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# **On the relation between the seismic activity data and Hurst exponent in support of energy investments in Albania.**

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**SESSION B: ENVIRONMENT – CLIMATE CHANGE**

Earthquakes constitute a threat to human activity and must be considered when designing engineering facilities.

We empirically examine the dependence between earthquake's magnitudes and their intrinsic value through *Hurst's rescaled range analysis*.

Estimating the Hurst exponent for a data set provides a measure of whether the data is a random process or has underlying trends.

## **Can the past be used to predict the future?**

The basic assumption of Probabilistic Seismic Hazard Analysis is the same as that of financial markets, and other disciplines that deal with self-similar processes, or even that of a Japanese quote: *“Through Inquiring of the Old We Learn the New”*.

We have a total of 4219 data (total number of earthquake's magnitudes).

Region	N	$M \geq 4.5$	$M_{\min(N)}$	$M_{\text{avg}(N)}$	$M_{\max(N)}$
Albania	4219	735	1.00	3.02	7.20

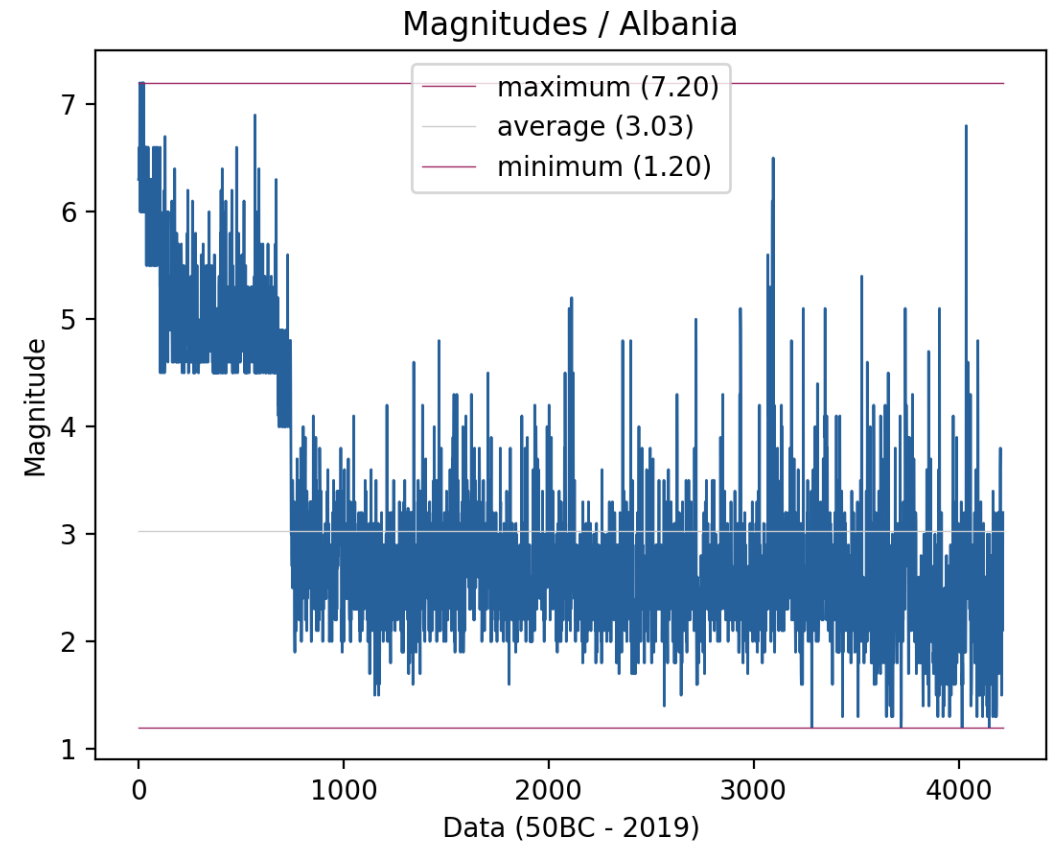
# Results

*Rescaled range analysis, 50BC to Apr. 2019, N=4219*

Average magnitude = 3.02

Maximum magnitude = 7.20

Minimum magnitude = 1.00



Magnitudes series in Albania, 4219 data, 50BC – 2019

Source: Institute Geosciences and Energy, Water and Environment (IGWE)

