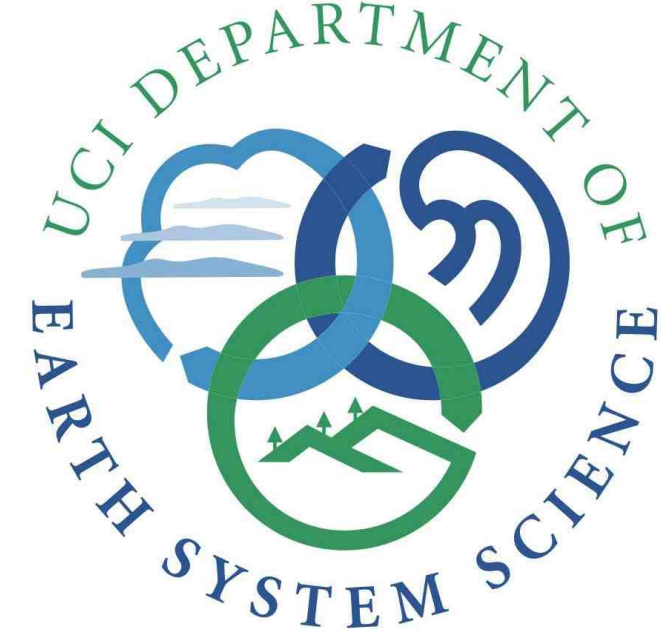


# Indian Ocean Dipole causes precipitation anomalies in the South American Monsoon



Ana Claudia Thome Sena and Gudrun Magnusdottir

Department of Earth System Science

University of California, Irvine



## Background

- The positive phase of the Indian Ocean Dipole (IODp) is suggested as connected to rainfall anomalies over South America<sup>1</sup>.

### Objective:

- Isolate the influence of both phases of the IOD on the South American Monsoon in CAM5 perturbation experiments.

## Methods

### Experiments:

- Community Atmospheric Model version 5 (CAM5) with 1° spatial resolution
- Cases with active IOD events were identified from Sea Surface Temperature (SST) observations over the Indian Ocean between September and November
- Each experiment was forced with the composite of the monthly SST anomalies during years with negative/positive IOD events

|                       |                      |
|-----------------------|----------------------|
| Climatology (control) | 100 ensemble members |
| IOD negative (IODn)   | 100 ensemble members |
| IOD positive (IODp)   | 100 ensemble members |

