

# Implications of global warming for West African precipitation

Rachel James, Richard Washington, and David P. Rowell  
AMMA International Conference, 4<sup>th</sup> July 2012  
[rachel.james@ouce.ox.ac.uk](mailto:rachel.james@ouce.ox.ac.uk)

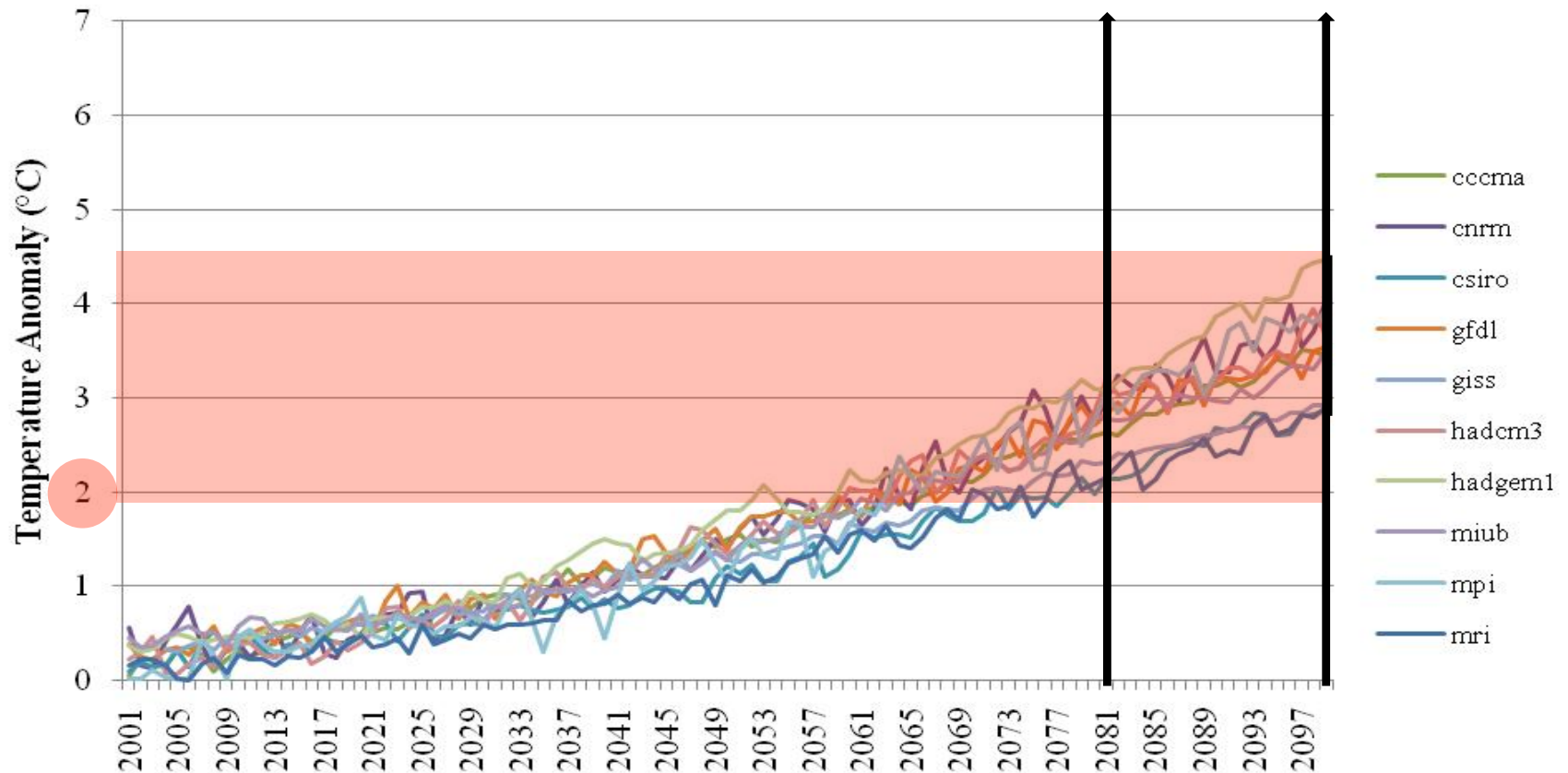


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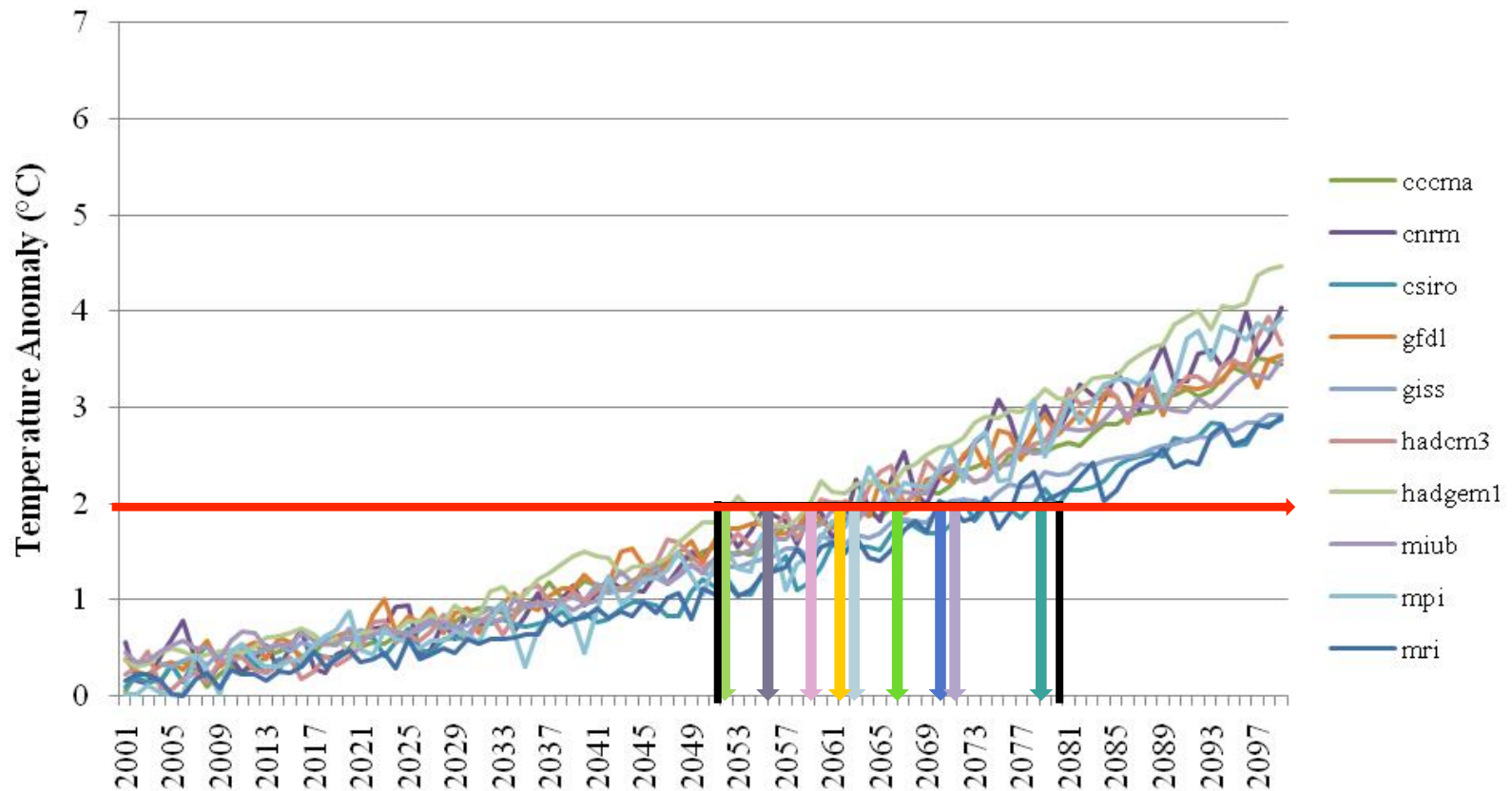


