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Simulation of Solid Transport from the Sub-watersheds and Hydrometrics Stations in the Catchment Area of the Wadi of Hammam (Algeria).

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Abstract: Deductions are an essential part of managing water resources in semi arid. Their protection against filling with sediment resulting from erosion of upstream watersheds is essential to ensure the profitability of these investments. The violence of water erosion on the catchment area of the wadi of Hammam as'[9] explains mainly by the presence of marly terrain, high rainfall intensities, runoff concentrated on steep slopes and vegetation almost not exist. The actual study of the phenomenon at different gauging stations is the subject of our study concerns the assessment of suspended sediment from the liquid-flow A relationship strong flows during the period of 20 years. Using the regression method in the evaluation, the power regression model was retained, while allowing to homogenization, quantification and hence the calculation of the specific erosion by two methods: the use of average flows monthly and instantaneous flow.

Key words: hydrology, erosion, flow, sediment transport, Mascara, Algeria.

INTRODUCTION

Erosion, this very complex phenomenon involving several parameters has grown significantly in Algeria[1] and threatens daily, farmland, water infrastructure, by pulling, scouring, transportation and sediment deposition creating elevation of wadis, the sapements riverbanks, flooding and siltation of dams that is sometimes almost impossible to overcome.

The silting of reservoirs[8] is probably the most serious consequence of this phenomenon in our regions where water, part of his inadequacy and poor distribution is a limiting factor for economic development with an annual average specific erosion ranging 2000T/km² and 4000T/km², Algeria is among the countries most erodible in the world[6].

The objective of this work is to quantify the erosion from the gauging station located in the watershed of wadi The Hammam using average monthly flows and annual[2].

2. Location: The watershed of the wadi Hammam is one of the great watersheds Macta (Figure.1). It is bounded by the mountains of Beni-Chougrane north and the mountains south of Saida. The watershed of the wadi Hammam presents sets very varied nature, which justifies its dimensions: 3468 Km². The wadi of Hammam arises south of Saida. The accuracy of the surface and the perimeter of the watershed depend on the scale of the surface and the drainage density; over this last factor is well marked, the boundary is clearer and more calculating various more or less accurate.

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METHODS AND MATERIALS

3.1 Presentation of the Database:

3.1.1 Introduction: All searches are done on the sediment transport involve the difficulty of measuring thrust although it constitutes a considerable share of total transport.

This mode of transport requires sophisticated equipment that is no gauging stations. Usually some authors estimate that 20% of the suspension.

Unfortunately, the proliferation and the vague language of thrust and are the first serious challenge to respond to the problem. So it is that measures of transport in suspension[5].

3.1.2 Method of Sampling: The general principle is simple: It filters the water collected in one place (either on the edge or middle) through plastic bottles with a capacity of 500cc and one recovers the suspended

