GROUND'2004
International Conference on Grounding and Earthing
&
1st LPE
International Conference on Lightning Physics and Effects

# CONTRAST IN THE ATMOSPHERIC DISCHARGES OVER LAND AND OCEAN AT RIO GRANDE DO SUL – BRAZIL

Vandoir Bourscheidt[1]; Fábio Marcelo Breunig[1]; João Paulo Minussi[1]; Nelson Jorge Schuch[1]; Osmar Pinto Junior[2]

[1]Southern Regional Space Research Center –
Federal University of Santa Maria
P.O. Box: 5021-97110-970 – Santa Maria, RS – Brazil.
[2]National Institute for Space Research – INPE/MCT
Av. dos Astronautas, 1.758 – P.O. 12227-010 –
São José dos Campos, SP – Brazil.

# CONTRAST IN THE ATMOSPHERIC DISCHARGES OVER LAND AND OCEAN AT RIO GRANDE DO SUL – BRAZIL

## INTRODUTION

- By LIS and OTD data was possible to see a great difference on lightning over land and ocean;
- The contrast between land and ocean can be seen in many phenomena;
- Lightning is one of this phenomena;
- Several factors and elements act simultaneously at earth's surface, such as by aerosol and thermal hypothesis;
- Other factor is the height variations, specially on the study area – the Rio Grande do Sul;
- Many researches believe that humidity have great importance in this studies;

# CONTRAST IN THE ATMOSPHERIC DISCHARGES OVER LAND AND OCEAN AT RIO GRANDE DO SUL – BRAZIL

## OBJECTIVES

- Identify the lightning contrast between land and ocean at Rio Grande do Sul;
- Understand the different elements and factors that act in the State;
- Analyze the importance of the relief in this phenomena, specially on study area;

