South Atlantic Meridional Overturning Circulation: Pathways and Modes of Variability

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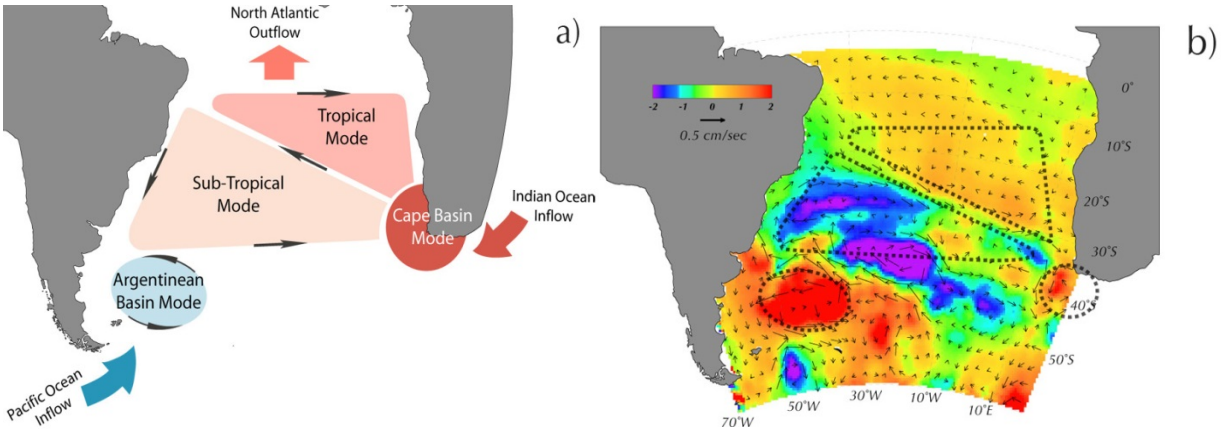
This project is a collaborative effort between AOML, Ricardo Matano (OSU/CEOAS), and Rym Msadek (CERFACS, France and NOAA/GFDL). Previous observational and modeling efforts on the meridional overturning circulation (MOC) have been focused on the North Atlantic and the Southern Oceans, which are the preferential sites for deep-water formation. To understand the feedbacks between the North Atlantic and the Southern Oceans we need to improve our understanding of the pathways of the upper and lower limbs of the MOC in the South Atlantic (SA) Ocean, which are the most important links between them. The SA is not just a passive conduit for the transit of remotely formed water masses, but actively influences them through air–sea interactions, mixing, subduction, and advection. Therefore, we are characterizing the pathways of the upper and lower limb of the MOC in the SA and identifying the dynamical mechanisms that control these pathways. The study focuses on identifying the natural modes of variability in the SA and their impact on the MOC. We are also determining the response of the SA pathways to predicted climate change scenarios and assessing the impact of this response on the MOC. Our research focuses on the analysis of state-of-the-art eddy-permitting and eddy-resolving NOAA/GFDL climate model simulations. Specifically, we are using a suite of experiments done with the CM2.5 and CM2.6 coupled models, which were forced with present day conditions and different climate change scenarios. We are to comparing those simulations against the non-eddying Coordinated Model Intercomparison Project and Intergovernmental Panel on Climate Change Fifth Assessment Report models including the NOAA/GFDL coarse resolution models (CM2.1, CM3), a suite of process-oriented numerical experiments using regional ocean models, and global in-situ and satellite observations.



The low-frequency modes of variability in the SA: a) schematic of the proposed modes; b) first EOF of the SSH AVISO data and its associated geostrophic circulation.