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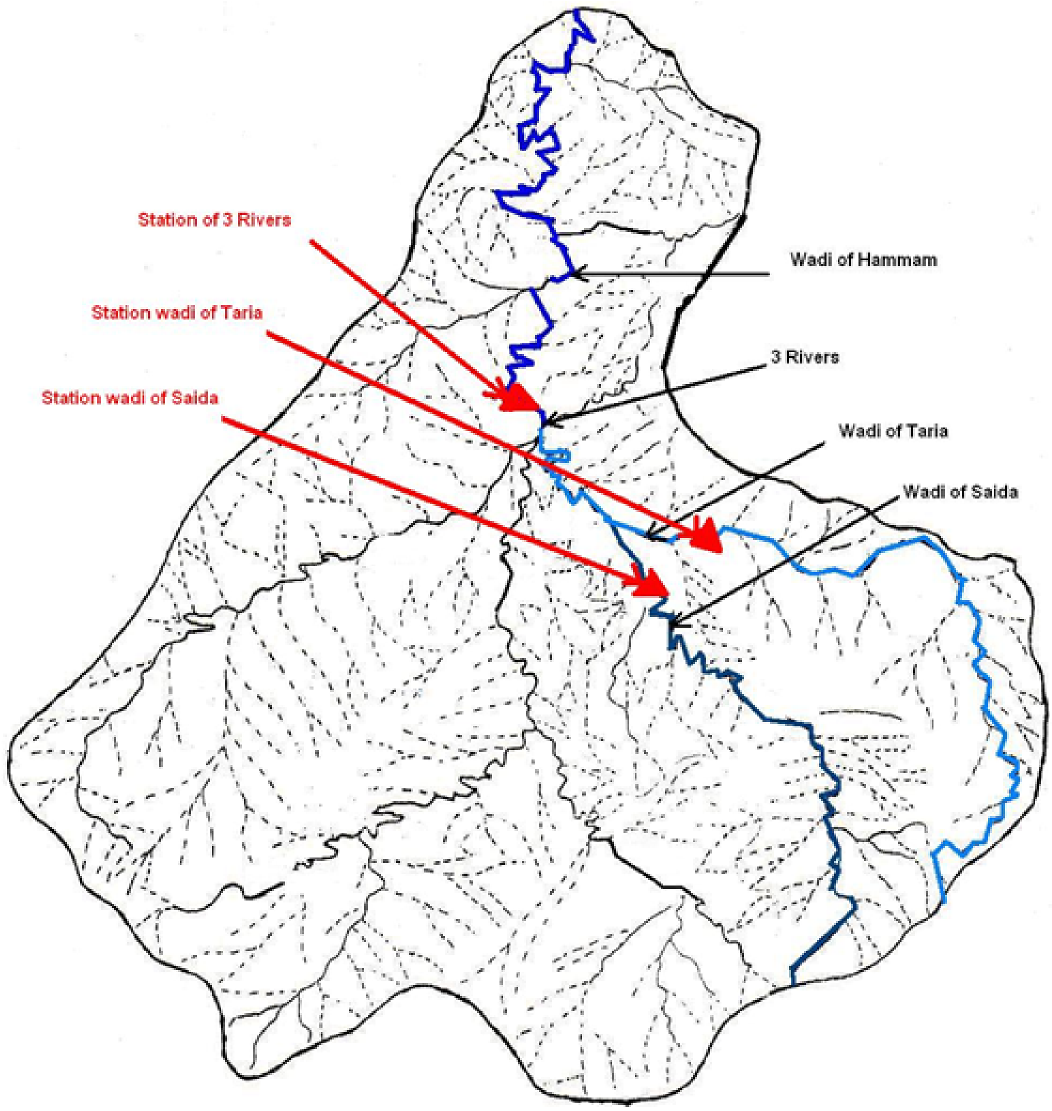


Fig. 1: Hydrographic Network Watershed of the wadi Hammam.

material on filter paper previously weighed. Then dried on paper in the oven increased to reach 100 ° C and weighed twice, we obtain the weight of the sediment load that leads to a unit volume (g / l or Kg/m3)[3].

With: $C = \dfrac{P.1000}{V}$

- C: concentration in g / l;
- P: weight (g) of material extracted from the sample;
- V: sample volume in cm^3 (water + mud)
- 1000: coefficient of transformation necessary to obtain the results (g / l)

3.3.3 Data Collection: Because of variability in affected areas and those of many factors governing erosion, transport and deposition of sediment from one area to another, we must mention that its data were forwarded by the National Agency of Water Resources (Algiers).

• The flow and water level
• The double-height daily concentration
There is a relationship between liquid flow and solid discharge. To calculate these, we proceed as follows: the liquid flow rates expressed in (m^3 / s) and cast in solid discharge (kg / s).

RESULTS AND DISCUSSION

4.1 Homogenization of Sediment Data by the Monthly Average Discharge Rates:

4.1.1. Application of the Pattern: The analysis of the various previous results shows that the power and parabolic models responds satisfac torily to adjust the data[7], but the more powerful model that meets the parabolic model interannual scale.

