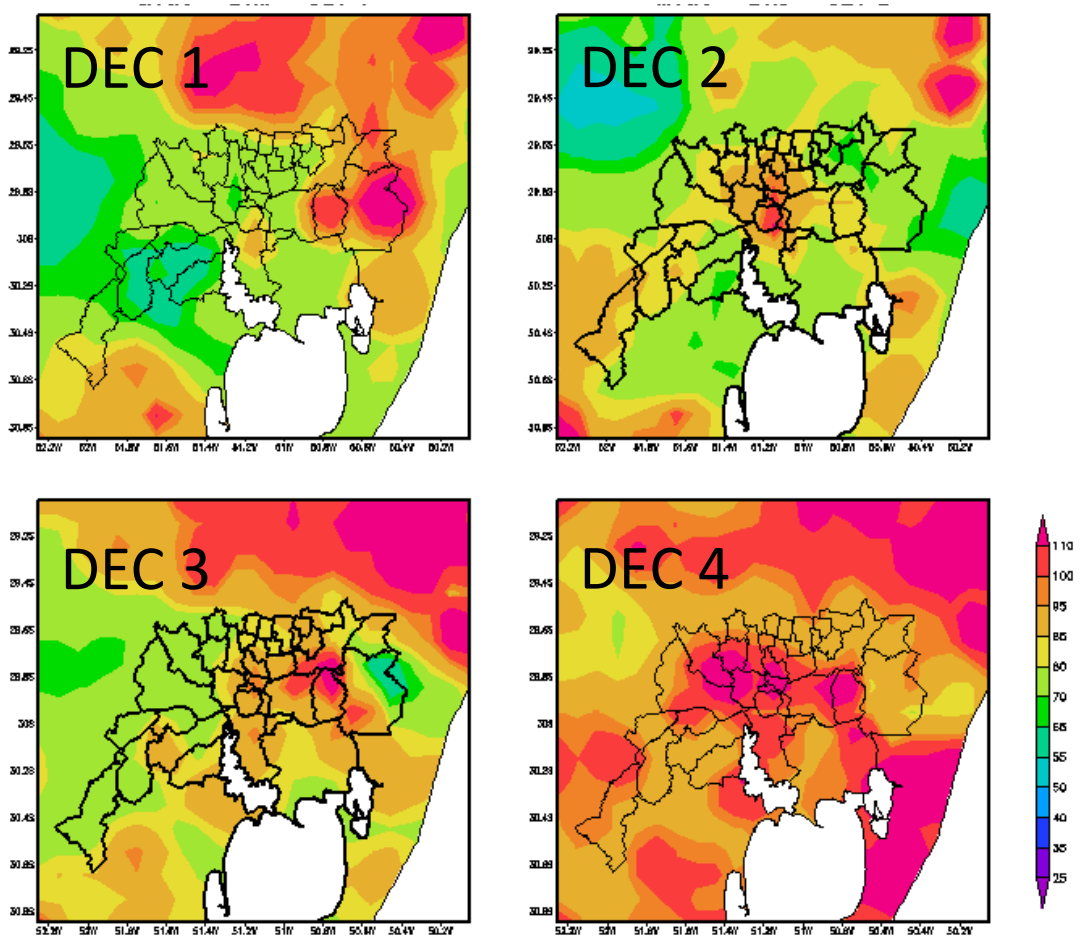
Variability and trends of intense precipitation in a metropolitan area in the southern Brazil

Daniel Allasia, **Ingrid Petry***, Raviel Basso, Rutineia Tassi, and Bruna Minetto

