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Coupling between the Atlantic Cold Tongue and the West African Monsoon in boreal Spring and Summer

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The Atlantic Cold Tongue (ACT) is the major seasonal signal which affects the eastern equatorial Atlantic basin. During its emplacement, sea surface temperatures (SST) decrease significantly south of the Equator. Cooling starts close to 10°W or some years along the western African coast and spreads quickly throughout the eastern equatorial Atlantic from May to August. At the time of its maximum extent, the cooling occupies an oceanic surface area equivalent to a quarter that of the Sahara.

Correlations between the date of the ACT formation and the West African Monsoon (WAM) onset date computed over the last 27 years, suggest that the ACT plays a key role on the WAM onset. By using composite analyses and simple models, we discuss the physical processes implied in the ACT setup, in the disturbances that it induces on the marine atmospheric boundary layer and in its potential role on the WAM onset.

We suggest that the air-sea coupling occurs in two distinct phases: during the first phase (April-May), the ACT forms after the intensification of the southeasterly trade winds associated with the northward austral winter march of the St. Helena anticyclone. During the second phase (June-July), winds increase (decrease) north (south) of the Equator, as a result of intense cross-equatorial surface heat flux gradients, mostly generated by the differential SST cooling away from the equator. During the short period when surface heat flux gradients are strong enough, a local circulation establishes superimposed over the large-scale circulation of the southeastern trades, with a maximum found near 2°N. Strengthening of the winds on the northern side of the Equator contributes to the northward migration of low-level moisture and convection to the north and could impact the WAM onset.