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Effects of biomass burning emissions on the rainy season of the South America Monsoon.

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Introduction

- Every year (from Jun. to Oct.) deforestation fires occur on the south of Amazonia and central part of South America.
- Aerosols from biomass burning are important to climate due to their impacts on radiation budget and precipitation.
- A parametrization called Hot Plume Rise (HPR) was added to HadGEM2-ES to improve the representation of emissions from biomass burning (Freitas *et al*, 2007).

Introduction

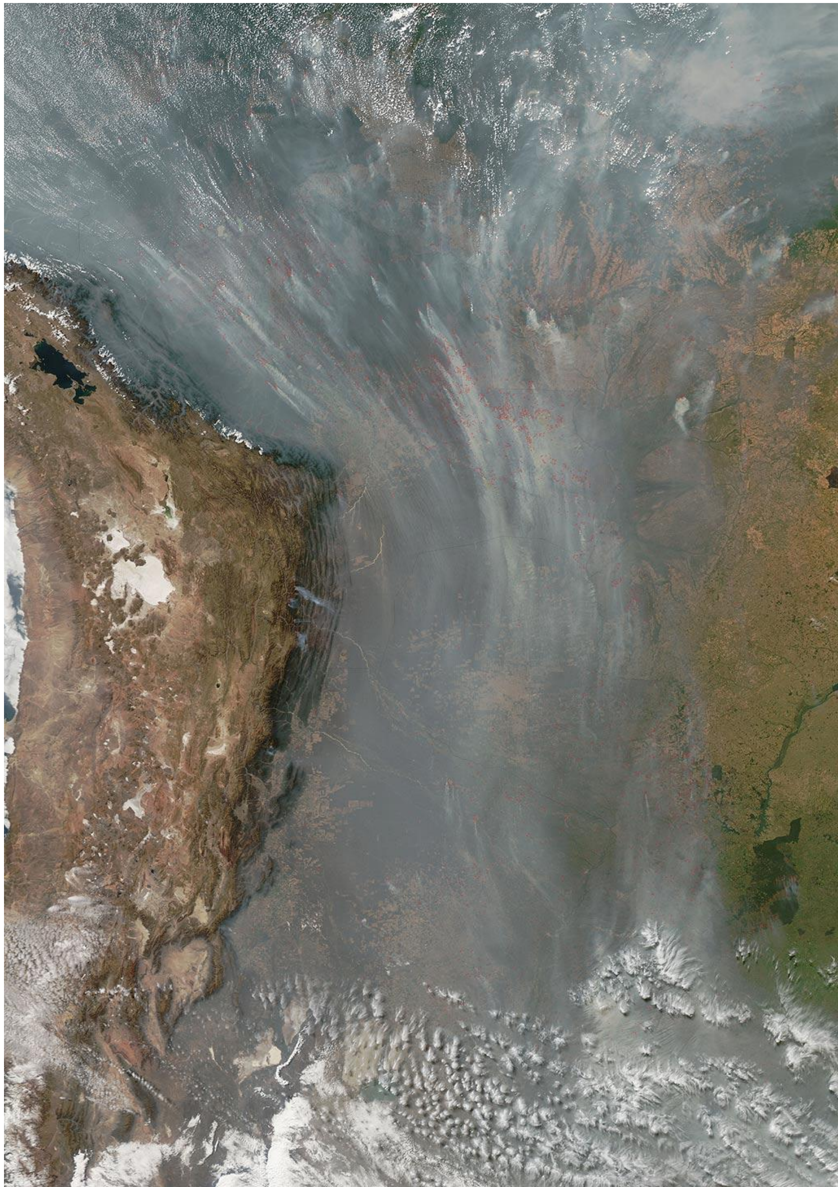
- Known effects of high concentration of aerosols at atmosphere:

1. Decrease of solar radiation at surface (absorption and scattering) and stabilization of boundary layer.
2. Changes at microphysical propriety of clouds - aerosol acts as cloud condensation nuclei (CCN) and increase the number of small droplets.

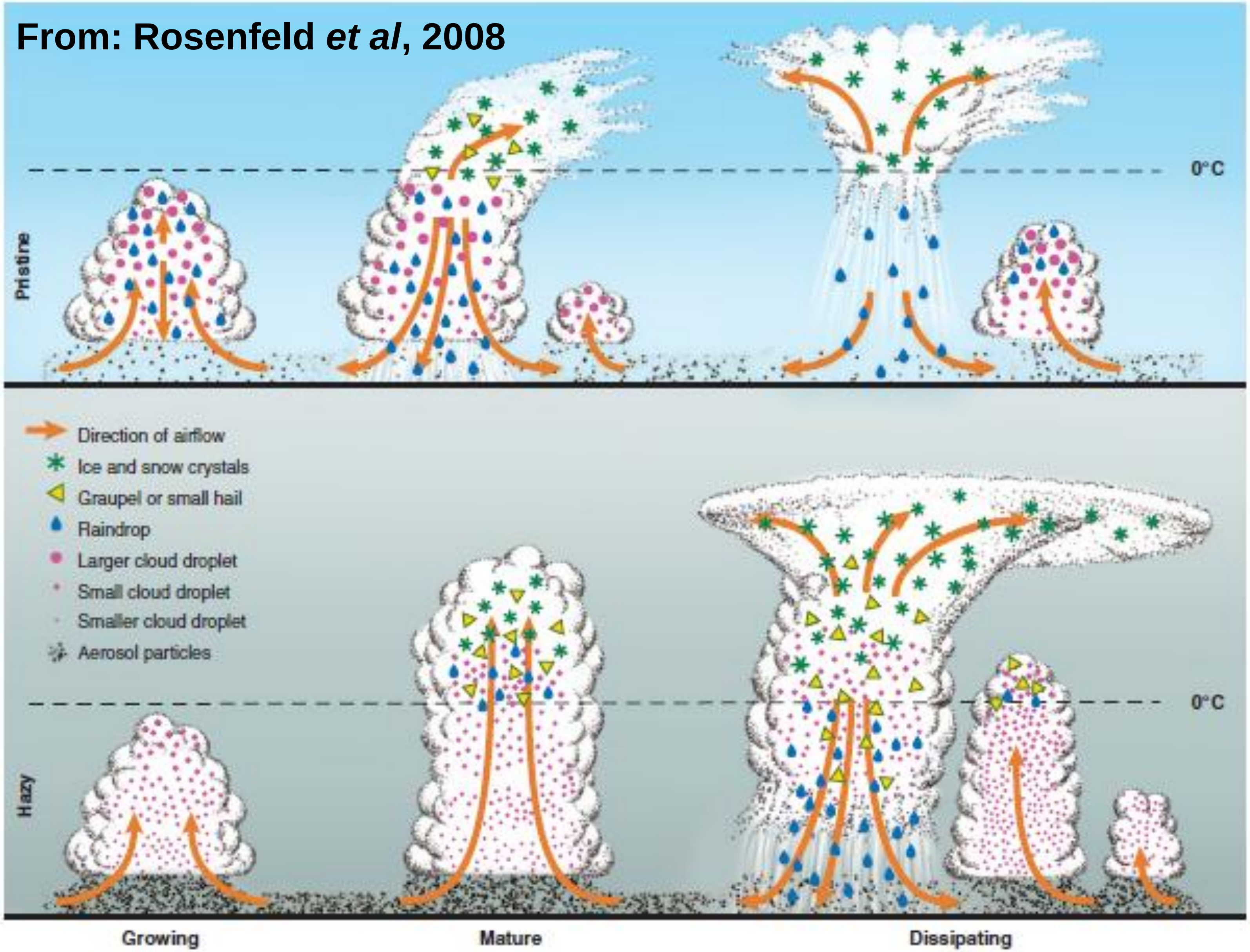
Introduction

- The aerosols can be transported far from the burning area by the winds.