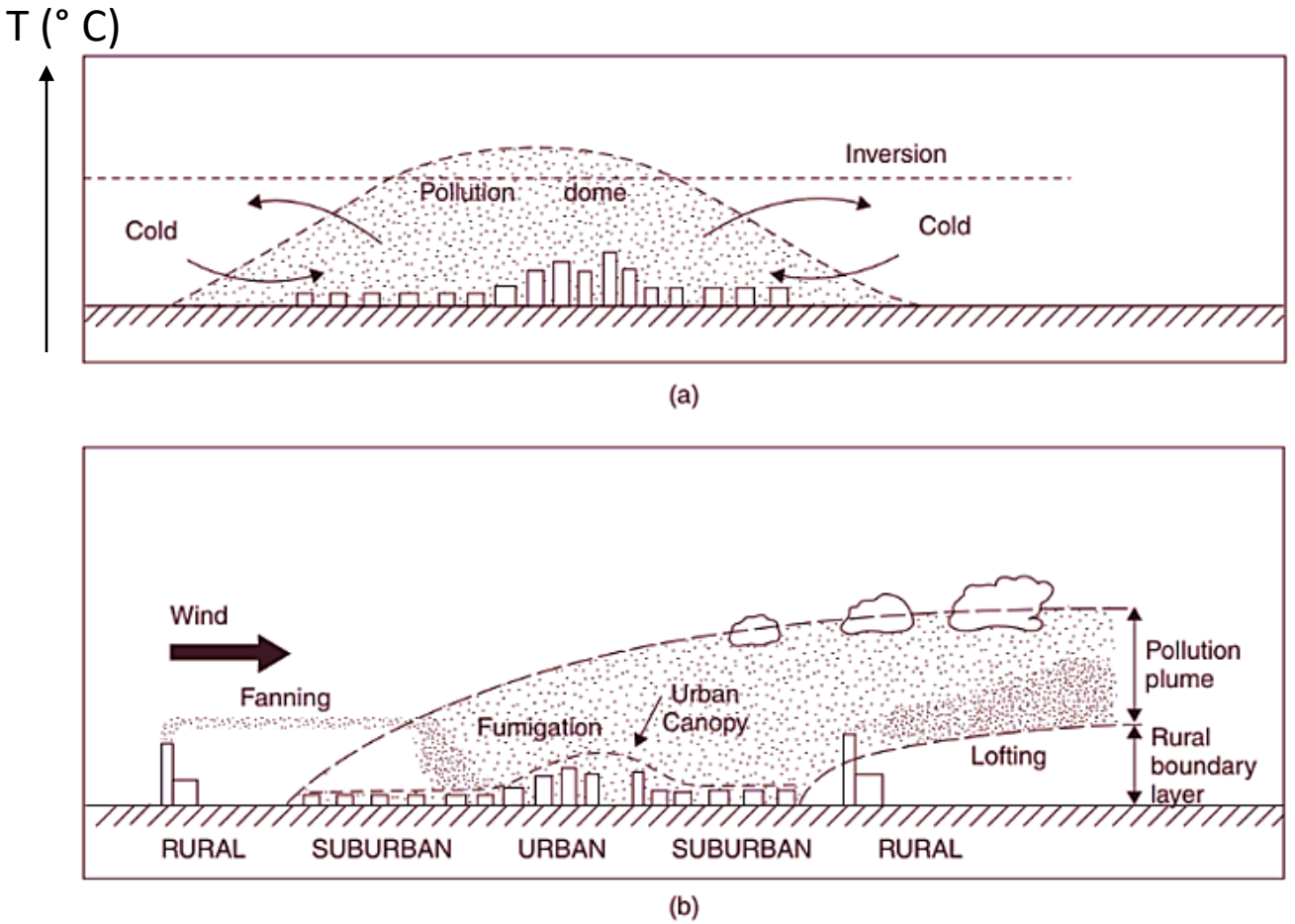
*ingridp8396@gmail.com

Average 24-hour maximum annual rainfall

Dec 1 – 1979 to 1988
Dec 2 – 1989 to 1998
Dec 2 – 1999 to 2008
Dec 3 – 2009 to 2016



With the increase in the global population**, urban centers are becoming more prominent, and their dynamic is now far from the natural**. The impact of urbanization on rainfall has been noticed since 1921 when **Horton observed that cities with more than 100,000 inhabitants created favorable conditions for convective precipitation**. Later, Huff and Changnon (1972) estimated an **increase of 6 to 15% on average rainfall during summer in these regions**



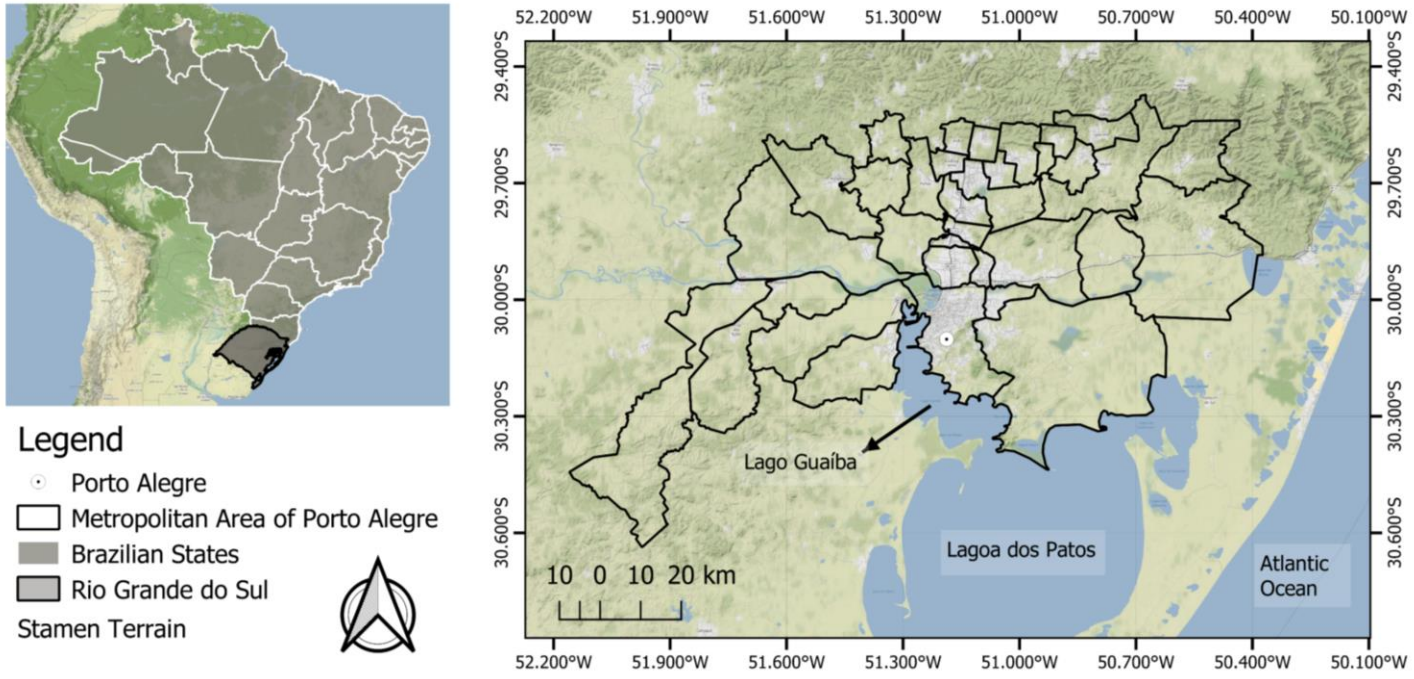
(After Oke, 1978;
Source: Barry and Chorley, 2003, p.355)