# CONTRAST IN THE ATMOSPHERIC DISCHARGES OVER LAND AND OCEAN AT RIO GRANDE DO SUL – BRAZIL

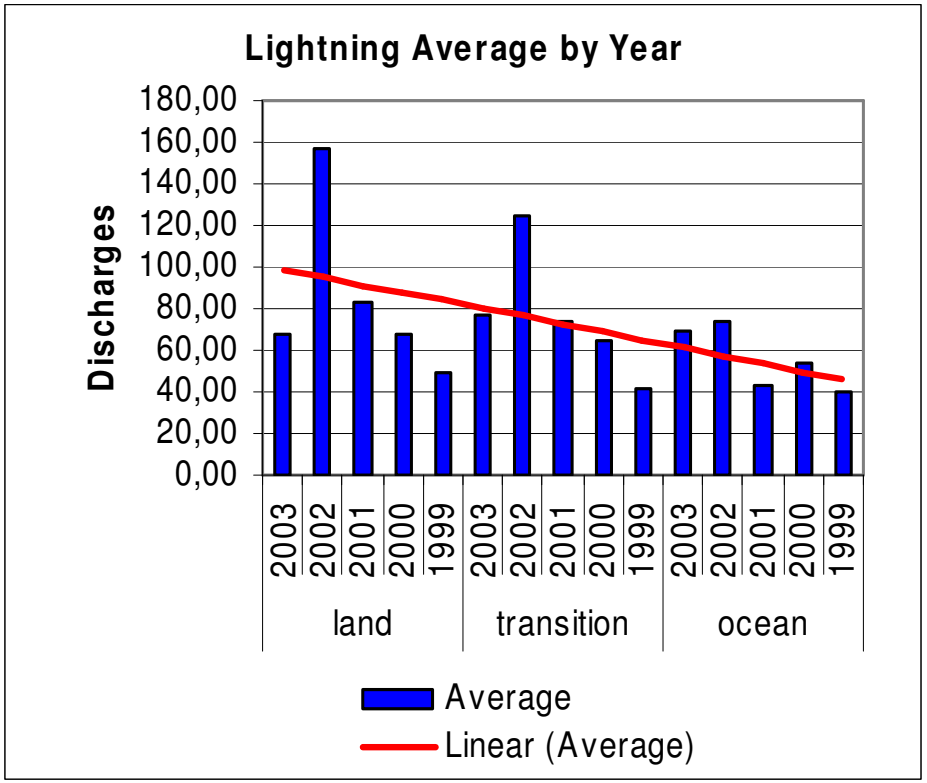
## METODOLOGY

- Data were selected by seasons since December 1998 to November 2003 at different latitude and longitude;
- The squares were obtained in sequence, such as -28.000 to -33.500 South latitude, with 0.5° interval; and along the seaboard, such as -54.000 to -8.000 West longitude, also with 0.5° interval ;
- Maps were elaborated to explain total lightning spacial variations, on 1998/1999 summer to 2003 spring interval.

# CONTRAST IN THE ATMOSPHERIC DISCHARGES OVER LAND AND OCEAN AT RIO GRANDE DO SUL – BRAZIL

## RESULTS

The results shows considerable lightning contrast between land and ocean, as it can be seen in Figure 1.



# CONTRAST IN THE ATMOSPHERIC DISCHARGES OVER LAND AND OCEAN AT RIO GRANDE DO SUL – BRAZIL

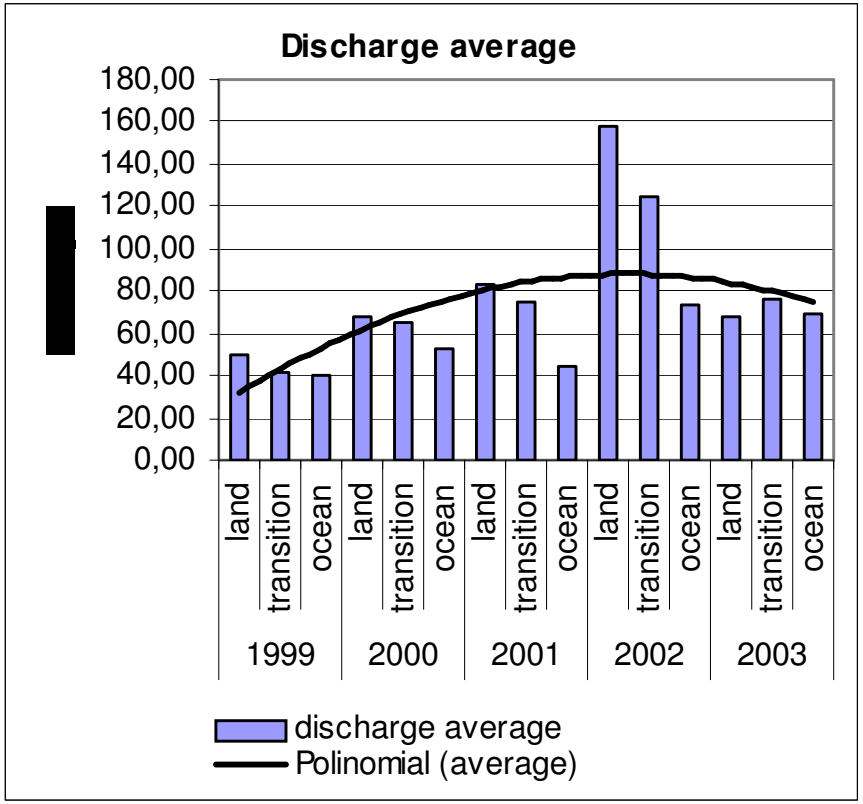
## RESULTS

- It is possible to identify a great lightning variation between land and ocean, by a tendency line analyze;
- It is possible still to see a great lightning increase in 2002 in three longitudes;
- During the five years analyzed, the greater activity was in 2002 followed by 2001 and it seems related to local meteorological characteristics (Figure 2).

