Quantifying Salt-Advection Feedback in GFDL and CESM Pre-Industrial Control Simulations

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Previous studies have identified freshwater transport by the AMOC across the southern boundary of the Atlantic Ocean as a key parameter controlling stability of the AMOC. This parameter, usually referred to as Fov, represents zonally- and vertically-integrated meridional freshwater transport contributed by the AMOC. A negative / southward (positive / northward) Fov indicates net freshwater export from (import to) the Atlantic Basin, and is associated with bistable (monostable) AMOC due to a positive (negative) salt-advection feedback. However, the time scale of this feedback (i.e., the travel time for South Atlantic salinity anomalies to reach the subpolar North Atlantic), its strength relative to other feedbacks involved in the AMOC, and how these processes may depend on model resolution and parameterizations are not fully understood. In this presentation, results from an ongoing effort aimed at addressing these questions and, thus, improving our understanding on related processes will be reported. In the initial phase of our study, we analyze solutions from several pre-industrial control simulations with the Geophysical Fluid Dynamics Laboratory (GFDL) models as well as simulations from an ensemble of pre-industrial Community Earth System Model (CESM) integrations in which different ocean model parameters are used. In addition to characterizing Fov in these simulations, we present a coherence analysis between Fov and AMOC, and quantify saline versus thermal contributions in setting up density gradients that drive the AMOC.