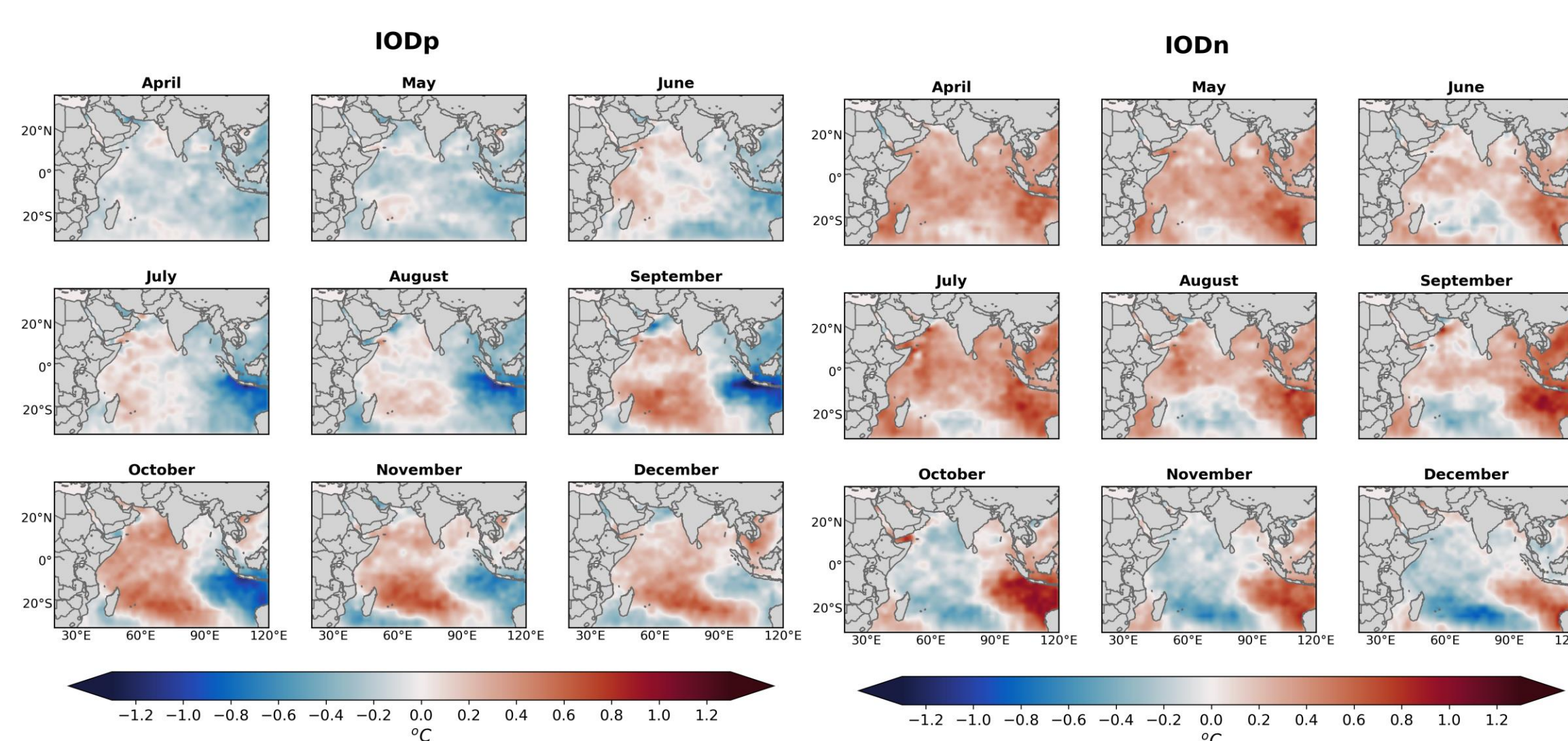


Figure 1: Sea surface temperature forcing for each month between April and December for positive IOD (IODp) and negative IOD (IODn)

## Results

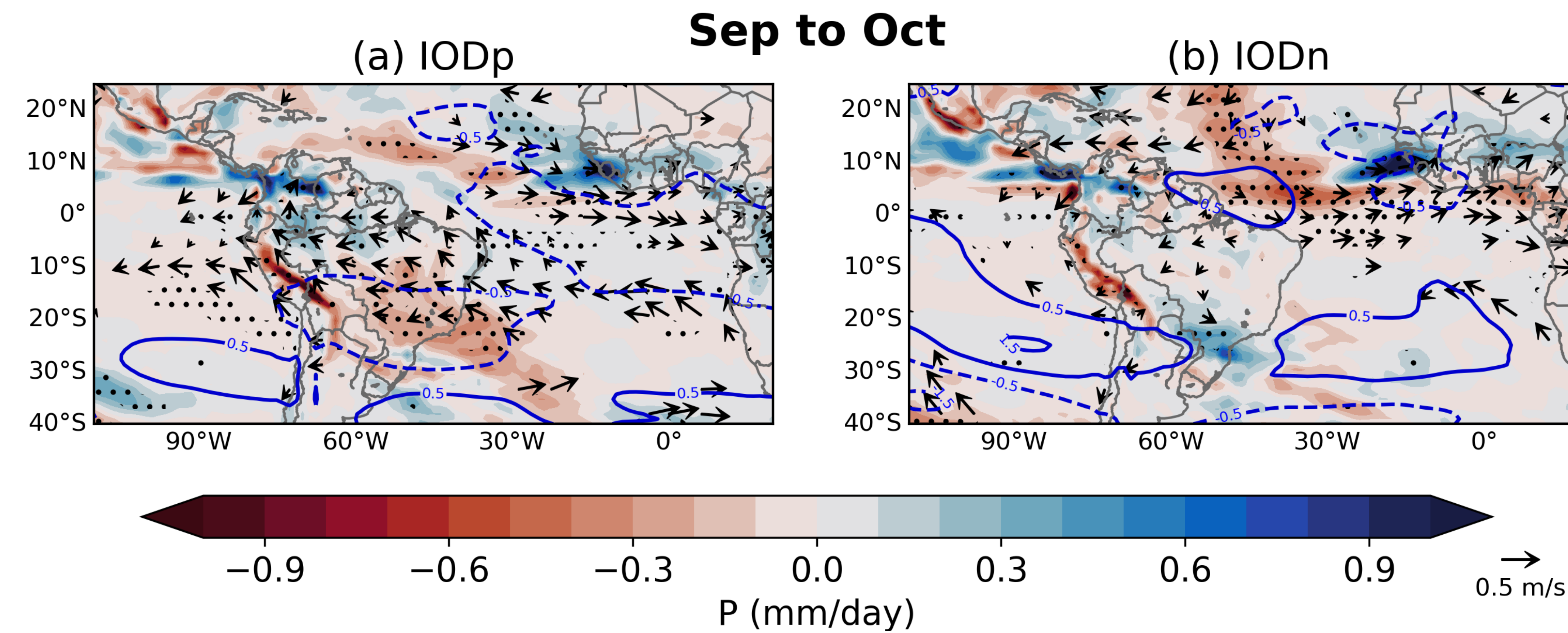


Figure 2: Anomalies of wind at 850hPa (vectors), zonal wind at 200hPa (contour) and precipitation (in colors) for (a) IODp and (b) IODn, averaged between September and October. Stippling indicates areas where precipitation anomalies are significant above the 95% confidence level.

