A primitive equations model study of the effect of heat sources over tropical South America and Atlantic

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Introduction

- Monsoon region associated with latitudinal displacement of 10º of ITCZ, among other mechanisms (Asnani, 1993);

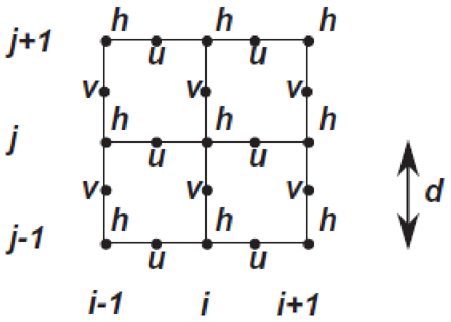
- Relationship between ITCZ and SAMS has not been well investigated (Garcia and Kayano, 2010).

Objective

- Simulate and analyze the impact of heat sources associcited with SACZ and ITCZ on vertical motion in tropical atmosphere.

Methodology - Model

- **Tropical Dynamic Model (Gandu, 1993; Gandu and Silva Dias, 1998):**
  - Non-linear primitive equations;
  - Arakawa C grid;
  - Horizontal spacing: 2,5º x 2,5º;
  - Tropical convection: heat sources.



Randall, 1994

Metodology - Heat sources

- OLR or precipitation data
- GPCP (2,5º x 2,5º) for DJF 1990-2009
  - Latent heat release (tropical deep convection)

↓

Total diabatic heating

- Vertical structure: sine, maximum: 400 mb

Metodology

- Experiments (30 days):
  - **(f0)** without SACZ and ITCZ
  - **(f1)** without SACZ
  - **(f2)** without ITCZ
  - **(f12)** control

- Factor separation (Stein and Alpert, 1993):