# “Time-slices” e.g. 2080-2100

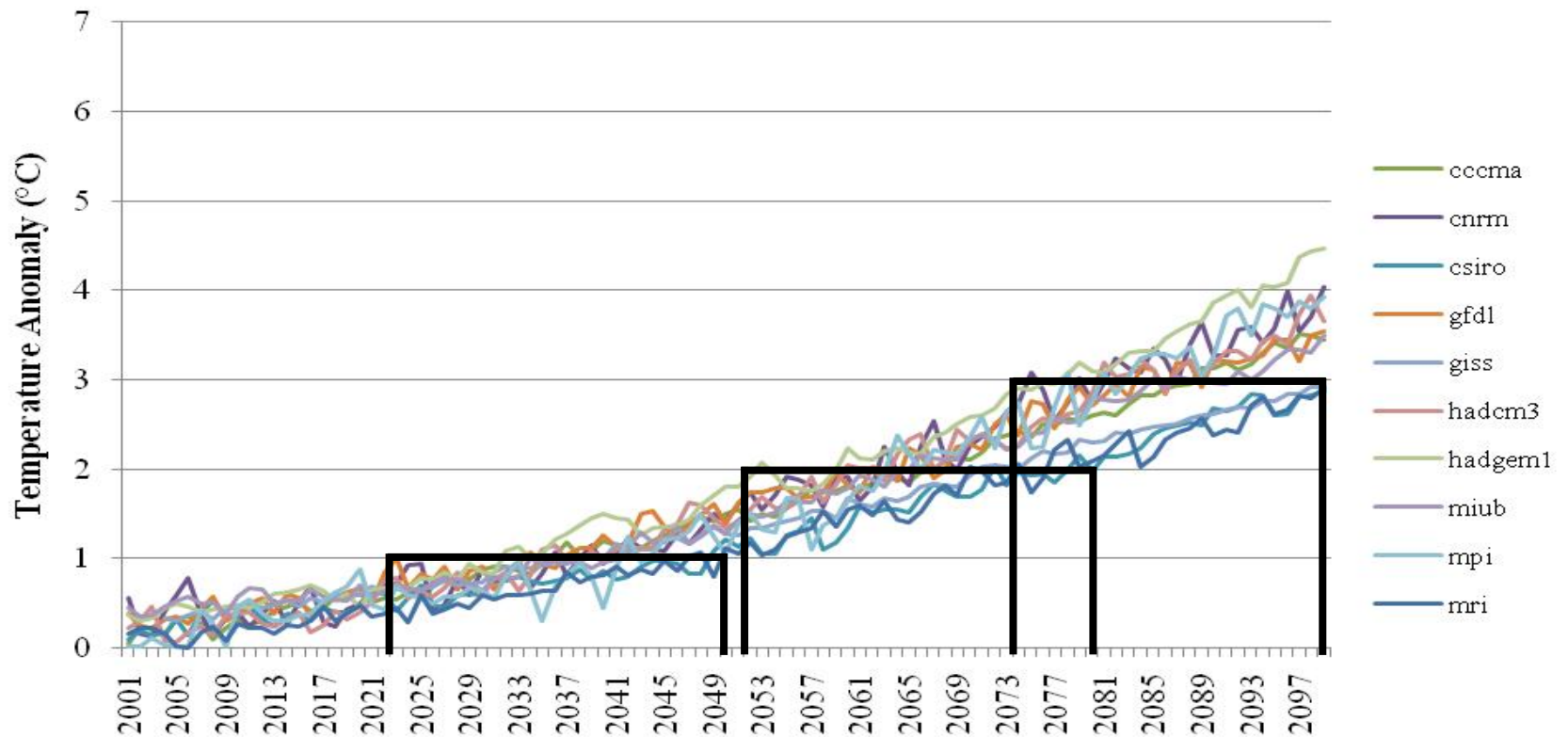


***Is 2°C safe for West Africa?***

# Temperature Intervals e.g. 2°C



# 1°C, 2°C, 3°C



# Aim

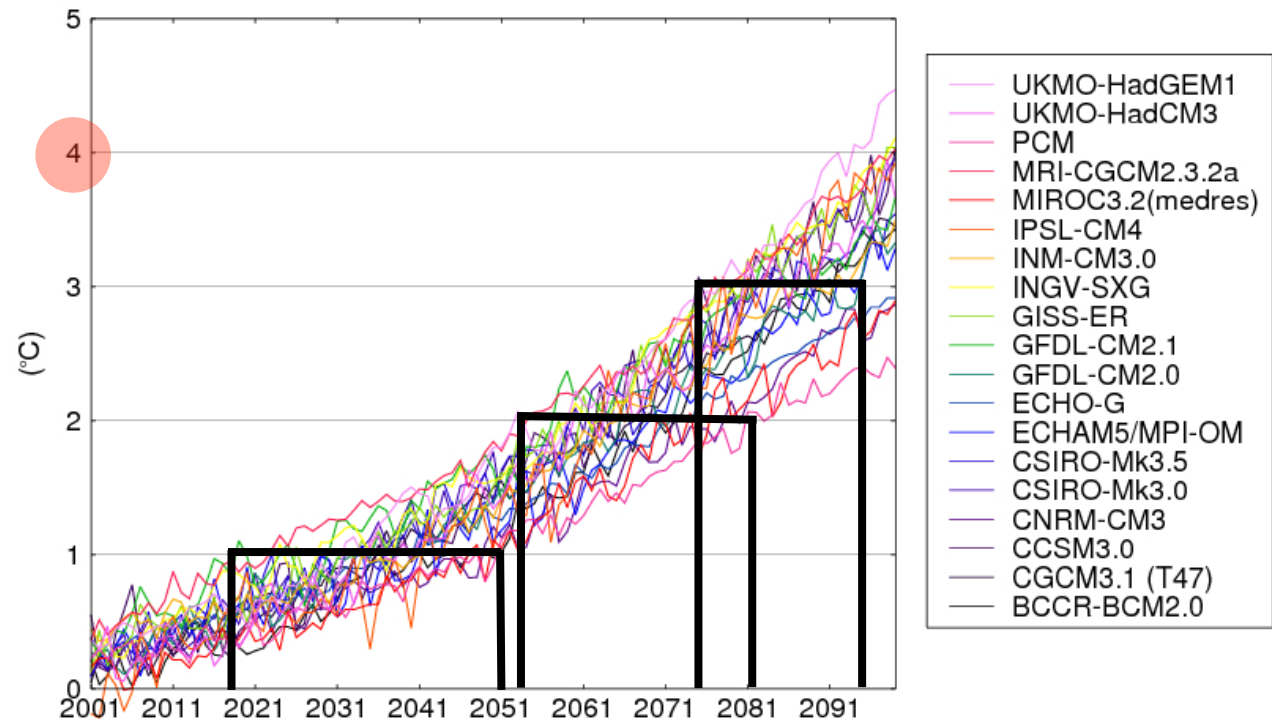


to investigate changes in West African precipitation  
at 1°C, 2°C, 3°C, 4°C, and beyond

- *Is 2°C safe for West Africa?*
- *What kind of adaptation needed at 4°C?*

