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Speleothems of South American and Asian Monsoons Influenced by a Green Sahara

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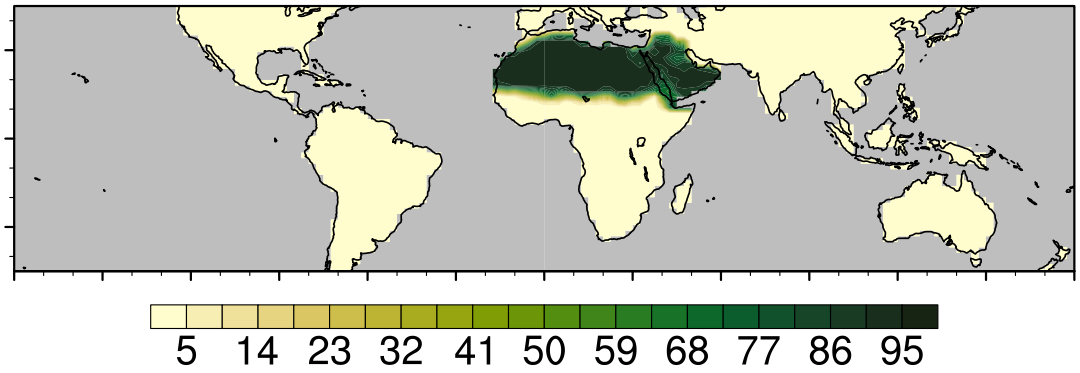
Mid-Holocene (6 ka)

- Warmer than preindustrial
- More NH summer insolation than preindustrial
- Green Sahara

'MH_{VEGE} - PI' Percent Vegetation Cover



Experiment Design

- iCESM1.2 (Brady et al., 2019)
- 3 simulations
  - Preindustrial control (**PI**)
  - 6-ka GHGs and orbital (**MH_{DESERT}**)
  - 6-ka + "Green Sahara" (**MH_{VEGE}**)

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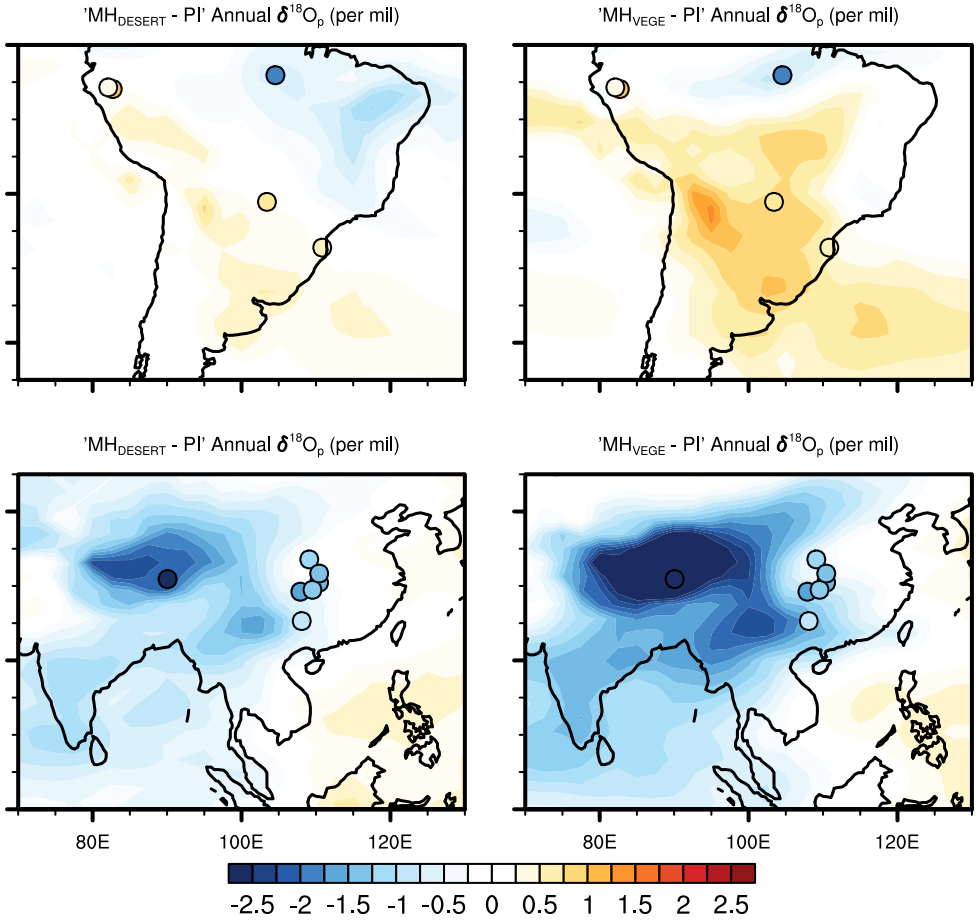
$\delta^{18}O$ of precip responses