$$\hat{f}_0 = f_0$$

$$\hat{f}_1 = f_1 - f_0$$

$$\hat{f}_2 = f_2 - f_0$$

$$\hat{f}_{12} = f_{12} - (f_1 + f_2) + f_0$$

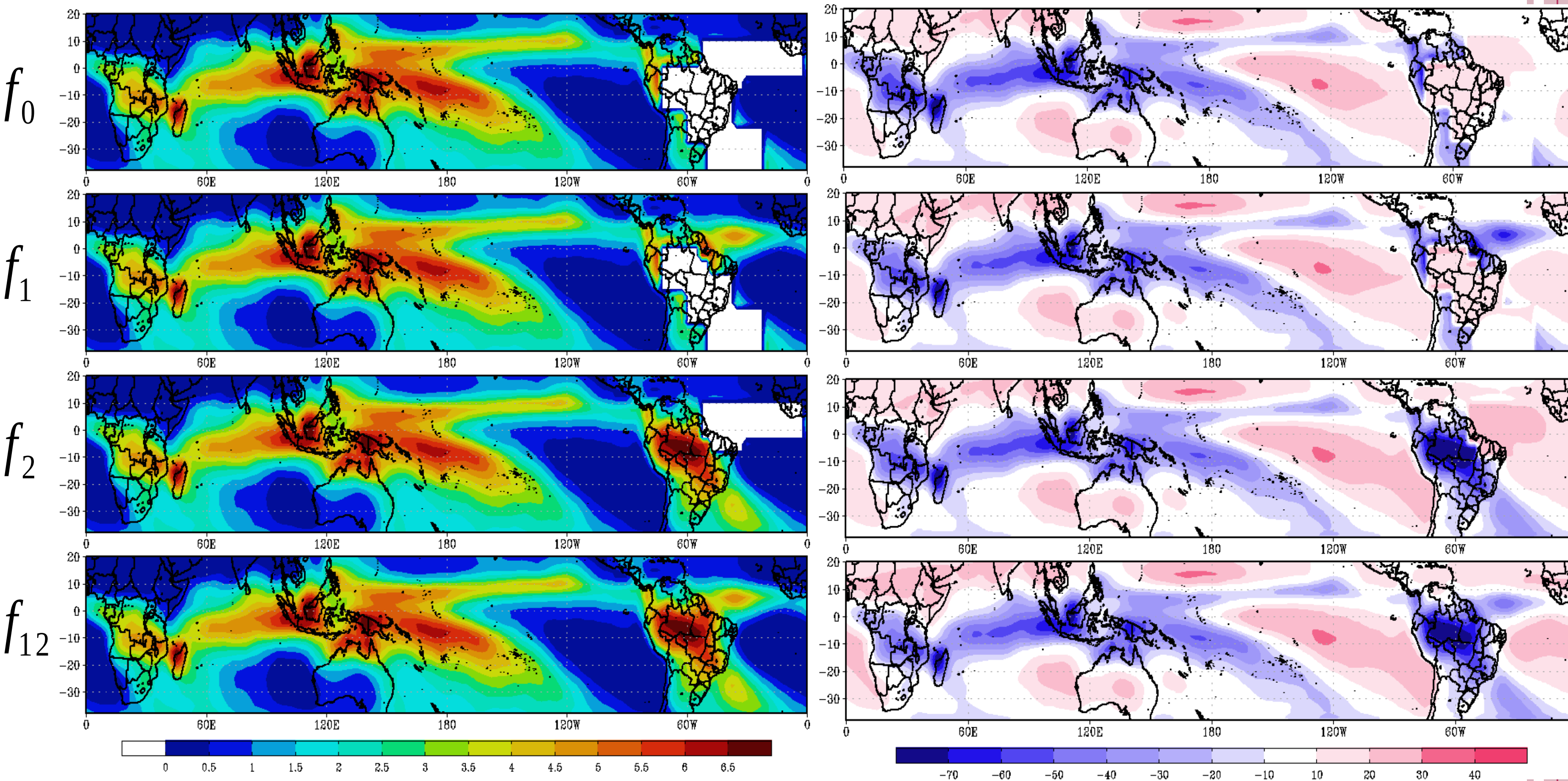
Factor 1 on – ITCZ

Factor 2 on – SACZ

RESULTS

Diabatic heating (K/day)
400 mb

Simulated omega (mb/day)
400 mb - 48 h