# CMIP3

- IPCC AR4
- multi-model ensemble
- 19 models
- Coupled models
- Scenarios:
  - 20C3M: 1985-99
  - SRES A2

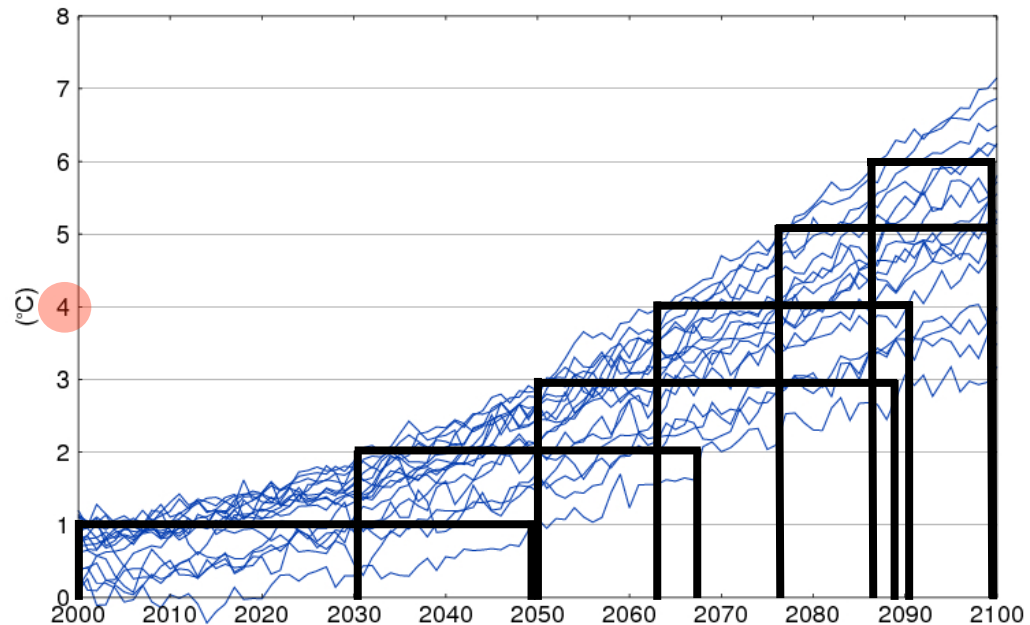


***4°C and beyond?  
Larger ensembles?***

# Perturbed Physics Ensembles (PPEs)

## AO-PPE

- HadCM3
- 17 model versions
- Coupled models
- Transient
- Scenarios
  - preindustrial
  - SRES A1FI



