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Research Article

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Study erositive rain: The case of station Mostaganem (Algeria)

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ABSTRACT

Rain and runoff have a decisive influence on the transport and deposition of sediment detached or under the impact of raindrops or by runoff exerts shear stress on the ground. In this study, we try to characterize the risk of erosion associated with rainfall data from the rainfall station Mostaganem (West Algeria). This will explain the importance and variability of water erosion of soils in the study area. We calculate its index by various methods namely Fournier, Arnoldus and Deffontaines with series of data collected during the period from 2000 to 2010.

Keywords: erosion, rainfall, flow, Mostaganem, Algeria

INTRODUCTION

The plateau of Mostaganem essentially two environments:
The first is characterized by an original sandstone material discontinuous coverage ancient dune generally stabilized, carrying wood and arable land whose appearance ranges from nearly flat to gently undulating where sand deposits are present.

The second is characterized by reddish eolian sediments that form often mobile dune and during wind erosion rarely works bearing bracket.

Forms of Erosion Observed the Area

Erosion can take various forms which combine in time and in space. In the initiation phase, detachment occurs under the action of two types of agents:

Raindrops, their impact but also wetness earth fragments they cause [7] and [8]. Runoff that carries a tractor forced to the surface, this constraint with slope gradient in the changing forms of linear erosion, detachment on the banks of ditches or gullies occurs also in the form micro mass movements [9].

Sheet erosion: this occurs when the surface of a ground is gradually eroded in a more or less uniform. The only manifestation of sheet erosion may be gradual loosening of the roots of trees or crops or the base of fence posts.

Rill erosion: occurs on land more or less steep, water found depressions in which to nest and ditches downstream where flow.

Gully erosion: Water flowing downstream, digs deep into the earth path and forms a landslide (phase gullies) in going upstream, the water can deepen and broaden the scar and starts form a trickle.

Shoreline Erosion: This form relates mainly very large gullies that dig their beds during floods relatively laden sediments.

Badlands: very advanced stage of erosion of running water that just chisel a slope by reducing it to a series of ridges.

EXPERIMENTAL SECTION

The rainfall erosivity index

Fournier index: This is the ratio between the square of the rainfall of the wettest month of the year and the average annual rainfall.

$$I_f = p^2/P \text{……} (1)$$

p: rainfall of wettest month
P: mean annual rainfall

Arnoldus Index
Arnoldus suggests taking into account rainfall every month of the year

$$I_a = \Sigma p_i^2/P \text{……} (2)$$

Pi: average rainfall of each month to reflect the importance
all showers.
P: mean annual rainfall

Deffontaines Index modified (ID)

$$ID = n \times C \text{……} (3)$$

n: average amount of daily rain days> = 20 mm.
C:% of torrential rains as

This index is used to classify months as the risk of erosion [3].

In our case, we take into account all the daily rainfall greater than or equal to 20 mm, because according to studies conducted in Medea (Central area of Algeria) [2], and in the catchment area of the river Mina [5], these rains cause runoff and sediment transport.

RESULTS AND DISCUSSION

The index values are calculated using the formula [4], then using the modified formula for [1]. The results presented in Table .1 show the values of the index Fournier between 12.52 and 76.33.

For index Arnoldus, values are grouped (54 -134). These were compared to those calculated by [6], gridded data interpretation:

Table 1. Interpretation grid index ARNOLDUS [6]

Index Arnoldus	Risk of erosion
Ia < 50	Low
50 < Ia < 500	Middle
500 < Ia < 1000	High
Ia > 1000	Very High

The station is in the Mostaganem class average erosivity (See Figures.1, 2 and 3).

Table .2 Annual indices Fournier and Arnoldus for Mostaganem station (period 2000-2010)

Years	Index Fournier	Index Arnoldus
2000	49.20	97.08
2001	60.66	115.71
2002	16.11	54.65
2003	48.56	95.24
2004	44.62	86.11
2005	35.66	64.82
2006	76.33	134.13
2007	14.99	62.54
2008	60.05	105.94
2009	57.75	82.69
2010	12.52	55.33

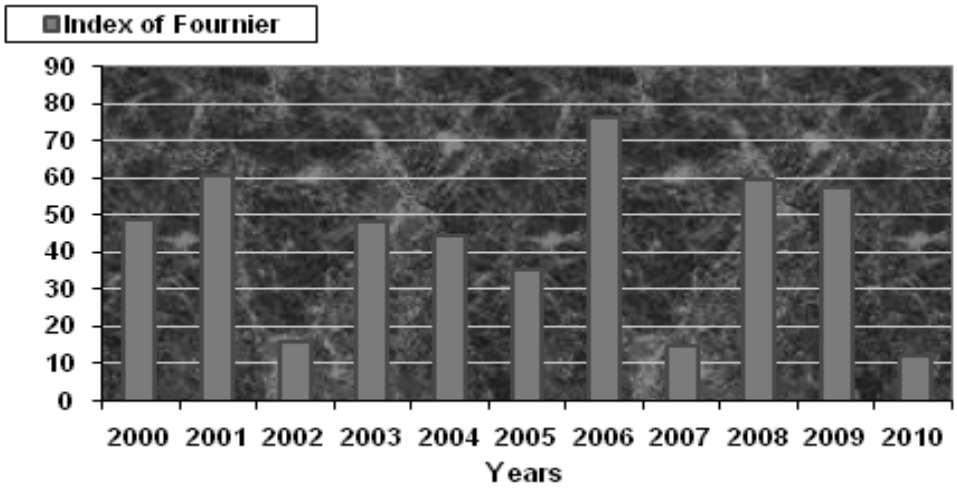

Figure.1: Annual index Fournier of Mostaganem to the station for the period 2000/2010