- Image from MODIS at Aug of 2010.



Introduction



HadGEM2-ES model

- The UK Met Office Earth System model includes atmospheric chemistry.
- The runs are set to CMIP5, with 38 vertical levels (approx. 40km) and 1.25° latitude / 1.875° longitude.
- By default (without the HPR), products from biomass burning are vertically uniformly distributed in the boundary layer.

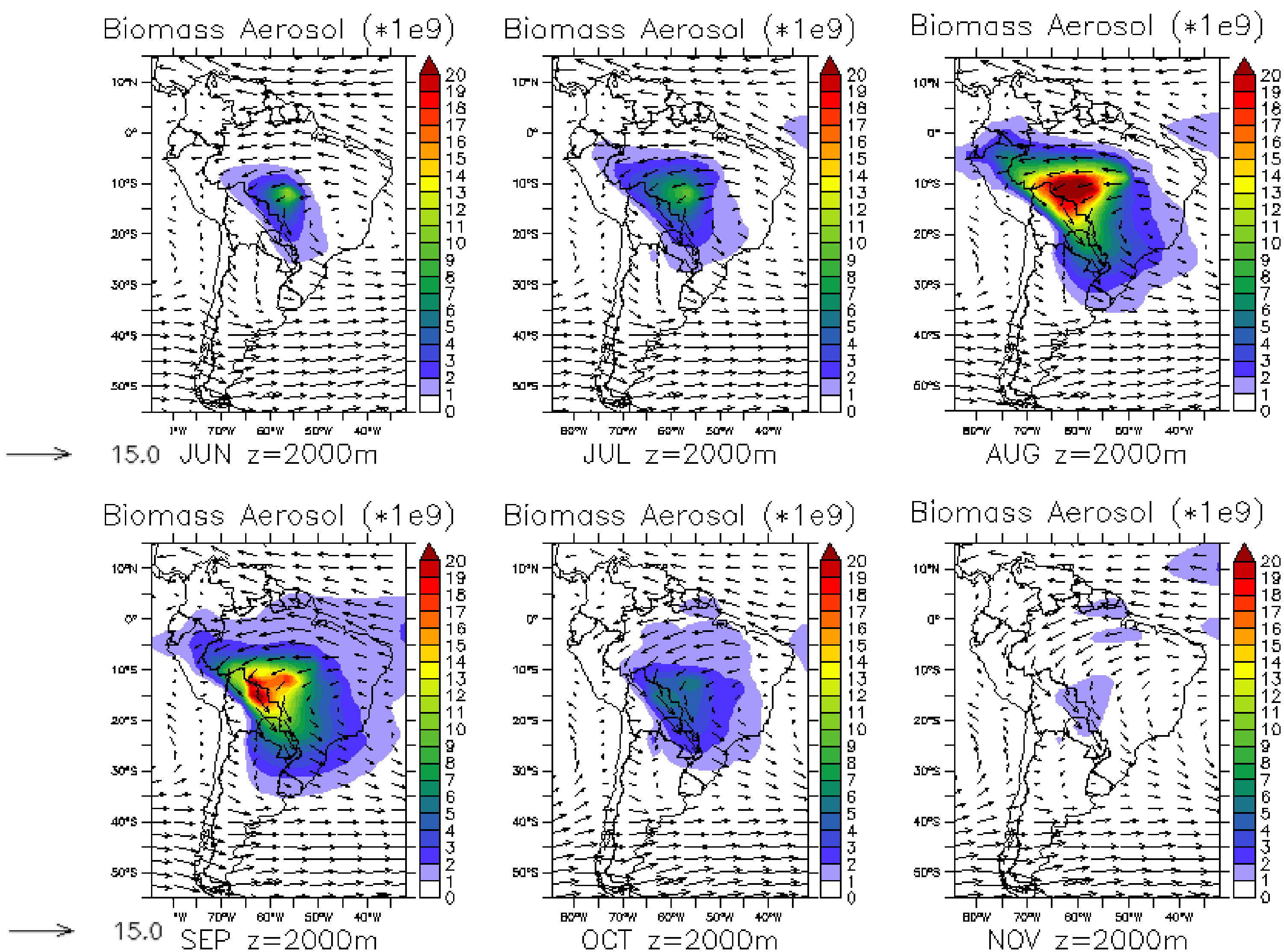
Hot Plume Rise (Freitas *et al*, 2007)

- It's a 1-D cloud model within the 3-D host model column.
- The purpose of HPR is to estimate the injection layer, based on thermodynamics of the host model, where the products of burning will be released.
- This way, the products may reach heights above the boundary layer.
- The HPR was turned on based on biomass burning emissions data sets given by CMIP5.