To understand these changes, high-resolution precipitation data is needed; however**, due to the lack of monitored data, especially on the largest cities in developing countries, new sources of information should be used.**

MSWEP is **a three hourly gridded precipitation dataset**, **with 0.1º spatial resolution** that combines data from gauges, satellite, and reanalysis-based data to provide precipitation estimates **over the entire globe** (Beck, 2019).

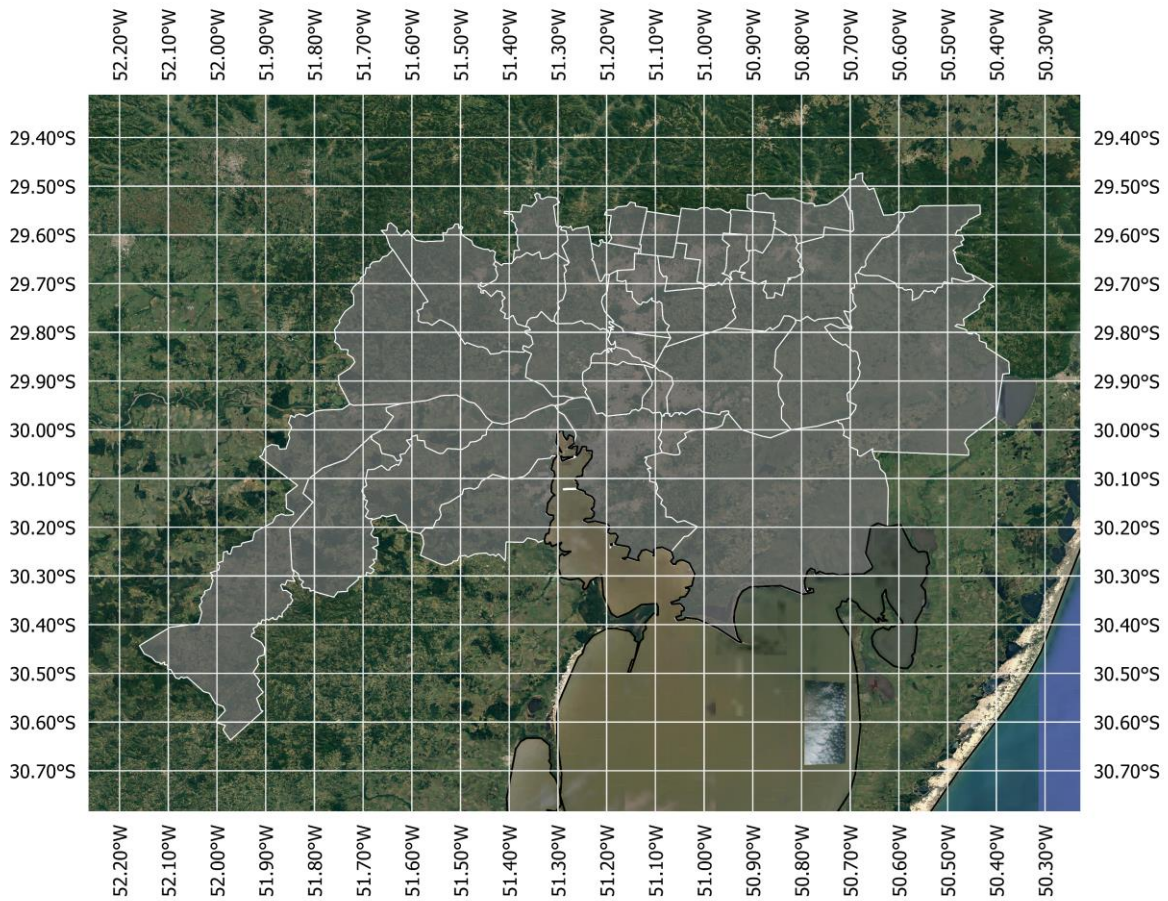
1. Objectives

MSWEP precipitation (Beck, 2017) was used in order to **observe the variability of intense precipitation over the Metropolitan Area of Porto Alegre** in Southern Brazil, where some previous studies indicated urban effects on precipitation.



