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Seasonal modes of surface cooling in the Gulf of Guinea

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A realistic numerical simulation of the Tropical Atlantic Ocean is analyzed to investigate the mechanisms responsible for the surface cooling in the Gulf of Guinea. Results suggest that surface cooling is mostly due to vertical mixing at the base of the surface mixed layer. At seasonal scale, the timing and distribution of turbulent heat fluxes in the Gulf of Guinea is strongly correlated with the spatial structure and the time variability of the northern and southern branches of the South Equatorial Current (SEC), and of the Guinea Current. Through modulation of the velocity shear at the subsurface, these surface currents are shown to control the vertical turbulent exchanges, bringing cold and nutrient rich waters to the surface. This mechanism better explains the seasonality and spatial distribution of surface chlorophyll concentrations than the generally accepted hypothesis that thermocline movements control the nutrient flux. The position of the southern SEC explains why both the cold tongue and high chlorophyll concentrations extend from the equator to 4°S in the southeastern part of the Tropical Atlantic ocean.