INTRODUCTION
Our motivation is primarily based on the important role surface relative humidity (sfc RH) plays in meningitis epidemics over tropical West Africa. The disease, caused by a gram-negative, diplococcal Neisseria meningitidis, is associated with several environmental factors such as dusty Harmattan winds & low humidity. It is a highly pervasive, devastating, and debilitating disease responsible for about 250,000 deaths annually (with case fatality rate of 10-50%). It imparts several degrees of disabilities that include, but not limited to, auditory impairment, cognitive impairment, necrosis, septicemia & paralysis, to surviving victims.

To date, on seasonal to interannual time scale, sfc RH variability & predictability associated with the disease, and in particular the roles of the tropical Atlantic & other large-scale teleconnection patterns actively engaged in the modulation have not been fully explored. The purpose of the study is to investigate these phenomena, and generate a climate-meningitis outlook for West Africa in one year in advance, so that the sub-Saharan governments, policymakers, & other stakeholders actively engaged in the vaccination campaigns can fully utilize our high-impact products to target the most vulnerable communities where low sfc RH levels (high meningitis occurrences) pose an imminent threat. This study has, therefore, the potential of contributing to effective reactive mass vaccinations, to save lives.

OBJECTIVES: To Investigate:
1. sfc RH variability & the tropical Atlantic Ocean modulation
2. the predictability of sfc RH up to 12 months lead time

DATA & METHODS
1. Data sources include:
   (a) NCEP/NCAR reanalysis
   (b) National Oceanic and Atmospheric Administration (NOAA) Extended Reconstructed SST(ERSST)
2. Variability
   (a) Seasonal cycle of sfc RH over North Hemisphere (NH) Africa is investigated by computing its climatologies, using 12 overlapping, 3-months sequences.
   (b) Empirical orthogonal function (EOF) analysis is performed on the tropical Atlantic & sfc RH, based on the same time sequences.
   (c) Statistically separate modes (principal components: PCs) are retained.

RESULTS 1. Variability: sfc RH & Tropical Atlantic

Sfc RH Seasonal Cycle

Leading modes of sfc RH: Patterns

Leading modes of sfc RH: Time series

Leading modes of trop. Atlantic SST: Patterns

RESULTS 2. Predictability: JFM 2009 sfc RH over West Africa based on JAS 2009 ACMAD Consensus Seasonal Rainfall Forecast Zones

DISCUSSION
- Sfc RH lows are a persistent feature of the W. African climate in all seasons.
- These suggest the region's vulnerability to meningitis epidemics.
- Spatial extent of the lows — highest in winter, & coincides with the Harmattan season, but lowest during the monsoon seasons (eg JJA).
- Sfc RH variability is associated with the 2-4 leading tropical Atlantic modes.
- CPA reveals that equatorial /South Atlantic & subtropical Atlantic co-vary synchronously with sfc RH.
- July predictors; global SST, U & V winds achieved the highest prediction skill of $R^2$ = 0.85 at 5 months lead time for JFM RH over zone 1.
- Similarly, July predictors, in addition to PW, achieved the highest prediction skill of $R^2$ = 0.89 at 5 months lead time over zone 2.
- March predictors, as in zone 2, achieved the highest prediction skill of $R^2$ = 0.88 at the longest lead time of 9 months for zone 3.

CONCLUSION
- Low sfc RH is a persistent feature over W. Africa, which is linked to meningitis occurrence.
- Tropical Atlantic modulates sfc RH variability, suggestive of a similar modulation of the disease, on seasonal to interannual time scales. This can also be inferred from the global & regional-scale predictors used for this study.
- Our algorithm is powerful; for it can predict sfc RH anomalies with very high skills at, e.g., nine months in advance. This is essential for meningitis vaccination campaign.