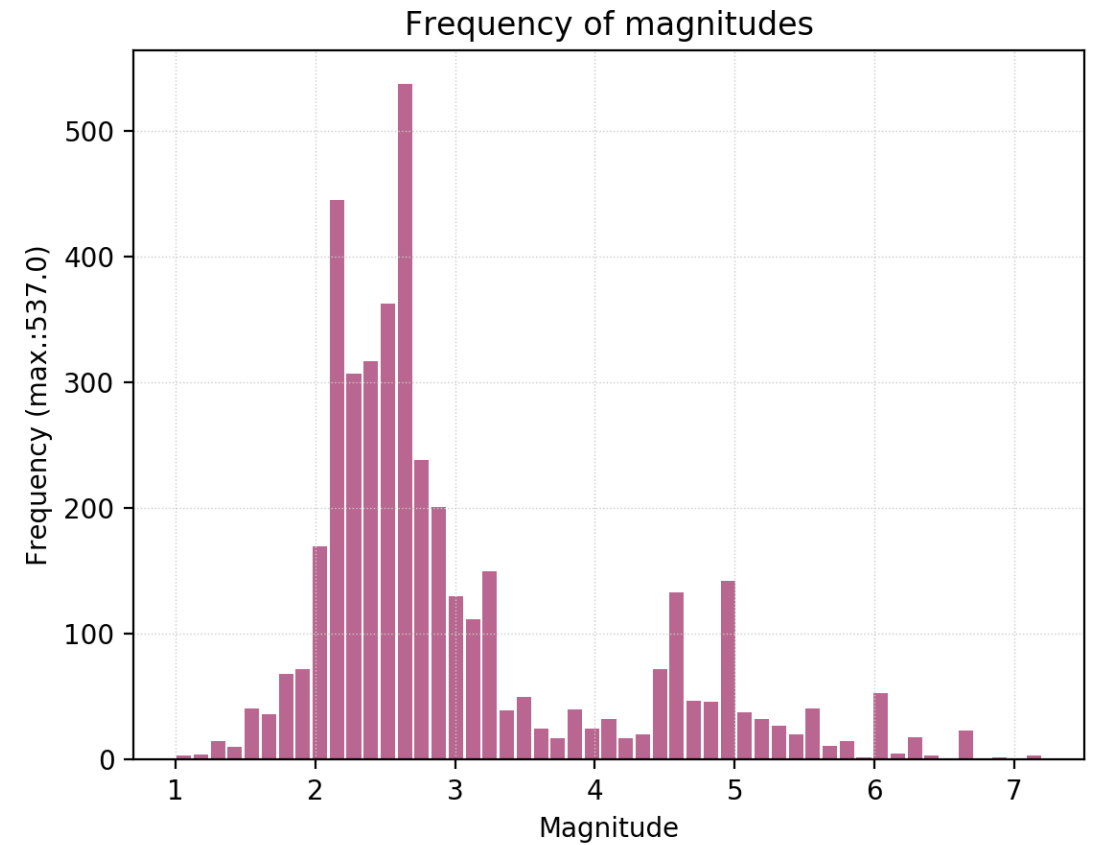
# Results

*Rescaled range analysis, 50BC to Apr. 2019, N=4219*

Average magnitude = 3.02

Maximum magnitude = 7.20

Minimum magnitude = 1.00



Frequency of magnitudes in Albania, 50BC – 2019.