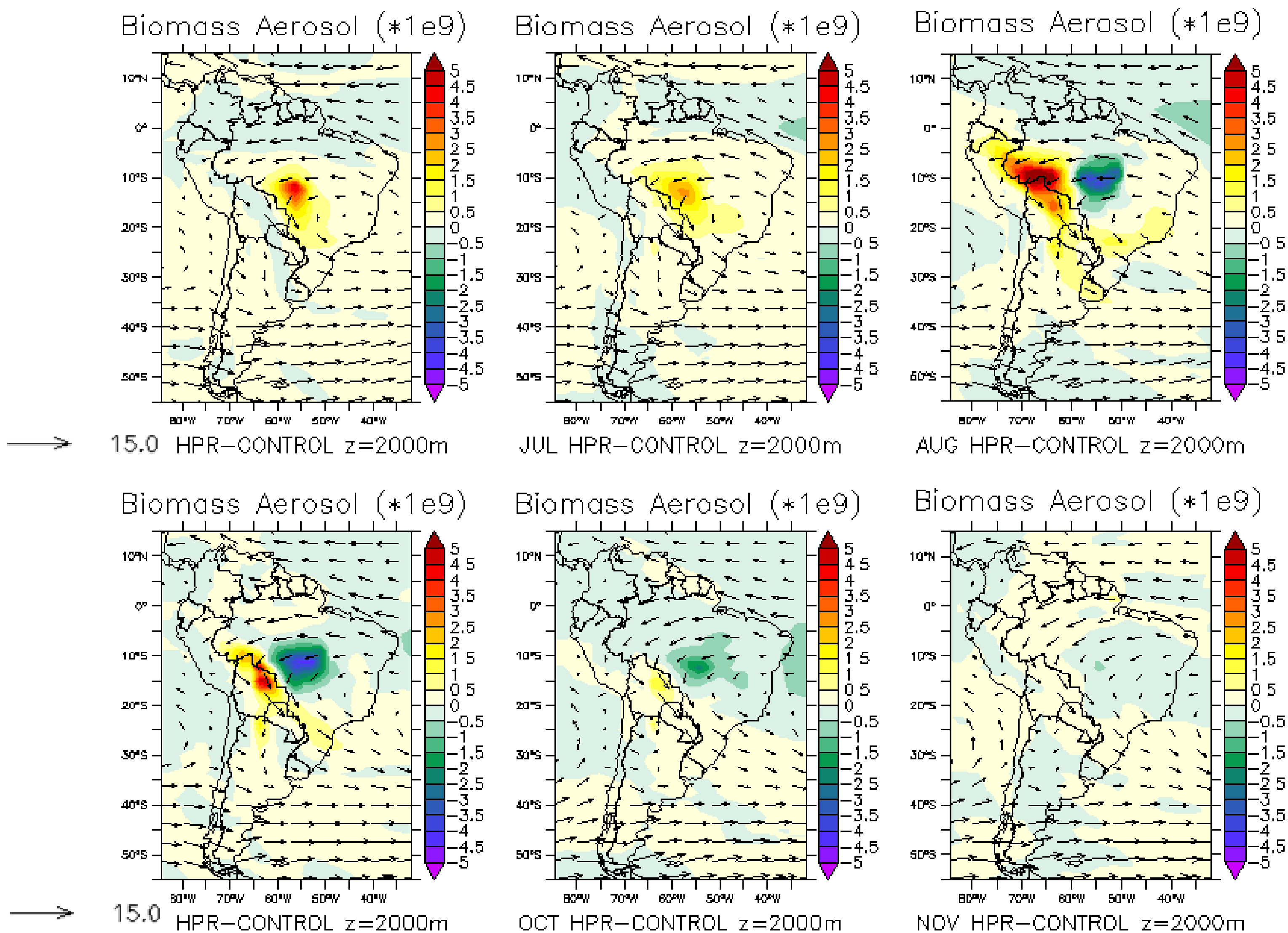
Results

- The following results (mostly) are the comparison between two simulations: HPR and CONTROL.
- The difference are HPR – CONTROL.

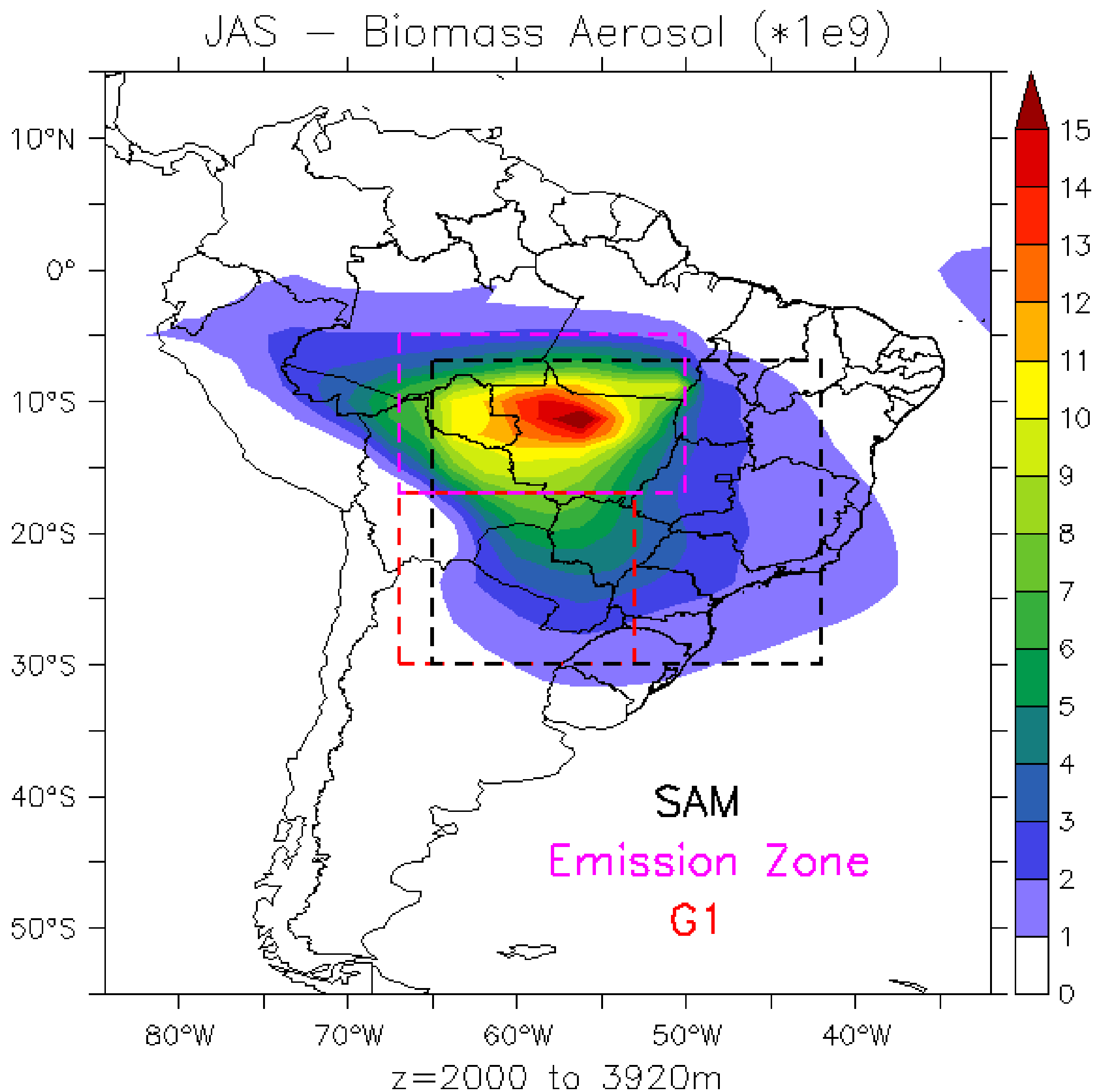
Wind (m/s) + Aerosols (kg/kg)



