

# Floods in Brazil

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# Introduction

- Floods are known to cause large damages [social, economical and environmental.]
- Objective: describe the causes for the major floods in Brazil in order to try to reduce the harms in future events.

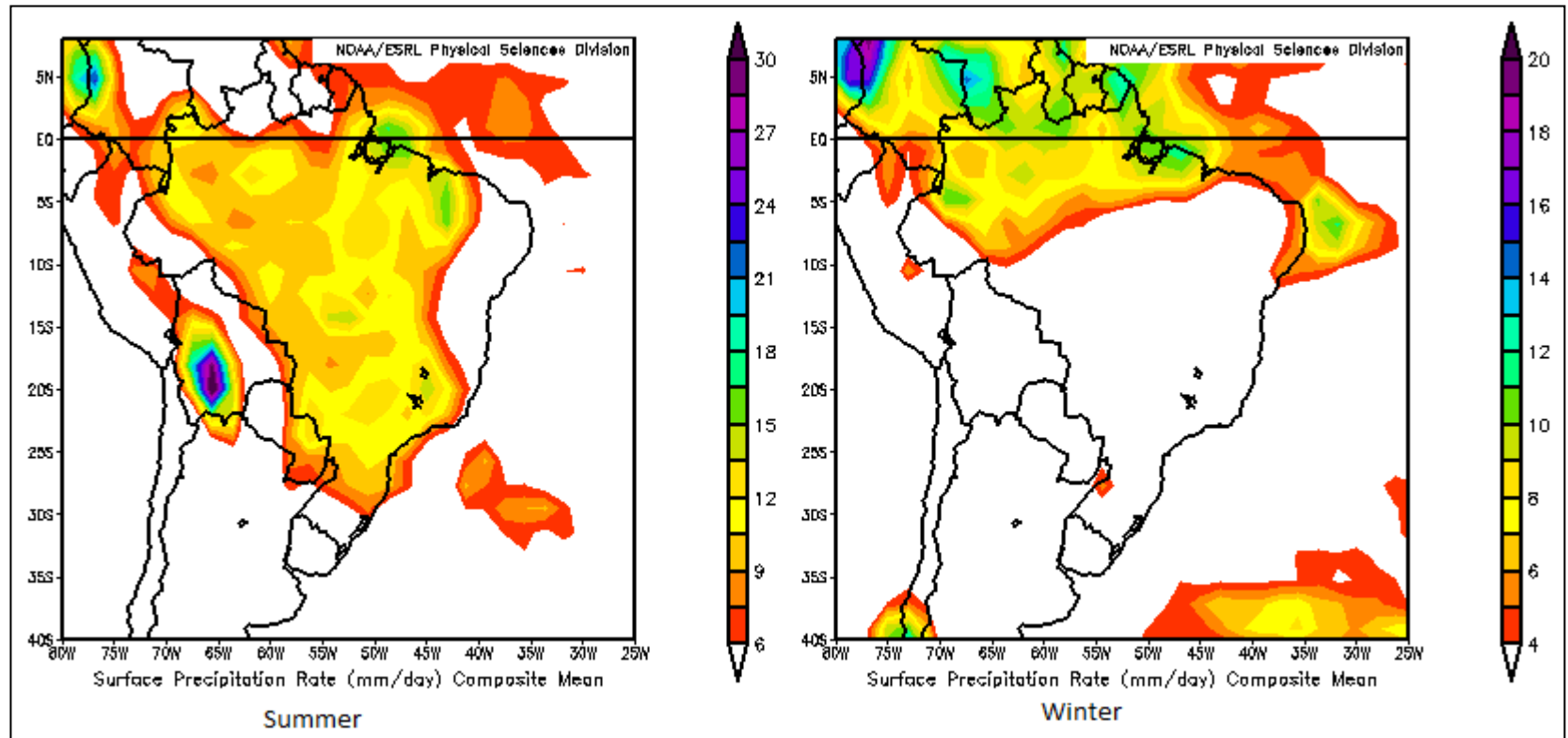


# Introduction

- South America is located over different latitudes, subjected to different atmospheric systems. Consequence: diversity of climates.
- Different precipitation patterns over the continent and also over Brazil.
- Wet season: Summer
  - Dec - Mar
- Dry season: Winter
  - May - Aug