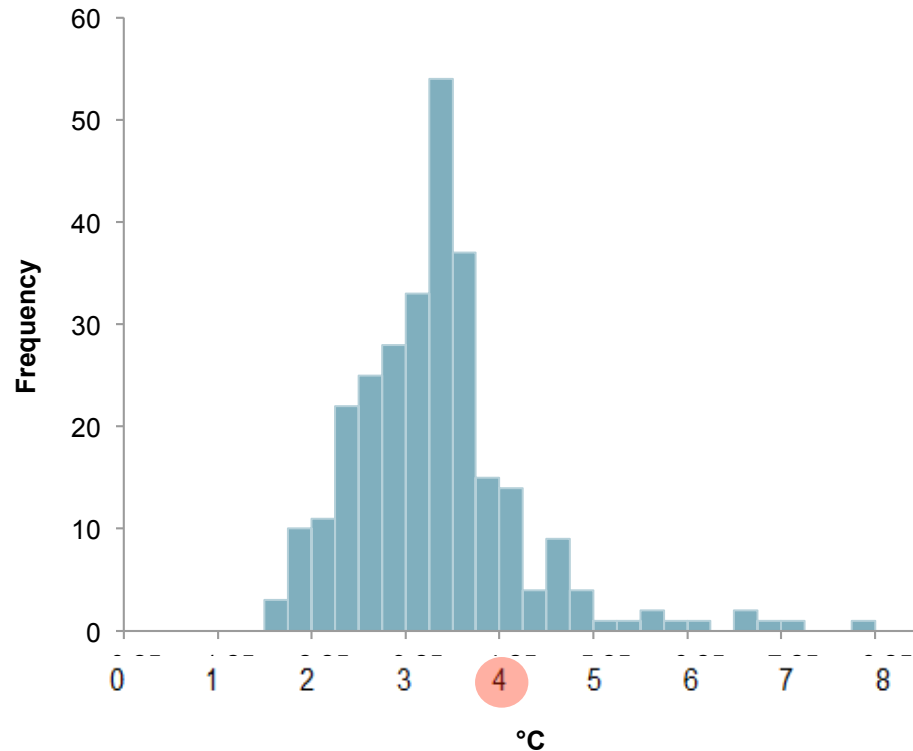
*Larger ensemble?*



# Perturbed Physics Ensembles (PPEs)

## AS-PPE

- HadSM3
- 280 model versions
- Slab models
- Equilibrium
- Scenarios
  - preindustrial
  - 2 x CO<sub>2</sub>



# Research Gaps

- CMIP3

  - 1°C, 2°C, 3°C

- AO-PPE

- AS-PPE

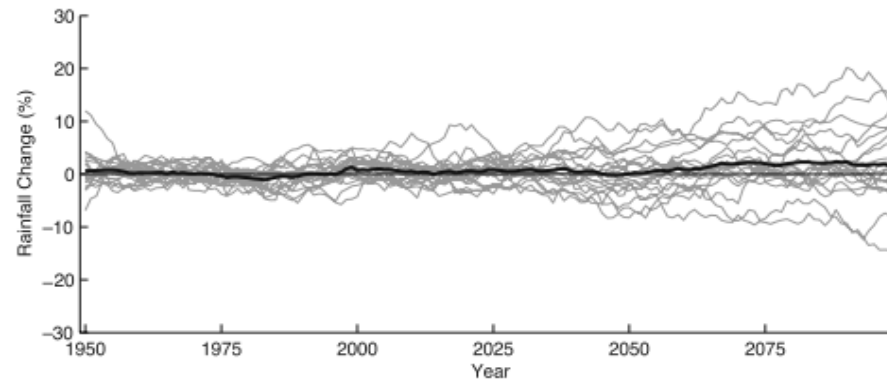
  - PPEs

  - 1°C, 2°C, 3°C

  - 4°C and beyond

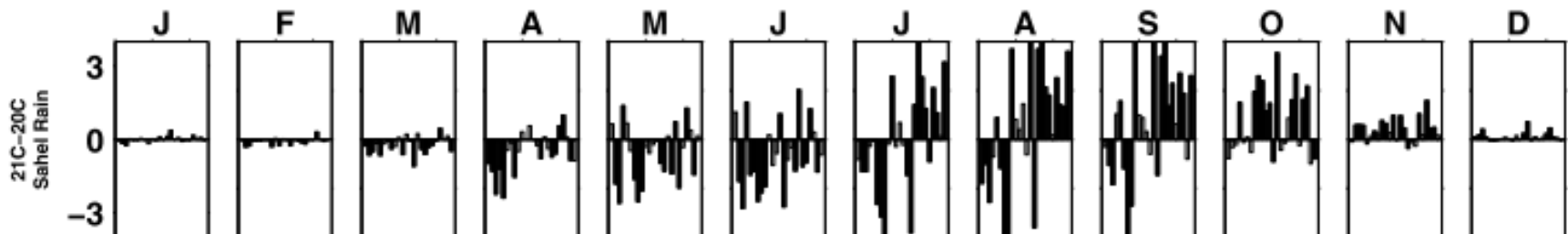
# Previous literature: Sahel rainfall

## Seasonal rainfall change (JAS)



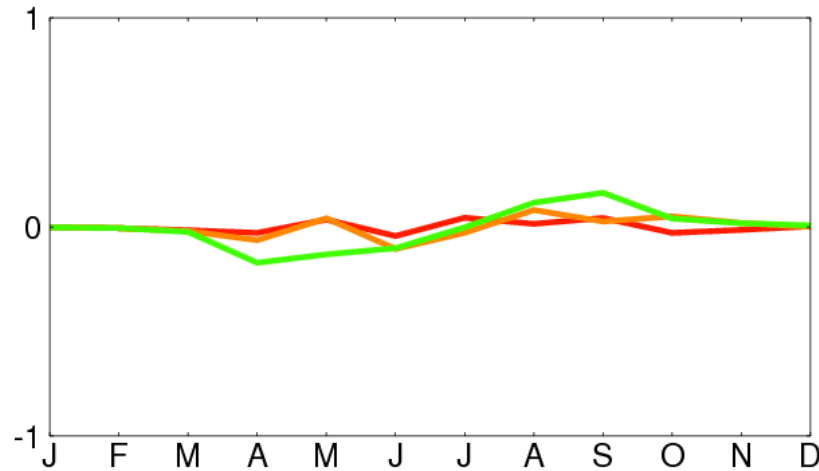
from Giannini et al (2008)