Given the value of the coefficient of determination R^2 for the model power approach statistical data processing to the monthly scale was used (Three Rivers station closest to our watershed).

The average monthly liquid flow periods of 20 years were the basis for the standardization of data.

4.1.2 Quantification Erosion Specific Hydrometric Stations: Erosion specific "Es" in tones / ha was calculated in the stations, including the inter annual variation is given by Table 2 and Figure 2.

4.1.3. Modulation of the Liquid and Solid Contributions in the Hydrometric Stations:

4.1.3.1. Modulation of the Input Sound: We calculated the interannual fluctuation of the amount of sediment brought by rivers monthly and interannual distribution and inter annual calculated for the same period of observation to interpret the results of the specific erosion of different gauging stations.

The contribution of sediment brought average monthly and its modulation in% over the period (20 years) are presented in the following table:

4.1.3.2. Modulation of the Liquid Intake:

- A_0: the annual intake liquid ($M.m^3$)
- Q_0: Annual cash flow (m^3 / s)
- T: Time for one year (31536.10^3)

The average annual cash flows of the three gauging stations:

- Three Rivers: A_0 = 30, 49 $M.m^3$
- Wadi of Saida: A_0 = 13, 90 $M.m^3$
- Wadi of Taria: A_0 = 5, 26 $M.m^3$

The development graph of the intra annual intake of liquid and solid percentage calculated over 20 years shows a fairly clear proportionality between input and solid liquid intake as shown in Figure: .3, 4, 5;

This proportionality is another more obvious between the annual runoff coefficient "This" and the specific annual erosion.

The inter annual variation of flow rate and specific erosion is given in Table 7 and Figure.6

There is certain proportionality between the specific erosion and runoff coefficient; however, the flow rate remains low.

Conclusion: Application of the pattern of power Three Rivers Contribution of sediment brought to the Tons catchment area of Wadi Hammam

Annual sediment discharge in tons:

- Three Rivers: As = 124,887.69 T / year
- Wadi of Saida: As = 27,269.10 T / year
- Wadi of Taria: As = 16,913.91 T / year

Table 1: Contribution of sediment brought tons annually in the hydrometric stations:

Years	Annual solid years in Tons		
	Three Rivers	Wadi of Saida	Wadi of Taria
Average	124887,69	27269,10	16913,91

Table 2: Erosion estimated specific hydrometric stations:

Years	Erosion specific Years Es (T / Ha)		
	Three Rivers	Wadi of Saida	Wadi of Taria
Average	1,38	0,18	0,36

Table 3: Providing solid income in Tons and modulation (in %) inter annual different gauging stations:

Stations	Three Rivers	Three Rivers	Wadi of Saida	Wadi of Saida	Wadi of Taria	Wadi of Taria
	Average intake (T)	M (%)	Average intake (T)	M (%)	Average intake (T)	M (%)
Total	124737,58	100,00	27269,10	100,00	16913,91	100,00

Table 4: fluid intake in million m^3 of various gauging stations:

Years	Years fluid intake in million m^3		
	Three Rivers	Wadi of Saida	Wadi of Taria
Average	30,49	13,90	5,26

Table 5: Fluid intakes in million m3et modulation (%) inter annual different gauging stations:

Stations	Three Rivers	Three Rivers	Wadi of Saida	Saida	Oued Taria	Oued Taria
Month	Average intake (M.m³)	M (%)	Average intake (M.m³)	M (%)	Average intake (M.m³)	M (%)
Total	30,17	100	18,84	100,00	5,64	100

Table 6: Variation (in %) inter annual intake and fluid intake sound different gauging stations:

Stations	Three Rivers	Three Rivers	Wadi of Saida	Wadi of Saida	Wadi of Taria	Wadi of Taria
	M (%) solid	M (%) Liquid	M (%) solid	M (%) Liquid	M (%) solid	M (%) Liquid
Total	100,00	100,00	100,00	100,00	100,00	100,00

Table 7: Inter annual fluctuation of flow rate of the different gauging stations:

Stations	Three Rivers	Three Rivers	Wadi of Saida	Wadi of Saida	Wadi of Taria	Wadi of Taria
	Ce (%)	Es (T/Ha)	Ce (%)	Es (T/Ha)	Ce (%)	Es (T/Ha)
Average	14,33	1,38	3,91	0,18	5,30	0,36

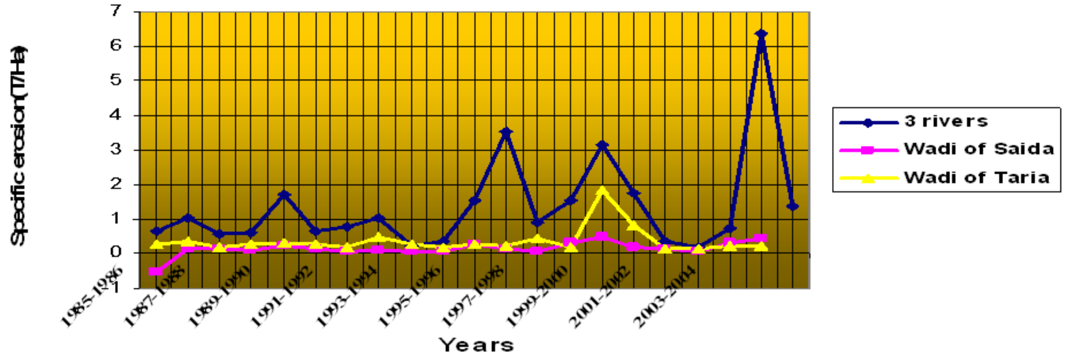


Fig 2: Variation of inter-specific erosion "Es"

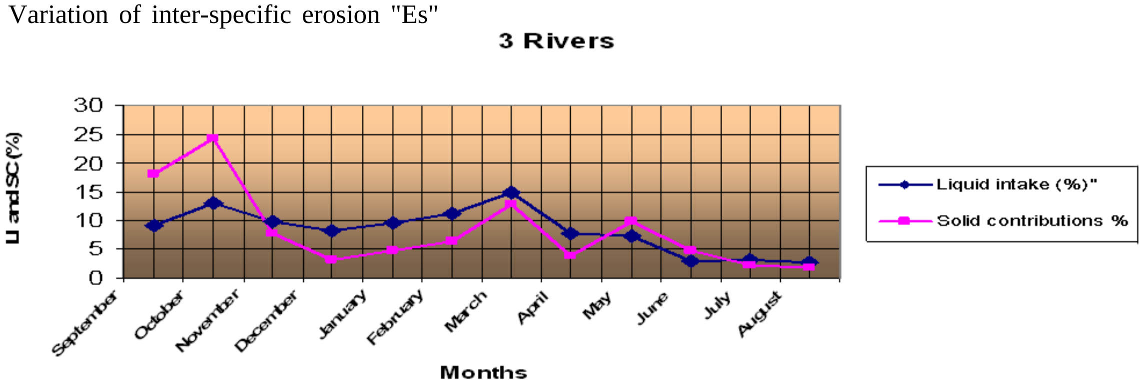


Fig. 3: Variation (in %) inter annual intake and fluid intake of solid Hydrometric Station Three Rivers (20 years).

The average annual contributions of the three gauging stations:

- Three Rivers: A0 = 30, 49 M.m3
- Wadi of Saida: A0 = 13, 90 M.m3
- Wadi of Taria: A0 = 5, 26 M.m3

There is a certain proportionality between:

- The specific erosion and runoff coefficient, however, the flow rate remains low.
- Providing solid and liquid intake

Thus, we offer a range of remedies, ie upstream to apply in the river system to fight against the phenomenon of erosion[4]:

- reforestation
- measures of soil conservation,
- terracing traditional arable
- correction gullies (mechanical and biological)
- correction banks (biological)
- creation of small dams,
- pastoral management,
- methods of hunting,
- withdrawal by current density and dredging.

