The diurnal cycle of precipitation over South America
and how preceding soil moisture conditions can affect precipitation events.

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BACKGROUND

- Analyses of the **diurnal cycle of precipitation (DCP)** over **South America** are still relatively scarce.

- The **DCP** is especially **difficult to reproduce** in climate models.

- **Satellite derived products** offer 3h precipitation data that makes them useful for comparison with climate models.

- Previous studies found **relationships** between a **precipitation event** in afternoon hours and the conditions of **soil moisture** preceding it.

OBJECTIVES

- **Analyze** the DCP over South America.

- **Compare** the performance of **RCA4** regional climate model against **satellite based products** TRMM 3B42 V7 and CMORPH V1.0.

- **Explore** the existence of a **relationship** between **afternoon precipitation events** and preceding **soil moisture** conditions.

METHODS

DCP analysis was computed from 15 years of South American monsoon (SAM) seasons.

- **3 hourly** precipitation **climatology**.

- **Nighttime – daytime difference** in frequency, intensity and amount of precipitation.

- **EOF** decomposition from the 3 hourly climatology.

Lastly, 30 years of **RCA4** data were used to identify **afternoon (9-18h) precipitation** events during the SAM seasons and **relate** them to the preceding **morning (6-9h) soil moisture** anomaly (SM) conditions.

$Ys = SM_{(MAX)} - SM_{(MIN)}$
$Yt = SM_{(MAX)}$
$Yh = std_{(SM)}$
$\delta = \text{mean}_{(Y\,event)} - \text{mean}_{(Y\,control)}$

We then compared the coupling metric δ to typical values obtained from bootstrapping.

Adapted from Guillod et al. (2015) *'Reconciling spatial and temporal soil moisture effects on afternoon rainfall'*

NIGHTTIME OR DAYTIME PREFERENCE
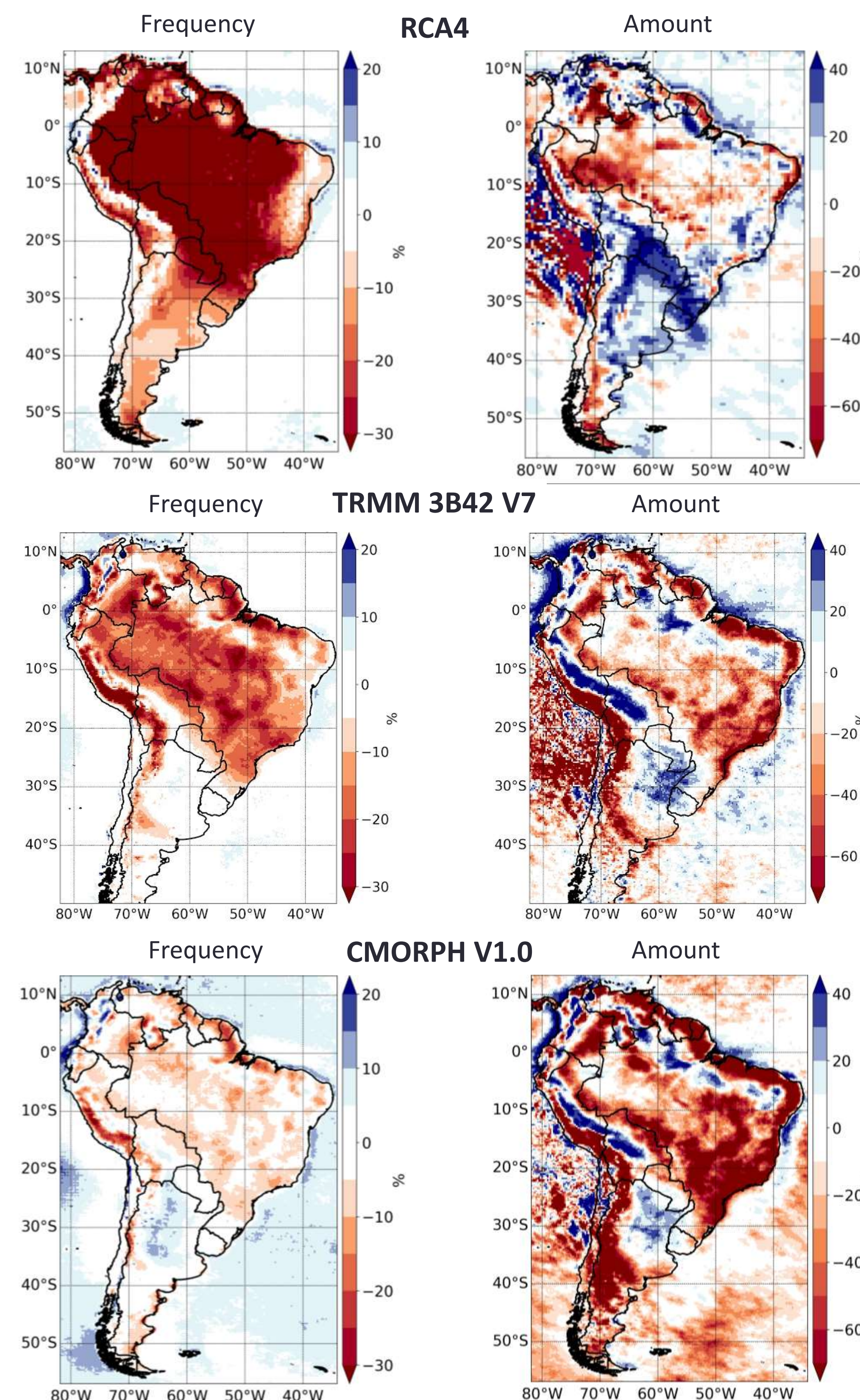
- Percentage difference of frequency and amount of precipitation between nighttime (21-9 UTC-3) and daytime (9-21 UTC-3) hours for RCA4, TRMM 3B42 V7 and CMORPH V1.0.