## Biasutti and Sobel (2009): monthly timescale



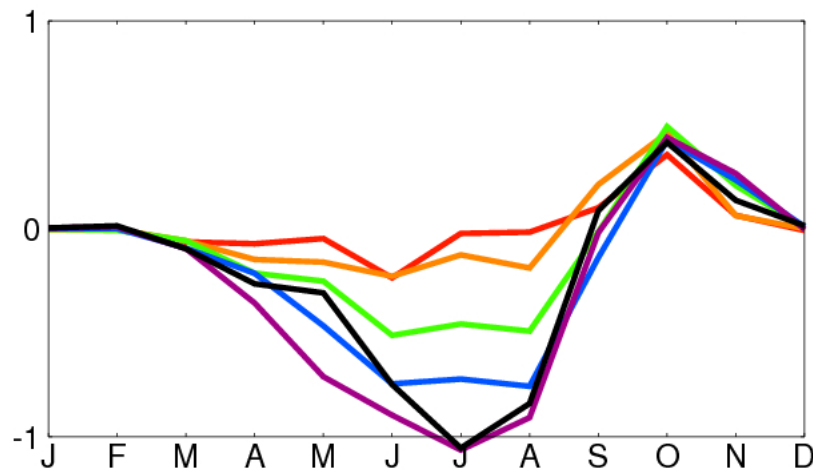
# Delay in seasonal cycle

**CMIP3**

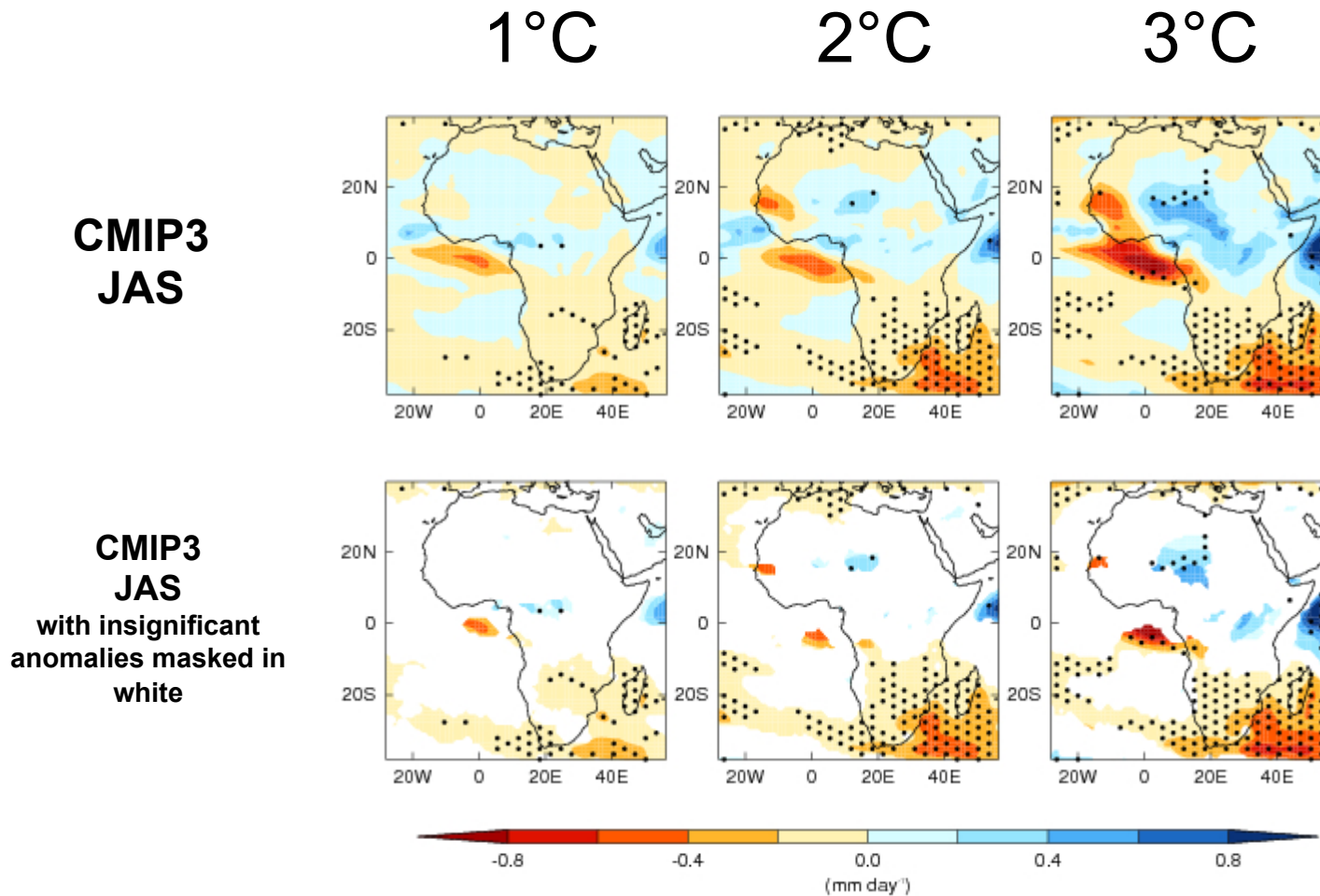


Ensemble mean  
precipitation anomalies  
(mm day<sup>-1</sup>)