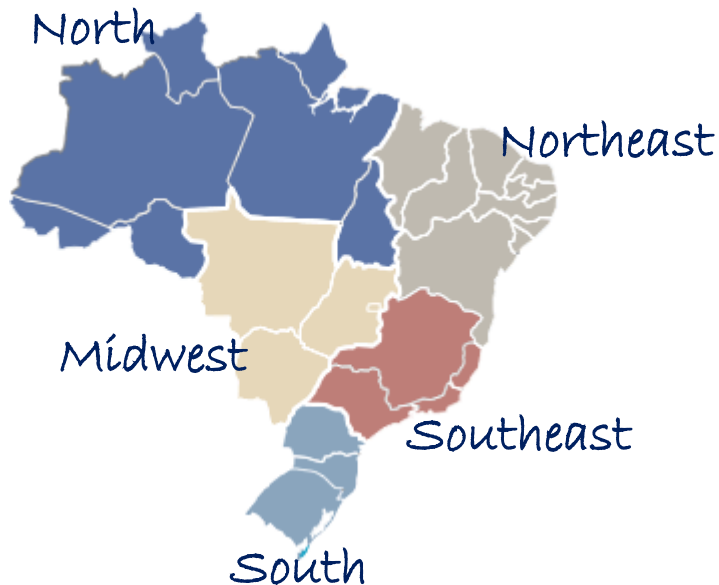


# General view



Precipitation mean for summer (left) and winter (right) from 2000-2011

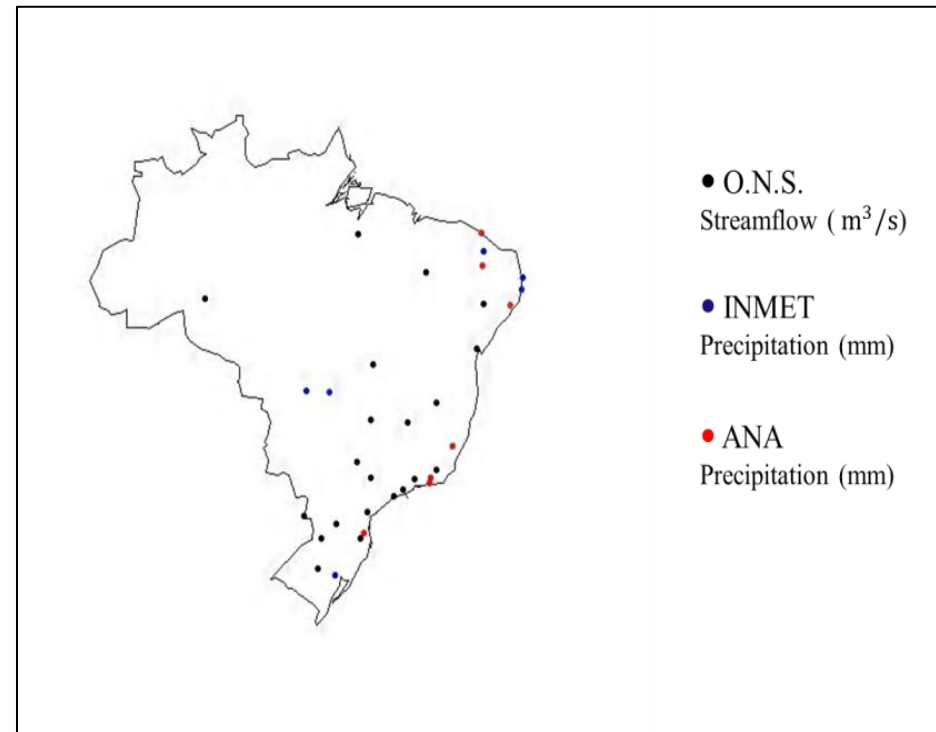
# Regions of Analysis



- Regions subjected to different atmospheric systems present different precipitation patterns during the year.
- Regions affected mainly by
  - Intertropical Convergence Zone (ITCZ)
  - South Atlantic Convergence Zone (SACZ)
  - South Atlantic Subtropical Anticyclone
  - Frontal Systems and Sea breeze (along the coast)
  - Mesoscale Convection Complexes (MCCs)
  - Trade Winds
  - Cyclonic Vortices at High Levels (CVHL)
  - Low Level Jets (LLJ)

# Data

- Flood Events from:
  - DFO
- Stations from:
  - O.N.S.
  - INMET
  - ANA
- Analysis made during the 1979-2010 period
- Considered an event if higher than the DFO event and the 0.99 percentile
- 383 events determined