SM PRECEDING PRECIPITATION EVENTS

Spatial preference   **Temporal preference**   **Heterogeneity preference**
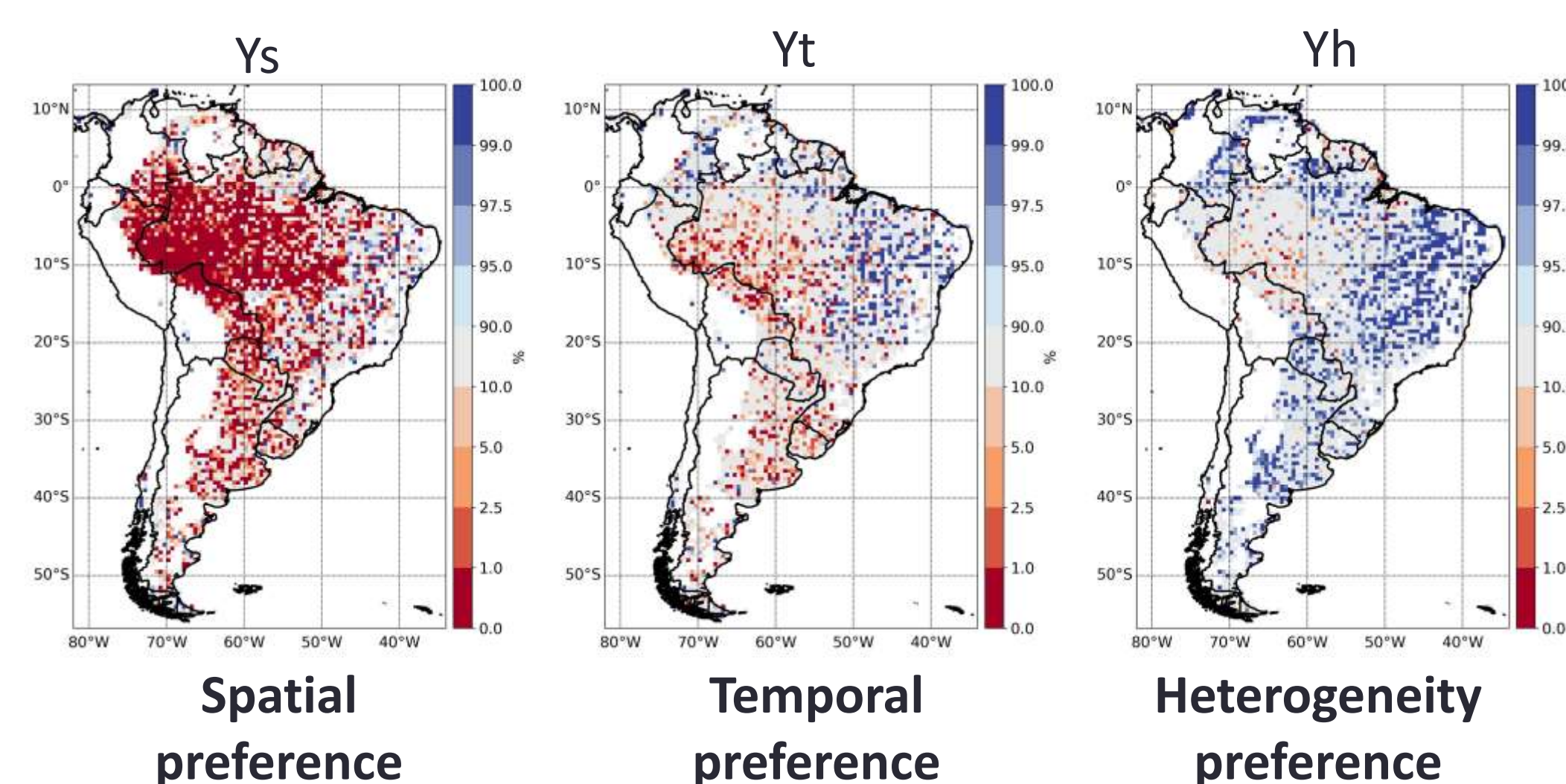
- Preferences for afternoon precipitation over soil moisture anomalies based on the quantile of the coupling metric. High (low) quantiles indicate where the SM metric is higher (lower) than expected.