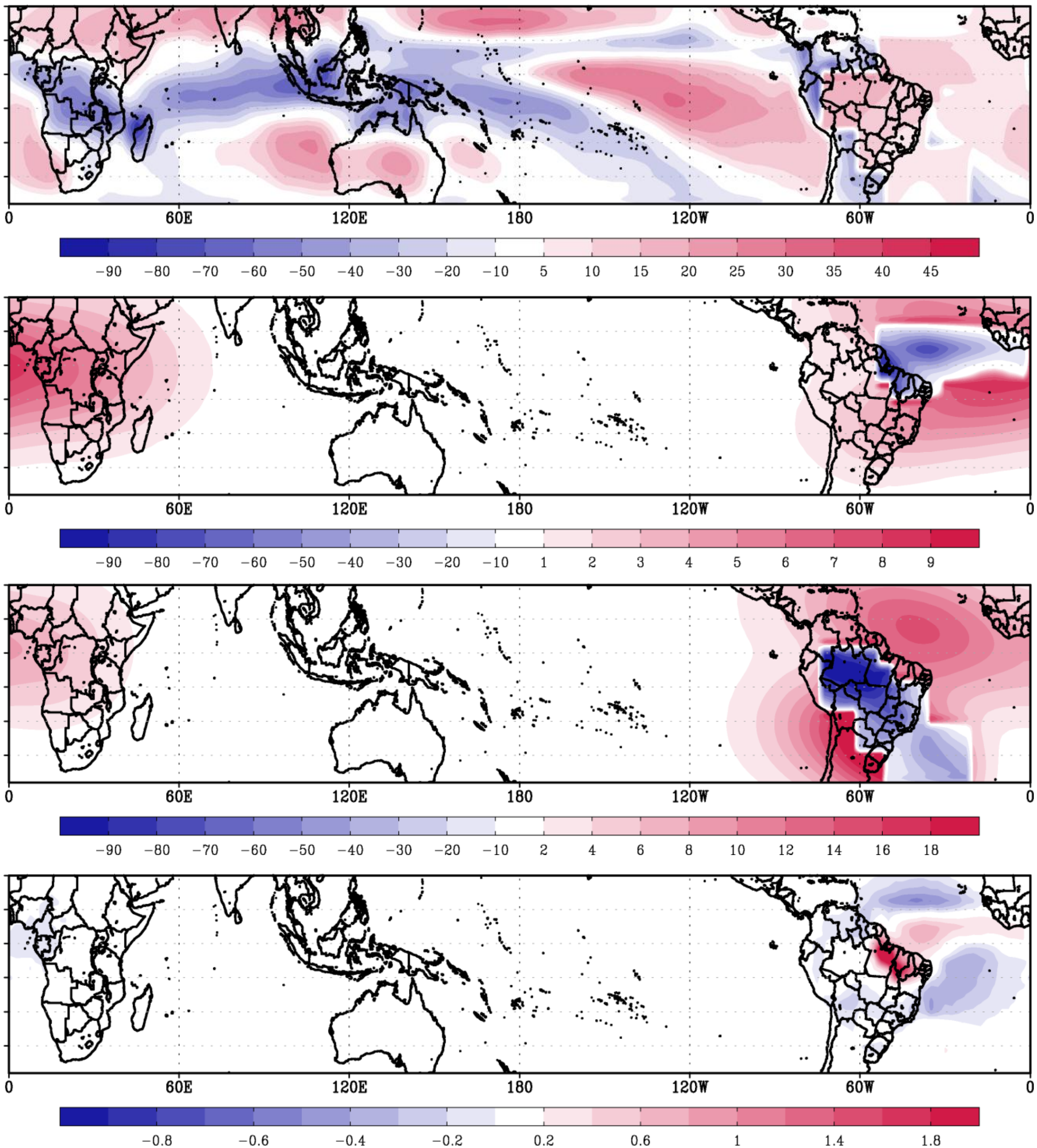
48 h

$\hat{f}_0$

$\hat{f}_1$

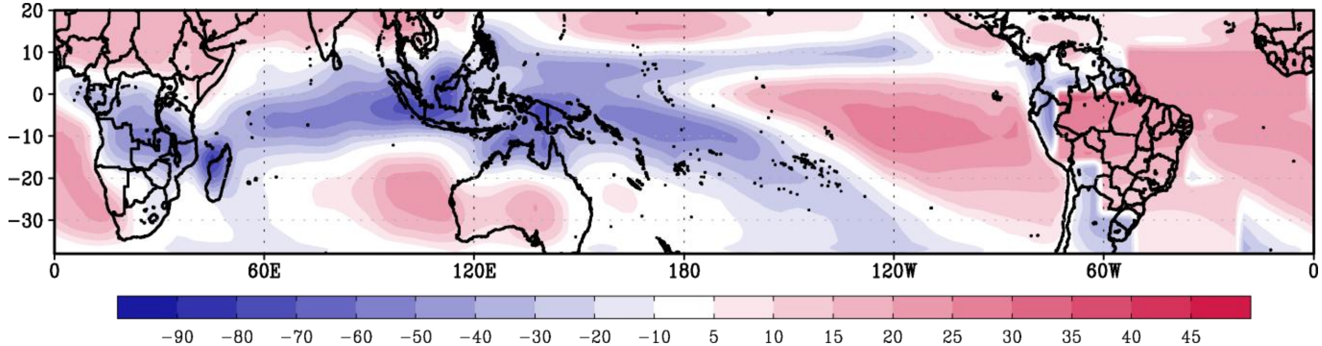
$\hat{f}_2$

$\hat{f}_{12}$

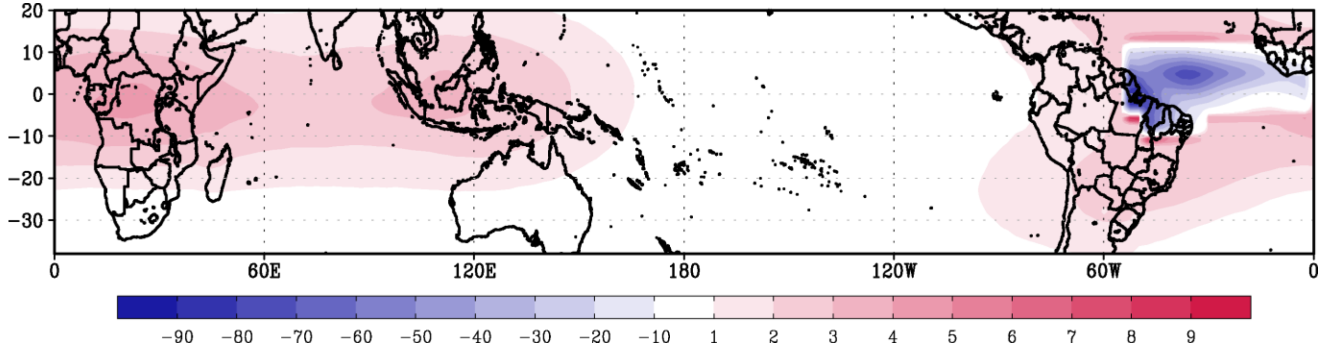


96 h

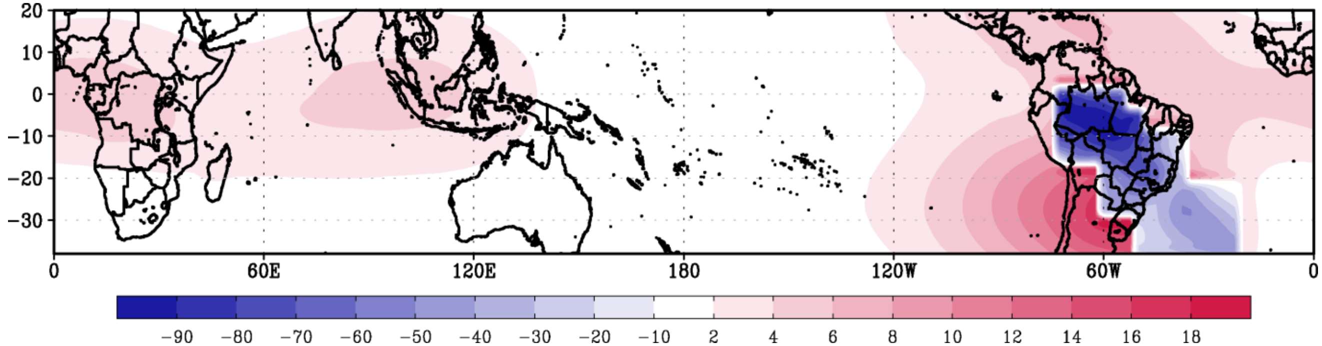
$\hat{f}_0$



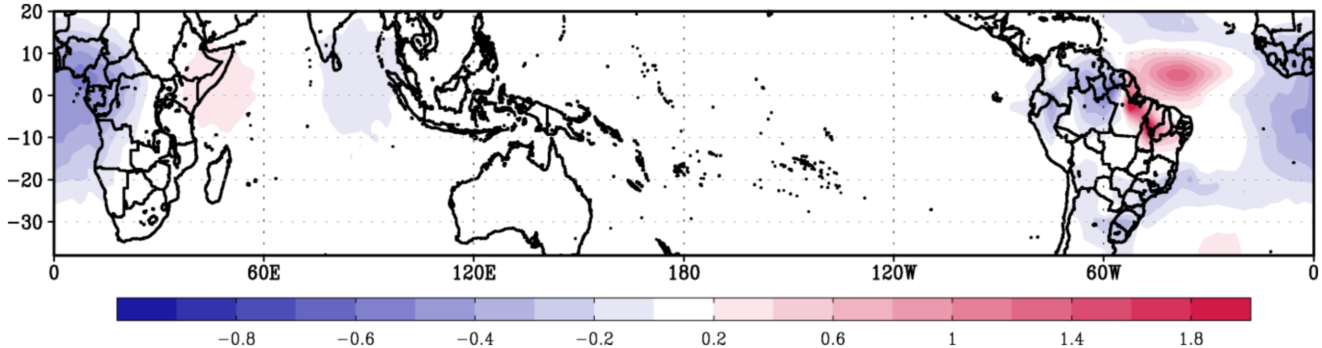