- Isotopic response with 6-ka GHGs (MH_{DESERT}) and orbit produces little change in monsoon regions
- Addition of a Green Sahara (MH_{VEGE}) amplifies the signals, in better agreement with speleothem records



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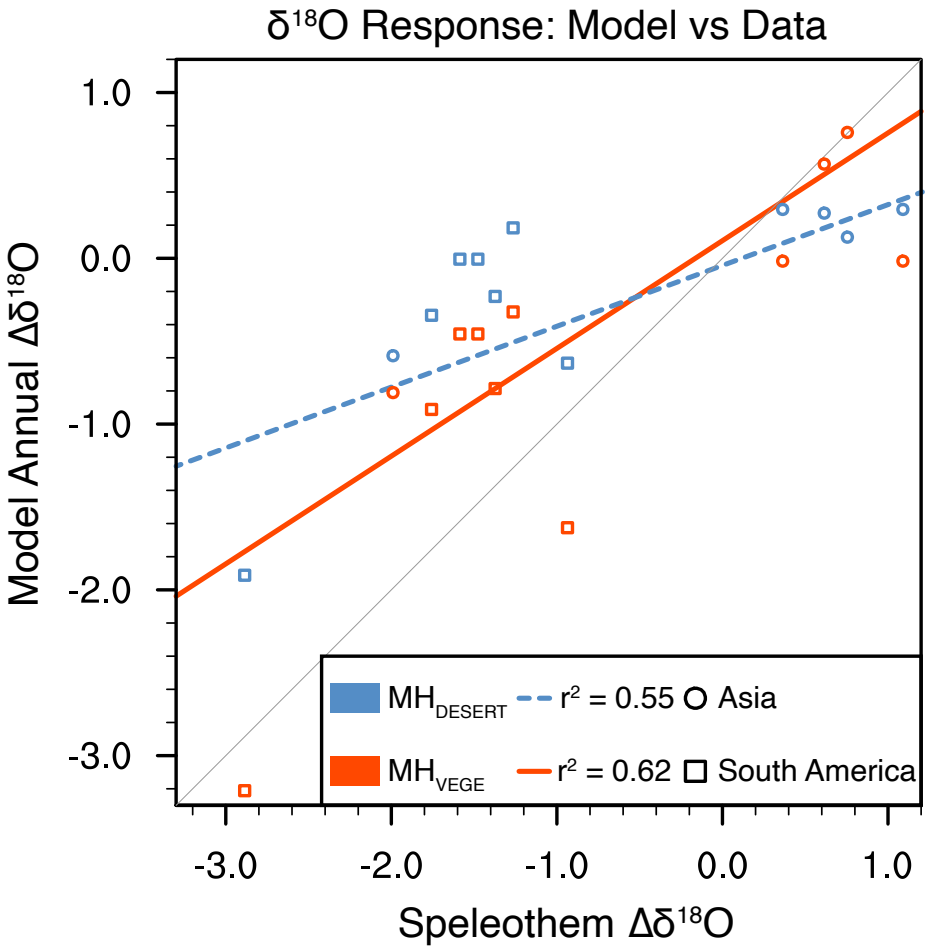
Model-Proxy comparison