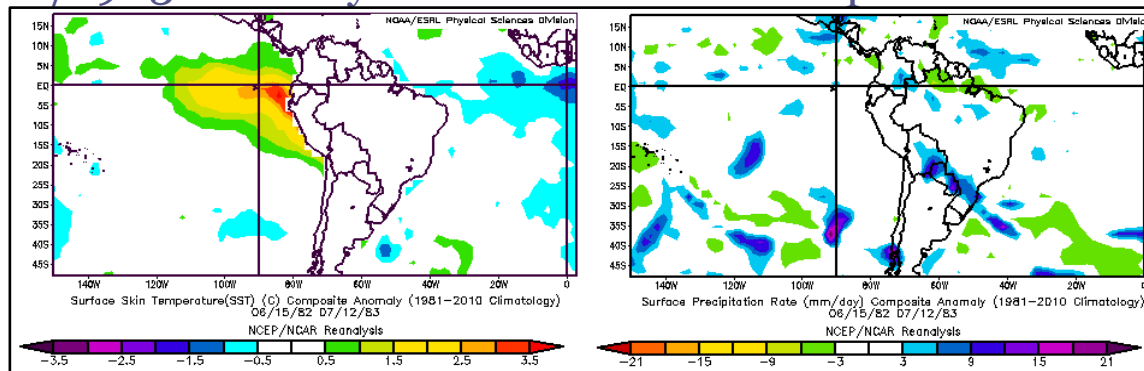
Stations considered in the study

# Extreme Events Analysed

Season	Date	Region	Station	Source
Summer	03/feb/79	Southeast	Irapé	O.N.S.
	12/mar/79	Northeast	Itaparica	O.N.S.
	20/feb/80	Midwest	Serra da Mesa	O.N.S.
	03/mar/80	North	Tucuruí	O.N.S.
	17/mar/80	Midwest	Poxoreo	INMET
	13/dec/81	Southeast	Itamarati	ANA
	06/feb/83	Southeast	Promissão	O.N.S.
	02/feb/85	Southeast	Ilha dos Pombos	O.N.S.
	08/mar/87	Midwest	Aragarças	INMET
	24/dec/89	Northeast	Pedra do Cavalo	O.N.S.
	23/jan/92	Northeast	Açude Bonito	ANA
	10/jan/97	Southeast	Três Marias	O.N.S.
	25/dec/97	South	Triunfo	INMET
	18/jan/98	Southeast	Laranja da Terra	ANA
	20/dec/01	Midwest	Poxoreo	INMET
	23/jan/03	South	Triunfo	INMET
	07/mar/04	Northeast	Fortaleza	ANA
	05/jan/07	Southeast	Ilha dos Pombos	O.N.S.
04/jan/10	South	Dona Francisca	O.N.S.	
05/jan/10	Southeast	Funil	O.N.S.	
Winter	15/jun/82	South	Triunfo	INMET
	12/jul/83	South	Salto Pilão	O.N.S.
	08/aug/84	South	Foz do Chapecó	O.N.S.

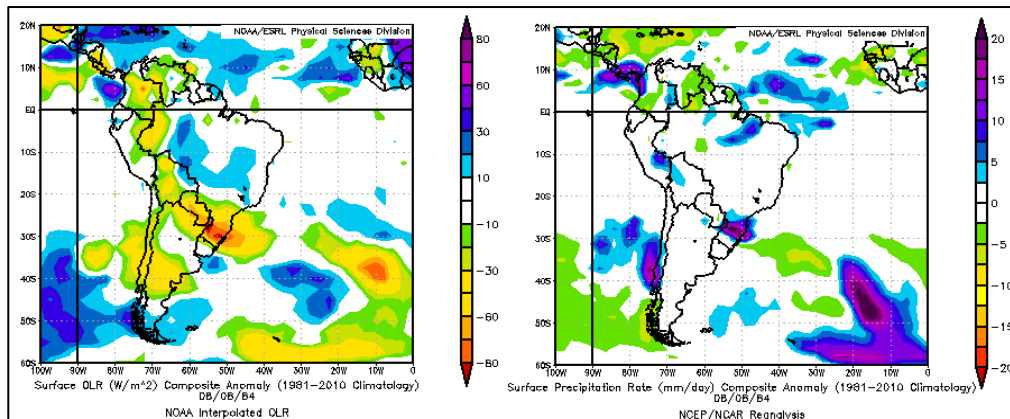
# Results

- Winter Events
  - South region
    - 1982 /1983: Directly related with El Nino episode



06/15/82 and 07/12/83 for SST (left) and precipitation rate (right)

