

Influence of reorganization of the tropical hydrologic cycle on Atlantic salinity and meridional overturning at the end of the last interglacial

Benjamin Blazey, Matthias Prange, André Paul, Aline Govin

Image credit NASA

The Amazon river system



The Amazon & Orinoco river systems



Image credit NASA

Image credit Wikipedia

South American precipitation seasonality

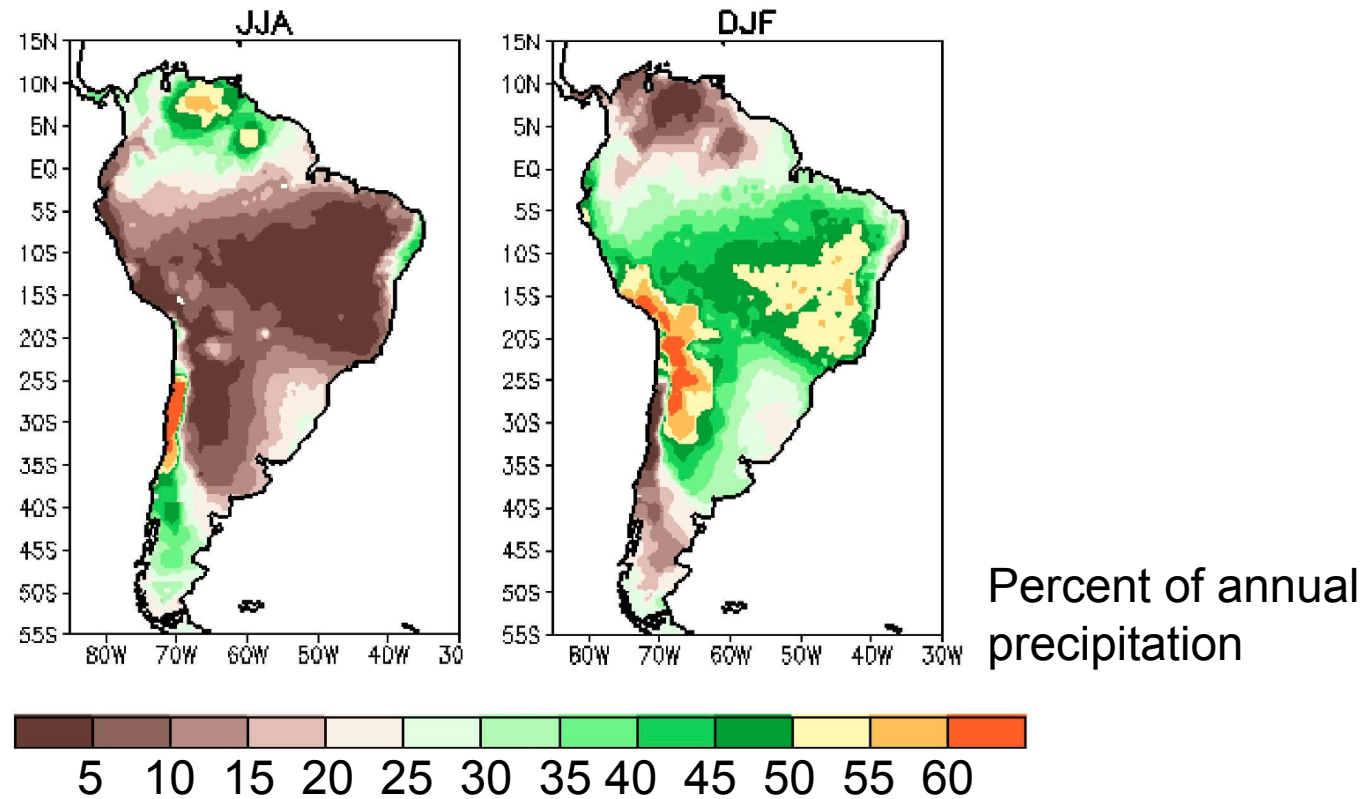


Figure: Silva and Kousky 2012

