterized by a northward flow of warm water in the upper layers from the South Atlantic into the North Atlantic, sinking and formation of North Atlantic Deep Water at high latitudes, and a southward return flow of cold water at depth. The AMOC carries a significant fraction of the total global ocean-atmosphere northward heat flux. The majority of this heat is lost to the atmosphere in the mid-latitudes where warm water meets cold, dry continental air masses. Changes in the AMOC can have a direct and pronounced impact on a variety of climate phenomena, such as African and Indian monsoon rainfall, hurricane activity, and climate variability over North America and Western Europe. Thus, monitoring the AMOC variability in the South Atlantic and its major current systems is crucial for a) assessing numerical climate models, b) improving the understanding of important climate processes, and c) assessing future climate change. Therefore, this work will place emphasis on monitoring interbasin and interhemispheric water and mass exchanges in the Atlantic Ocean, and of the South Atlantic subtropical gyre variability.