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ubduction of decadal
s, *J. Phys. Oceanogr.*,

seidon large scale sea
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J. Busalacchi, An ex-
into a nonlinear nu-
alidation, *J. Geophys.*

A synthetic float analysis of upper-limb meridional overturning circulation interior ocean pathways in the tropical/subtropical Atlantic

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Synthetic floats are released in an ocean general circulation model to study fluid pathways followed by the upper limb of the meridional overturning circulation from the subtropical South Atlantic to the subtropical North Atlantic. The floats are designed to track this fundamentally three-dimensional, non-isentropic flow while sampling water properties and all terms of the equation governing the vertical component of relative vorticity. The low-resolution ocean simulations demonstrate how upper-limb flow navigates the complex, time-dependent system of wind-driven gyres. Pathways that extend into the interior North Atlantic before entering the Caribbean Sea are emphasized over the more direct western boundary route. A large number of floats are released in the southern hemisphere to verify the importance of such interior pathways in the model and document key events that occur along them. Upper limb water first approaches the equator in a modified inertial western boundary layer. Equatorial processes (visco-inertial boundary layer dynamics, upwelling, heating) are necessary to reset water properties and permit fluid to permanently cross the equator, typically requiring eastward retroflection into the EUC. After upwelling at the equator, fluid that does not advect northward or southward into the interior returns to the western boundary and turns northward in a frictional western boundary layer. The generation of negative relative vorticity by planetary vorticity advection can break the boundary layer constraint and permit retroflection into the NECC near 5°N from late spring through fall. Once in the

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