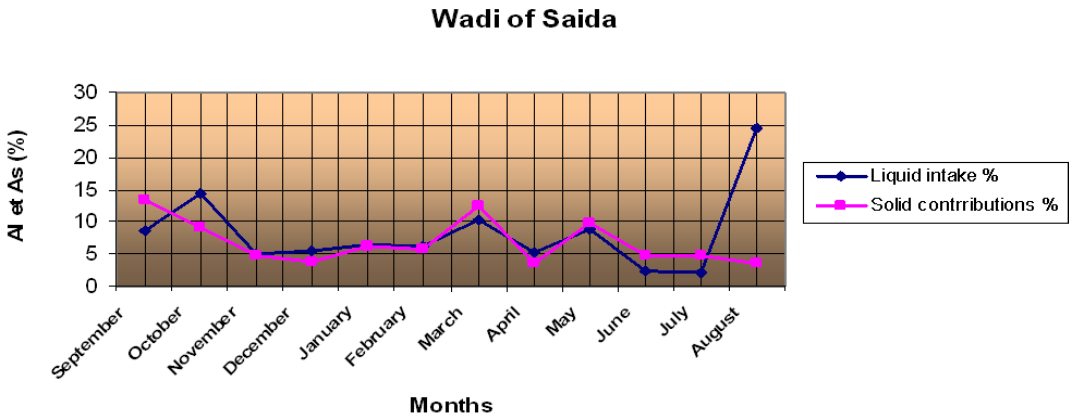


Fig. 4: Variation (in %) inter annual intake and fluid intake, solid gauging station wadi of Saida (20 years).

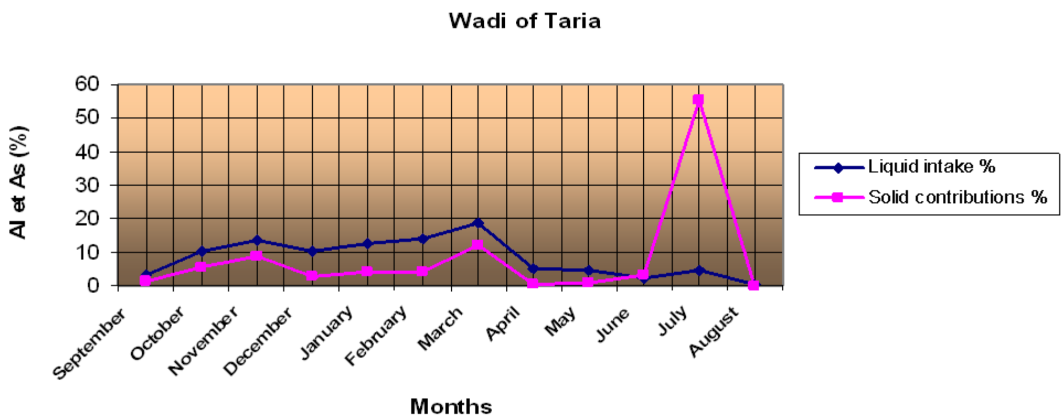
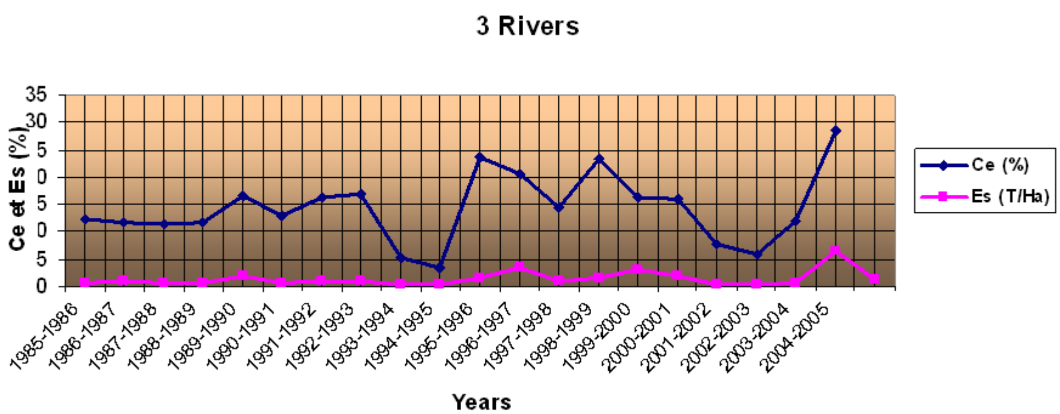
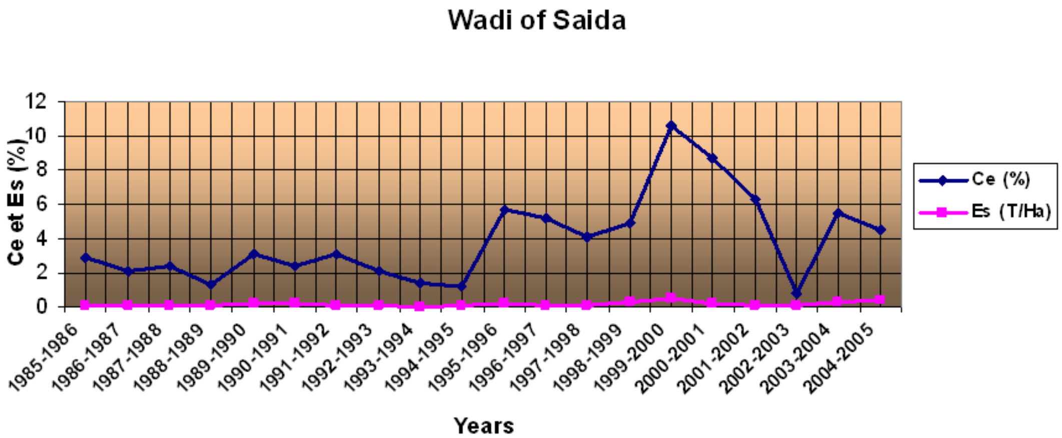