South American precipitation seasonality

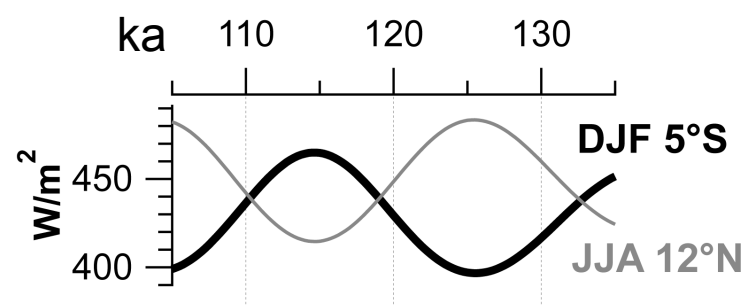
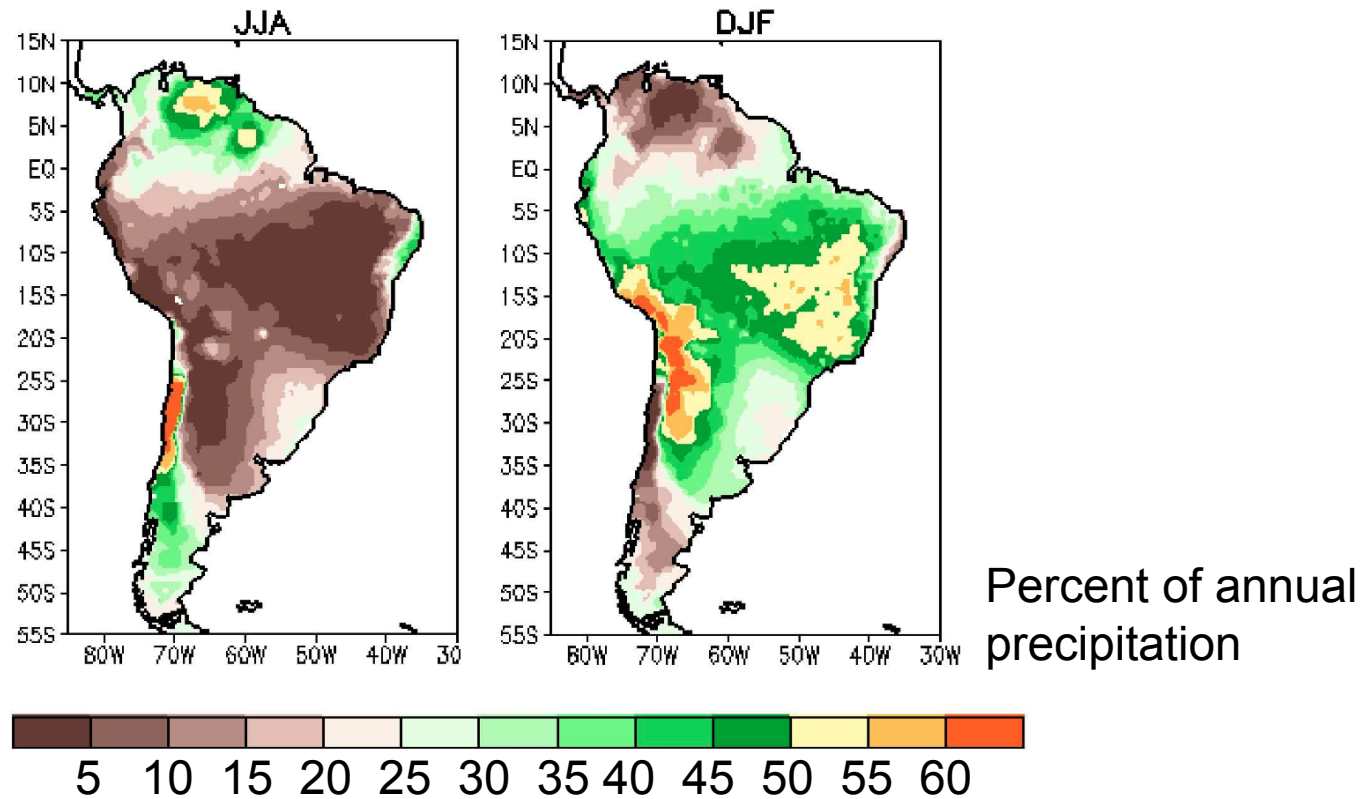
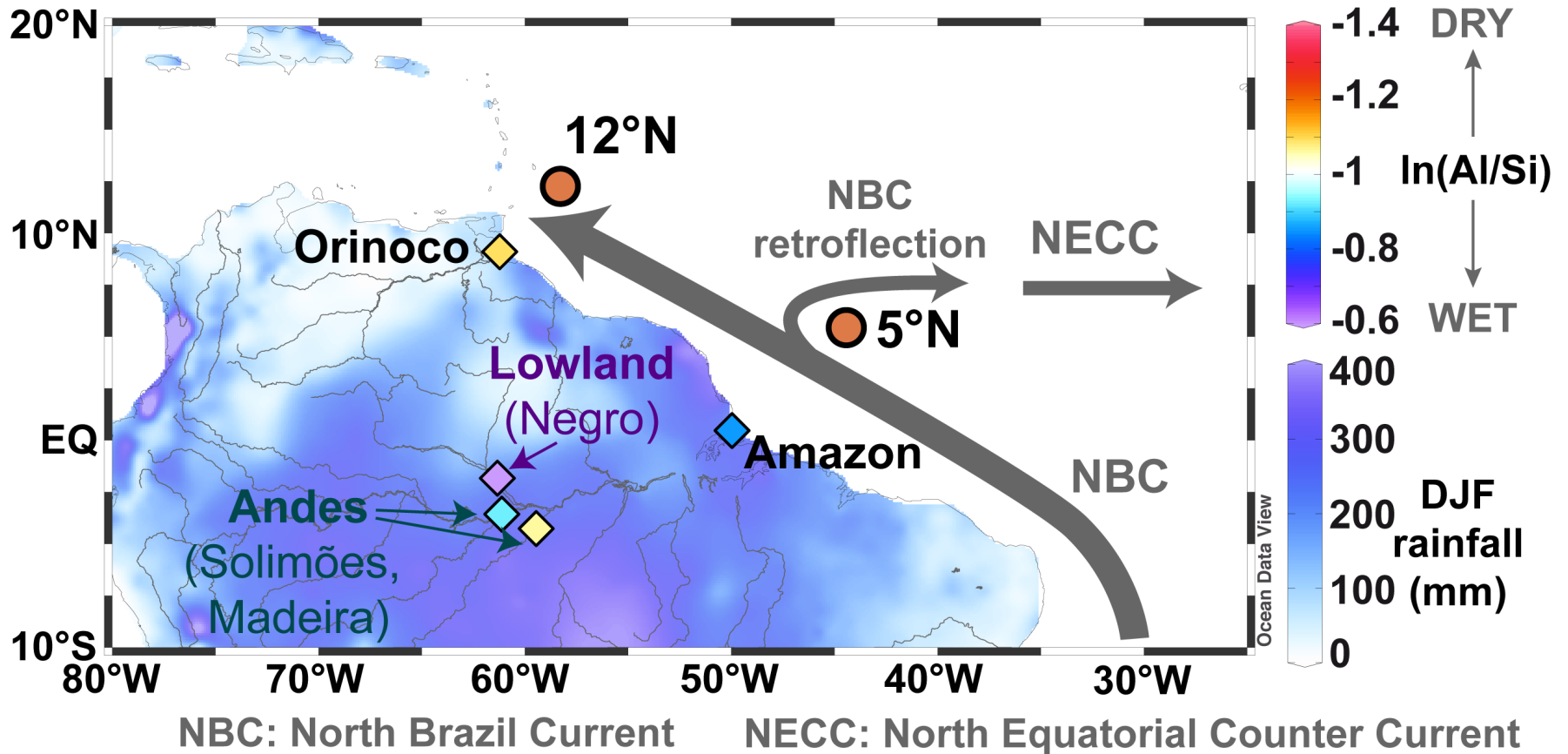
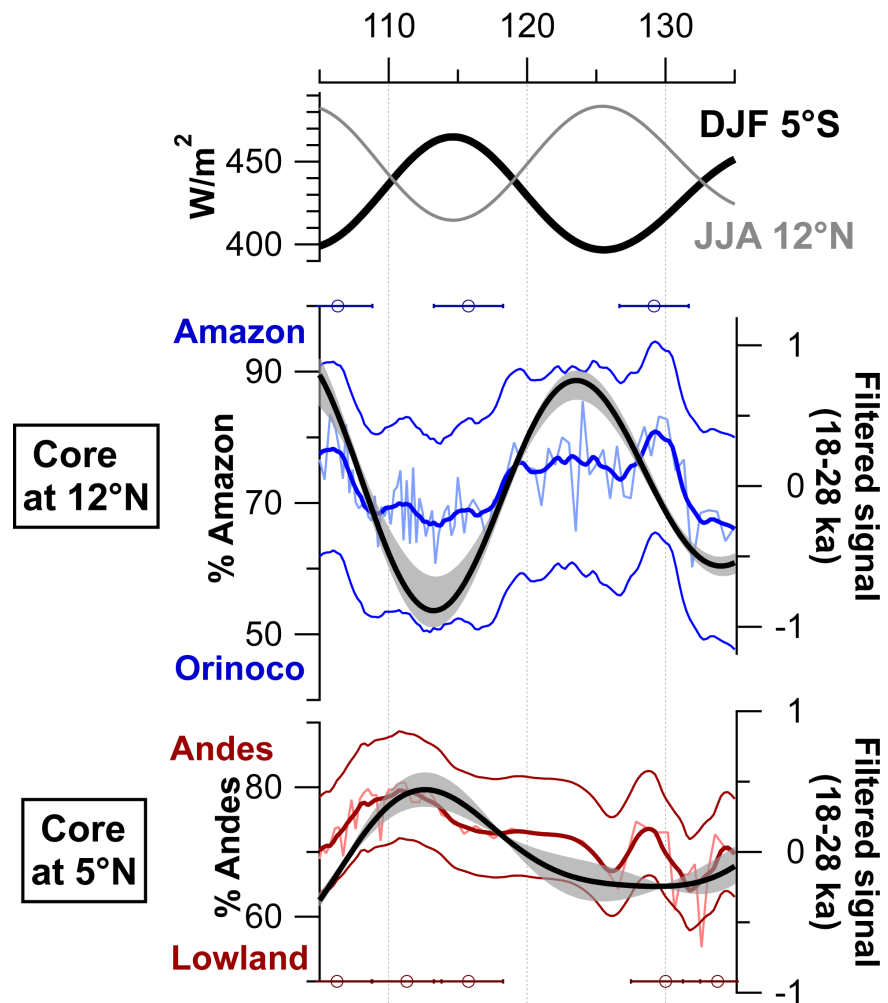