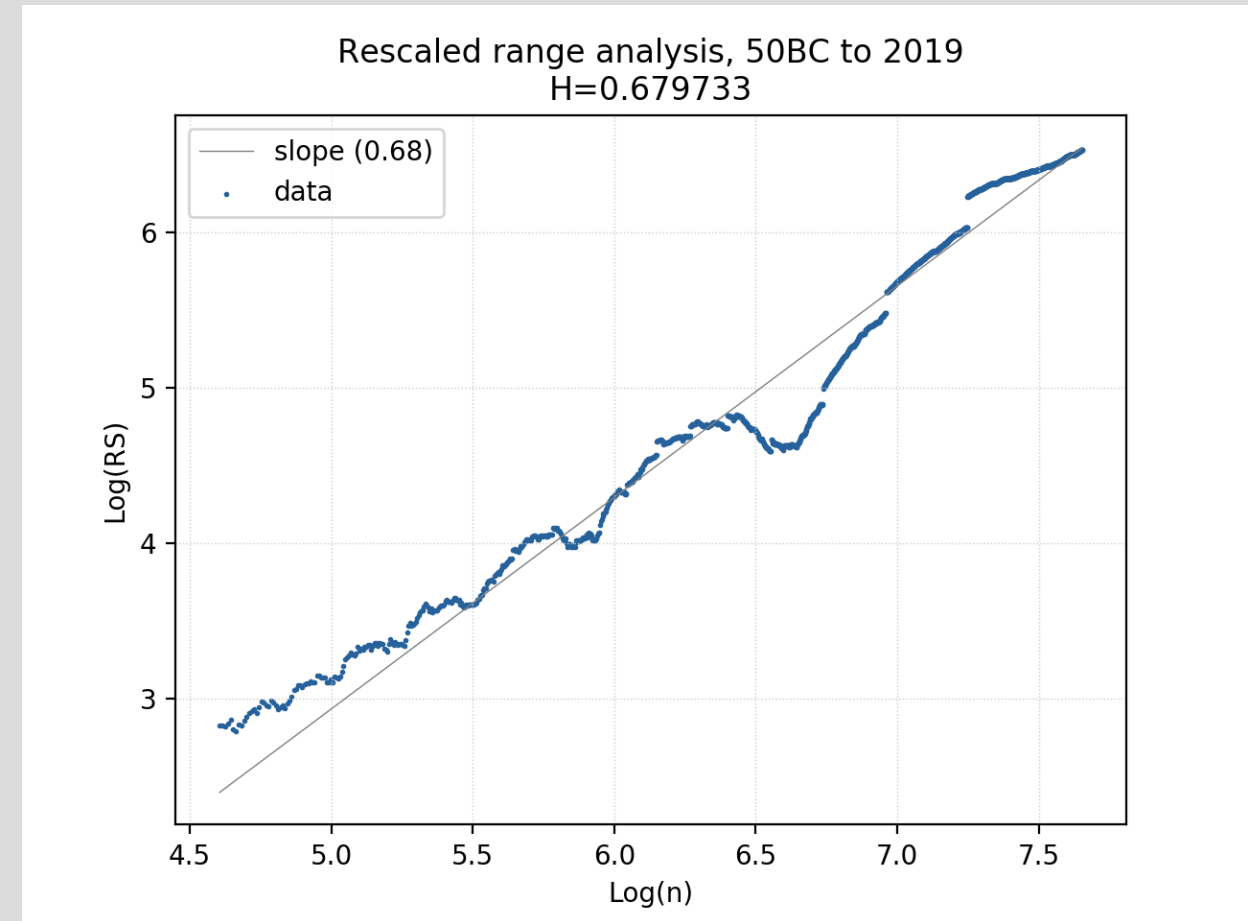
Source: Institute Geosciences and Energy, Water and Environment (IGEWE)