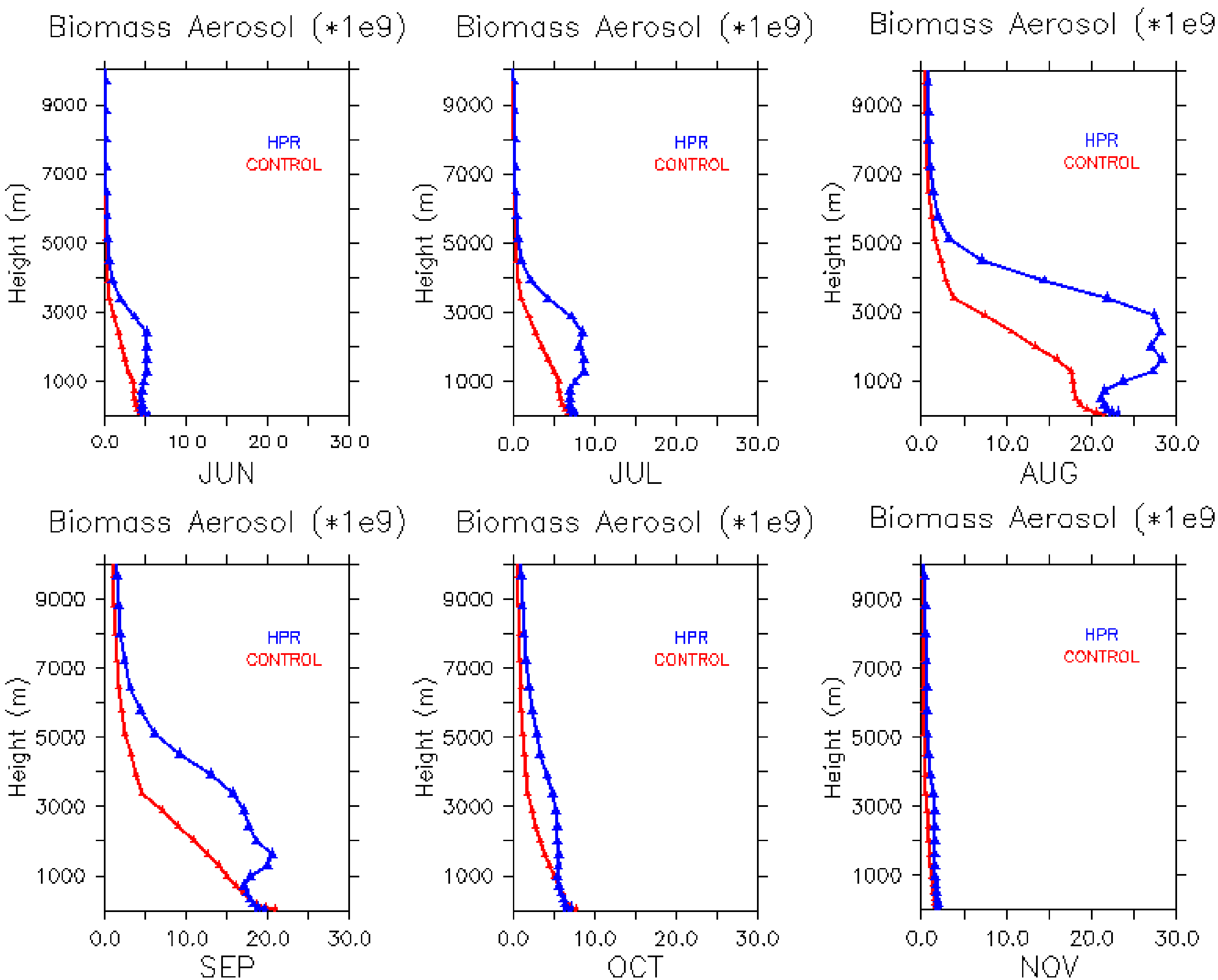
Difference of Aerosols $(z = 2000m)$



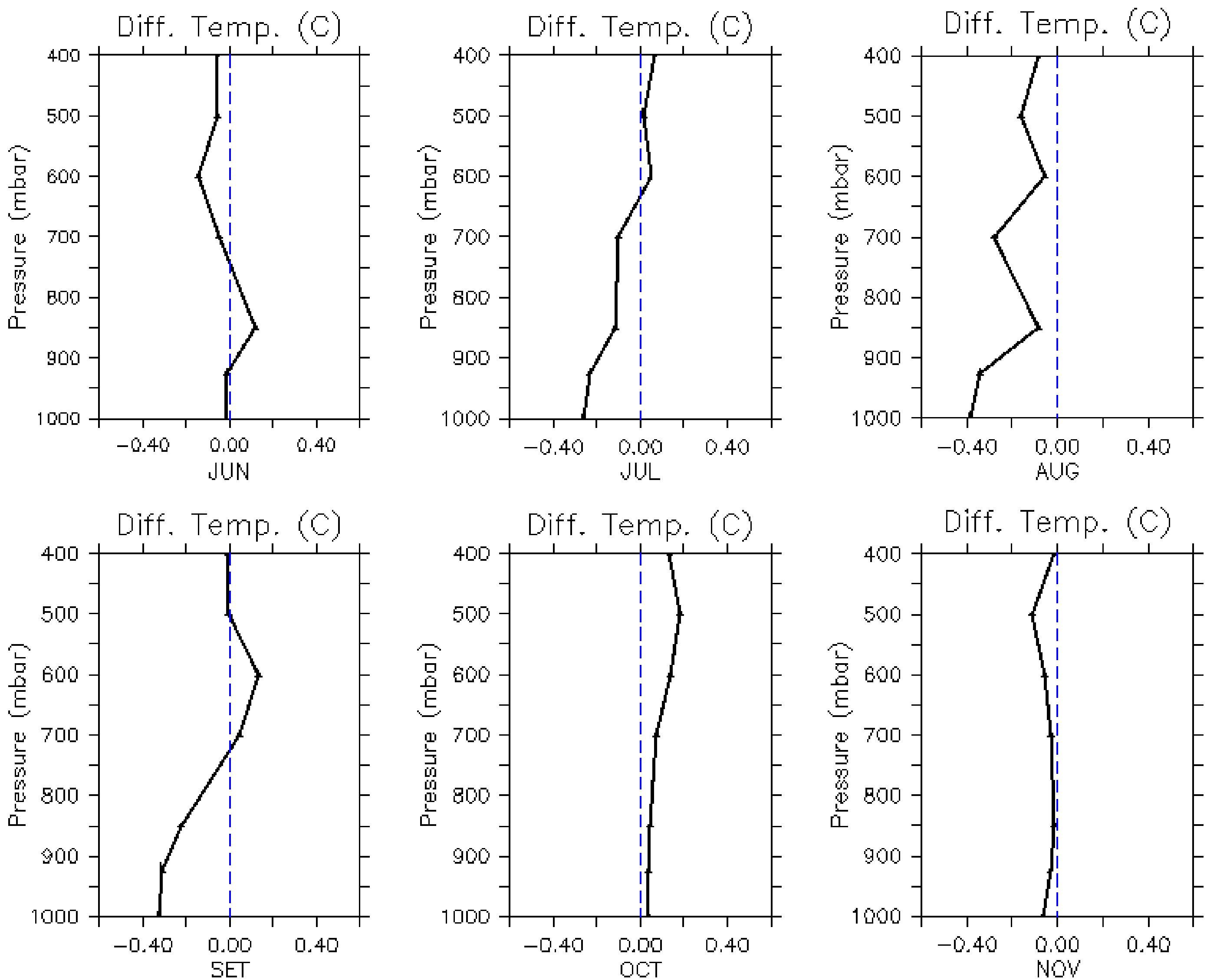
Aerosols and Areas of Interest



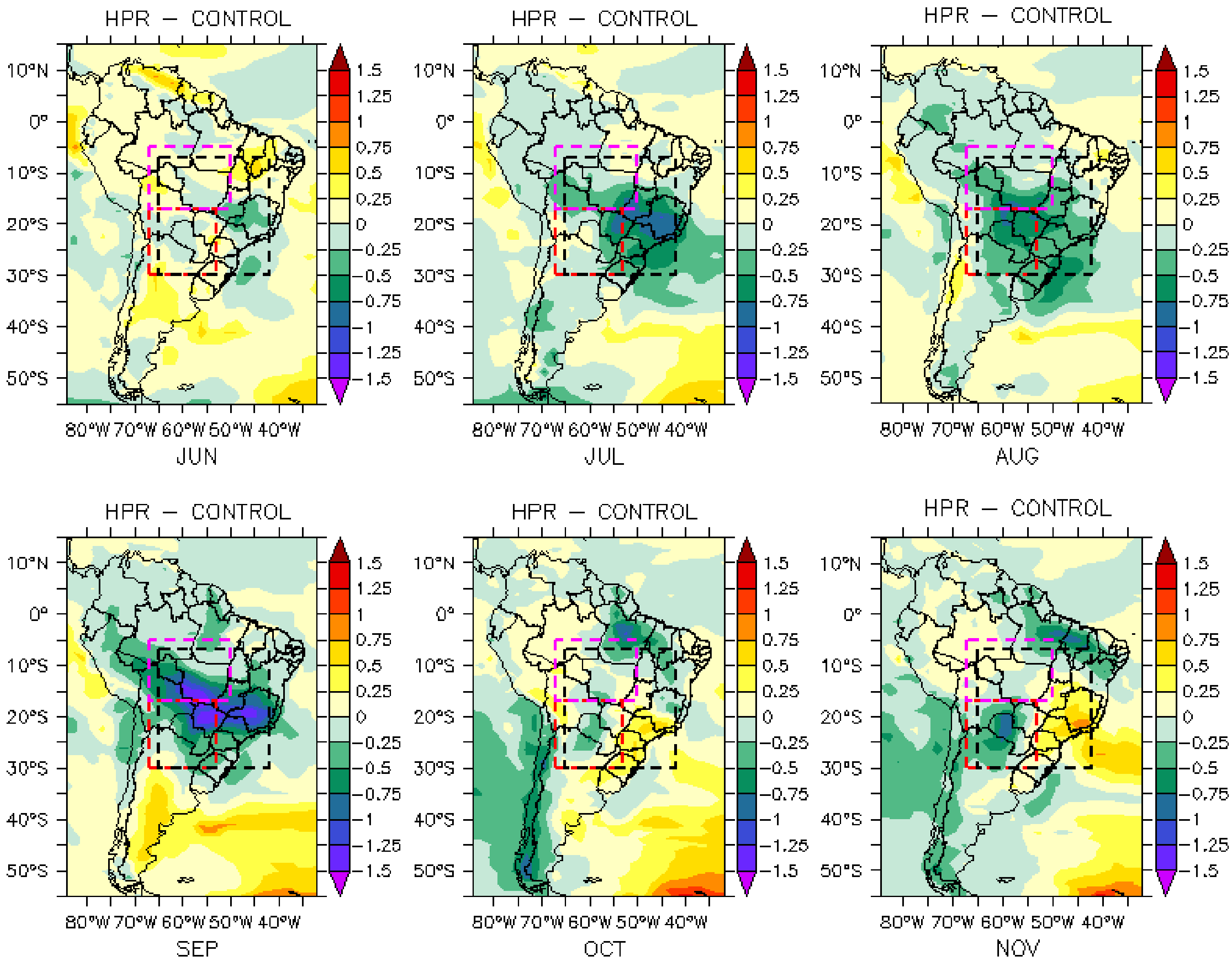
