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# Why is the Atlantic Cold Tongue south of the Equator?

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The Atlantic cold tongue is an area of cold water, appearing every year in boreal spring and summer, on and south of the equator, between the African coast and approximately 20°W. The question addressed is why the cold tongue is located on the southward side of the equator or equivalently, why the surface water masses, circulating northward and cooling during the cold season as well, remain always warmer. For that, a high-resolution, realistic simulation of the 2006 cold tongue setup is used. An on-line mixed layer heat budget is diagnosed to estimate the surface processes at play during this period. The budget shows the major role of horizontal advection and turbulent mixing in the temperature balance of the cold tongue, while the surface net heat flux and vertical transport have a reduced contribution. In the cold tongue, the main source of cooling is driven by vertical mixing consecutive to the increased vertical shear associated to the wind stress reinforcement in May/June. Moreover, the wind energy flux injected from the atmosphere into the oceanic upper layers, is astonishingly higher in the area of the South Equatorial Current instead of being the most intense where the winds are. Finally the North and South asymmetric seasonal cooling in the eastern equatorial basin results from the occurrence of both asymmetry of the wind energy flux, of the mixed layer depths and of the vertical turbulent mixing.