# Results

*Rescaled range analysis, 50BC to Apr. 2019, N=4219*

Hurst exponent (H) = **0.68**

Fractal Dimension (D) = 1.32



R/S - earthquake's magnitude data in Albania

# Results

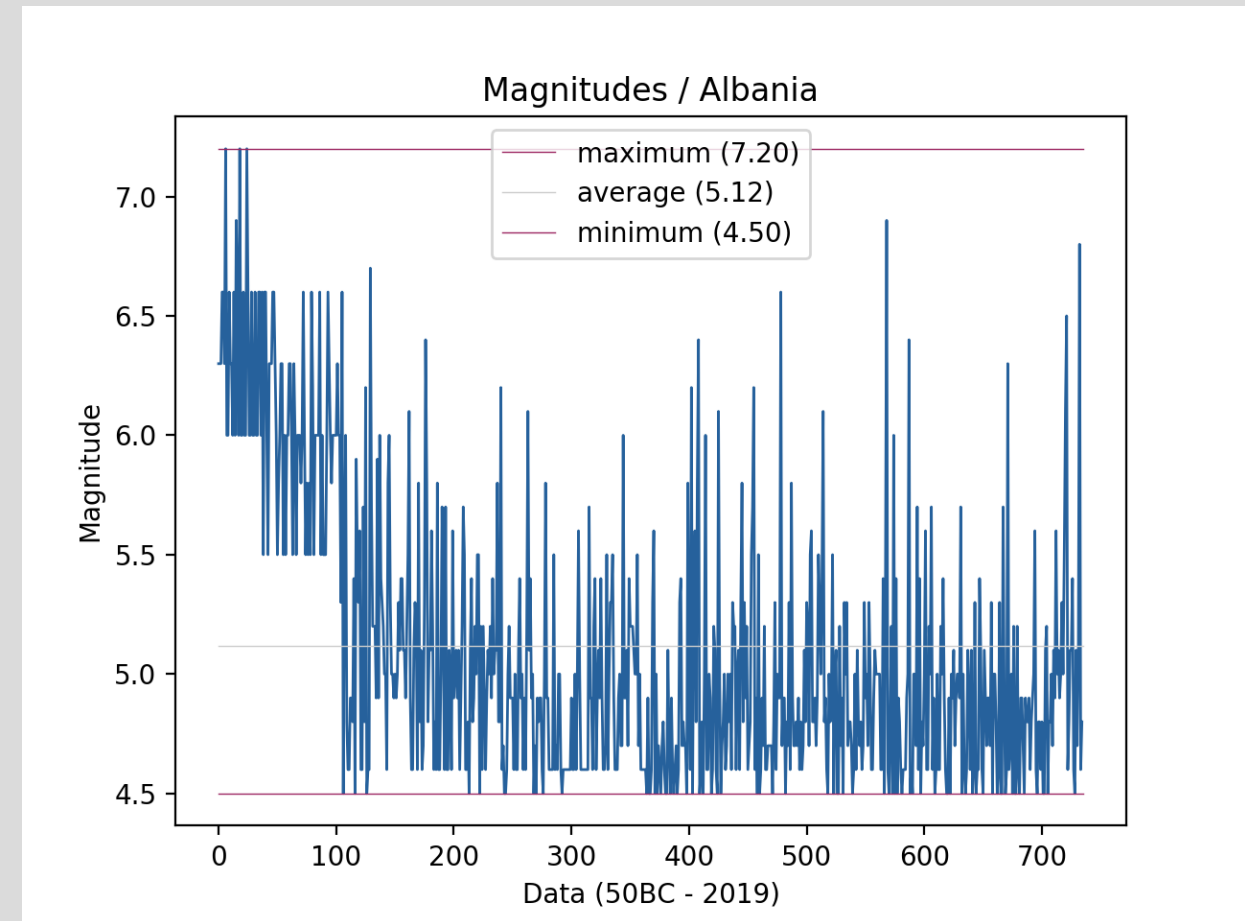
*Rescaled range analysis, 50BC to Apr. 2019*

$M \geq 4.5$ ,  $N=735$

Average magnitude = 5.12

Maximum magnitude = 7.20

Minimum magnitude = 4.50



Magnitudes series in Albania, 735 data;  $M \geq 4.5$

Source: Institute Geosciences and Energy, Water and Environment (IGWE)