Vertical Profile of Biomass Aerosols (kg/kg) – Emission Zone



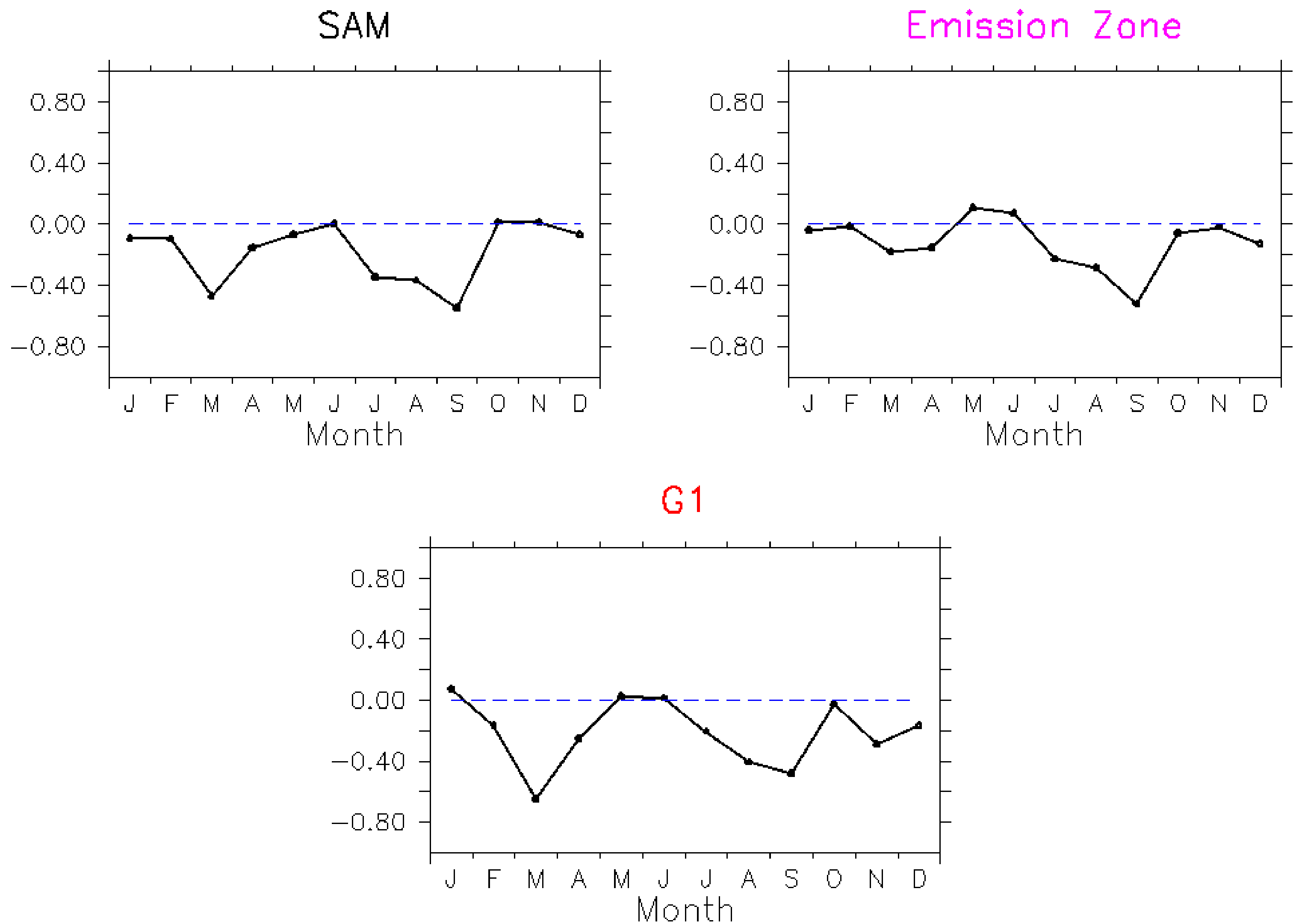
Difference of Vertical Temperature $(°C)$ – Emission Zone