Figure: Silva and Kousky 2012

Core locations



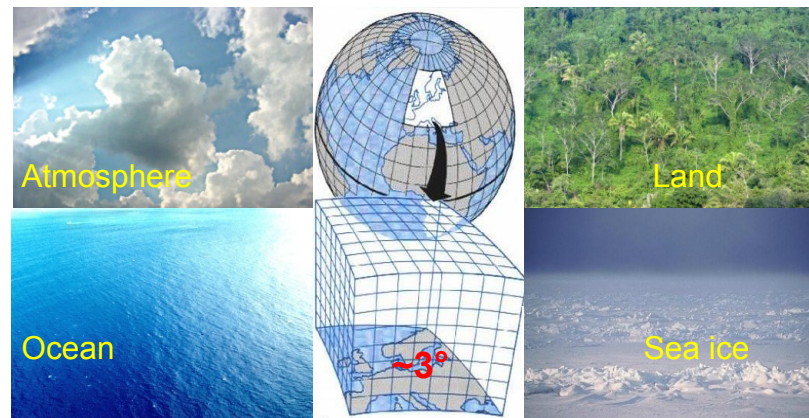
Core reconstructions



Model environment & simulations

CCSM3

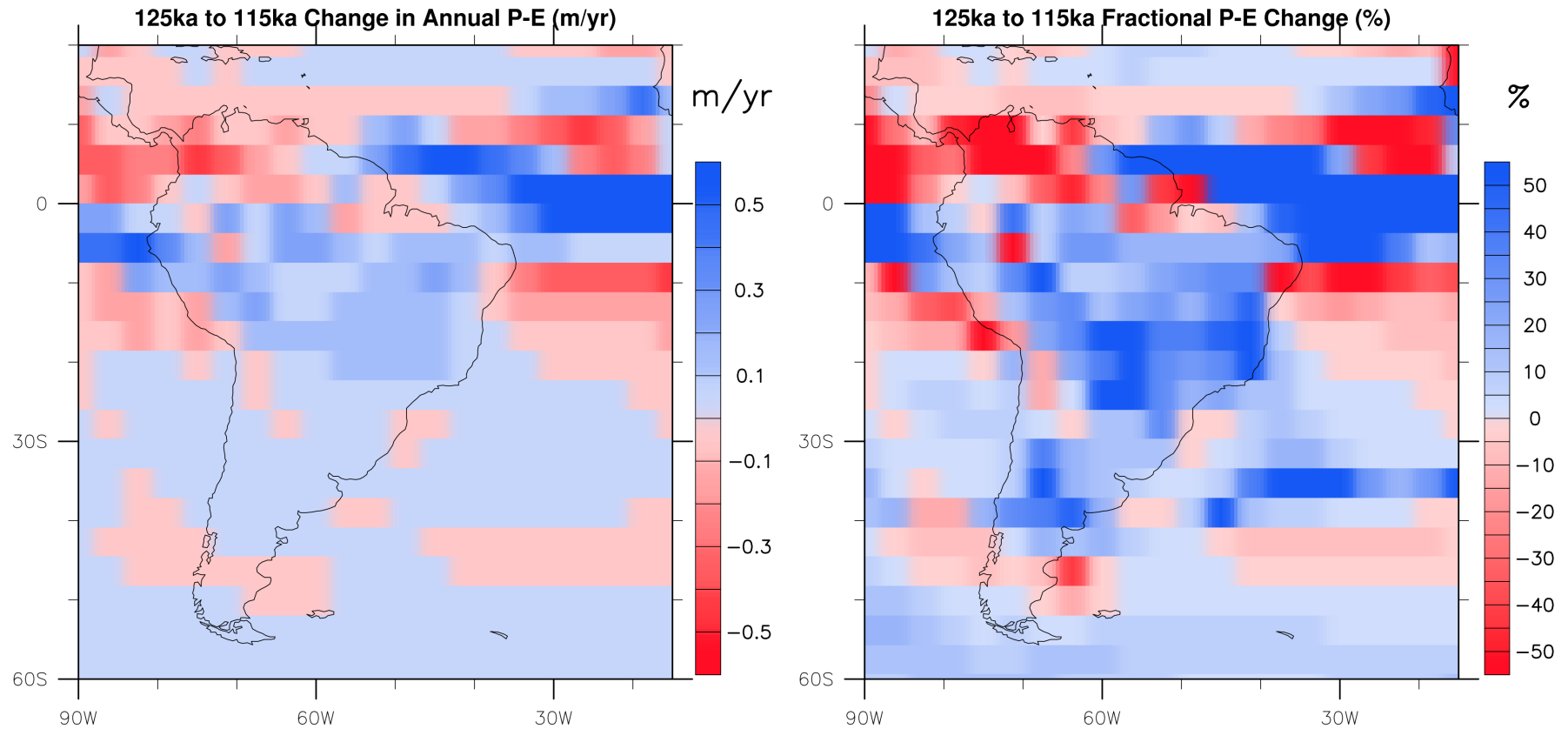
T31 (3.7°)



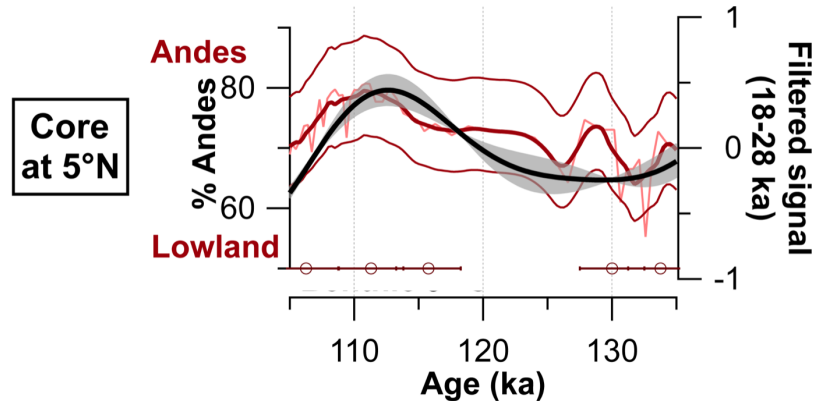
We use two equilibrated simulations: 125ka and 115ka

We use boundary conditions including insolation and greenhouse gases

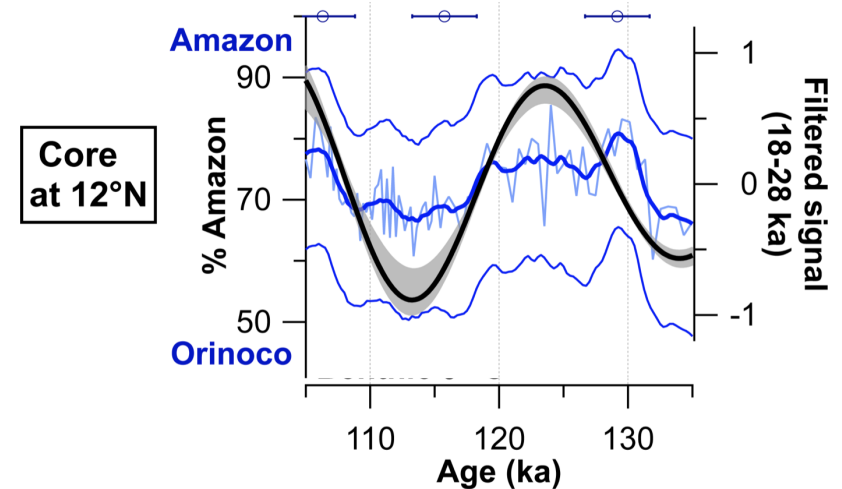
CCSM3 annual net precipitation anomalies