# Results

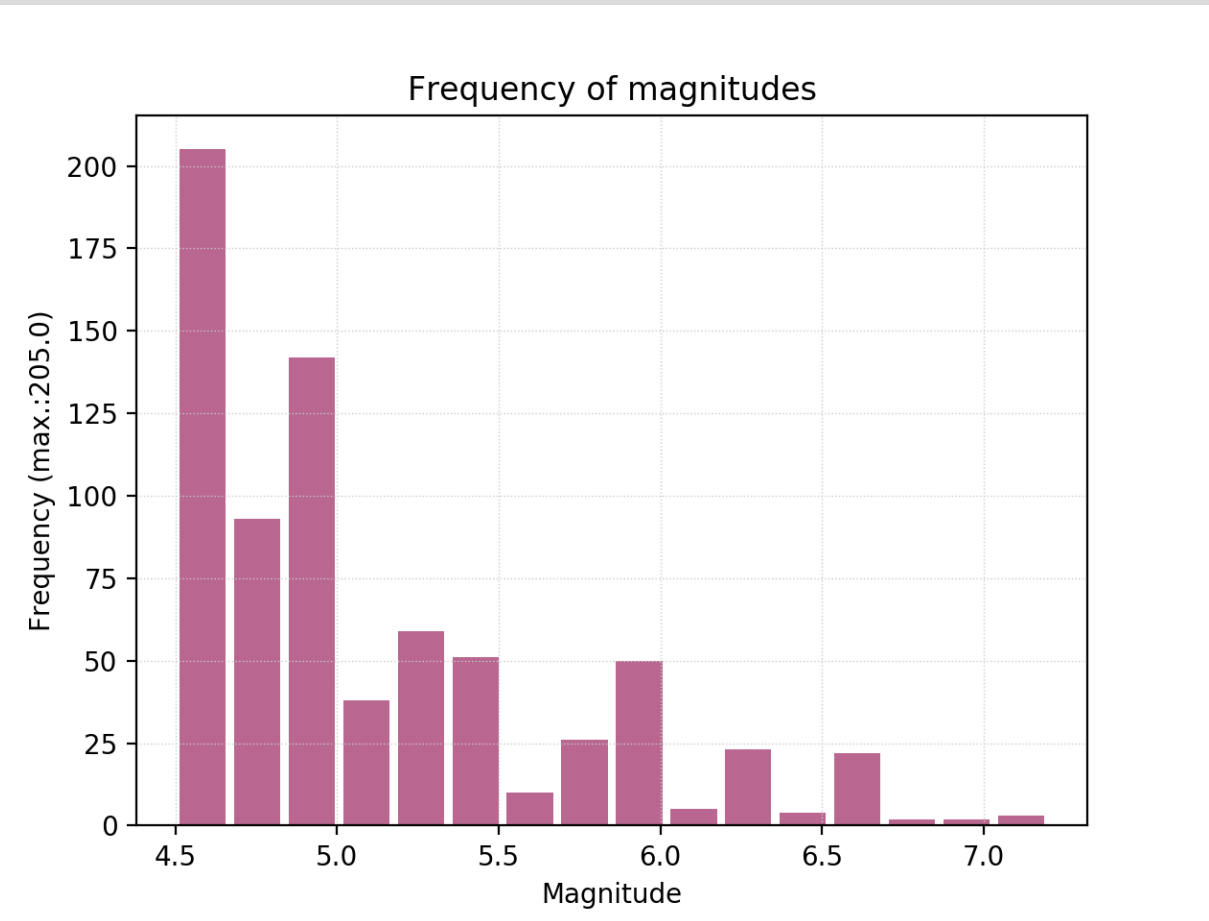
*Rescaled range analysis, 50BC to Apr. 2019*

$M \geq 4.5$ ,  $N=735$

Average magnitude = 5.12

Maximum magnitude = 7.20

Minimum magnitude = 4.50



Frequency of magnitudes in Albania, 735 data;  $M \geq 4.5$

Source: Institute Geosciences and Energy, Water and Environment (IGEWE)

