SPSAS Climate Change

São Paulo School of Advanced Science on Climate Change: Scientific basis, adaptation, vulnerability and mitigation

CHANGES OF PRECIPITATION AMOUNTS AND EXTREMES AND THEIRS LINKS WITH HISTORICAL FLASH FLOODS IN SOUTHERN BRAZIL

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INTRODUCTION

Natural hazards related to extreme weather events have severely impacted Brazil in the last three decades (CEPED-UFSC, 2013; Ávila et al 2016.

In 2011 in Brazil, more than 510 natural disasters were caused by water-related, resulting in approximately 1100 deaths and affecting around 12.5 million people (Lorentz et al 2016).

In order to understand the daily extreme precipitation events and their link to flash floods in southeastern Brazil, this study….

This study is focused on analyzing the yearly and seasonal precipitation extremes using amount precipitation and climate extreme indices from 1978-2014

The connection between historical flash floods and climate indices is explored from 1991-2012. We focus on the sensitivity of mountainous regions, specifically in the Rio de Janeiro (RJMR) and Santa Catarina (SCMR) regions for Brazil .

METHODOLOGY

RESEARCH

1 **Inputs**
The Brazilian National Water Authority provided daily precipitation data (ANA; http://hidroweb.aneel.gov.br)

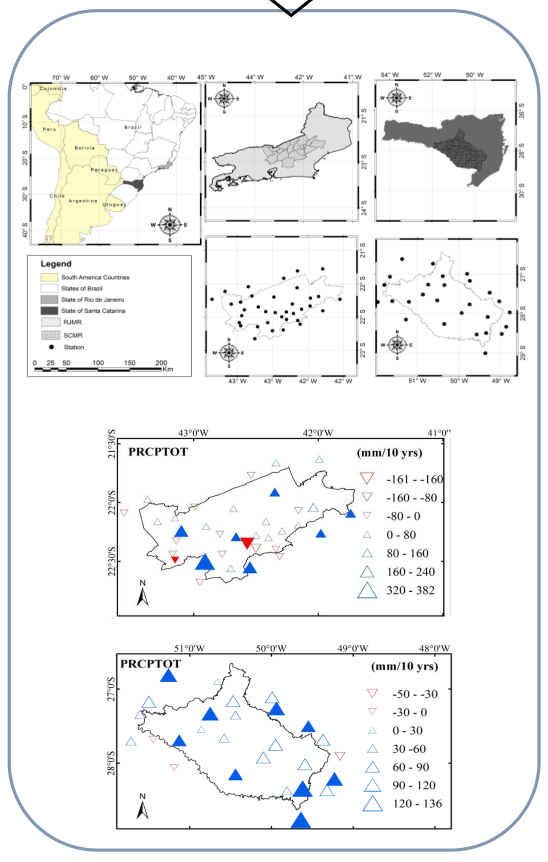
2 **Outputs:**
Identifies trends and key relationships between extreme precipitation indexes and flash floods that may be used in advanced warning systems.

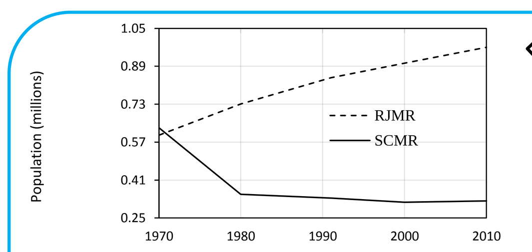
3 **Contributions**
Both regions displayed positive trends in the annual, seasonal and extreme Pr indices. Some indexes maybe useful indicators of natural hazard events for these regions.

Methods and Packages
RHtestsV3
RClimDex

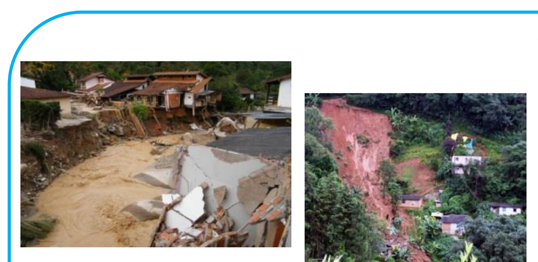
Precipitation Series
1. Seasonal precipitation: summer (DJF), autumn (MAM), winter (JJA), and spring (SON).
2. Series of the eight extreme precipitation indexes are selected.

