# Simulation of the Holocene climate over South America and impacts on the vegetation

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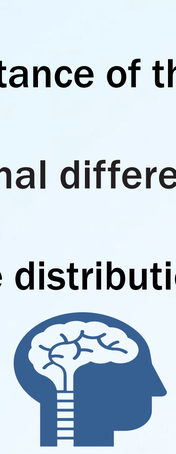
## 1 Background

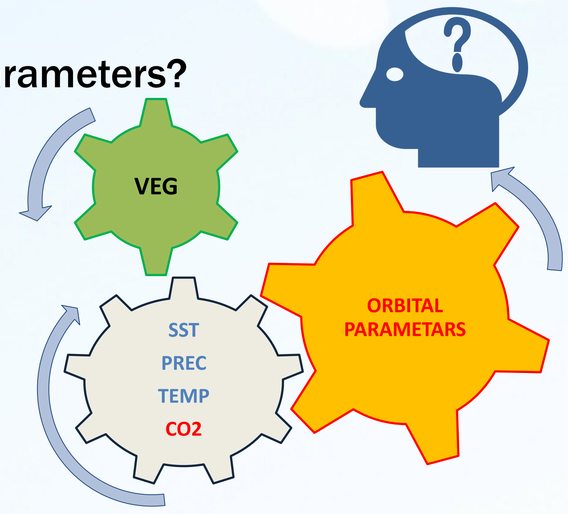
Insolation variations throughout the Holocene influenced tropical precipitation, which was considered one of the main causes for observed vegetation changes in the tropics (Mayle et al., 2000). Despite great advances in the studies in the last decade (Prado et al., 2013; Rossetti et al., 2017; Calegari et al., 2017) vegetation and climate during the Holocene over South America are still under debate.

In this context, Holocene climate for several periods were simulated by an Atmospheric General Circulation Model, forced with orbital parameters, $CO_2$ concentrations and sea surface temperature (SST), while the analysis of the biome distributions was made with a Potential Vegetation Model (PVM).

## 2 Questions

- Holocene climate conditions over South America?
- Importance of the forcing parameters?
- Regional differences?
- Biome distribution?






## 3 Methods

The CPTEC-AGCM is derived from the Center for Ocean, Land and Atmosphere Studies (COLA) model (T62L28); Model equations are in spectral form and the equations of horizontal motion are transformed into the vorticity and divergence equations (Shukla et al., 2000)

3-4 simulations

- VEGMAP
- Orbital parametars
- $CO_2$
- 8 experiments
- 2k, 4k, 6k, 8k

CPTEC-AGCM

CPTEC-PVM2

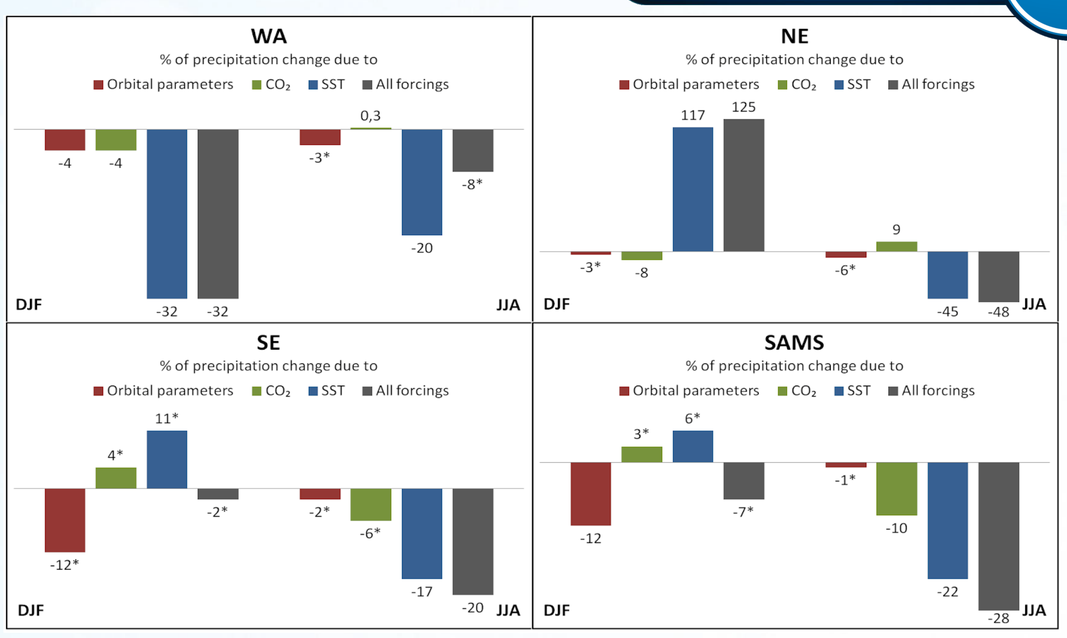
- statistical correction of precipitation, temperature and wind