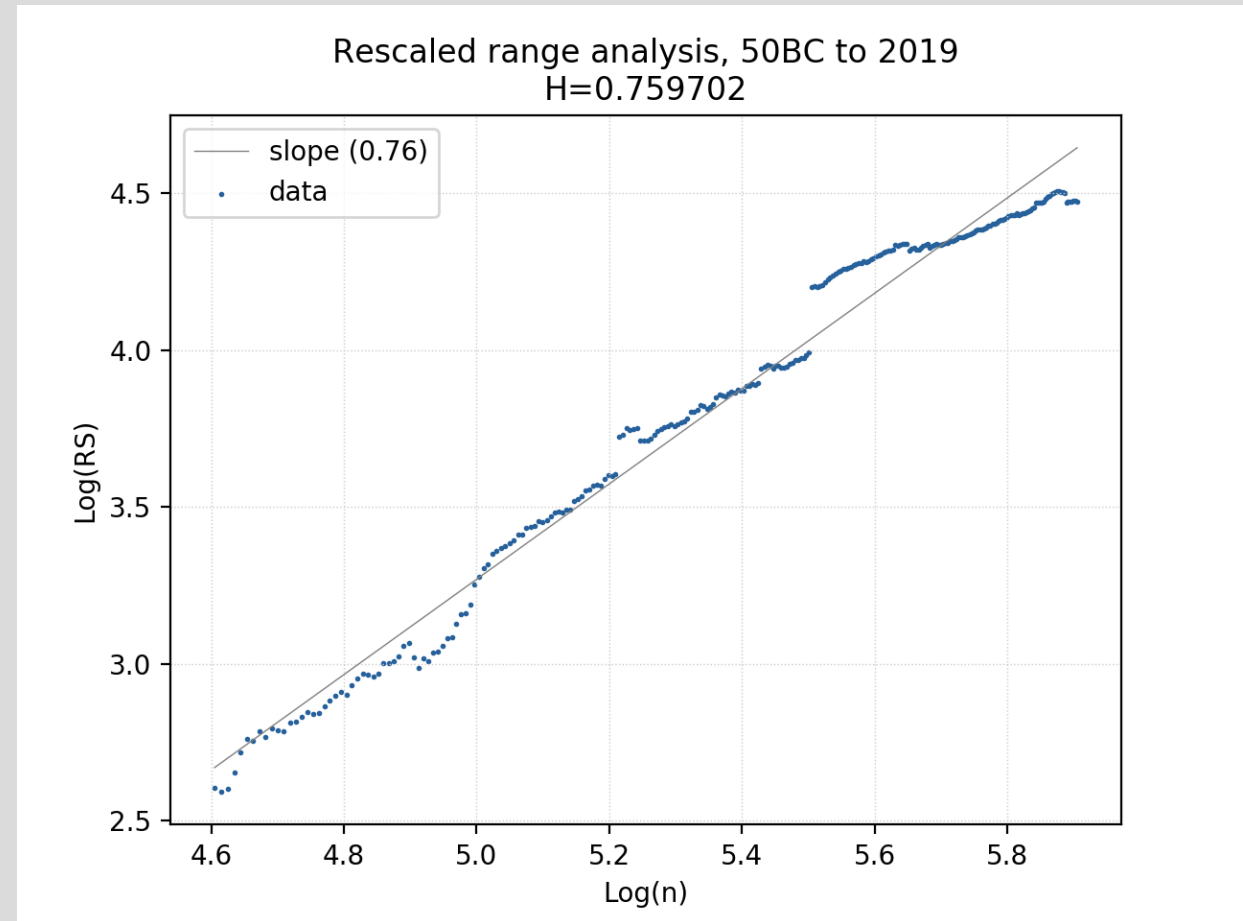
# Results

*Rescaled range analysis, 50BC to Apr. 2019*

$M \geq 4.5, N=735$

Hurst exponent (H) = **0.76**

Fractal Dimension (D) = 1.24



R/S - earthquake's magnitude data  $\geq 4.5$

We conclude by indicating a long-term correlation in earthquakes magnitudes in Albania.

Examination of seismic data series through Hurst's rescaled range analysis shows that seismicity is a memory process, not random.  
( $H > 0.5$ )

Regarding the fractal dimension ( $D$ ) we estimated that the seismicity in Albania has a dimension between the roughness of a snowflake (Van Koch Snowflake) and that of Sierpinski triangle.  
( $D = 1.32$  ;  $D_{M>4.5} = 1.24$ )

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