**A1FI**



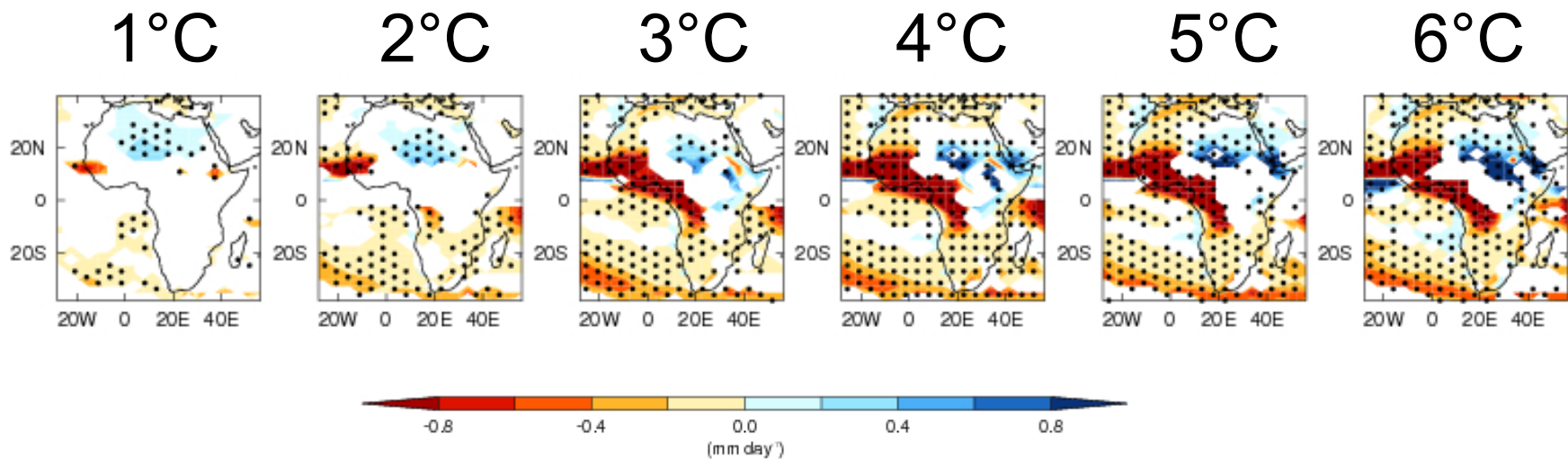
# Zonal Contrast in the Sahel



*Stippling indicates 80% model agreement in direction of change*

# Zonal Contrast in the Sahel

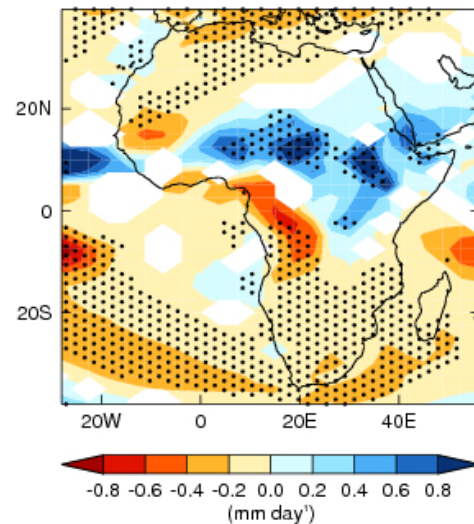
**AO-PPE - JAS**



*Stippling indicates 80% model agreement in direction of change*

# Zonal Contrast in the Sahel

**AS-PPE (2xCO<sub>2</sub>) - JAS**

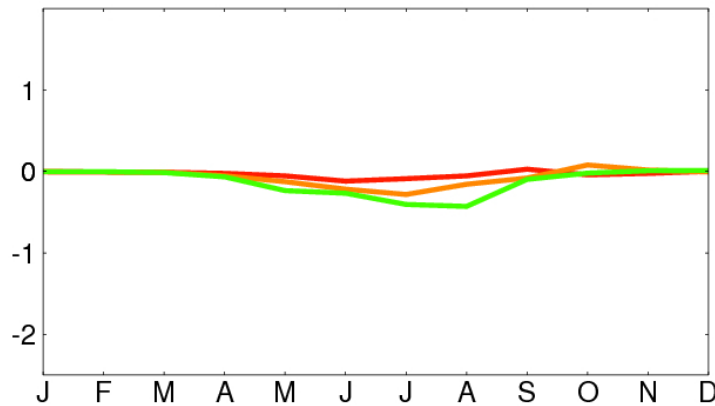


*Stippling indicates 80% model agreement in direction of change*

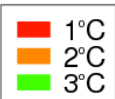
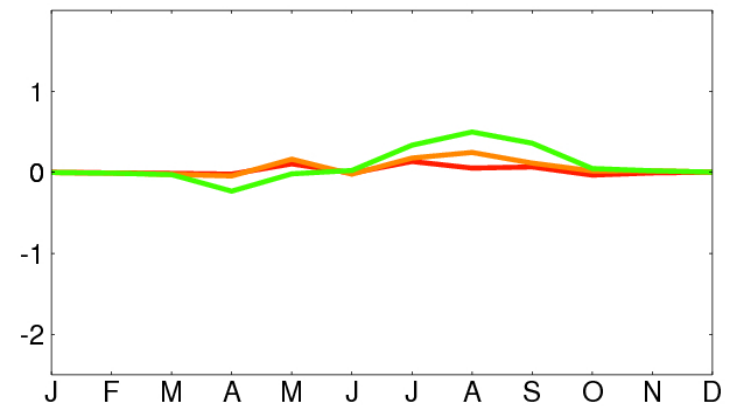
# Zonal Contrast: Annual Cycle

CMIP3

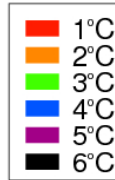
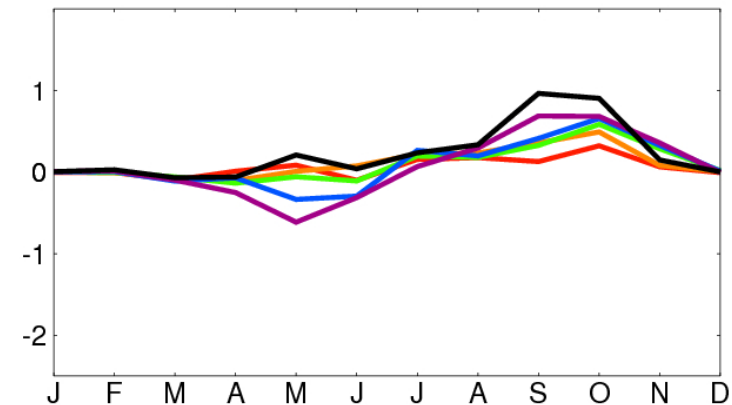
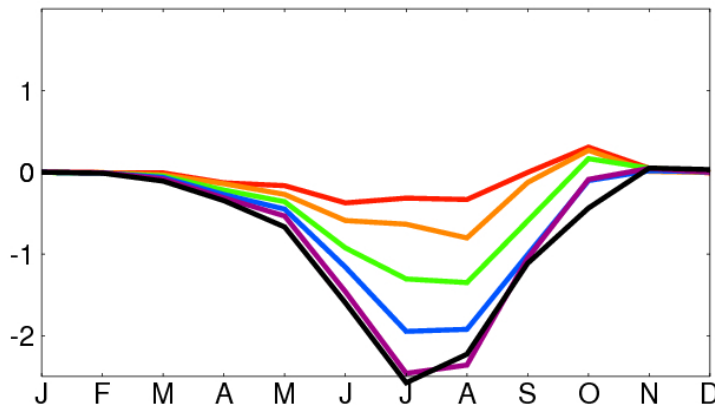
West Sahel