VEGETATION

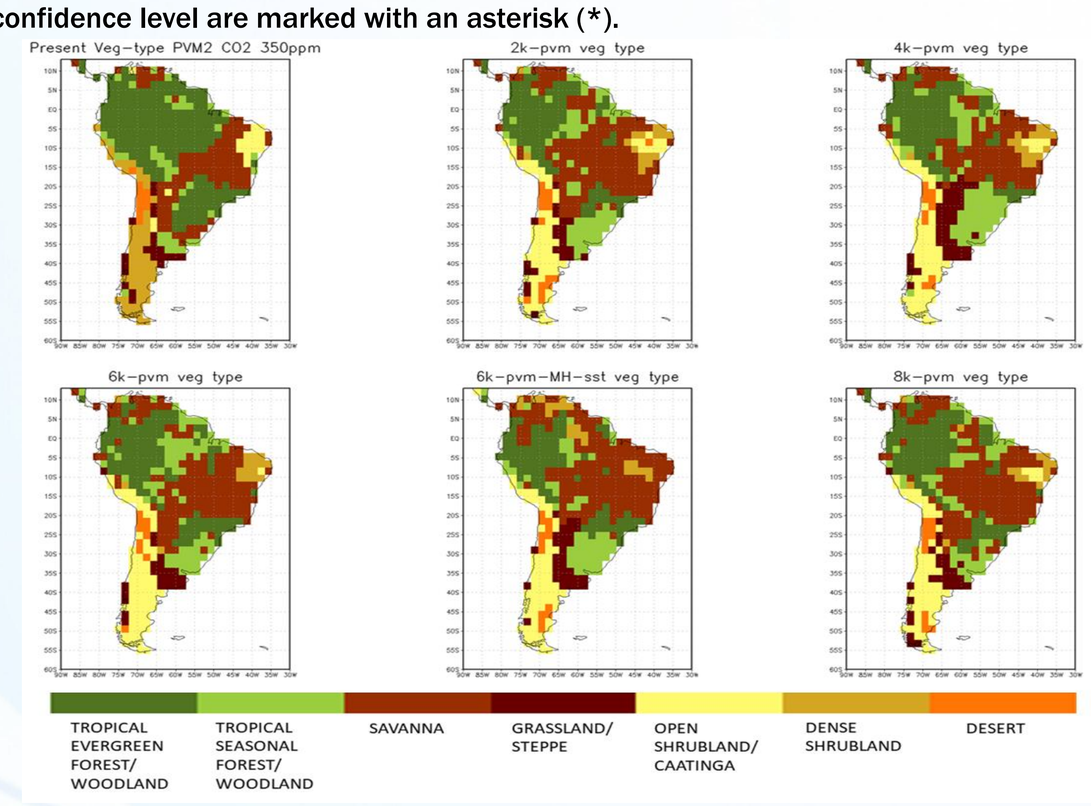
- Proxy data

CPTEC-PVM2.0 is potential vegetation model; a non dynamic model, calculates only equilibrium solutions(Lapola et al., 2009)

## 4 Results




The importance of the forcing parameters for each domain (WA, NE, SE, SAMS) for austral summer (DJF) and winter (JJA). Negative and positive sign means precipitation reduction and increase, respectively. No significant differences by Student's t-test at 95% confidence level are marked with an asterisk (*).




Vegetation map for South America projected for different Holocene periods (2 ka, 4 ka, 6 ka and 8 ka) by the CPTEC-PVM2 with CO2 concentration of 280 ppm

## 5 Conclusions

- Drier-than-present conditions over central and southern South America and wetter conditions over Northeast Brazil
- Rainy season was continuously anticipated as we go further into the past
- ITCZ is shifted southward during summer and northward during winter
- Increase of precipitation over NE was primarily driven by the ITCZ southward shift due to the SST conditions
- Tropical climate change was not uniform across the Amazon basin, nor Neotropics, and the same applies to vegetation
- PVM simulations suggest presence of rainforest in western Amazonia throughout the Holocene and the savanna/dry forest expansion and their coexistence with rainforest in the Eastern Amazonia

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## 6 References

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