- Improved comparison at almost every location
- Both $\delta^{18}O$ and annual temperature work to improve comparison



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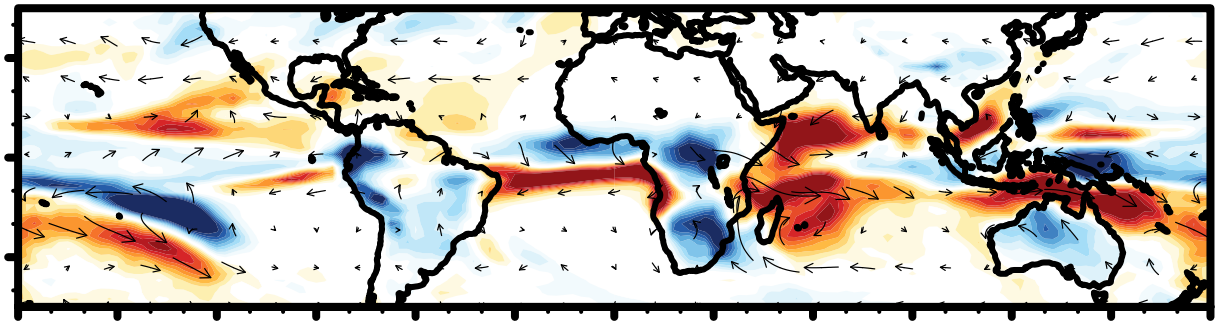
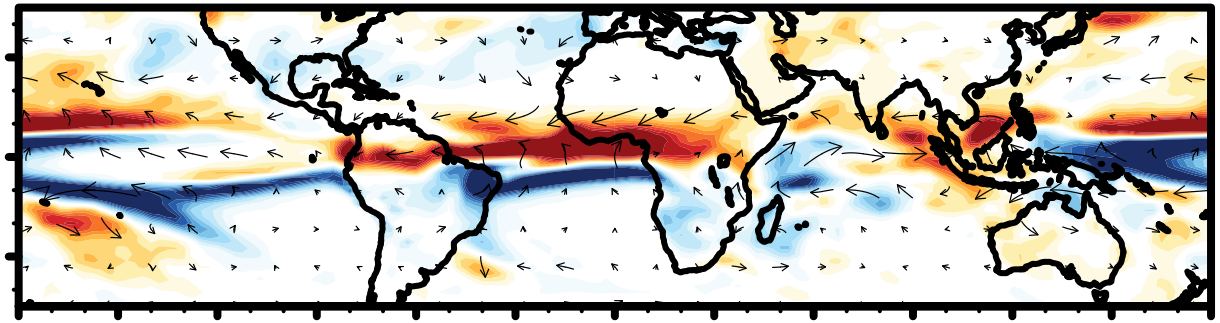
Austral Summer Precipitation

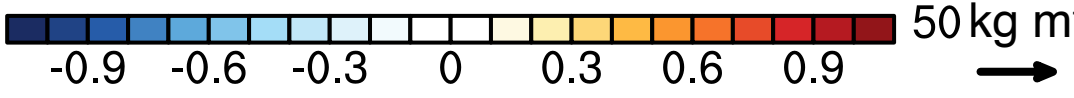
- A Green Sahara shifts the Atlantic ITCZ northward
- Less efficient precipitation in Brazil drives $\delta^{18}O$ enrichment with a Green Sahara

'MH_{DESERT} - PI' Nov-Mar Precip (mm day^{-1}) & IVT (kg $m^{-1}s^{-1}$)



