African Journal of Advanced Pure and Applied Sciences (AJAPAS)

Online ISSN: 2957-644X

Volume 2, Issue 3, July-September 2023, Page No: 257-263

Website: *https://aaasjournals.com/index.php/ajapas/index*

||Arab Impact factor 2022: 0.87|| SJIFactor 2023: 5.689|| ISI 2022-2023: 0.557

Mapping Hydrological Yields in The Ouaoumana River Basin: (November 2021-May 2022)

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Received: June 24, 2023	Accepted: August 16, 2023	Published: August 25, 2023

Abstract:

In period of low water, the water table is the main supplier of water in all the catchment areas, the objective of this article is to study the hydrological yield in the River Basin Ouaoumana, which forms a tributary of the Oum Er-Rabia basin, in order to extract the most productive sub-basins during this period. The methodology adopted in this work is based on the method of quantitative assessment of water resources in order to measure flows during the period between (November 2021 and May 2022) and thus produce hydrometric data at several points along the watercourse. The main results obtained show that this basin suffers from the loss of large quantities of water, and this is linked to the agricultural activities that are concentrated on the banks of the river. The fragility of these water resources results from the imbalance between the capacity of the river and the needs of the growing population, which leads to a strong emptying of the aquifer and the reduction of surface water in the river.

Keywords: River Basin Ouaoumana, Low Flow, Yield Maps, Groundwater.

Cite this article as: E. Omaima, E. Mohamed, "Mapping Hydrological Yields in The Ouaoumana River Basin: (November 2021-May 2022)," African Journal of Advanced Pure and Applied Sciences (AJAPAS), vol. 2, no. 3, pp. 257–263, July-September 2023.

كارطوغرافية العائدات الهيدرولوجية في حوض واد واومنة: (نوفمبر 2021 - مايو 2022)

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الملخص

في فترة الشح المائي تشكل الفرشة الباطنية المزود الرئيسي لمعظم الأودية بالمياه، الهدف من هذا المقال هو دراسة الإنتاج الهيدرولوجي بحوض واد واومنة الذي يشكل رافدا من روافد حوض أم الربيع من أجل استخراج الأحواض الفرعية الأكثر إنتاجية في هذه الفترة. ترتكز المنهجية المعتمدة في هذا العمل على طريقة التقييم الكمي للموار المائية من أجل قياسات الصبيب خلال الفترة الممتدة ما بين (نوفمبر 2021 ومايو 2022) وبالتالي إنتاج معطيات هيدرومترية في عدة نقاط على طول المجرى المائي. تبين النتائج الرئيسية التي تم الحصول عليها أن هذا الحوض يعاني من فقدان كميات كبيرة من المياه وهذا مرتبط بالأنشطة الفلاحية التي ترتكز في جانب الواد، وبذلك فإن هشاشة هذه الموارد المائية ناتجة عن عدم التوازن بين قدرة الواد واحتياجات الساكنة المتزايدة مما يؤدي إلى ارتفاع تفريغ الفرشة الباطنية وتناقص المياه السطحية للواد.

الكلمات المفتاحية: حوض واد واومنة، الشح المائي، خرائط الإنتاج، الفرشة الباطنية.

I. Introduction

Water is one of the major challenges of the coming years. As a result of climate change, there is a real risk of water shortages as needs continue to increase. Indeed, the increasing number of uses of water, which resort to direct abstraction from the river or pumping into the groundwater, aggravate low water situations (Langue, 2007).

Hydrological yield mapping plays an important role in understanding the spatial organisation of aquifer discharge in the low water period and in determining the areas of water loss and emergence the most productive sub-catchments).The mapping of hydrological yields, established from specific flows per spatial slice (difference in flow between two consecutive measurement points), reveals areas of abundance, average yield, loss or even no flow Its main objective is to highlight the spatial distribution of aquifer drainage, which depends essentially on the bedrock. It allows the determination of sectors with low or even negative yields (losses), medium or high yields (Lejeune and Devos, 2004).