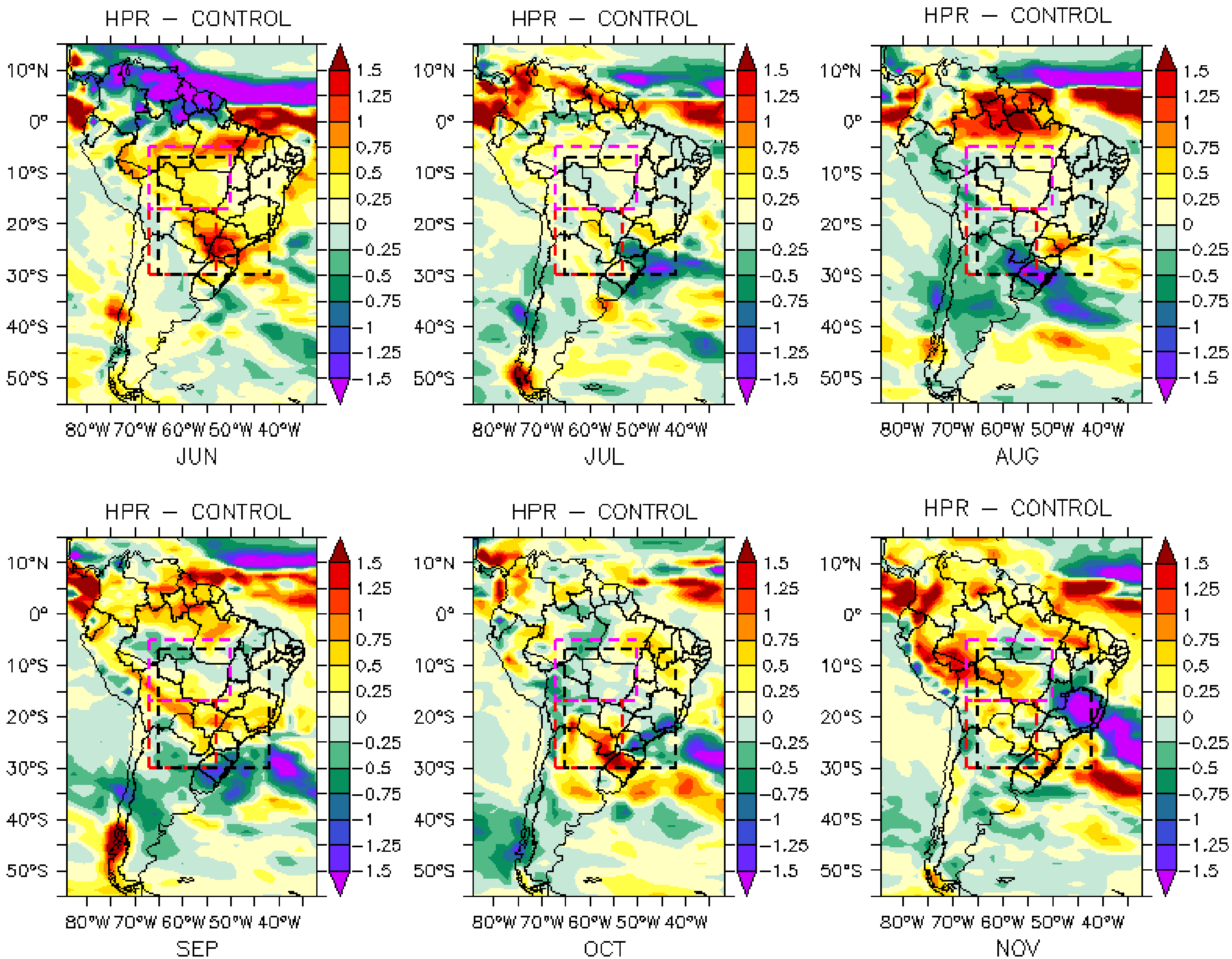
Difference of Temperature $(°C)$



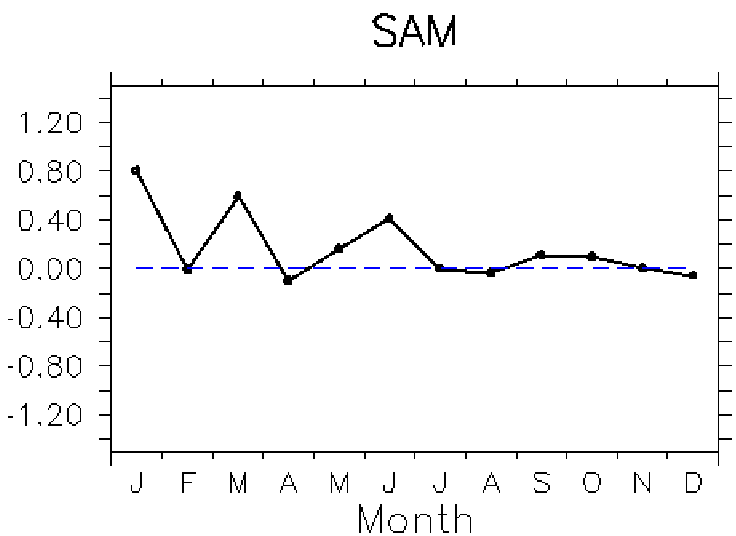
Difference of Temperature $(°C)$

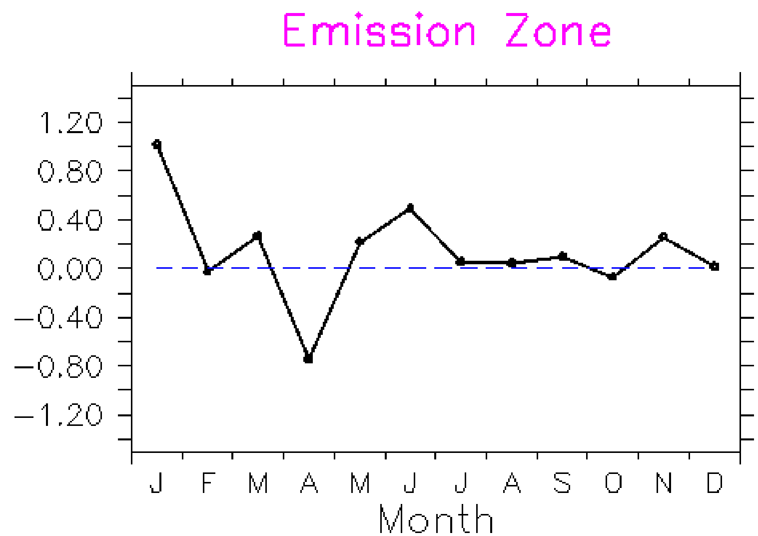


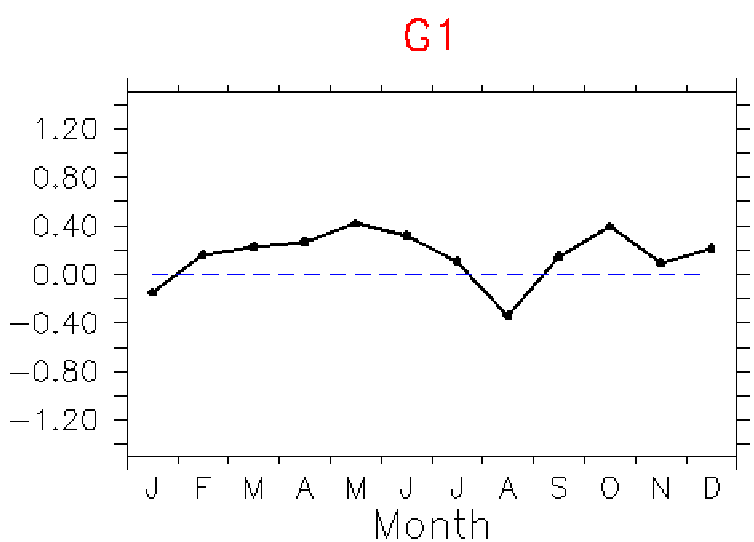
Difference of Precipitation (mm/day)



Difference of Precipitation (mm/day)