'MH_{VEGE} - MH_{DESERT}' Nov-Mar Precip (mm day^{-1}) & IVT (kg $m^{-1}s^{-1}$)





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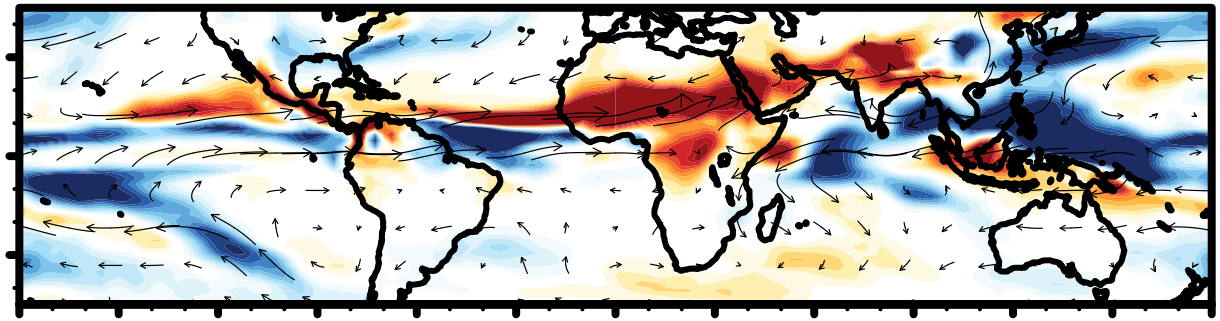
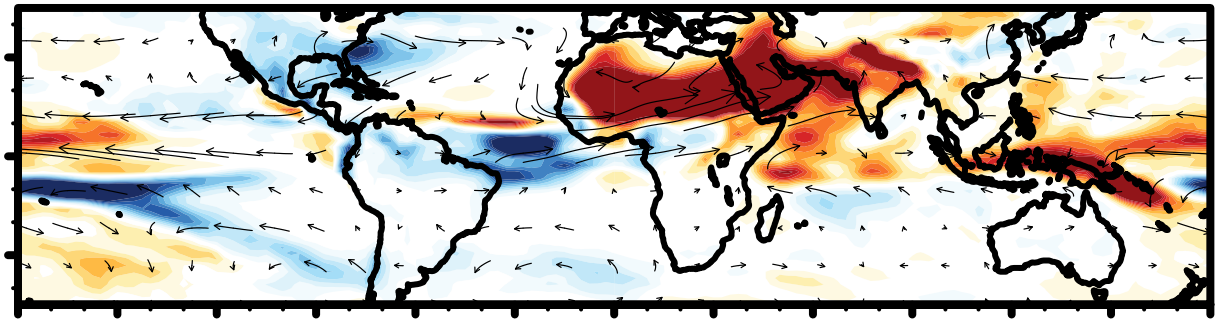
Boreal Summer Precipitation

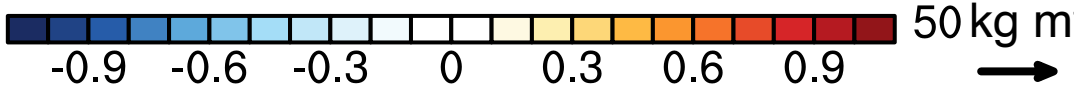
- 6-ka orbit leads to more NH summer insolation, which drives the ITCZ north
- Intensified Asian monsoon sources more distant moisture, driving $\delta^{18}O$ depletion

'MH_{DESERT} - PI' May-Sep Precip (mm day^{-1}) & IVT (kg $m^{-1}s^{-1}$)



'MH_{VEGE} - MH_{DESERT}' May-Sep Precip (mm day^{-1}) & IVT (kg $m^{-1}s^{-1}$)





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Thank you!

- If you have questions, please contact me.
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Annual Temperature

- Lower GHG concentration at 6-ka results in cooling
- Inclusion of a Green Sahara results in warming
  - Helps explain model-proxy disagreement