Statistics methods applied
The M-K and Sen Slope estimator for trend analysis. Regional characteristics of extreme PR are also analyzed using PCA.





Population trends in the main municipalities over mountainous areas between 1970–2010.



Source: CEPED-UFSC *Source: G1-Globo*

Flash Floods and Mass Movements events on RJMR-Brazil in January 2011.

Eight extreme precipitation indexes are selected: **(1)** Precipitation (PRCPTOT), **(2)** Annual highest daily PR in 24 hours (RX1day), **(3)** Annual highest 5 consecutive daily PR (RX5day), **(4)** Annual PR due to very wet days when RR >95th of daily PR (R95), **(5)** Annual PR due to very wet days when RR >99th of daily PR (R99), **(6)** Wet days (NW), **(7)** Number of days with daily PR above 30mm (R30mm) , **(8)** Consecutive wet days (CDW).

RESULTS

Figure 1 shows the percentage of stations with positive, negative and stationary trends out of the total stations examined over the (a) RJMR and the (b)SCMR during 1978–2014.

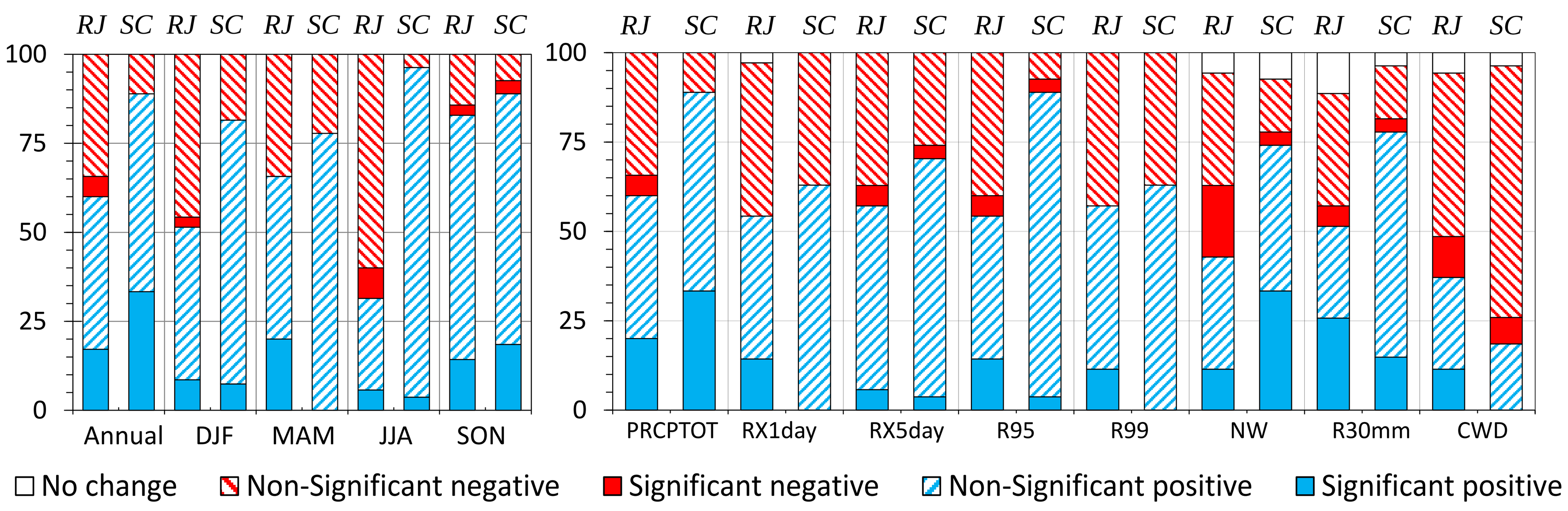


Figure 1. (a) Percentage of stations with positive, negative and stationary trends out of the total examined stations.

