Climate of the Meningitis Belt

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Meningitis and Climate

- Predicted Probability of Meningitis Epidemics
- Dry, dusty environment
Meningitis and Climate

- Predicted Probability of Meningitis Epidemics
- Mean rainfall

Rainfall seasonal!!!
July-September

Molesworth et al., 2003
Seasonal cycle of Atmospheric circulation

- Mean Low level wind
  - Seasonal reversal of winds
  - In summer, southwesterly flows bring moisture inland
  - Atlantic Ocean – main source of moisture
West African Monsoon – in brief...

- **Sub-regional scale**
  - strong precipitation gradients

- **Finer scales**
  - Time: Northward shift then retreat
  - Space: Complex structures

- **Regional scale**
  - strong decadal variability
Time Scales of Variability

2m Air Temperature: South Africa

DJF Season

Linear Trend
+0.04 deg.C/decade (std.dev = 0.10 deg. C)

Decadal Variability
(std.dev = 0.22 deg. C)

Interannual Variability
(std.dev = 0.55 deg. C)
West African Monsoon – Impact of Sea Surface Temperatures

- SST – principal cause of inter-annual and decadal-scale variability

- Interannual and decadal variability captured by General Circulation Models

Atmospheric dust production on Seasonal, Interannual and multidecadal Time Scales in the West African Sahel

Time series of estimated average monthly dust mass concentrations for
- Sahara (top)
- Sahel (bottom)
zones of Niger

Ben Mohamed et al. 2007 (subm)
The models that were successful in reproducing the late 20th century drought in Sahel disagree as to future projections in Sahel

- Do not reproduce correctly the main modes of variability and teleconnections (Joly et al. 2006)

Biasutti and Giannini, GRL 2006
Conclusions

- **Mean Rainfall**
  - Strong gradients
  - Seasonality of rain and circulations
    - northward – southward movement of rainy belt and wind convergence

- **Rainfall variability**
  - Different scales
    - Strong Interannual/Decadal variability linked to SST, reproduced in GCM
    - Climate Change – models disagreement
Environmental Factors

E.g. **TOMS w 1-20**

- Northward progression of Meningitis linked to highest temperatures, in the region of convergence between Harmattan and southwesterlies
- Highest dustiness (not shown)
- NOT lowest humidity

1. **Termination** linked to arrival of moister, cooler and cleaner air