Predictability of seasonal Sahel rainfall beyond the spring barrier using GCM MOS correction

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Are GCMs useless just because they cannot represent precipitation?
Fig. III.7b: The 925 hPa climatological wind simulated by AGCMs depicting the low level monsoon flow during JAS 1968-2001.
APPROACH FOR CORRECTING GCM SIMULATION

Ndiaye et al., 2009, Int Jour. of Climatol.

First EOF of model’s low level (925mb) zonal wind over tropical Atlantic
33.8% of variance
(used as predictor for Sahel rainfall)
USING REGIONAL WIND TO CORRECT POOR GCM rainfall simulation over 1968-2001

Raw GCM skill (shaded bar) MOS skill with MOS (open)
Consistency and robustness of GCM’s EOF approach

Time-series of each of the GCM EOFs used in the MOS (colored lines), along with GHCN Sahel rainfall index (black line).
GCM rainfall vs regional wind MOS correction
Forecast for JAS season over Sahel (10-20N and 20W-30E) 1968-03

Lead time

Observation
Jul-Aug-Sep

1 month lag
June SSTA

2 months lag
May SSTA

3 months lag
April SSTA

Skill barrier

Wind correction
Model rainfall
Systematic tendency of SSTA, Surface wind and 200hPa wind between good forecast in June and failed forecast in May.
CFS skill correlation over 1981-2008 from raw precipitation and through MOS approach

Raw CFS skill (shaded bar) MOS skill with one EOF (open)

Accepted in Journal of Climate, Ndiaye et al. 2011, April issue
Obs JAS Nino 3 versus Obs SST fields (left panels) and CFS SST JAS forecast fields (right panels)

Correlation is over the 1981-2001 period
lead-time improvements in the coupled CFS model
CONCLUSION

- Tropical Atlantic winds are a good proxy for Sahel rainfall in GCMs at seasonal to multidecadal timescales
- Previous attempts at prediction limited by SST development during boreal spring (true for GCMs and empirical methods)
- CFS contains skill r~0.6 at lead times up to six months, with clear skill on the interannual timescale when the MOS is applied

THE WAY FORWARD MAYBE WITH CORDEX

- Take advantage on what GCMs can do
- Balance between “what GCM cannot do” and “what GCM can do”
- Need to explore further the MOS approach:
  - Correction of Spatial shift
  - What variables/phenomena GCMs can represent better in each region
- MOS easy: to do, to diagnostic, understand
THANK YOU