- 1984: Cyclone from the Pacific Ocean + SASA

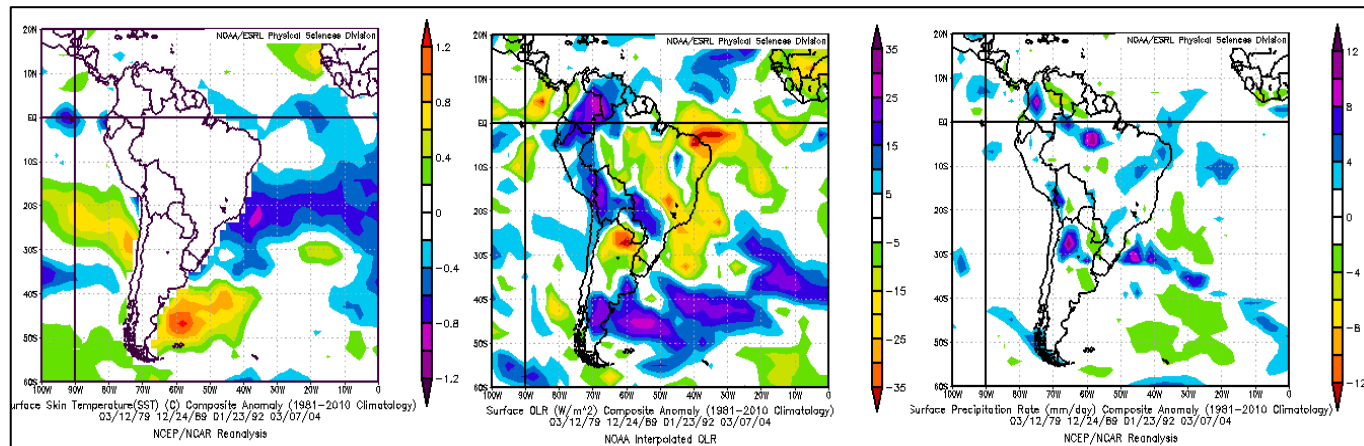


08/08/1984 for OLR (left) and precipitation rate (right).



# Results

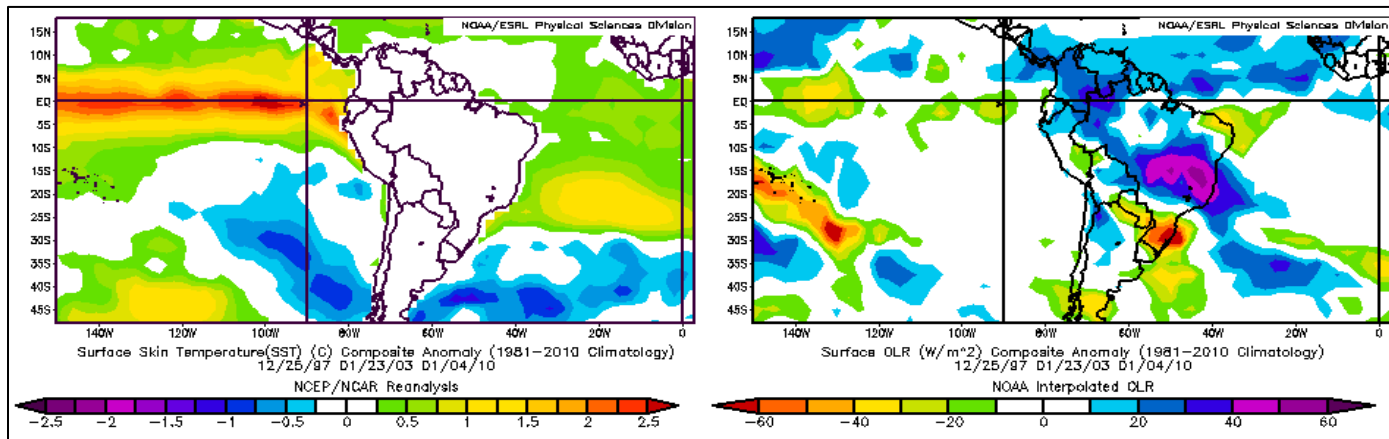
- Summer events
  - Midwest and North region
    - Related with MJO negative or turning into negative
      - Previous studies claims about the existence of this relation
    - ITCZ and trade winds
  - Northeast Region
    - SST dipole between North/South in South Atlantic
    - CVHL and ITCZ



03/12/1979, 12/24/1989, 01/23/1992 and 03/07/2004 for SST (left), OLR (middle) and precipitation rate (right)