Runoff model & data



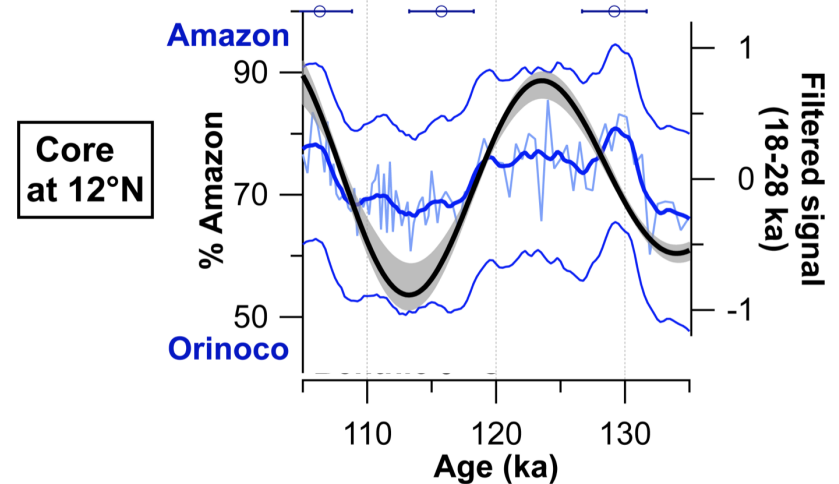
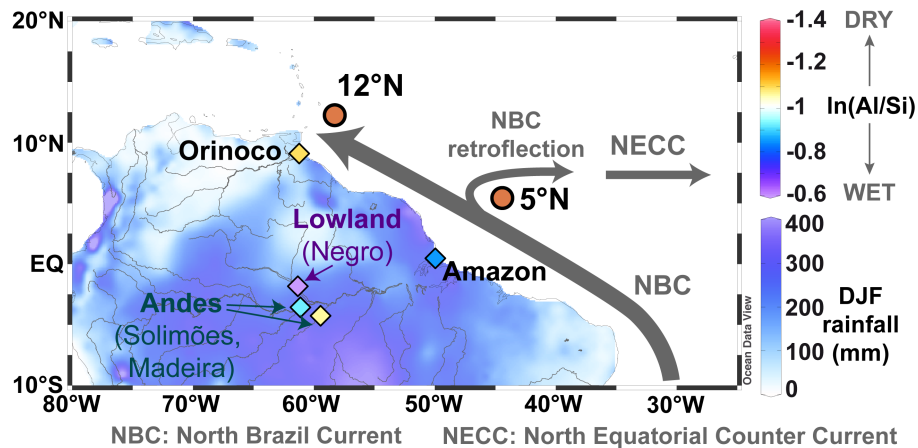
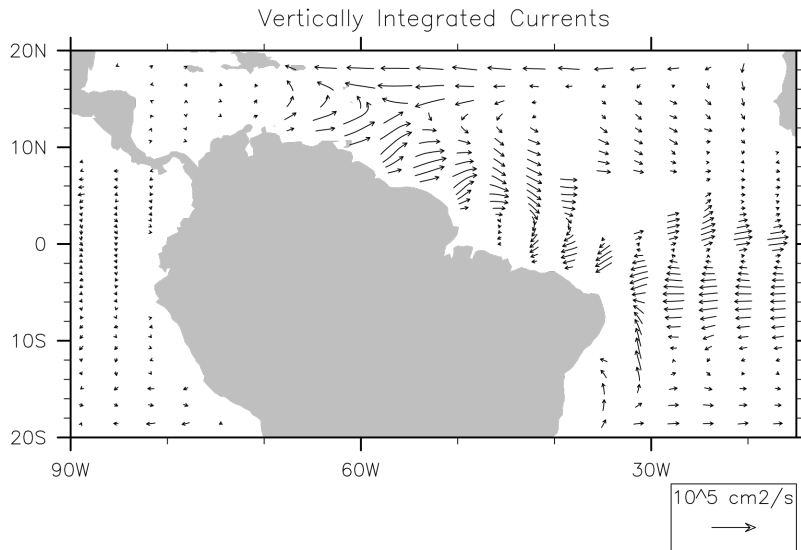
River	115 ka	125 ka
Amazon	3560 km ³ /yr	3070 km ³ /yr
Madeira & Marañón	1720 km ³ /yr (48%)	1460 km ³ /yr (41%)



River	115 ka	125 ka
Amazon	3560 km ³ /yr	3070 km ³ /yr
Orinoco	350 km ³ /yr (10%)	430 km ³ /yr (14%)