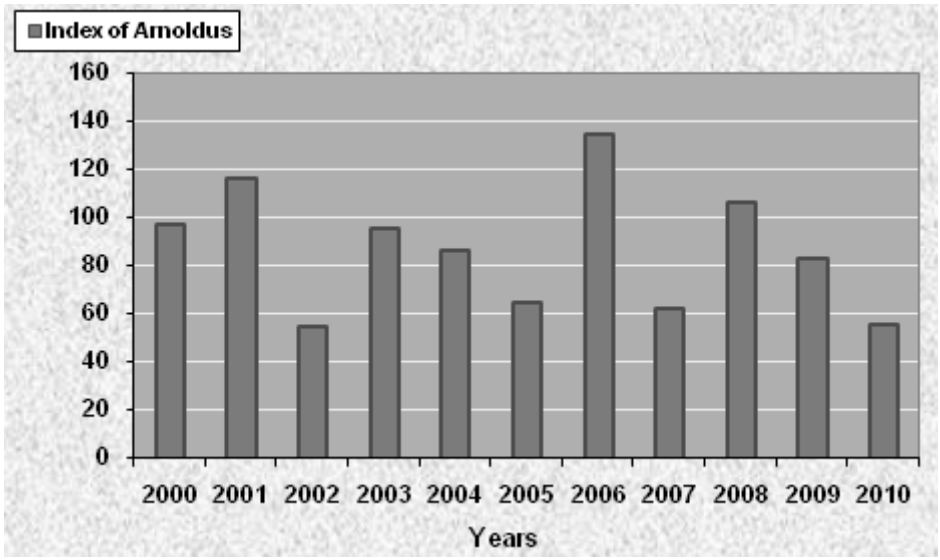

Figure. 2: Annual index of Arnoldus Mostaganem to the station for the period 2000/2010

Deffontaines Index

The highest values of this index are mainly in October, November, and December, with values between 240 and 577 (Table.3 and Figure.3).

There is a strong climatic aggressiveness particularly strong during the fall season (October and December). During this period the cultivated lands are particularly vulnerable to water erosion, due to the low ground covered by annual crops.

Table 3. Monthly values of the index Deffontaines (between 2001 and 2010)

Months	Number of rain days> = 20mm (n)	% Rain> = 20mm compared to the total rainfall (c)	The index values Deffontaines (ID)
January	5	33.65	168.25
February	4	22.76	91.04
March	0	0	0
April	4	34.33	137.32
May	4	37.18	148.72
June	0	0	0
July	0	0	0
August	1	60.15	60.15
September	2	30.48	60.96
October	6	40.10	240.60
November	10	51.62	516.2
December	11	52.54	577.94

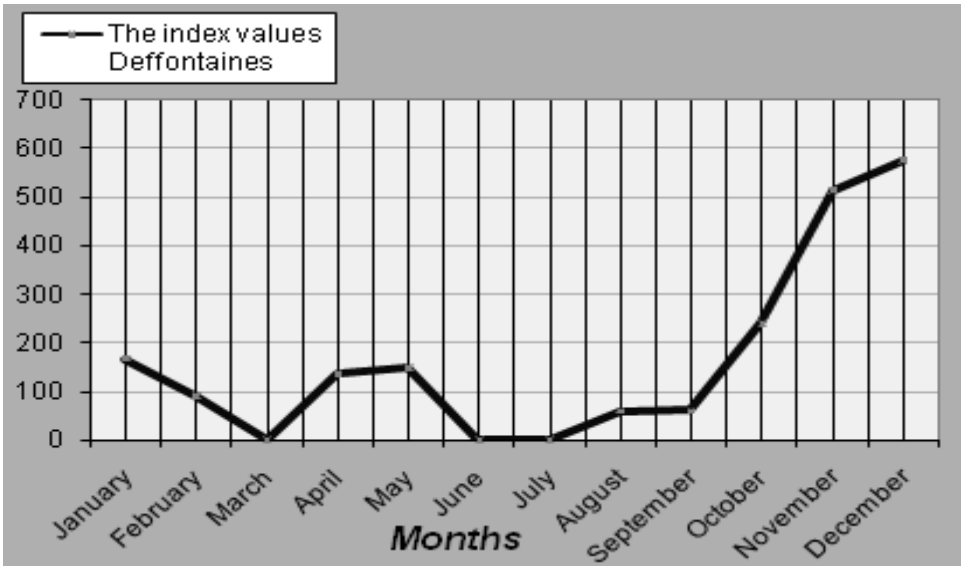

Figure.3: Monthly values of the index Deffontaines for station Mostaganem (2000/2010

CONCLUSION

The results allow the following conclusions:
- Temporal variations of the different criteria used erosivity calculated from annual rainfall and maximum daily show strong rainfall erosivity mainly in winter, autumn and spring.

- Index Arnoldus- Fournier and show that the risk of erosion is moderate.

The different criteria erosivity used, such as index Fournier and Arnoldus give a low to moderate erosivity. That of Deffontaines shows that aggression coincides with the rainy winter season, spring and fall.

This sensitivity to erosion can be explained by the predominance:
• The high silt content of some courses (green marl)
• The low organic matter content (0.31 to 2.22%)
• The ability to cracking is excellent in soil texture clay, average soil clay-loam texture and low soil texture silty clay.

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