3H CLIMATOLOGY EOF DECOMPOSITION
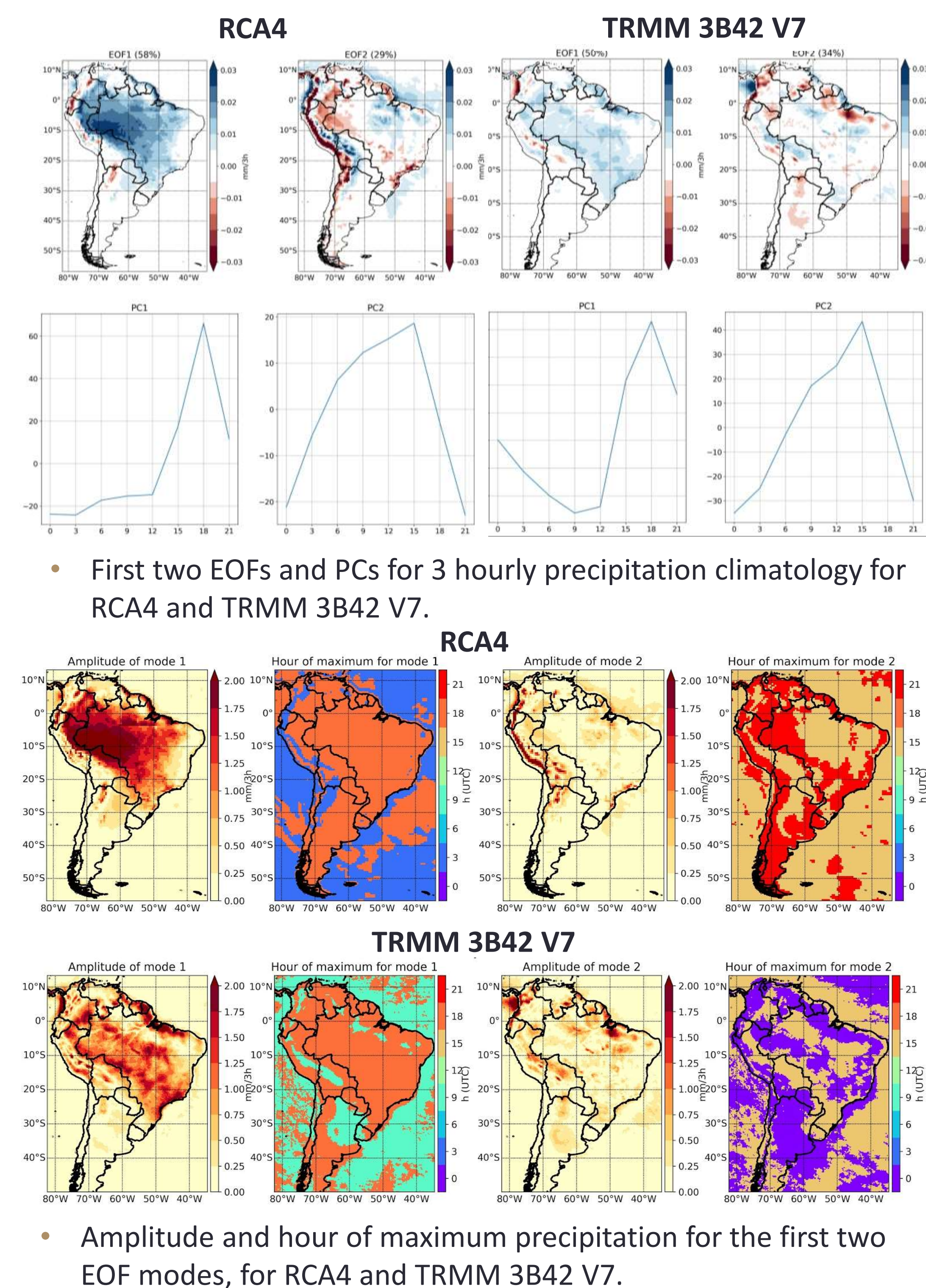
- First two EOFs and PCs for 3 hourly precipitation climatology for RCA4 and TRMM 3B42 V7.

- Amplitude and hour of maximum precipitation for the first two EOF modes, for RCA4 and TRMM 3B42 V7.

CONCLUSIONS

- **RCA4** reproduces most of the **characteristics** of the **DCP** over South America, especially the **timing** of the maximum, compared to satellite products.

- Main **differences** between RCA4 and the satellite products are located in **Southeastern South America**.

- The satellite products exhibit non negligible differences between them.

- RCA4 data shows mostly an **afternoon precipitation** preference for heterogeneous **SM conditions** over a patch dryer than its surroundings. Western Brazil and Southeastern SA have a preference for dryer than normal days while Eastern Brazil has a preference for wetter days.

ACKNOWLEDGMENTS