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30.04.2026

On the Mechanisms of the Atlantic Niño/Niña Decadal Variability

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**Abstract** - The observed Atlantic Niño/Niña displays robust variations at decadal timescale (decadal ATL), besides the well-known interannual variability. The underlying mechanisms, however, remain largely elusive. Analyzing observations and model outputs, we find the decadal ATL originates in the South Atlantic. During its positive phase, the cold tongue warming, triggering atmospheric Rossby wave train, weakens the St. Helena anticyclone, which enhances wind and cools sea surface temperature over the Southwestern Atlantic, leading to the positive phase of the South Atlantic Ocean Dipole. Meanwhile, the weakened anticyclone reduces the transport of the subtropical cell, suppressing the equatorial upwelling, which amplifies the initial cold tongue warming. The phase shift of the decadal ATL is attributed to an eastward propagation of thermocline displacements at 3°S-15°S, induced by a propagation of local wind stress curl anomalies in response to combined effects of the equatorial and mid-latitude air-sea coupling.