2. Methodology

120 pixels over the area



Dec 1 – 1979 to 1988
Dec 2 – 1989 to 1998
Dec 2 – 1999 to 2008
Dec 3 – 2009 to 2016

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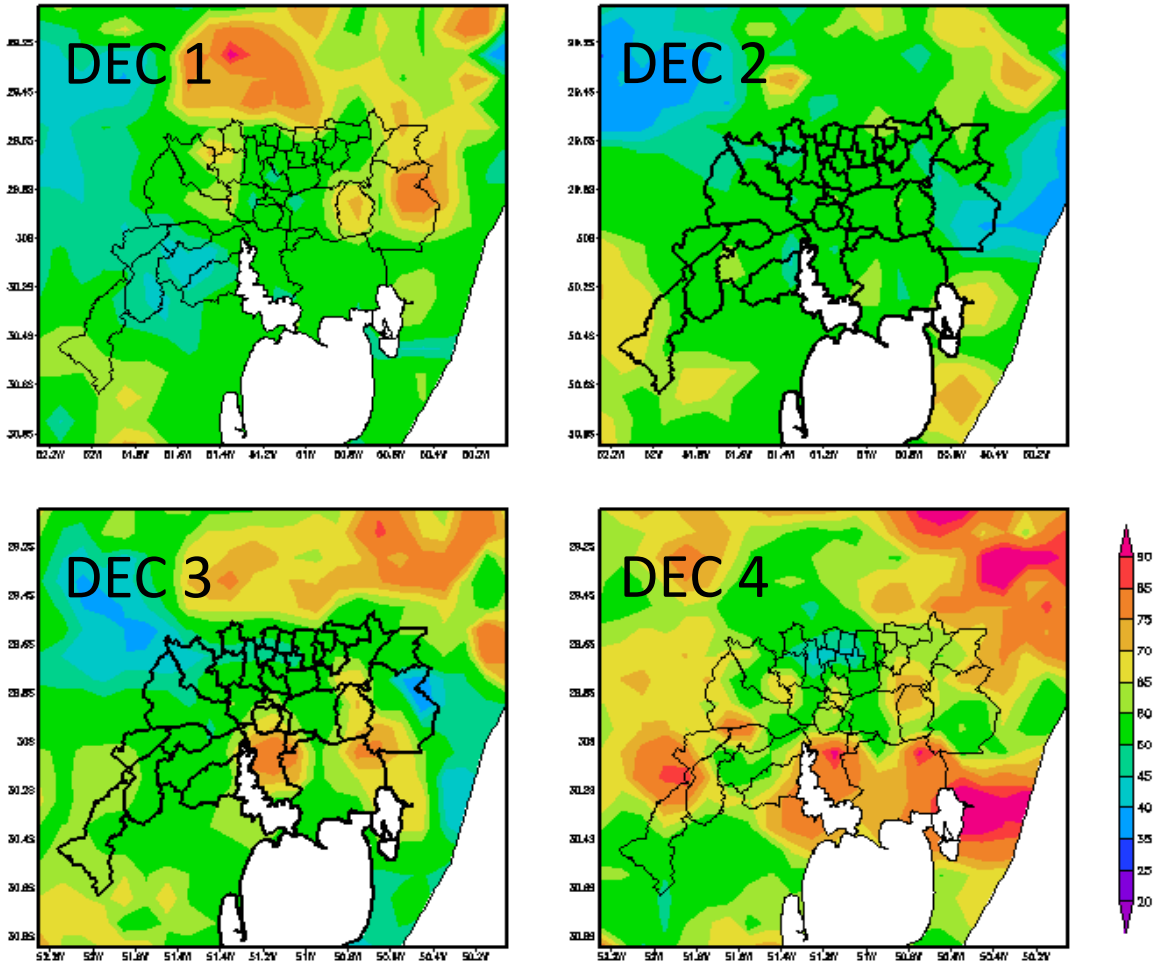
Maximum 24-hour anual precipitation time series