# CONTRAST IN THE ATMOSPHERIC DISCHARGES OVER LAND AND OCEAN AT RIO GRANDE DO SUL – BRAZIL

## RESULTS

In five years, only 2003 have more lightning over ocean than land, and it seems to be associated with local synoptic characteristics. Among these synoptic characteristics, cyclogenesis have great importance on total discharges over ocean, specially by extratropical cyclones that happen [3].



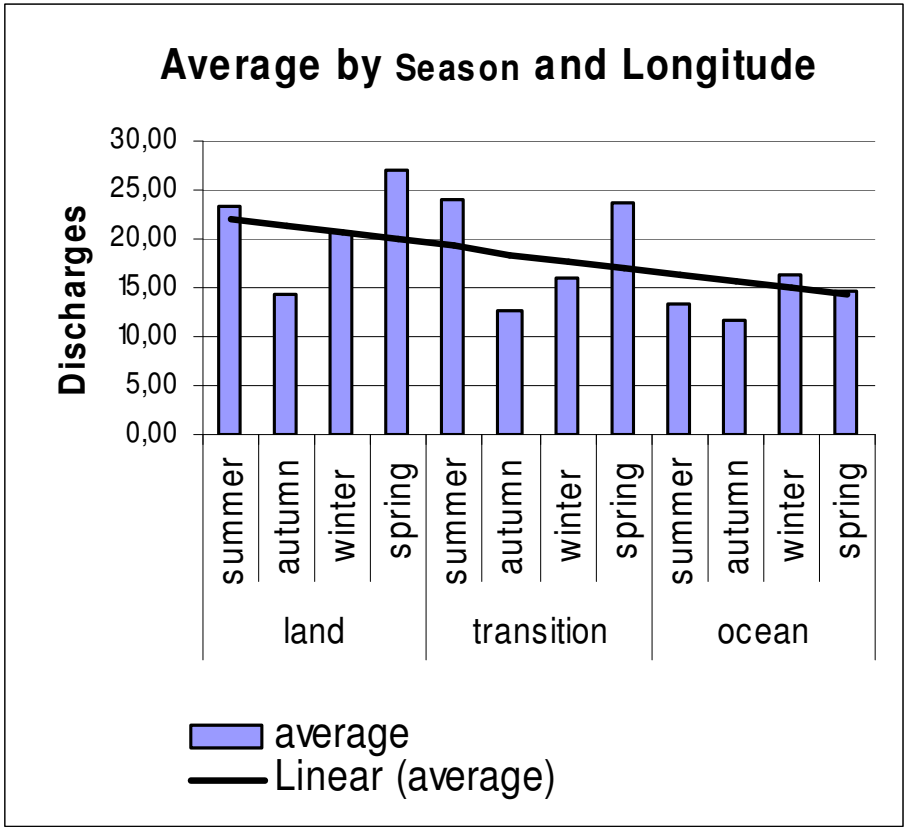
# CONTRAST IN THE ATMOSPHERIC DISCHARGES OVER LAND AND OCEAN AT RIO GRANDE DO SUL – BRAZIL

RESULTS

Figure 3 shows each season lightning variation, with a greater variations in summer and spring seasons, by larger heating on middle latitude during this period.

There is still a great occurrence on winter, which is associated with local frontogenesis and cyclogenesis.

In autumn the lightning occurrence is reduced, like a middle period between Summer Instabilities and Frontogenesis.