Central Sahel

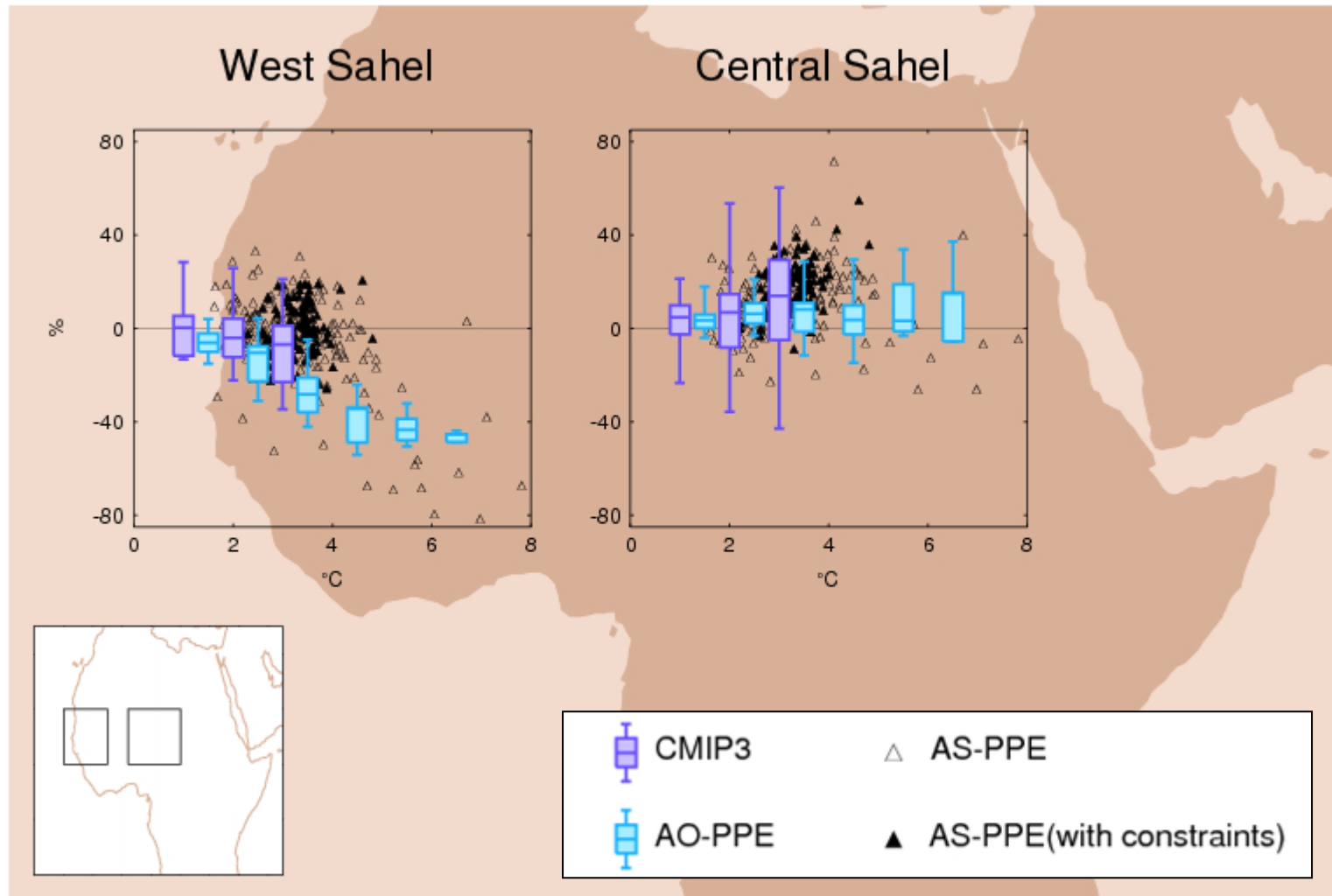


A1FI





# Zonal contrast: JAS



# Summary

## *Implications of global warming?*

### ▣ Central Sahel:

- delay in rainfall season
- increase during rainfall season

### ▣ West Sahel:

- drying, including some large changes from 1°C
- Strong drying at 4°C and beyond