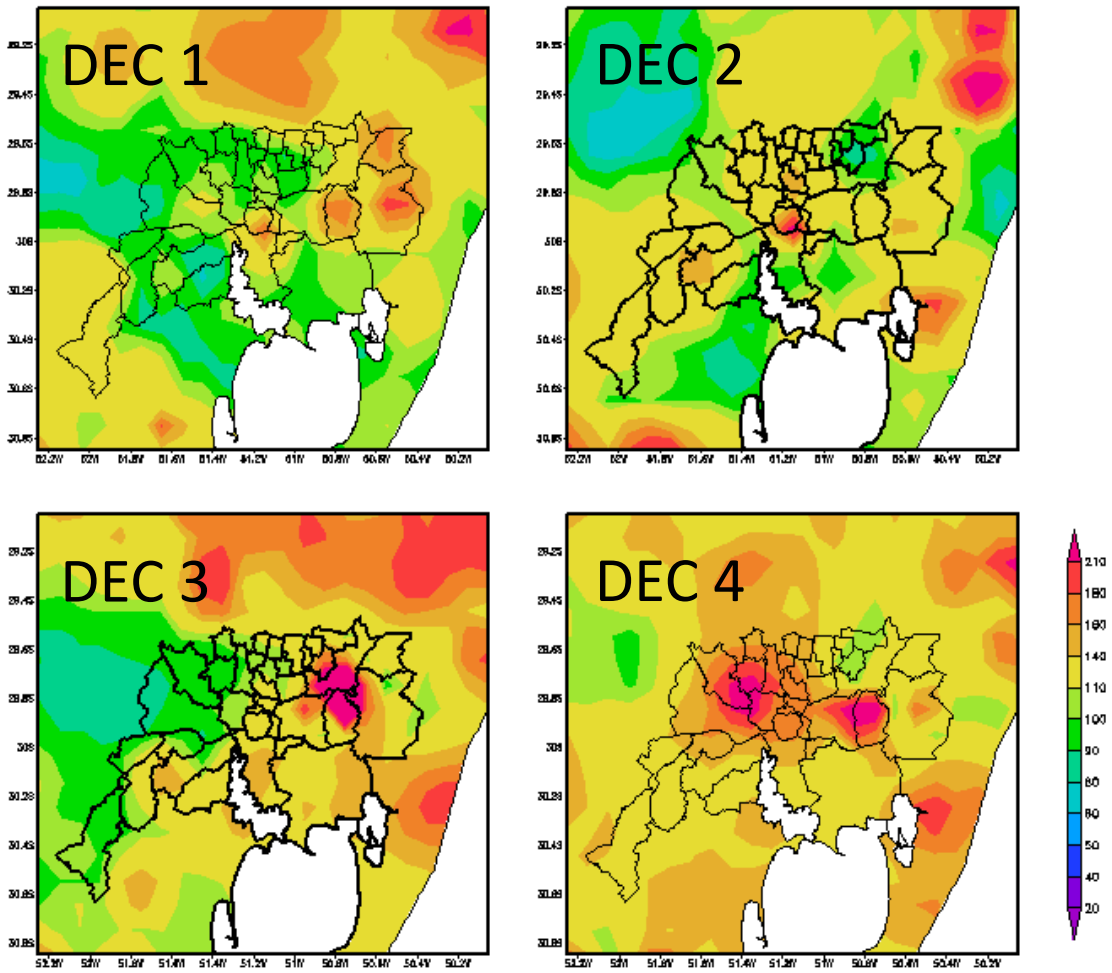
↓

Maximum
Minimum
Average
Standard Deviation
Amplitude

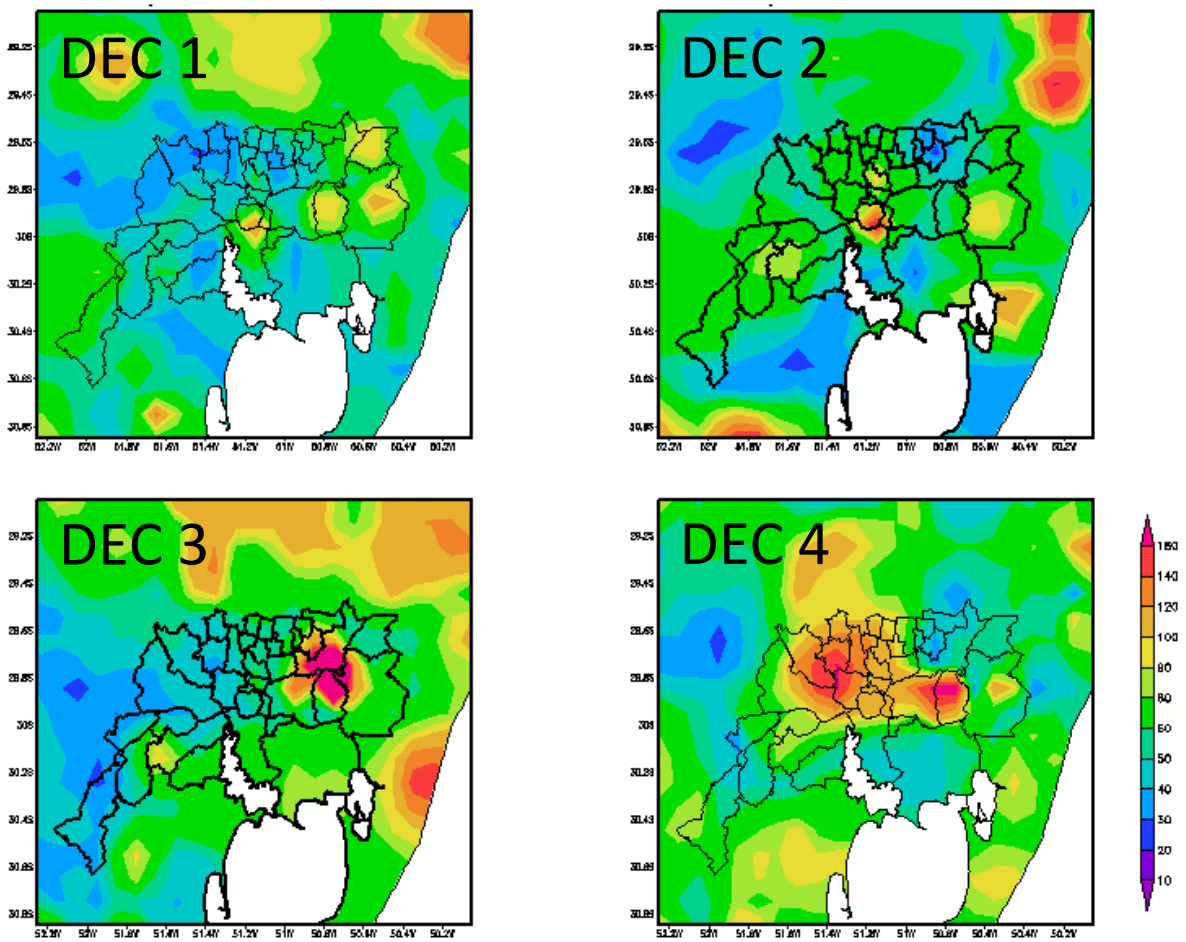
Minimum 24-hour maximum annual precipitation