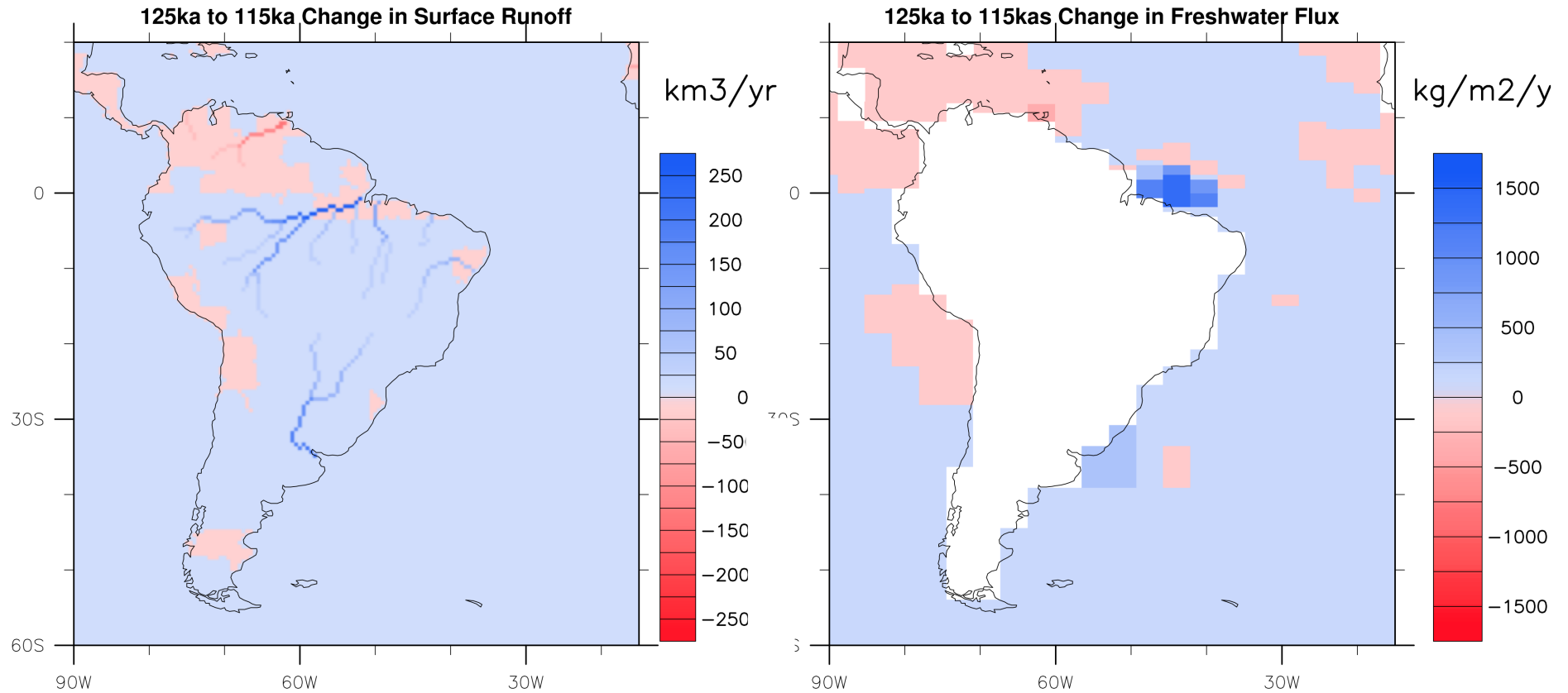
Runoff model & data

125 ka to 115ka Change in POP Oceanic Transport



River	115 ka	125 ka
Amazon	3560 km ³ /yr	3070 km ³ /yr
Orinoco	350 km ³ /yr (10%)	430 km ³ /yr (14%)

South American Runoff



Fixed Runoff Experiment

115ky insolation & GHG

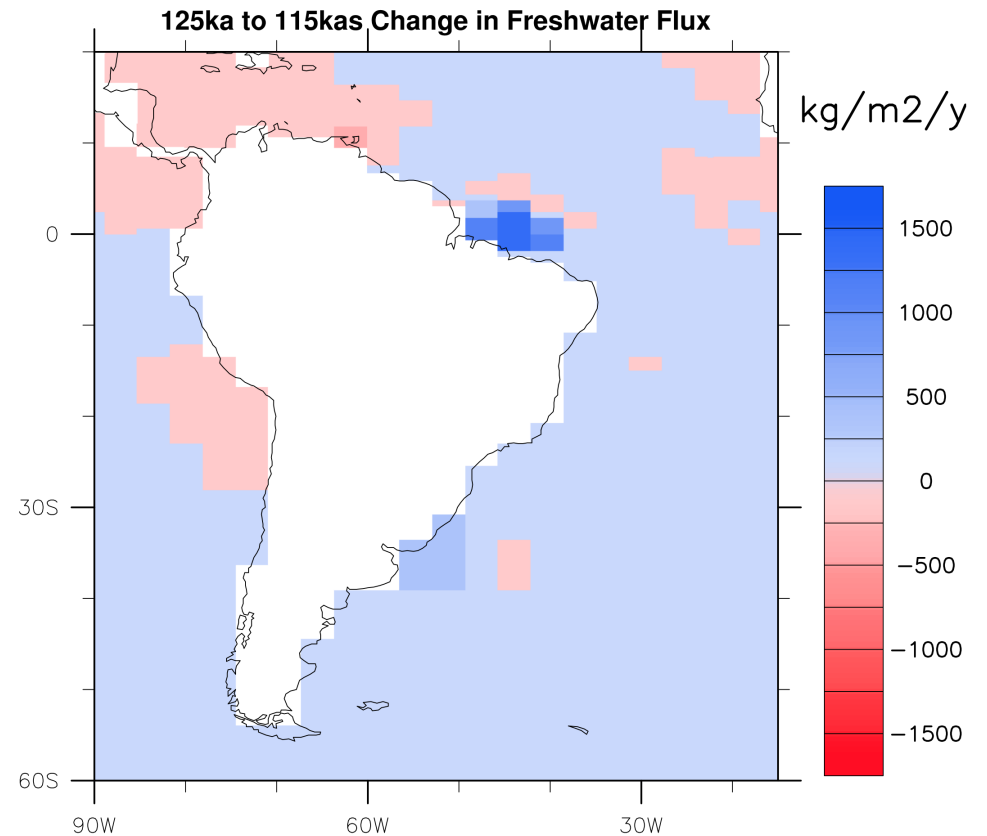
Fully Coupled

Exception: Virtual freshwater flux from South America is fixed:

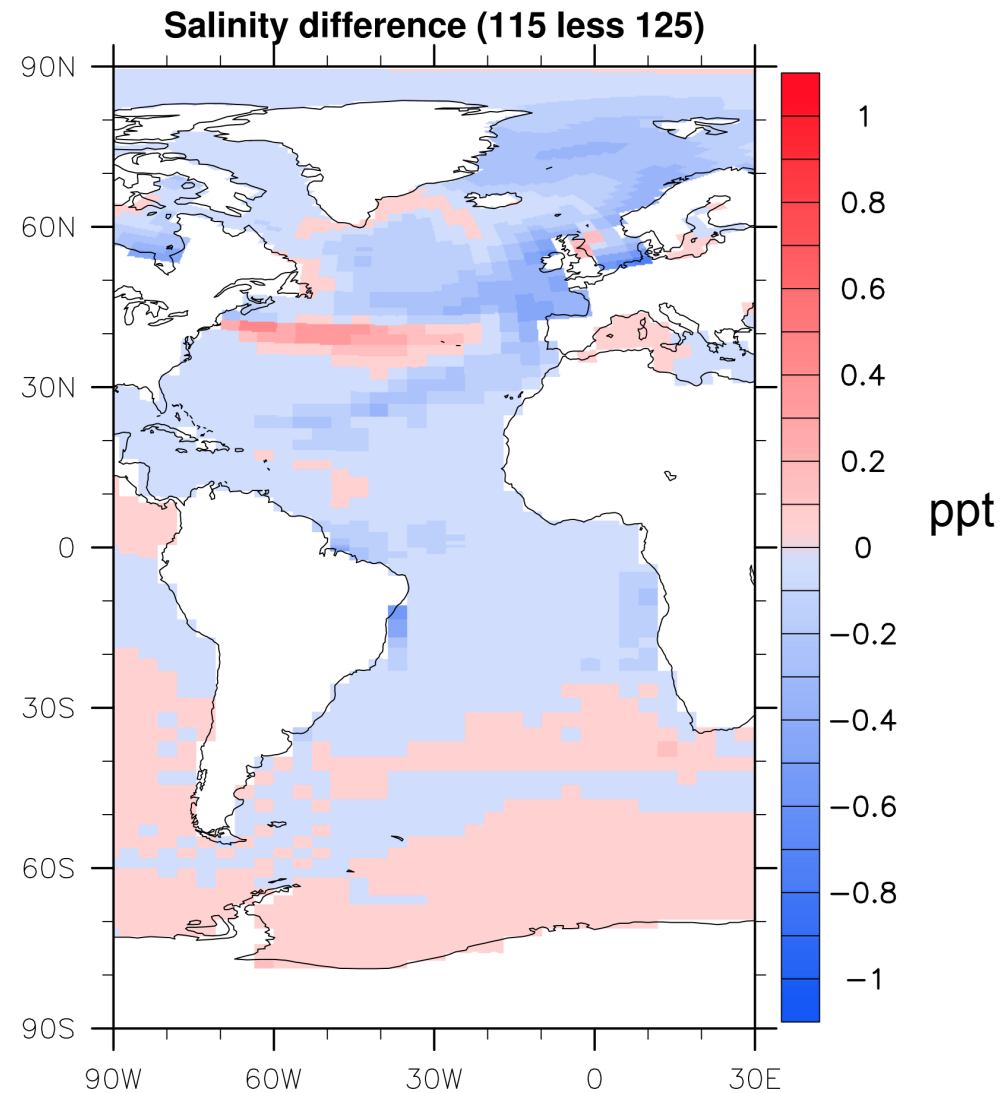
-115ky or 125ky runoff

-Monthly means (smoothed)

