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Numerical analysis of ocean circulation in the Northern Gulf of Guinea

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The ocean circulation and its variability in the Northern Gulf of Guinea has been found to modulate the amplitude of the African monsoon. Changes in Sea Surface Temperature due to coastal upwelling may also influence the regional climate. This upwelling is found along a zonal coast and its causes are still not clearly identified: local forcing (winds effect, Guinea Current, cape effect) or remote forcing (Kelvin waves generated at the equator). To document and study this particular coastal upwelling is thus relevant for climate dynamics and for local fisheries.
A modeling approach is used for a better understanding of the processes that lead to this coastal upwelling. A realistic configuration with the Regional Ocean Modeling System (ROMS) is built.
It is based on AGRIF (Adaptative Grid Refinement In Fortran) two-way nesting over the Tropical Atlantic (1/5°) with a zoom in the Gulf of Guinea (1/15°). Two different surface winds forcing are tested: COADS (Comprehensive Ocean Atmosphere Data Set) and the QuikSCAT scatterometer winds. The model is able to reproduce the mean circulation, the typical ocean patterns and their variability. According to observations from satellite and in situ data the QuikSCAT wind's are found to produce better results. Mesoscale cyclonic eddies seem to play a role on the regional dynamics. An idealistic configuration where the Cape Palmas and Cape of Three Points are removed is made to reveal their effects of the coastal upwelling. The model will also be used to investigate biogeochemical processes of the first trophic level in the Gulf of Guinea ecosystem.