Examining the relationship between low-frequency SST and AMOC variability

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Observations indicate that Atlantic sea surface temperatures (SSTs) exhibit significant low-frequency variability, but the processes (e.g. local atmospheric forcing, changes in the AMOC, etc.) responsible for these SST anomalies are unclear. In this presentation we use a recent state estimate from the consortium on Estimating the Circulation and Climate of the Ocean (ECCO) to examine the relative roles of local atmospheric (wind and buoyancy) forcing and ocean dynamics in creating low-frequency SST/upper-ocean heat content (UOHC) anomalies. In the interior of the subtropical gyre, UOHC variability is primarily the result of local atmospheric forcing. In contrast along the Gulf Stream path, changes in geostrophic advection, which are related to variability of the Gulf Stream path, play a leading order role in the UOHC budget. Geostrophic convergences and air-sea heat fluxes are strongly anticorrelated, suggesting that at low-frequencies UOHC anomalies in the Gulf Stream region are forced by geostrophic convergences and damped by air-sea heat fluxes. On intraannual timescales UOHC variability in the interior of the subpolar gyre is primarily related to local atmospheric forcing, but on longer timescales diffusion, non-linearity, and geostrophic advection also play significant roles. The importance of local and remote atmospheric forcing in setting UOHC suggests that on the (intrannual to interannual) timescales analyzed here, changes in the deep AMOC may not need to be invoked to explain observed SST/UOHC anomalies.