Climatic Characterization of Ecuadorian Littoral Zone

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1 Introduction

The definition of homogeneous climatic zones is an important element in the hydrometeorological characterization of a region. Characterizing the climatic phenomena of the last decades allows understanding the influence of climatic variation in the hydrological cycle and provides important information to understand the impact on ecosystems.

From the analysis of precipitation and temperature since 1950 it has been noted that the influence of different phenomena, including changes in the activity of tropical storms (El Niño and La Niña) that trigger floods or droughts in the coastal plains, the rise in sea level and the atmospheric temperature in combination with anthropogenic activity can affect the integrity of coastal ecosystems.

The availability of climate information in Ecuador has been a problem because there is no adequate monitoring network, the length of the data series has a serious lack of information or the reliability of the observations is poor.

The main objective of this research is to characterize the climate of the Ecuadorian Littoral on basis precipitation and temperature records from using two sources and by using three algorithms.

2 Study area

For the present investigation, the study region is the Ecuadorian Litoral region, which has been defined as the area that starts in the Pacific Ocean coastal line up to the elevation line of 1000 meters above sea level in the Andes mountain range.

The climate of Ecuador is influenced by its location on the equatorial line, where the Andes Mountains act as a barrier where rainfall is generated, while the Amazon Rainforest and the Pacific Ocean are the sources of moisture regulated by the migration of the area. of intertropical convergence (ITCZ) and the surface temperature of the Pacific Ocean (SST). The coastal region is characterized by a complex orography, dense vegetation, high rainfall, high temperatures and high humidity.

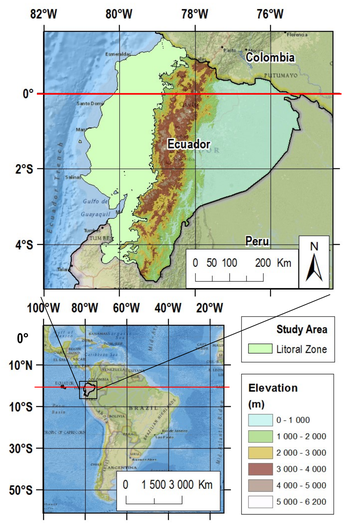

Figure 1. Location of study : Ecuadorian Littoral Zone.

3 Data sources

3.1 World Clim data base

The climatic data of precipitation and temperature was taken from the world clim database, where the data is in a series of maps with a spatial resolution of 1 km2. These maps are the result of interpolating the records of precipitation, minimum, average and maximum monthly temperature for the period 1970-2000.

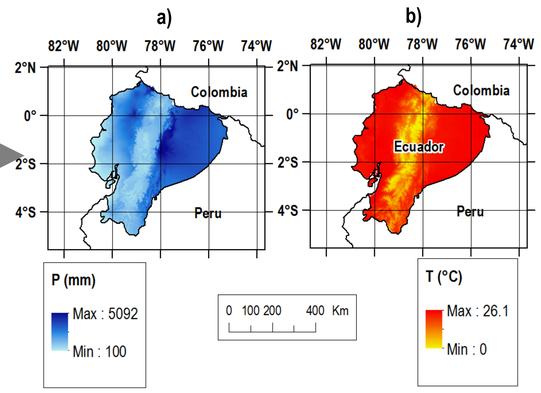

Figure 2. World Clim maps: *a) M*ean annual precipitation, b) Mean Annual temperature.

3.2 National Institute of Hydrology and meteorology of Ecuador (INAMHI)

INAMHI has a wide hydrometeorological network, however, it presents a lack of information, where in many cases the period of observation is short, there are gaps, the stations have been closed or relocated.

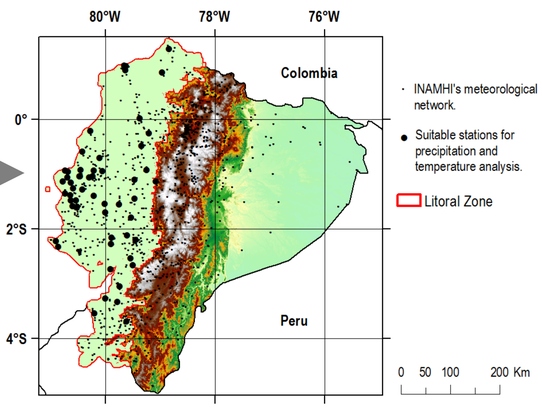

Figure 3. Ecuadorian hydrometeorological monitoring network.