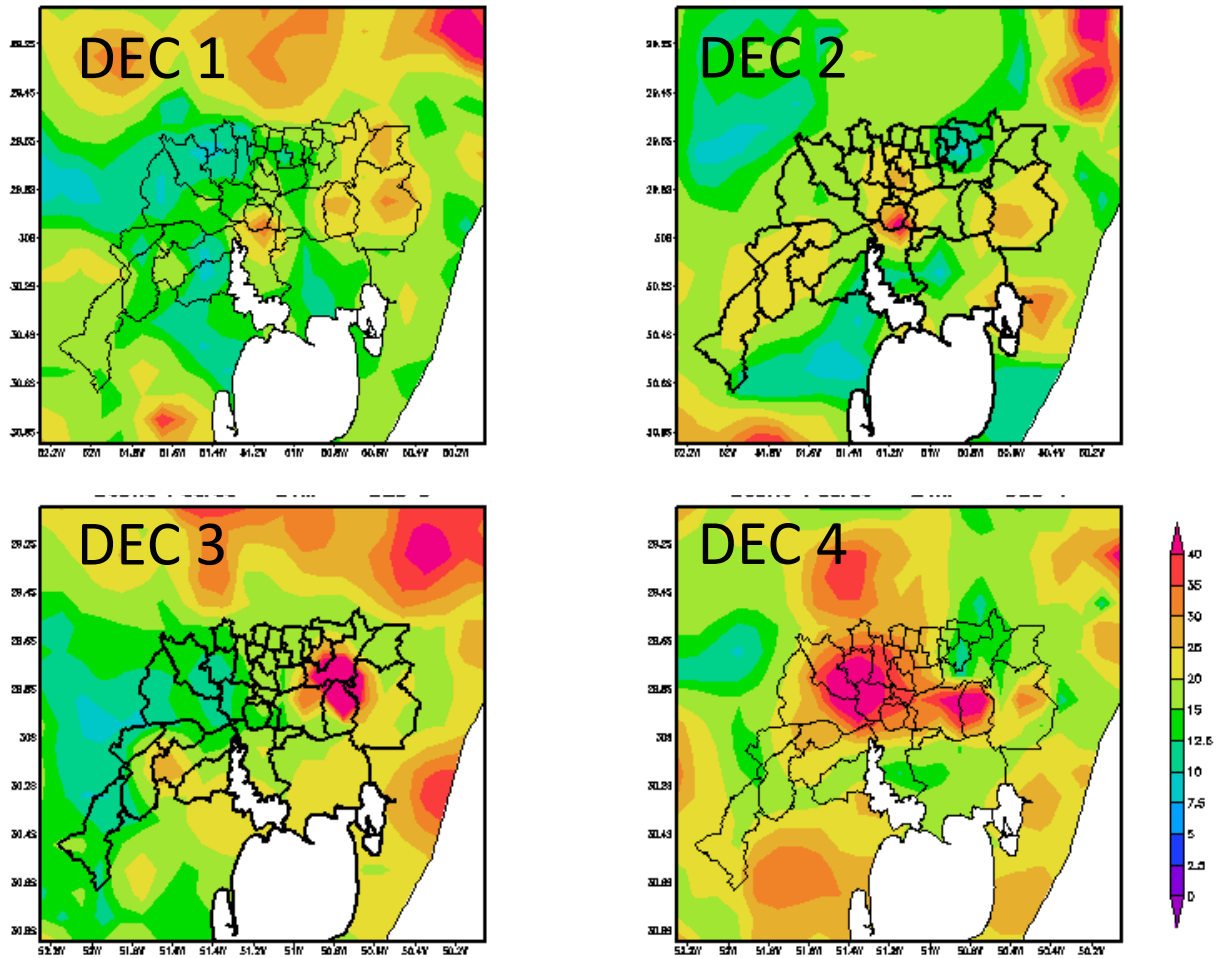
Maximum 24-hour maximum anual precipitation



