CMIP5, CORDEX and higher resolution RegCM4 multimodel ensembles comparison of projected changes in climate zones over West Africa

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I/ Background and Motivation

Figure 1
I/ Background and Motivation ...

Ø IPCC (2013):
- Acceleration of future warming
- Large uncertainties in precipitation change

→ Combining temperature and Precipitation --- Climate Classification

Is there any consistent pattern that emerges for the future?

What's the added value by CORDEX?

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## Experiment and Data Description

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<th>CMIP5</th>
<th>CanRCM4</th>
<th>RegCM4</th>
<th>CCLM4</th>
<th>RCA4</th>
<th>RACMO22T</th>
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III/ Methods

Thornthwaite climate classification

- Thermal Factor: Potential Evapotranspiration

\[
P/PE - 1 \quad \text{if } P < PE
\]

- Moisture Factor:

\[
1 - PE/P \quad \text{if } P > PE
\]

<table>
<thead>
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<th>Thermal Classification</th>
<th>Thermal Type</th>
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<th>Moisture Classification</th>
<th>Moisture Type</th>
<th>Moisture Index</th>
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<td>Torrid</td>
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<td>Saturated</td>
<td>0.66 – 1.00</td>
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<td>Hot</td>
<td>1,200 – 1,500</td>
<td>Wet</td>
<td>0.33 – 0.66</td>
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<td>Warm</td>
<td>900 – 1,200</td>
<td>Moist</td>
<td>0.00 – 0.33</td>
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<td>Cool</td>
<td>600 – 900</td>
<td>Dry</td>
<td>-0.33 – 0.00</td>
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<td>Cold</td>
<td>300 – 600</td>
<td>Semi-arid</td>
<td>-0.66 – -0.33</td>
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<td>Frigid</td>
<td>0 – 300</td>
<td>Arid</td>
<td>-1.00 – -0.66</td>
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</tbody>
</table>
IV/ Results

✓ Present-day: 1975-2004

- General pattern captured – Hamon more consistent

- Ensemble types and sizes are consistent:
  - Gulf of Guinea: mostly dry, few areas moist
  - Sahel: both semiarid and arid, few areas dry
  - West Africa: arid at 40% with 20% wet, dry and semiarid

- Added Value?

Sylla et al. 2016 [Climatic Change]
**III/ Results**

- Late 21st Century: 2080-2099 spatial patterns
  - Generalized torrid climates
  - More extended arid conditions
  - Shift and extension of semiarid band

Shifts more pronounced in HIRES — the role of resolution —

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*Sylla et al. 2016 [Climatic Change]*

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III/ Results

☑ Late 21st Century: 2080-2099 quantitative assessment

- Guinea: Increased semiarid
- Sahel: Increased arid
- West Africa: arid and semiarid
- Recession of wet, moist, dry
- Sensitive to number of models and bias
- Uncertainties

Sylla et al. 2015 [Climatic Change]
III/ Results

✓ Late 21st Century: 2080-2099 cause of the shifts

Change in moisture component

Ratio between $\Delta P / \Delta PE$

Temperature is the primary driver

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Thank you for your attention