Pearson´s correlations coefficients between precipitation indices and flash floods between 1991-2012 in the RJMR and SCMR (figure 3).

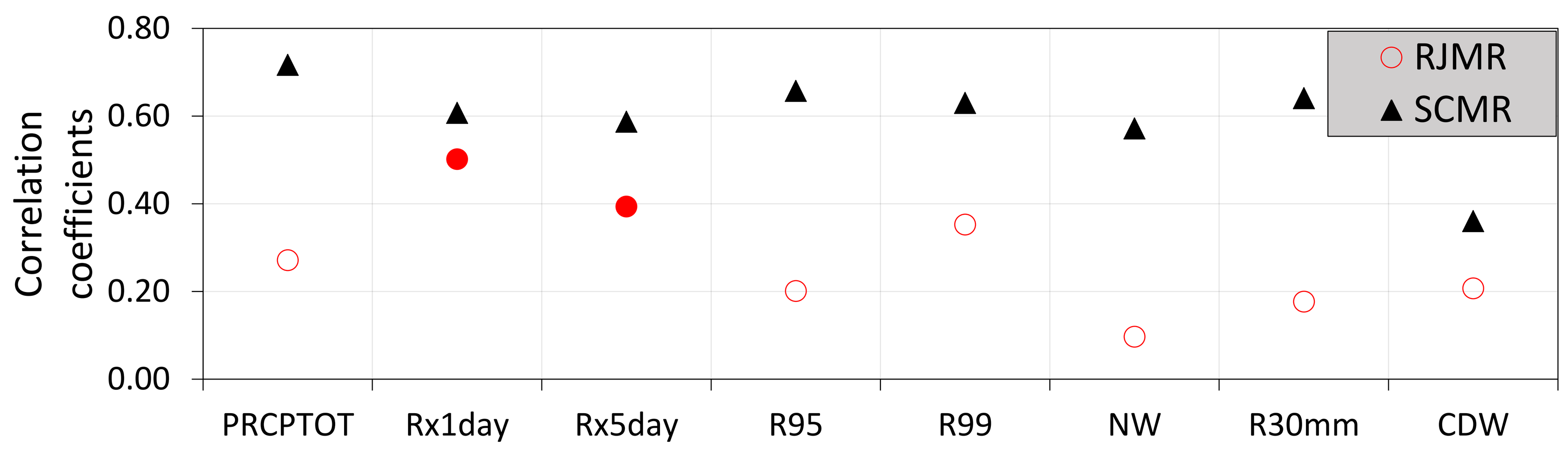


Figure 2. Pearson´s correlation coefficients between precipitation indices and flash floods. Saturated circles and triangles are statistically significant at 90% confidence level.

Based on the number of flash floods events, we conducted the principal component analysis (PCA) with focus on six precipitation extremes (without NW and CDW).

The first two components explained 91% of the total variance. The PC1 and PC2 explained 76-78% and 14-12% of the total variance over the RJMR and SCMR, respectively.