$\hat{f}_1$



$\hat{f}_2$



$\hat{f}_{12}$



Conclusions

- Upward motion in ITCZ is more intense without SACZ;
- Upward motion over SAMS region is affected when ITCZ is removed;
- Mechanism: **compensatory subsidence**;
- Combined effect SACZ+ITCZ impacts mainly ITCZ;
- SACZ and ITCZ excite a **Gill-type response**;
- ITCZ (faster Kelvin) X SACZ (faster Rossby).

Acknowledgements

FAPESP

CNPq

CAPES

References

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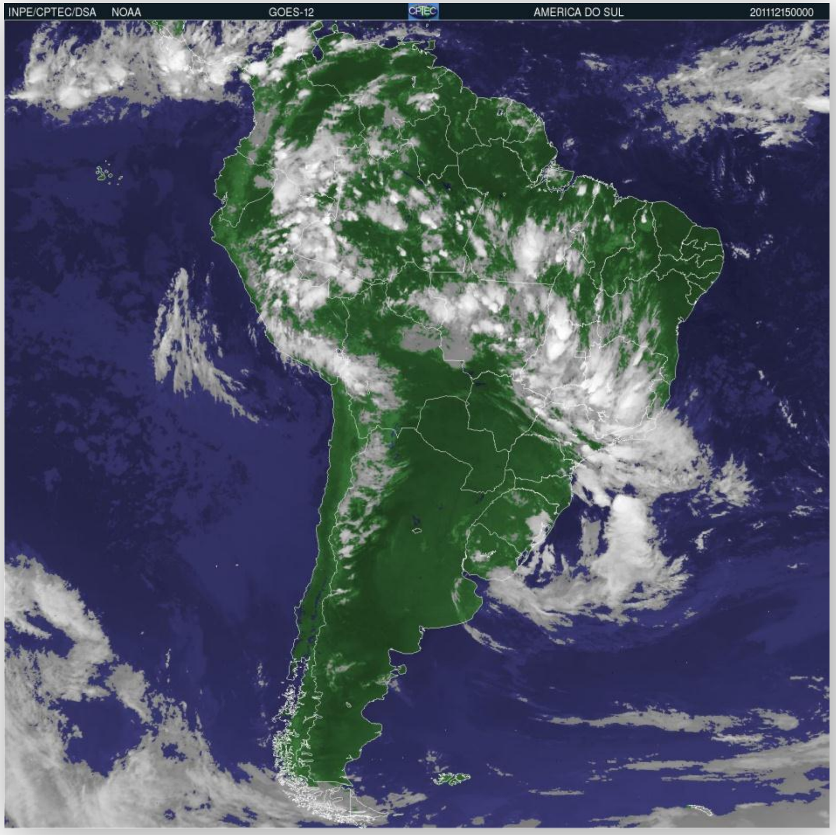

THANK YOU!

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