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On the anisotropy in the spatial distribution of the correlation of precipitation in Upper Magdalena river basin in Colombia

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Abstract

The spatial structure of correlation of monthly precipitation for a given region is analyzed estimating the maximum angular correlation, as a way for exploring the compliance of the Tobler´s First Law of Geography (FLG), which states: "everything is related to everything else, but near things are more related than distant things". The analysis was made for the Upper Magdalena river basin using monthly precipitation data of 30 weather stations for 1980-2008 period. After checking the quality of data and estimating missing data with ARIMA models, it was organized time series of monthly anomalies of precipitation. Spatial structure of correlation was analyzed for the multiyear monthly averages and monthly maximum values of precipitation, as well for monthly anomalies caused by El Niño and La Niña.

1. Background

The objective of this research is related to show the space-temporal configuration of regional precipitation and its relationships with processes at territory, such as: Hydrological Extremes generating Floodings and changes of available Water; in this context concepts of territory and processes are defined then how the interactions climate and society contributes to link space-temporal configuration of regional precipitaton with processes and finally the stages proposed for this research according with geographical context.

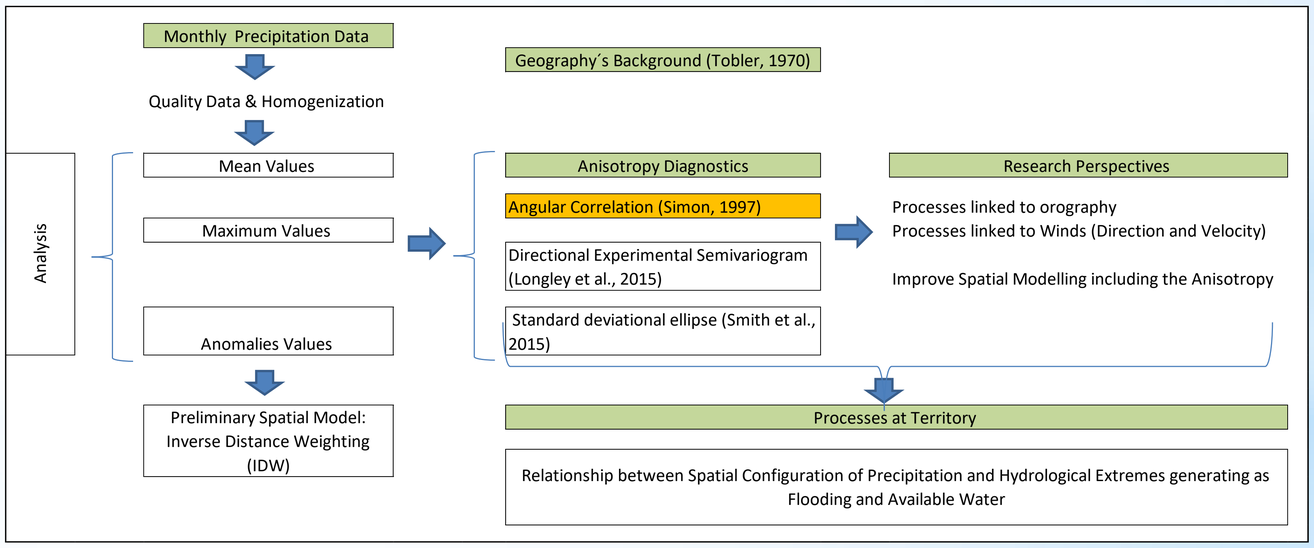
Some authors such as Humboldt (1858) analized the spatial analysis of isothermes, its inflexions and its relationsship with expantion and configuration of continental masses and comparison with ocean; Caldas (1808) defined concepts of climate and its influence over «organized beings»; recently Bondel, 2008 has investigated about how the climate conditions the development of some socio-economics activities and Blij et al., 2004 comments about relationships between humans and their climatic enviroment.

According with extreme climate variability associated with the ocurrence of El Niño and La Niña events and analysis of their socioeconomics impacts (Pabón y Montealegre, 2017); these type of interannual variability modifies the spatial configuration of precipitation, and it will generate changes of Hydrological Variables as flows of rivers (Poveda y Mesa, 1996). The physical Geography contributes to analyze the classification climatic, using methods as Köppen in 1918 (Straheler, 1960); to understand the space-temporal of some climatic variables at the regional climatic scales (Guhl, 1967; Eslava et al., 1986).

