

## THE SPATIOTEMPORAL CLIMATE VARIABILITY OVER SENEGAL AND ITS RELATIONSHIP TO GLOBAL CLIMATE

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### ABSTRACT

Climate variability over Senegal (West Africa) and its relationship to global climate are examined for the period 1979–1998. Monthly observed rainfall for 20 stations and monthly CPC merged analysis precipitation (CMAP) over Senegal were averaged for the months of June, July, August, and September in order to generate seasonal rainfall totals for the wet season, as well as climate indices averaged over the study period. The spatial distribution patterns are mapped and analyzed using ArcGIS Spatial Analyst. Rainfall distribution over Senegal is dominated by a N–S gradient.

To investigate the climate variability over Senegal, an empirical orthogonal function (EOF) analysis is performed for the 1979–1998 period, using rain-gauge and CMAP rainfall data over Senegal, and CMAP data only for West Africa. The first West African mode agrees strongly with Lamb's rainfall index. One of our major findings is that EOF2 for West Africa is well correlated with EOF1 for rainfall in Senegal. This relationship is supported by the projection of winds on the EOF2 mode by the National Centers for Environmental Prediction (NCEP), as well as the grid-point correlation between the time series of EOF2 over West Africa and the Atlantic sea-surface temperature (SST). The typical circulation associated with positive anomalies over Senegal is a moisture convergence, which takes place over the Guinea Gulf, in conjunction with the warm waters in this area.

The time series for rainfall over Senegal show positive correlations with the South Atlantic SST. Over the Pacific Ocean, the greatest correlation coefficients (up to  $-0.72$ ) are observed during the April–July period, which provide a modest possibility of predicting Senegal's rainy season.

Given the specificity of coastal West Africa, the traditional indices used by policy makers and end users for the whole Sahel–Sudan region will not work for Senegal.

The CMAP data are robust and suitable for analyses over West Africa. On the basis of its reliability, CMAP data has proven to be a good validation for analyses based on rain-gauge precipitation. Copyright © 2006 Royal Meteorological Society.

KEY WORDS: Senegal; West Africa; EOF; GIS; precipitation; temperature

### 1. INTRODUCTION

Enclosed between latitudes  $12^{\circ}30'N$  and  $16^{\circ}30'N$  and longitudes  $11^{\circ}30'W$  and  $17^{\circ}30'W$ , Senegal is the westernmost country in Africa. With the North Atlantic Ocean to the west, it stretches between the moist part of West Africa to the south and the dry Sahara desert to the north. Senegal is generally free of steep terrain, with altitudes mostly under 130 m. The northern part of the country is part of the Sahel zone, and the southern part is situated in the West African climatic zone called the Sudan, a transition zone between the Sahel zone and the very moist Guinean and equatorial climates.

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