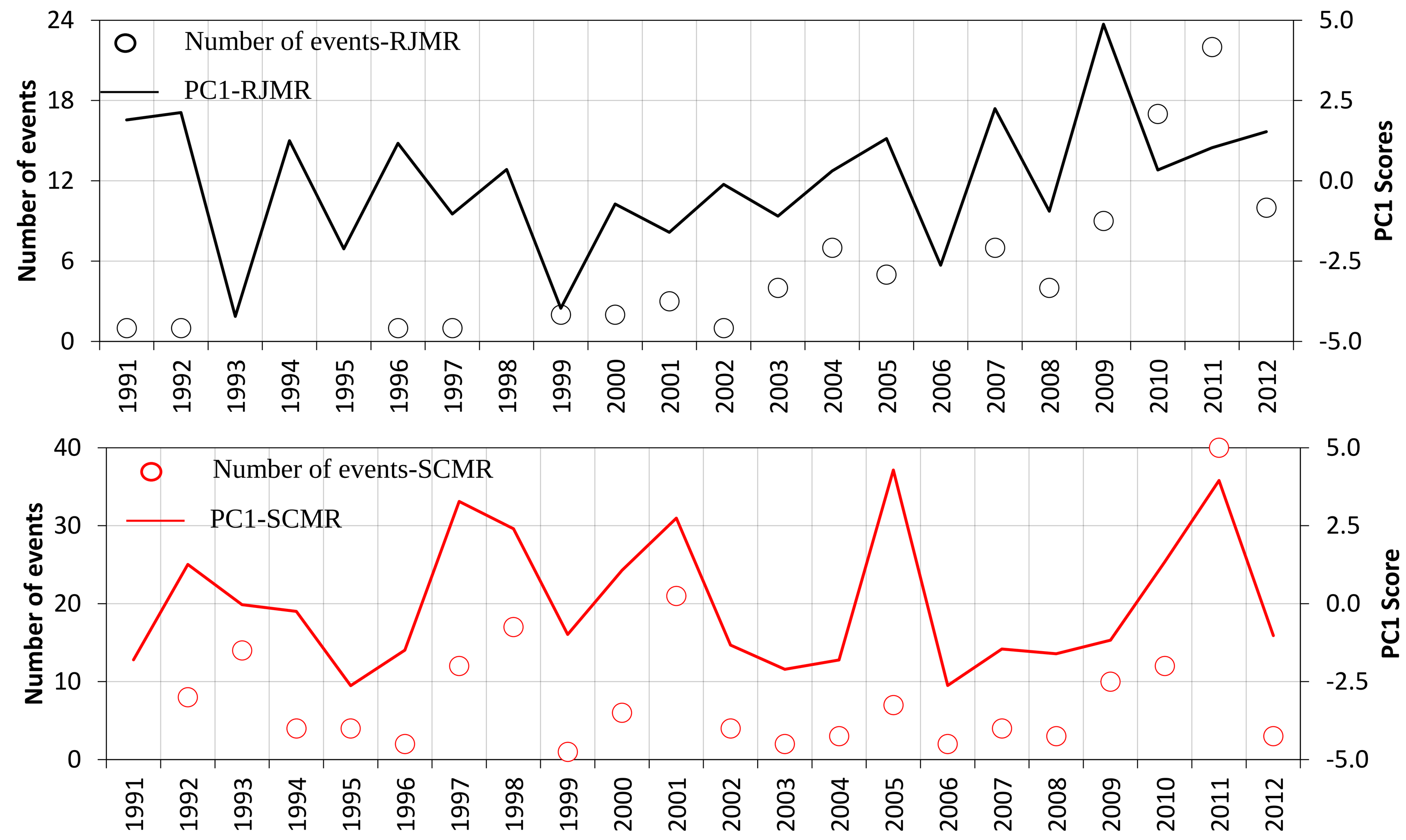


Figure 3. Long-term changes in the first principal component for the period 1991–2014

CONCLUSIONS

Results show positive annual and seasonal precipitation trends during all seasons except for the winter season in the RJMR

The majority of precipitation-related indices present a positive trend, especially in the extreme precipitation indices (PRCPTOT, RX1day, Rx5day, R95, R99 and R30mm).

Results shows that the intensity of precipitation is increasing in most recent years.

Higher values of RX1day/5day are currently associated with and are likely to lead to future severe flash floods, and these indices maybe useful indicators of natural hazard events

The PCA reveals that selected indices can be used as indicators of changes in flash floods conditions.

RECOMMENDATION FOR FUTURE RESEARCH

More methodological effort is required on how to capture the possible changes in trends precipitation and hydrological hazards, including further environmental and socioeconomic analysis could be useful to find more robust conclusions.

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FAPEMIG

C A P E S

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