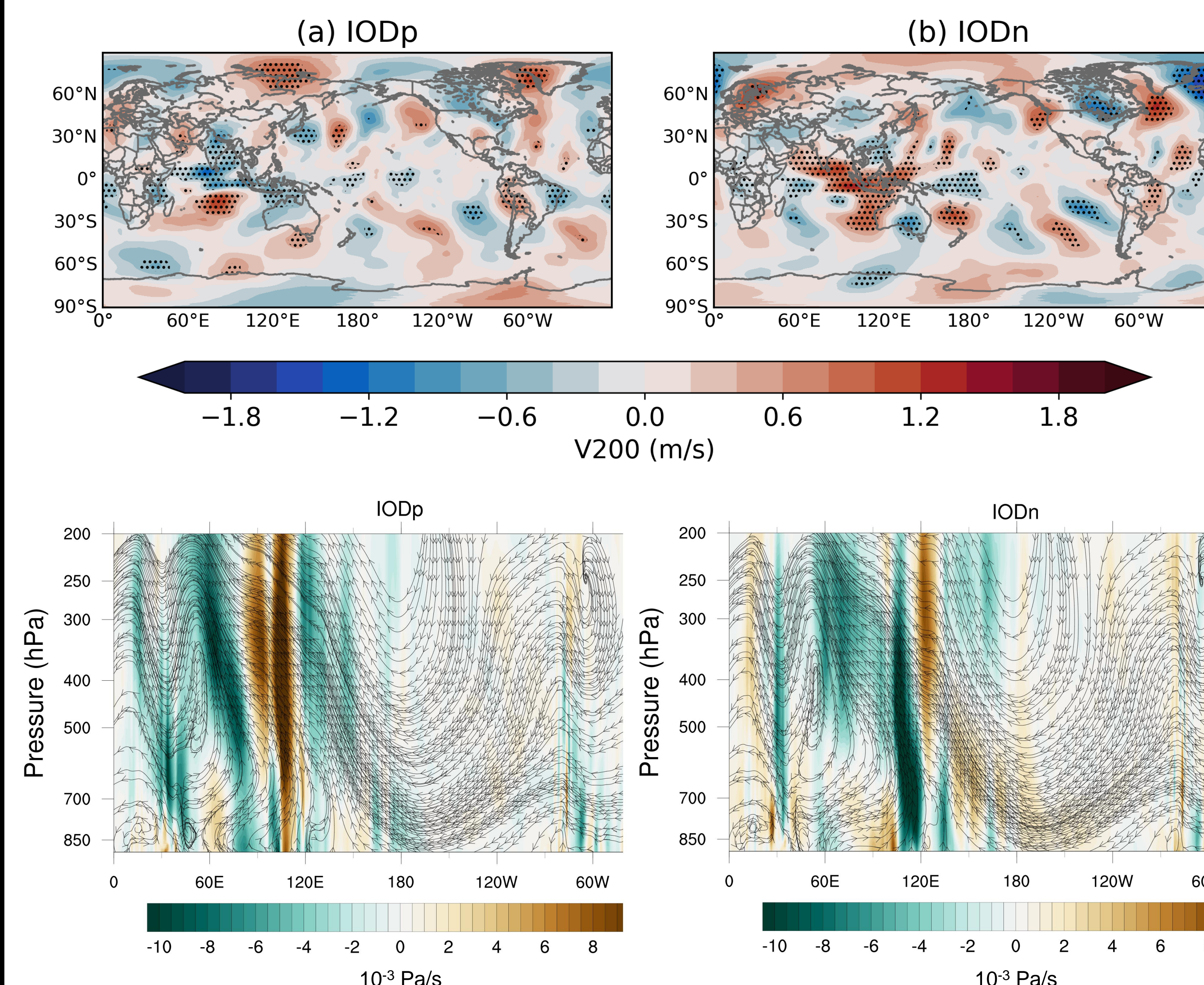


Figure 3: Anomalies of meridional wind at 200hPa for (a) IODp and (b) IODn averaged between September and October. Stippling indicates areas where anomalies are significant above the 95% confidence level.

Figure 4: Walker circulation profile averaged between 5°S and 5°N and vertical wind difference from control for (a) IODp and (b) IODn, averaged between September and October.

## Conclusions

- Both phases of the IOD excite extratropical wave trains that reach South America
- During IODp:
  - Negative anomalies of rainfall over the subtropical South Atlantic and central and Southeastern Brazil, and positive anomalies of rainfall over the Amazon
  - Extratropical wave train dislocates the South Atlantic Subtropical High closer to the continent.
  - The South American low-level jet weakens
  - The jet stream is located south from the climatology due to the strengthening of the Hadley circulation.
- During IODn:
  - Positive anomalies of rainfall over Southern Brazil
  - Jet stream is located north from its climatology
  - Small, but significant, intensification of the moisture flux from the SALLJ to Southern Brazil
- These results are confirmed by the CESM Large Ensemble

### Reference:

1. Chan, Steven C., Swadhin K. Behera, and Toshio Yamagata. "Indian Ocean dipole influence on South American rainfall." *Geophysical Research Letters* 35.14 (2008).