INTERQUARTILE ANALYSIS OF NO_2 TOTAL COLUMN EXTREMES FOR PORTO ALEGRE METROPOLITAN REGION WITH AVERAGE DATA DAILY OF OMI/AURA SENSOR

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ABSTRACT

An interquartile analysis was performed for the 12-year daily data of the total Nitrogen Dioxide Column obtained through the OMI sensor coupled to NASA's Aura satellite for the Metropolitan Region of Porto Alegre. Results showed that the statistical method of quantile regression maintained that there was a seasonality during the year of the NO_2 emission values and during the months of January, April, May and July the lower quartile (Q10) shows that there was a negative trend stronger in relation to the other quantiles, due to the decrease of the emission and the increase of the variability, whereas in the month of February the average quartile (Q50) and higher (Q90) indicated a decrease in emission and variability.

RESUMEN

Se realizó un análisis intercuartil para los datos diarios de 12 años de la Columna Total de Dióxido de Nitrógeno obtenida a través del sensor OMI acoplado al satélite Aura de la NASA para la Región Metropolitana de Porto Alegre. Los resultados mostraron que el método estadístico de regresión cuantil mantuvo que hubo una estacionalidad durante el año de los valores de emisión de NO_2 y durante los meses de enero, abril, mayo y julio el cuantil inferior (Q10) muestra que hubo una tendencia negativa más fuerte en relación con los otros cuantiles, debido a la disminución de la emisión y al aumento de la variabilidad, mientras que en el mes de febrero el cuartil promedio (Q50) y más (Q90) indicaron una disminución en la emisión y la variabilidad.

Keywords: OMI/Aura, Nitrogen Dioxide, Quantile Regression

1) INTRODUCTION

Nitrogen Dioxide (NO_2) has a short life time in the lower troposphere and plays a fundamental role in the chemical composition of the atmosphere in urban centers due to its temporal behavior with great diurnal variation and strong dependence on the vehicular emissions and the radiation incident, to the resulting in a large spatial-temporal variability around the areas of origin (Heron-Torpe et.al, 2010). Measurements of tropospheric NO_2, through the sensors on board in satellites, have been the subject of several studies in recent decades. The Ozone Tropospheric Instrument (OMI) sensor, coupled with NASA's Aura satellite, provides daily data on the concentration of the nitrogen dioxide column since October 2004, allowing the study of natural and anthropogenic emissions from regional to global scale for different regions of the world (Krotkov et.al, 2016). The objective of this work is to evaluate and detect changes in the distribution of NO_2 daily concentration in Metropolitan Region of Porto Alegre (RMPOA).

2) METODOLOGY

The daily concentration series of the NO_2 total column for RMPOA, measured by the OMI Tropospheric Column NO_2 sensor, was obtained between 2005 and 2017 through the Giovanni platform (http://giovanni.sci.gsfc.nasa.gov / giovanni /). The mean distribution of the data by boxplot type graphics was initially evaluated, which synthesizes this information for all months of the year. The trend of the mean (Q50) and the extremes (Q10 and Q90) were obtained by quantile regression (RQ). The advantage of RQ is that it does not assume any probability distribution, is not influenced by serial correlations, and allows a complete analysis of the change in the distribution of the data. The statistical significance of the trends was estimated by bootstrap sampling at a significance level of 10%. For more details on RQ, see Dhakal & Tharu (2018).

3) RESULTS

Figure 1 shows a well-defined seasonality of daily NO_2 emission over the Metropolitan Region of Porto Alegre with maximum trend in the months of October-December and minimum in the months of April-June. The average distribution of nitrogen dioxide emission is fairly uniform for most months. The highest positive trends are in March and December and the biggest and the negative ones are in April-May. In most of the year, the most of the trends are negative in all quantiles, indicating a shift to the left of the monthly distribution of NO_2 emission. In the period of January, April, May and July, is observed that the lower quantile (Q10) trends are more pronounced than the upper (Q90) and average (Q50) quantiles trends, indicating that besides the decrease in emission, variability is increasing. In the month of February, there are more pronounced trends in Q50 and Q90. In that month there is a tendency to decrease NO_2 emission and decrease variability.

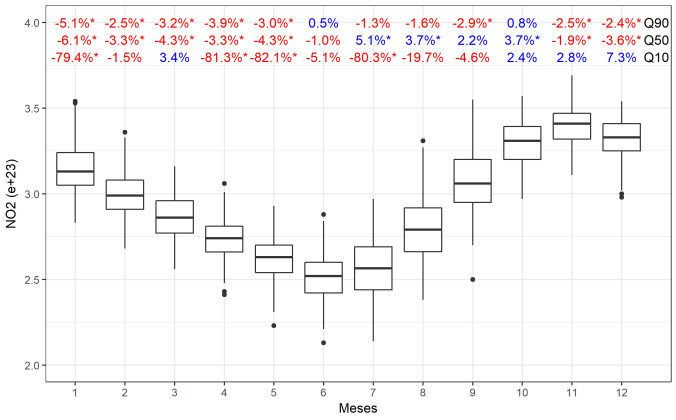

Figure 1: Boxplot of daily data of NO2 on South America and trend of the upper and middle quantiles. Statistically significant trends are highlighted by an asterist

4) CONCLUSIONS

There is a very characteristic seasonality in the emission of nitrogen dioxide during the year and, in general, the distribution of all months is very uniform. There is an evident and significant negative trend in almost every month of the year. Between January, April, May and July, the variability is increasing and in the month of February, the variability is decreasing. The methods employed in this study are robust and support the results. With the classical trend analysis (Simple Regression and Mann-Kendall test) it would only be possible to infer about the trend of the mean, assuming that the data follow approximately a normal distribution. The methods employed in this study are robust and support the results. There is a need for more work for specific regions, especially in urban areas.

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