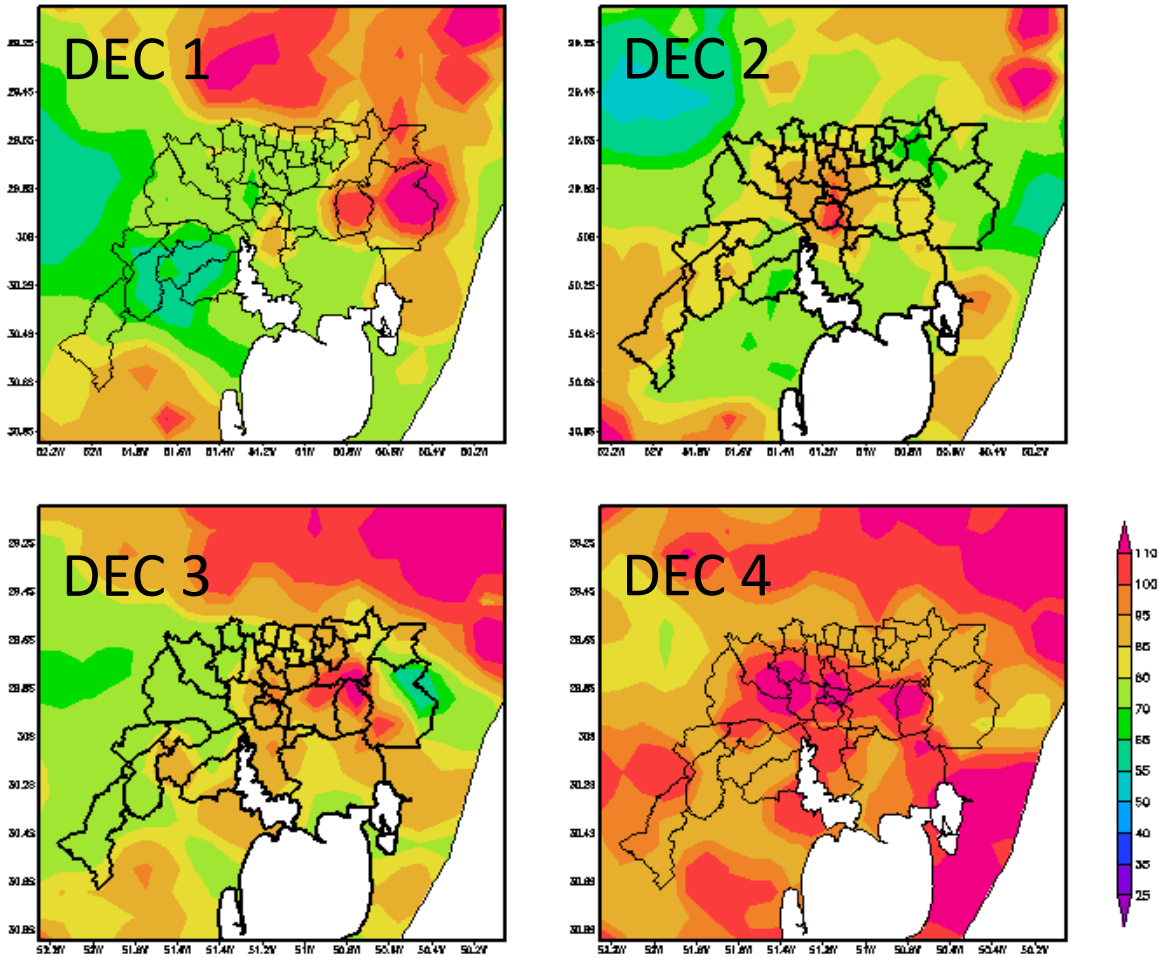
Amplitude 24-hour maximum annual rainfall