Conclusions

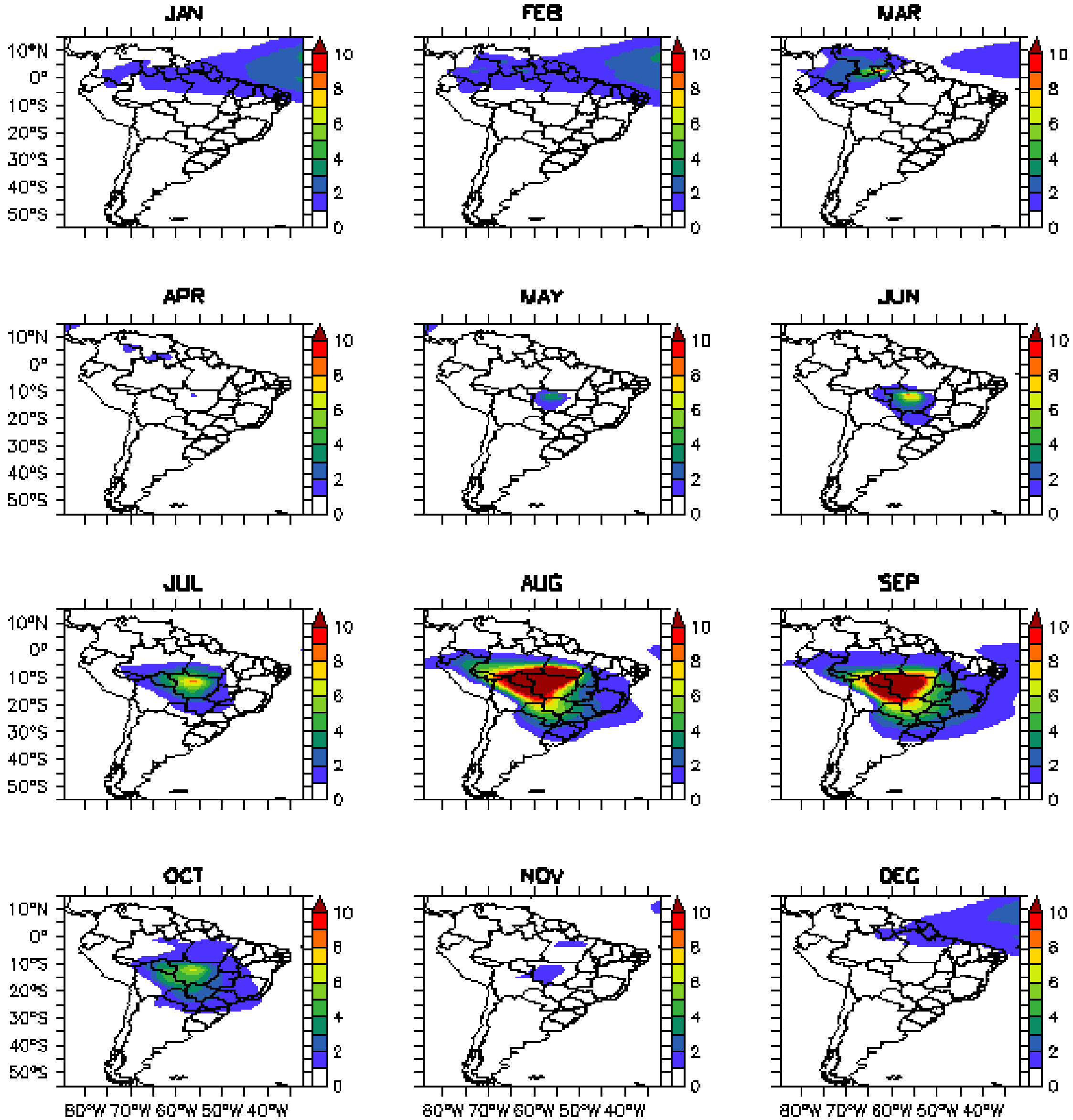
- The atmospheric height where the biomass burning aerosols are injected is important for their impacts on climate.
- The area that is more affected by biomass burning aerosols is G1, because it directly receives the aerosols from the Emission Zone.