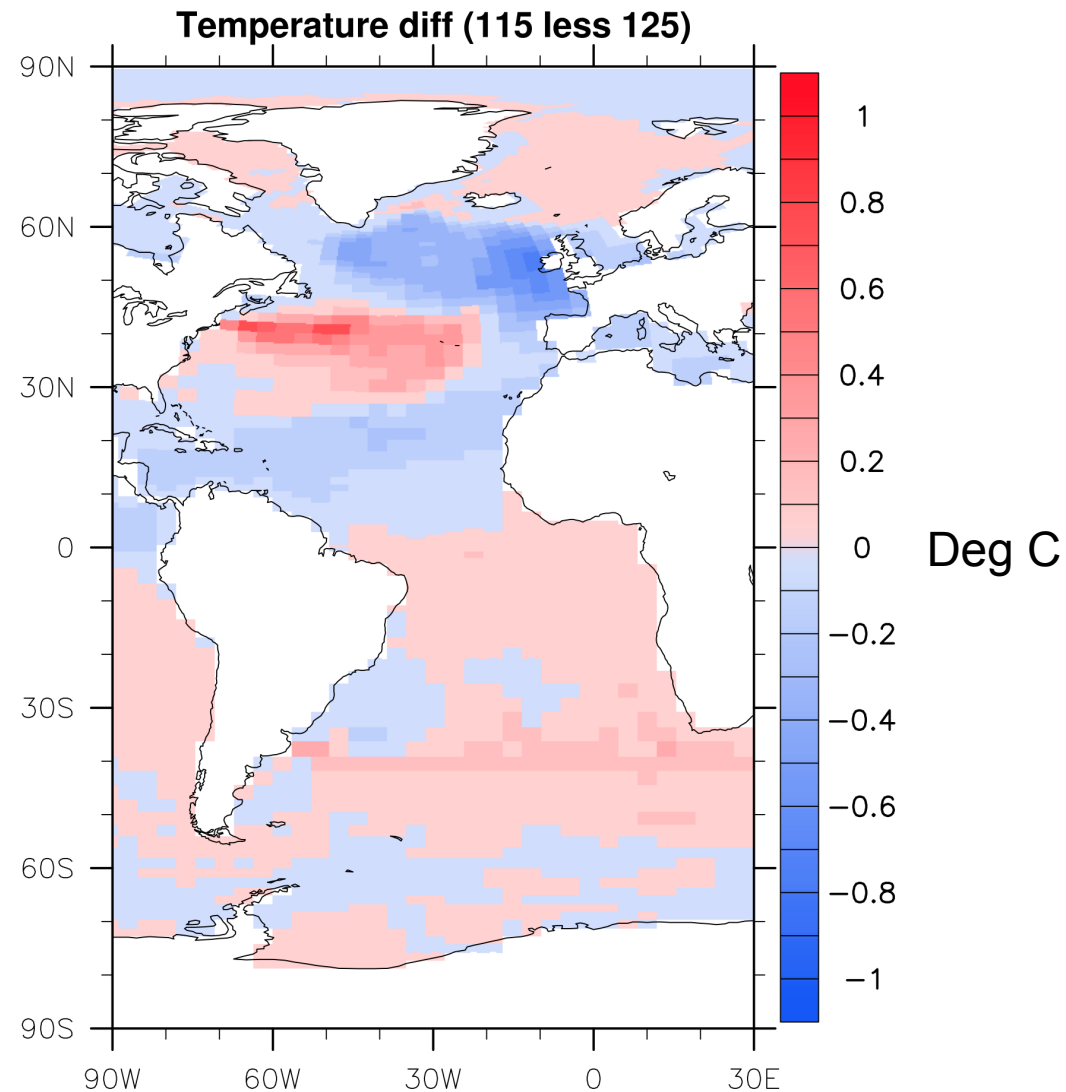
-115ky runoff > 125ky runoff



Fixed Runoff Experiment: Atlantic Upper Ocean Salinity

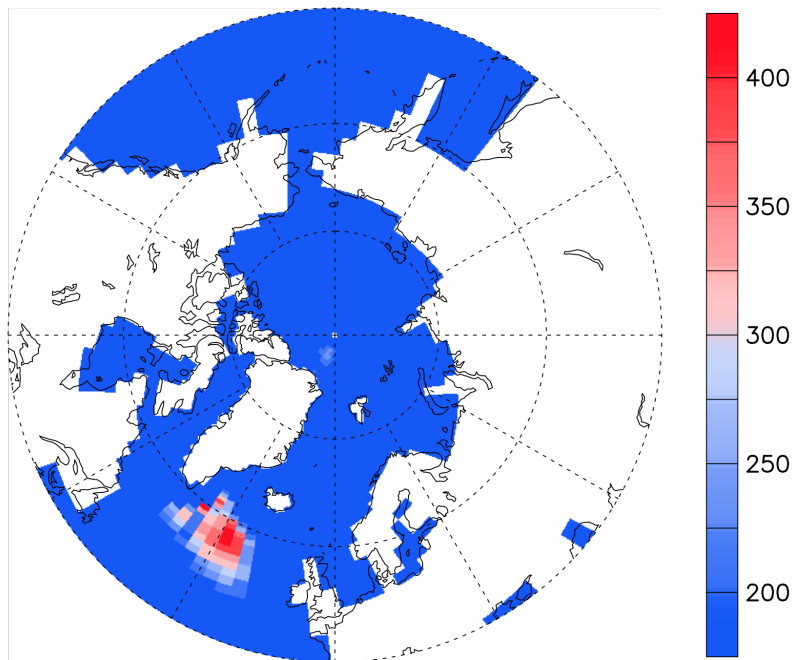


Fixed Runoff Experiment: Atlantic Upper Ocean Temperature

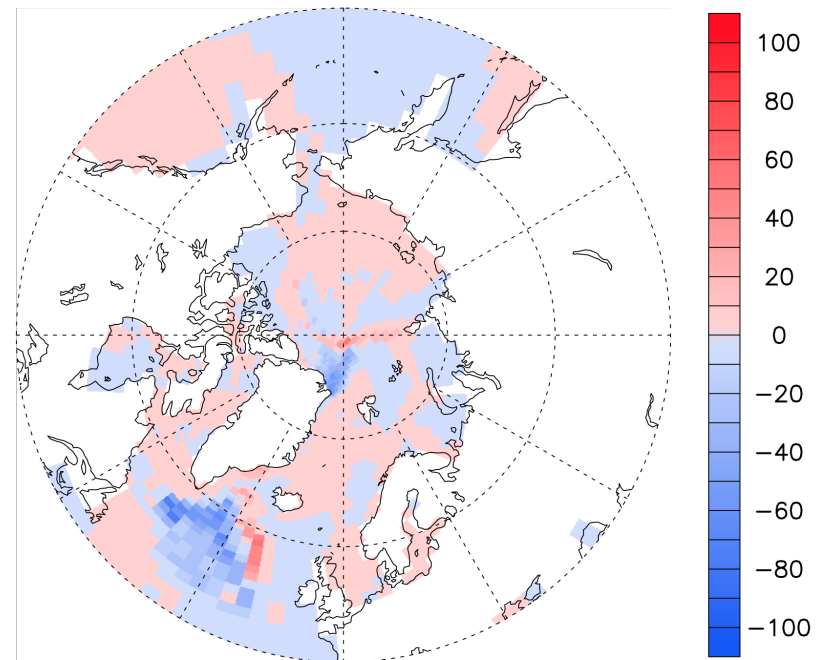


Fixed Runoff Experiments: Winter Mixed Layer Depth

JFM. mixed layer depth 115 runoff 115 climate (m)



JFM. mixed layer depth diff.(115 less 125) - m



Summary

We found the model & core reconstructions to be in agreement with regards to the transition from 125ka to 115ka including:

- Increase in highland precipitation in Amazon basin
- Decrease in Orinoco basin precipitation
- Increase in North Brazil Current Retroflexion

Enhanced precipitation over South America at 115ka relative to 125ka leads to changes in the Atlantic including:

- Lower Salinity in deep water formation regions
- Lower Temperature in deep water formation regions
- Weakening of deep water formation
- Northward shift in deepwater formation region