Geophysical Research Abstracts
Vol. 14, EGU2012-12365, 2012
EGU General Assembly 2012

Low-frequency Sahel rainfall variability and Atlantic Sea Surface Temperatures during the last century

B. Dieppois (1,*), A. Durand (1,*), M. Fournier (1), A. Diedhiou (2), B. Fontaine (3), N. Massei (1,*), Z. Nouaceur (4), D. Sebag (1,5,*)

(1) CNRS/INSU UMR 6143 Morphodynamique Continentale et Cotière (M2C), FED 4116 SCALE, Université de Rouen, Mont-Saint-Aignan, France (bastien.dieppois@univ-rouen.fr), (2) IRD UMR 5564 Laboratoire d'étude des transferts en Hydrologie et Environnement (LTHE), Université de Grenoble, Grenoble, France, (3) CNRS/UMR 5210 Centre de Recherches de Climatologie (CRC), Université de Dijon, Dijon, France, (4) CNRS UMR 6228 Identité et Différenciation de l'Espace, de l'Environnement et des Sociétés(IDEES), FED 4116 SCALE, Université de Rouen, Mont-Saint-Aignan, France , (5) IRD UMR 5569 HydroSciences Montpellier (HSM), Université de Montpellier 2, Montpellier, France, (*) CORUS-2 6116

This study revisits the question of the Atlantic SSTs-Sahel rainfall teleconnection variability along the 20th century using gridded data sets (SST, rainfall), selected Sahel rainfall time-series (Dakar in Senegal; Nioro du Sahel and Mopti in Mali; Niamey, Maradi and Maine-Soroa in Niger) and climate indices (AMO and TSA). In this study, we introduce a mixed time-series and spatial approach based on the spectral analysis (continuous wavelet transform and wavelet coherence and phase), which enables accurately assess the temporal, spatial and frequency non-stationarity of Atlantic SSTs-Sahel rainfall teleconnections.

West African rainfalls show a pronounced negative trend over the Sahel since the late 1960s. Several dominant variability modes are observed according to the nearness of Atlantic Ocean. Three non-stationary areas of Sahel rainfall are thus revealed: Atlantic Coast (Dakar), Central Sahel (Nioro du Sahel and Mopti) and Eastern Sahel (Niamey, Maradi and Maine-Soroa). Previous hypothesis highlight the positive and negative weights of the North and (Tropical) South Atlantic SSTs respectively. Nevertheless, the statistical time-frequency study reveals an independent rainfall teleconnections with the North and (Tropical) South Atlantic SSTs.

Increased rainfall over the Sahel is related to the positive phase of the AMO, due to a northward shift of the ITCZ. But behind 10°W-0°, the influence of North Atlantic SSTs variability is weak. In addition, as in the 50's the quasi-decadal teleconnections (9-19yrs) between Sahel rainfall and the North Atlantic SSTs can be associated with NAO patterns. A cold (warm) SSTs anomaly over the Tropical South Atlantic is associated with wet (dry) rainfall anomaly over the Sahel, and opposite anomaly over the Gulf of Guinea. But, this teleconnection is not geographically stable. Before 1970's, Western Sahel rainfall (including the coastal zone; Dakar, Nioro du Sahel, Mopti) appears to be statistically teleconnected with multi-decadal variability of South Atlantic SSTs. While since 1970's, Eastern Sahel rainfall (Niamey, Maradi, Maine-Soroa) appears to be teleconnected with quasi-decadal variability of Tropical South Atlantic SST.

This study is focused on the Atlantic, but the longitudinal heterogeneity of Sahel rainfall is also dependent of land surfaces (albedo, vegetation cover and soil moisture) and the contrast between Indian and Atlantic SSTs, that modulating ascendance/subsidence in the east-west circulation. Nevertheless, over the 20th century, combinations of these various states of Atlantic SSTs explain a large part of annual Sahel rainfall amount fluctuations. The superposition of various teleconnections modulating an enhanced rainfall led to wet anomaly, and conversely for dry anomaly.