Standard Deviation 24-hour maximum annual rainfall

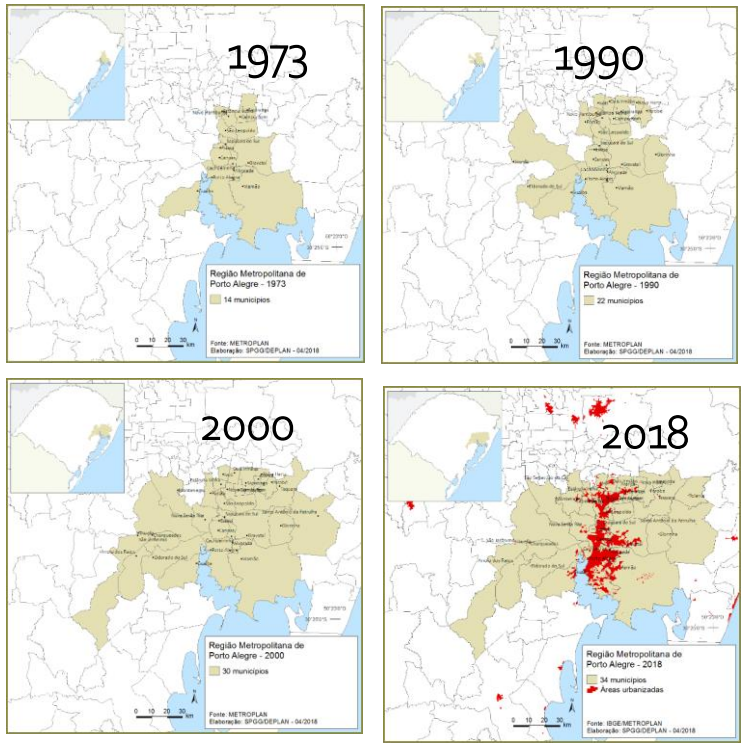


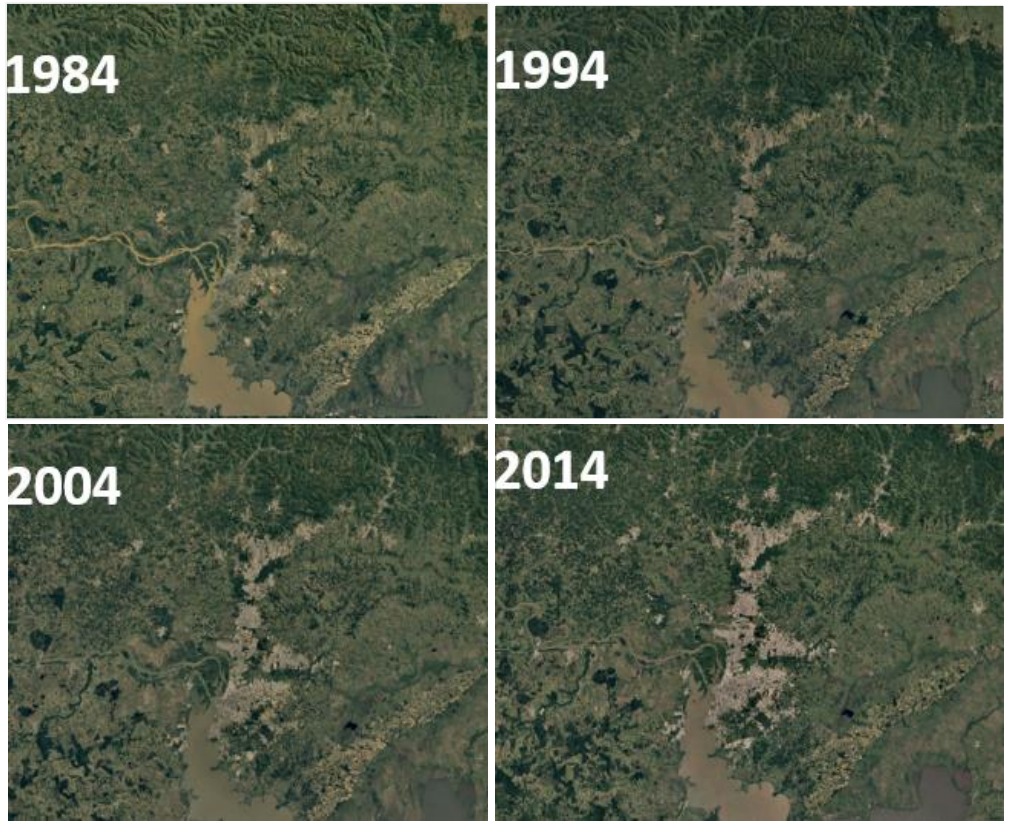
Average 24-hour maximum annual rainfall



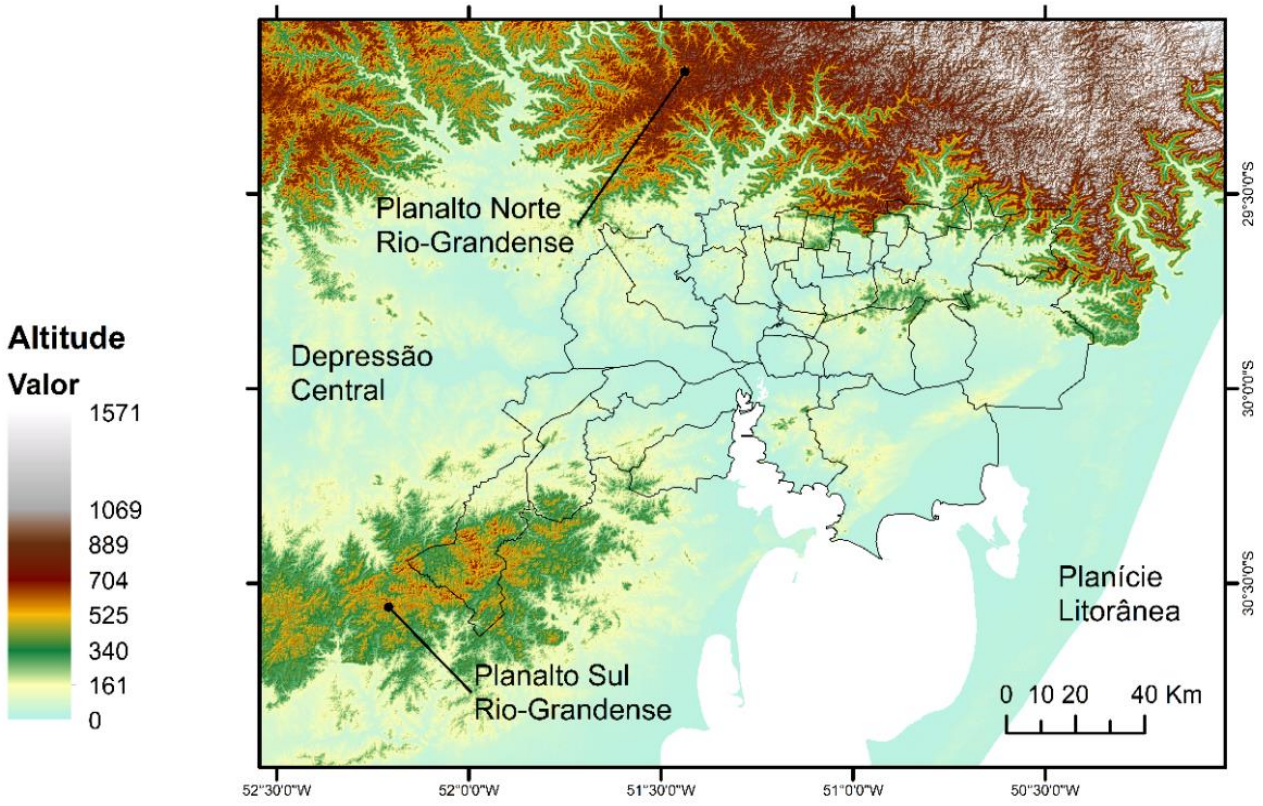
In all statistics applied, it was possible to observe an **increase in minimum, medium and maximum** in intense precipitation over the decades. **Heavy rainfall average increased from 80 to 130 mm in the most recent decade.**

This characteristics follows the increase of the urbanized area over time.





Besides that, the results show that the **spatial distribution patterns of intense precipitation are maintained over the decades**, with the highest precipitation in the North region, what is justified by its **mountainous relief.**



5. Conclusions

- With the study carried out it was possible to observe the influence of relief on precipitation, since the highest volumes remain at the highest altitudes, regardless of the decade.

- Variations in rainfall have been observed over time, and may be related to the effect of heat islands, however, due to the high variability that rainfall presents, several other factors may be influencing, such as large bodies of water, the increase in global temperature, atmospheric systems.

References

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