# Results

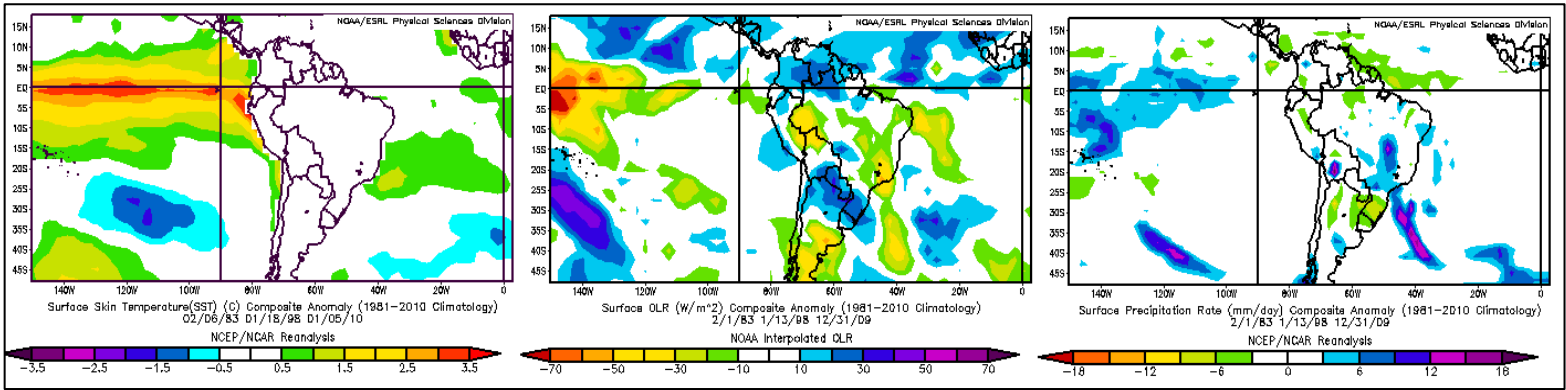
- South region
  - El Nino episodes
  - South/Northeast dipole: Floods/droughts



12/25/1997, 01/23/2003 and 01/04/2010 for SST (left) and OLR (right)

# Results

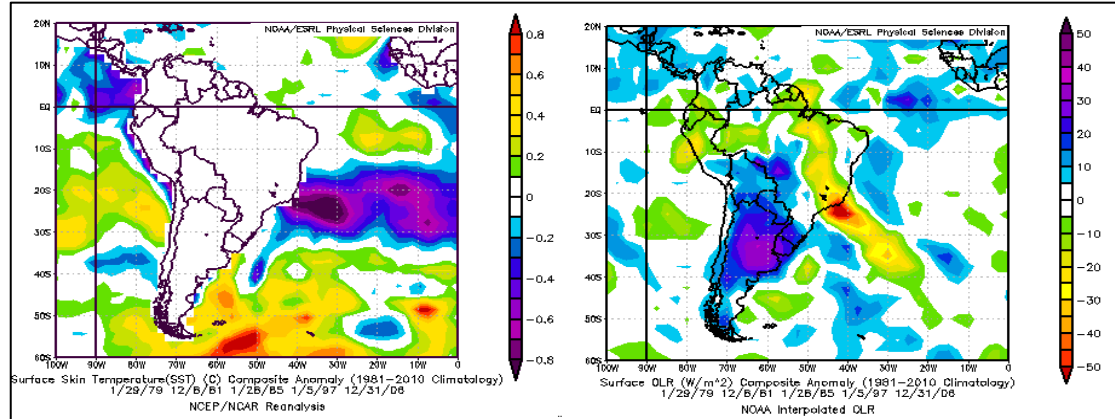
- Southeast region
  - El Nino episodes – winds favored->higher cloudiness->SACZ



02/06/1983, 01/18/1998 and 01/05/2010 for SST (left), OLR (middle) and precipitation rate (right)

- Negative SST anomalies
- SACZ

• Same features, but these are not El Niño years.



02/03/1979, 12/13/1981, 02/02/1985, 01/10/1997 and 01/05/2007 for SST (left) and for OLR (right), both for 5 days prior to the events

# Conclusions

- In general, the causes of the events could be grouped by region, which presented similarities.
- The events had different causes depending on the season and on the region.
- Most of the events, when not related with anomalies as El Nino episodes, are nothing but an intensification of usual atmospheric systems.
- New question: causes for this intensification.



**Thank you!**