Fig. 5: Variation (in %) inter annual intake and fluid intake, solid gauging station wadi of Taria (20 years).





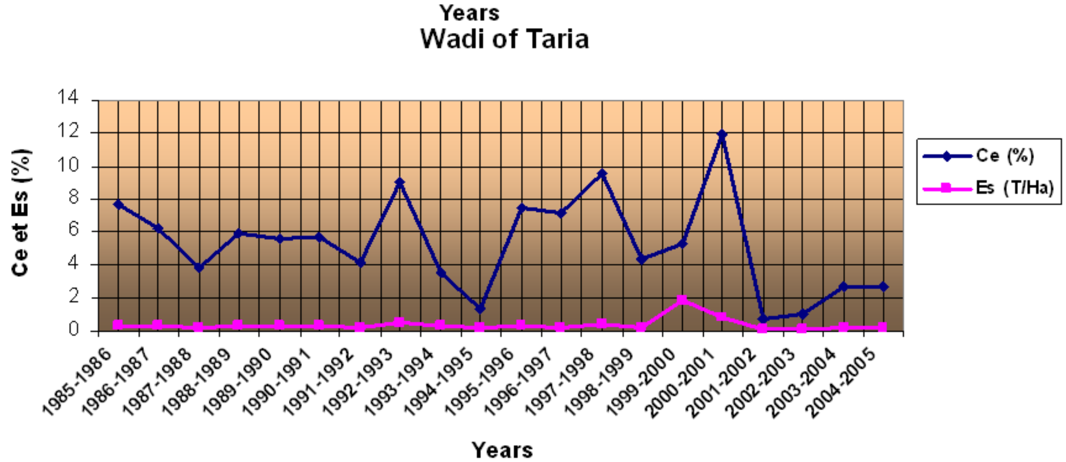


Fig. 6: Change inter annual runoff coefficient (Ce) and specific erosion (Es) of the different gauging stations

Al: Liquid intake
As: Solid contribution
Ce: runoff coefficient
Es: specific erosion

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