4 Methodology

4.1 Multispectral imagine analysis - ISODATA

For the multispectral analysis, the information of World Clim database was used to elaborate a composed image. By processing the image with ISODATA algorithm was defined a set of homogeneous regions. The minimization of the quadratic error of the distance between clusters is used as the criterion for evaluating the number of regions.

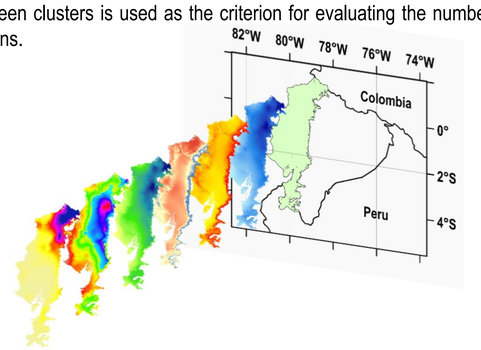

Figure 4. Multiespectral map composition of Ecuadorian Litroral Zone.

4.2 Regional Vector

For the application of the Regional Vector, the stations were grouped according to the spatial zones obtained through ISODATA algorithm. Regional Z vectors distributed in each zone were computed, where Z is obtained by minimizing the sum of the differences between Z and the quotient of the variable for a defined year and the average for the entire data series. Finally, the correlation of the areas obtained by the regional vector with the areas obtained with the ISODATA algorithm was calculated.

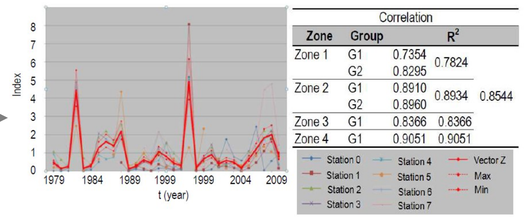

Figure 5. Regional vector Analysis

4.3 Cluster Analysis

For the identification of the groups using the INAMHI's database, the method of cluster analysis was used due to a hierarchical method, evaluating the distance by the k-mean metric. The reliability of methodology was checked by the optimality J and silhouette criterion.

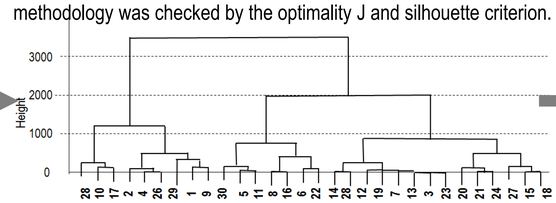

Figure 6. Dendrogram: Data clustering k-means metric..

5 Results

Five climatic zones were found using the ISODATA algorithm, where the sum of the squared error was the least for five groups.

The 5 climatic zones were validated through the use of the regional vector method. The regions are analogous and have a good correlation (R2 = 0.85).

Using the clustering algorithm 3 climatic zones were found, where the value of the criterion silhouette coefficient between 0.2 and 0.6, and the J1 = 0.305 and J2 = 147.82.

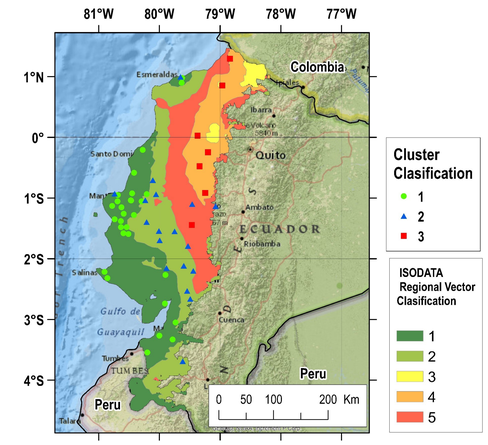

Figure 6. Clustering of precipitation and temperature.

6 Conclusions

As a conclusion, the Ecuadorian littoral region can be classified into 3 homogeneous climatic zones observed by the three methodologies, despite the ISODATA algorithm and regional vector propose five. The three zones are justified by the alterations associated with the climatic phenomena that are observed in the proximity of the equatorial line and the changes of topography, to characterize these zones is necessary to lead a climatic classification of the Andean region.

7 References

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