Conclusions

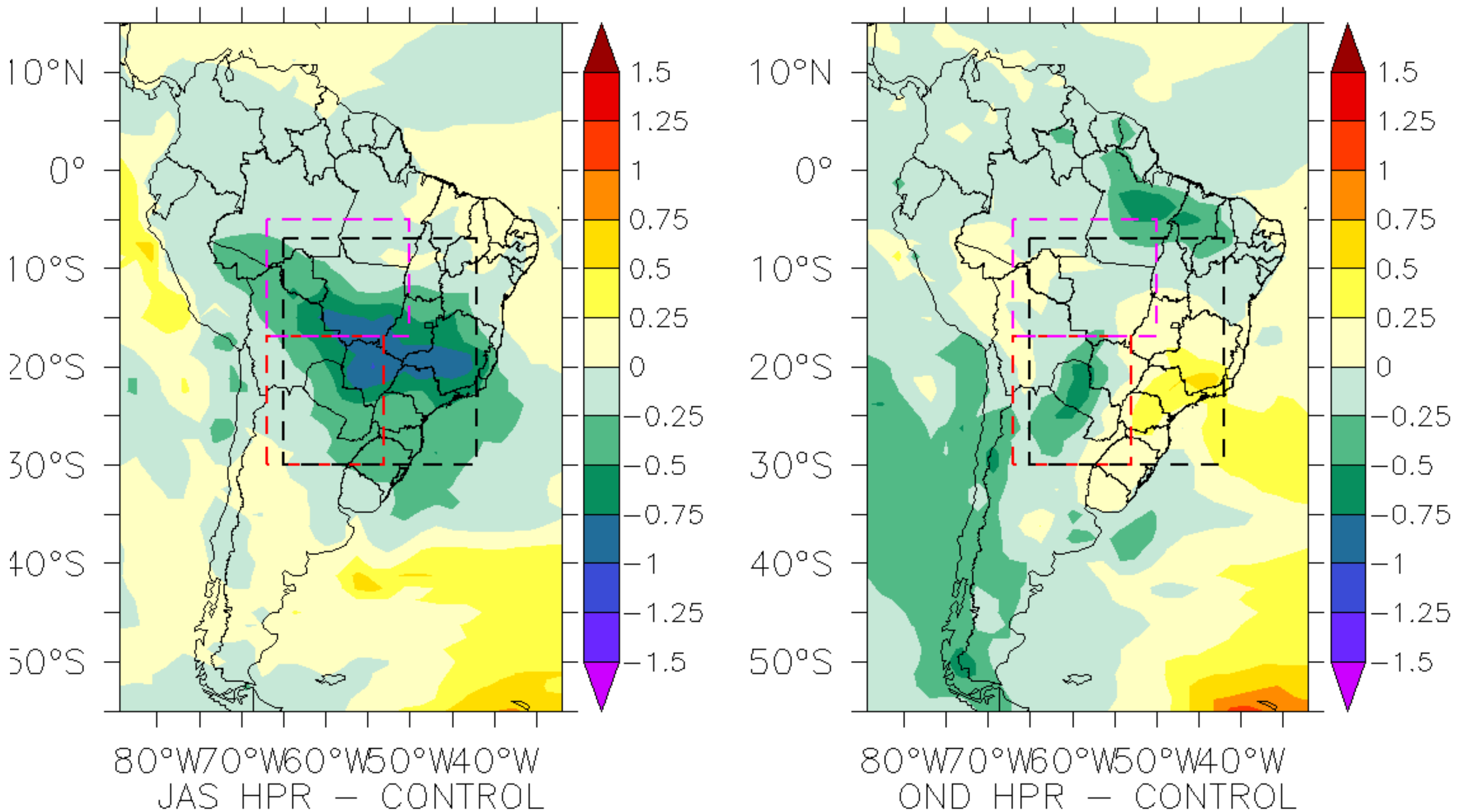
- Understanding the precipitation changes is a more complex task than for temperature.
- For the area G1, the results are as follows:
- Temperature:
  - There´s a decrease of surface temperature, from Jul. to Sep.
- Precipitation:
  - There´s an increase of precipitation from Sep. to Dec.
  - August is the only month that shows a decrease of precipitation, and needs more investigation.

Thank you.

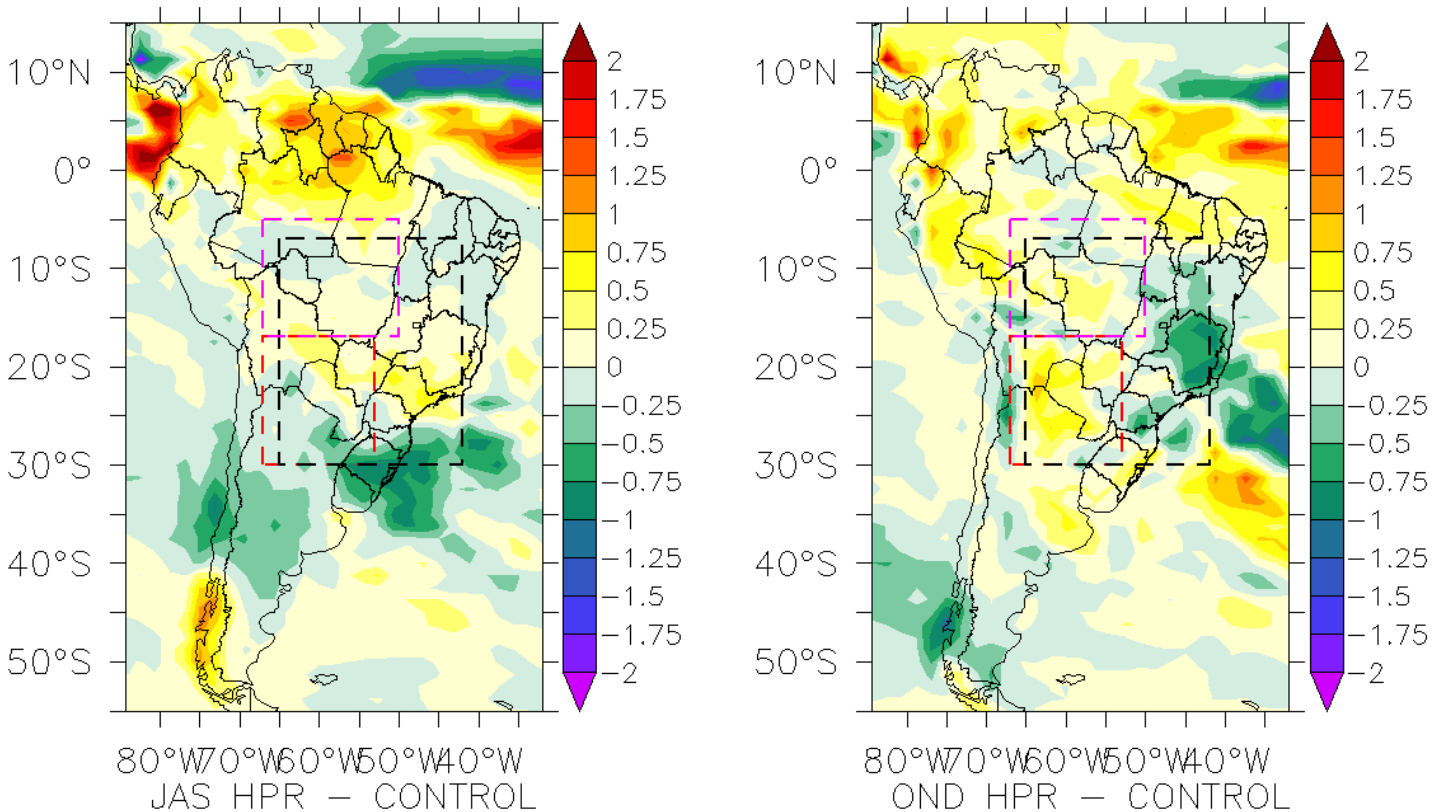
Aerosols by month



Temperature JAS & OND



Precipitation JAS & OND



HPR References

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