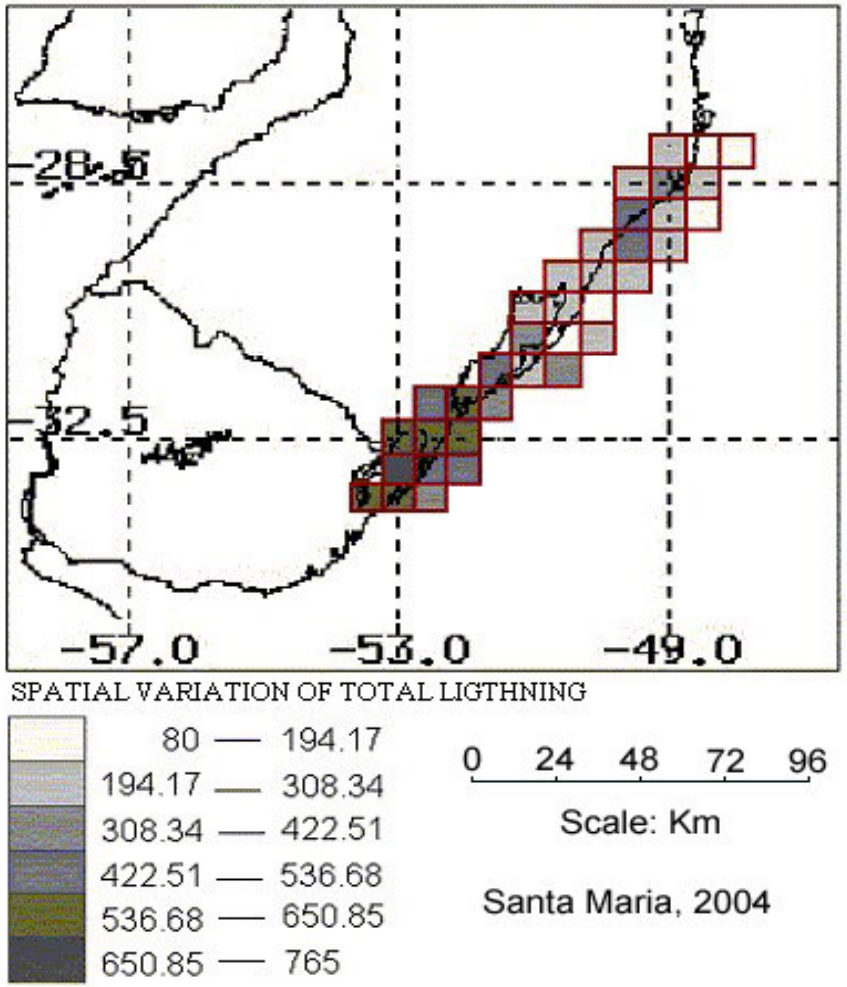


# CONTRAST IN THE ATMOSPHERIC DISCHARGES OVER LAND AND OCEAN AT RIO GRANDE DO SUL – BRAZIL

## RESULTS

Lightning maps indicated that most activity is located specially in Southern to middle State coast region, where it's beginning to decrease, with intermediary variations.

Considering the latitude, lightning should increase, but it was not observed, possibly conditioned by northern State sierra.



# CONTRAST IN THE ATMOSPHERIC DISCHARGES OVER LAND AND OCEAN AT RIO GRANDE DO SUL – BRAZIL

## RESULTS

- During all seasons the total lightning follows the general region climatic and temporal characteristics;
- During summer lightning are more disperse and regular along the coast, following the ocean and land.;
- In autumn there is less lightning and a smaller concentration on State southern region, associated with South Pacific frontogenesis;
- During the winter there is a total lightning increase, due to local cyclogenesis and frontogenesis, which is very intense in this region;
- In spring there is a considerable lightning increase on coast region, but still exist an elevated discharge amount associated to local meteorological characteristics;
- In spring the greatest number of discharges during all period occurred;

# CONTRAST IN THE ATMOSPHERIC DISCHARGES OVER LAND AND OCEAN AT RIO GRANDE DO SUL – BRAZIL

## CONCLUSIONS

- Seasonal meteorological variations have considerable influence on total lightning, specially by cyclogenesis and frontogenesis at Rio Grande do Sul, but don't have many effects on spatial variation between land and ocean;
- Many other factors are capable to determinate lightning activity in the region of study, like height variations, temperature, humidity, solid particles and aerosol present in the atmosphere;
- Even if is considerated smaller areas or regions, it is possible to identify a difference between land and ocean in total lightning;
- This analyze is very important to understand the atmospheric dynamics, interaction among surface and atmosphere, elements and factors that affect this dynamics.