→ *Further research needed*

**with multiple ensembles**

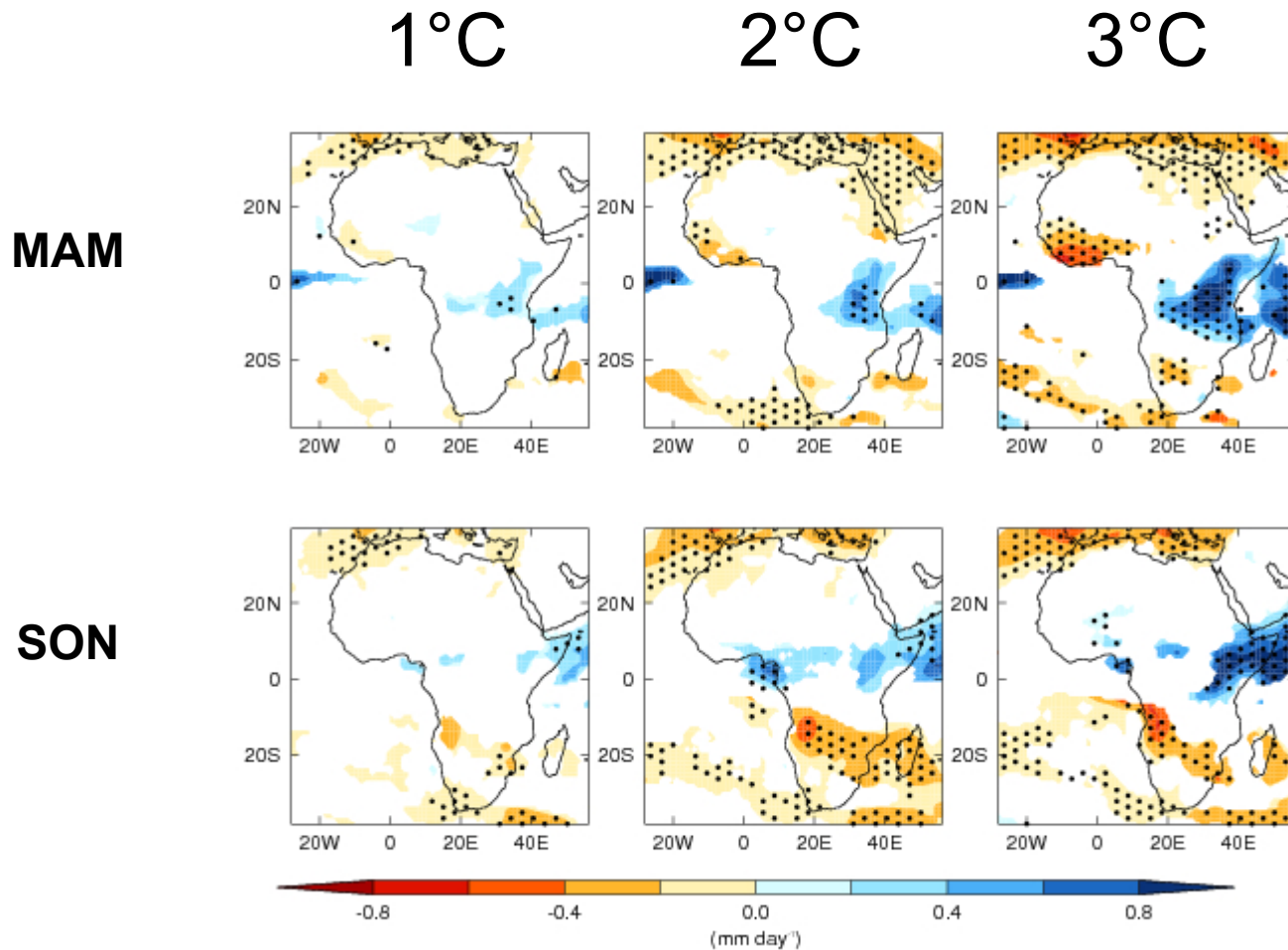
***Is 2°C safe for West Africa?***

*Thank you for your attention*

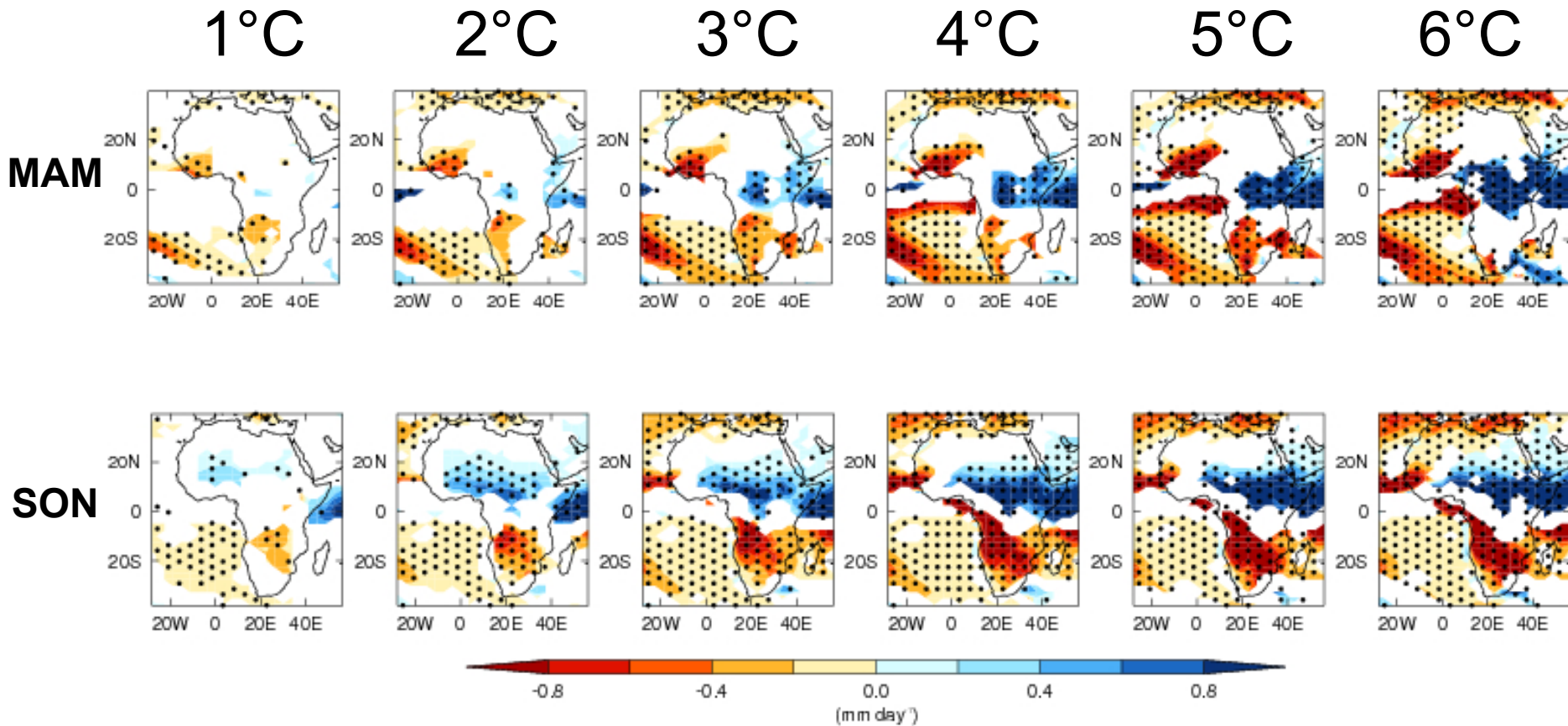
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# CMIP3 – delayed precipitation?

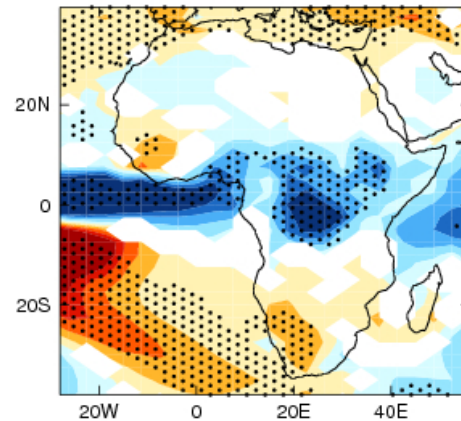


# AO-PPE – delayed precipitation?

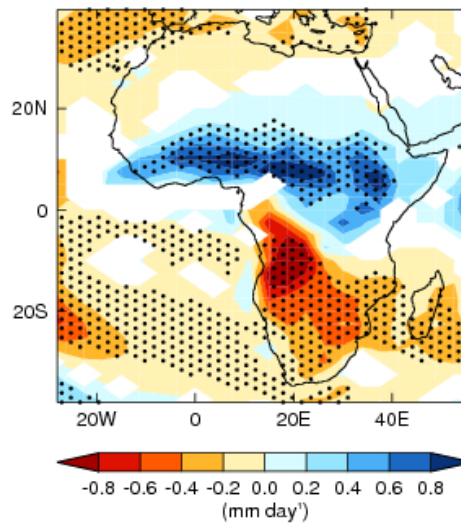


# AS-PPE (2xCO<sub>2</sub>) - delayed precipitation?

**MAM**



**SON**



# CMIP3 – 1985-99 climatology