2. Methodology

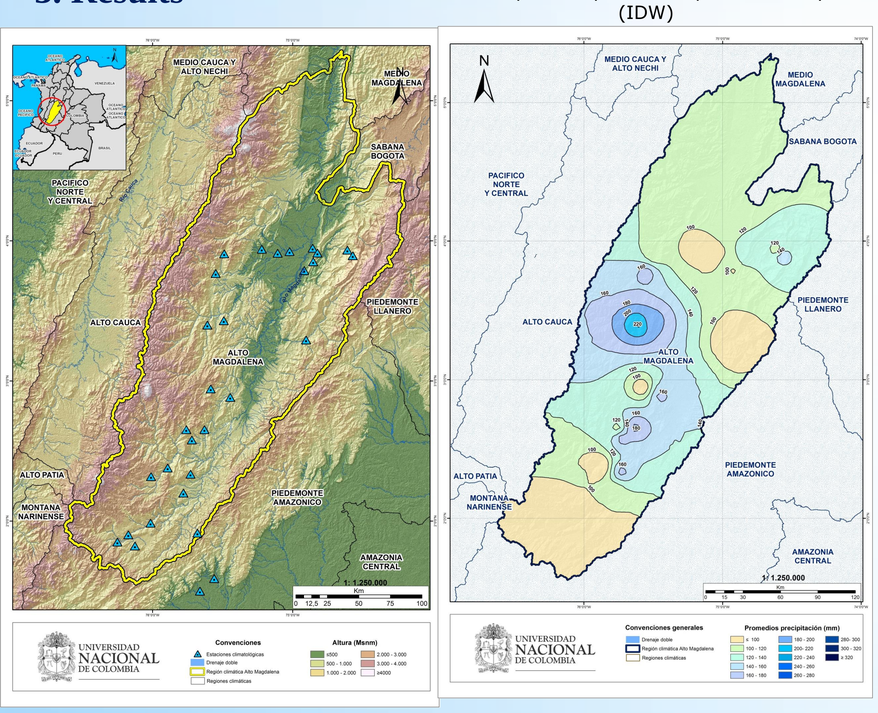
The methodological framwwork will include quantitative methods in geography (Fotheringham et al., 2000) supported by the First Law in Geography declared by Tobler (1970) and it will be analysed using spatial correlation of precipitation using spatial statistics (Cressie, 1993) and how it could change according to changes in direction, it is called anisotropy: «an anisotropy variogram asks how spatial dependence changes in different directions « (Longley *et al.*, 2015).

The angular correlation (Simon, 1997) is estimated for monthly precipitation data, maximum monthly data and precipitation for with ENSO (El Niño & La Niña Events. This approach is related to «anisotropic variogram» cited by Longley *et al.*, 2015.

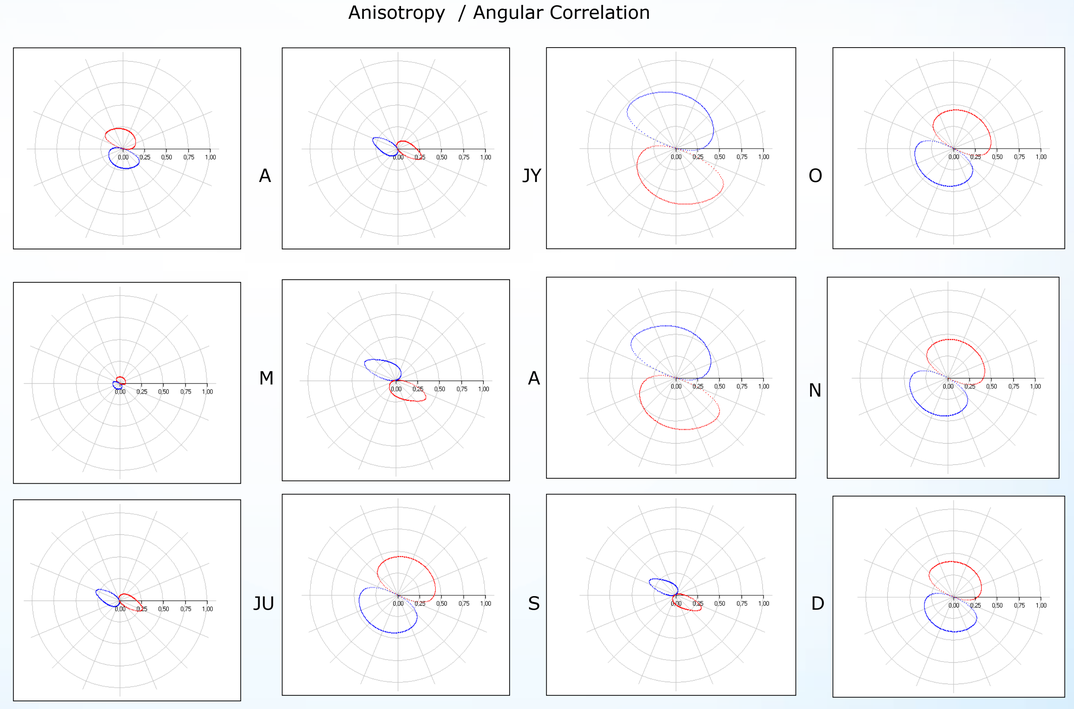


3. Results

Example Precipitation Mapa for January (IDW)



Anisotropy / Angular Correlation



4. Conclusion

The results with multiyear monthly averages indicates that the maximum correlation observes in SE/NW direction in January, since March still September and December, while in the remain months de main direction is SW/NE; for the maximum monthly values the main direction was SE/NW in January and March-August, and SW/NE for the rest of the year.

5. References

Simon, G., 1997. An angular version of Spatial Correlations, with Exact Significance Tests, Geographical Analysis 29, 267-78.

Tobler, W-, 1970- A Computer Movie Simulating Urban Growth in the Detroit Region, Economic Geography, Vol. 46, Supplement: Proceedings. International Geographical Union. Commission on Quantitative Methods (Jun., 1970), pp. 234-240.

4. Acknowledgments

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