II. Study Area

The Ouaoumana river basin belongs to the Oum ER-Rabia basin and is located in the Middle Atlas between longitudes 5°43' and 5°50' and latitudes 32°33' and 32°36'. It is a small catchment area covering approximately 176 km2. Administratively, it belongs to the rural municipality of Ouaoumana in the Beni Mellal Khenifra region, this municipality is located 40 km from the town of Khenifra on national road nº8.

Its administrative boundaries are as follows:

- To the north: The municipality of Aït Ishak
- To the south: The municipality of Tizi Nisli
- To the east: The municipality of Sidi Yahya Ou Saad
- To the west: The municipality of Ait Oum El Bekht.

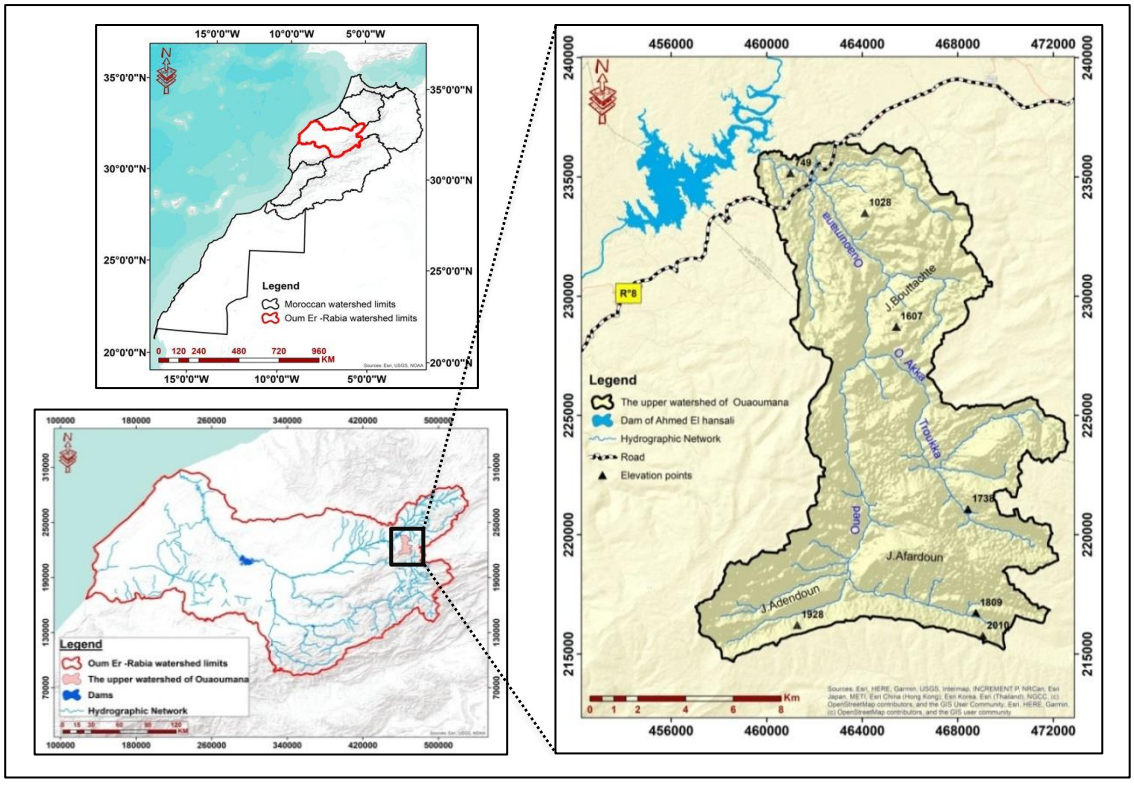

Figure 1: Location of the Ouaouman river basin

The altitudes in this basin is varied between 2200m And 600m at the outlet, it also has various geological substrates (marl, limestone, sandstone, shale ...) and characterized by a dominance of semi-permeable rocks. The rainfall of this watershed is variable in time and space with an annual average of 507 mm for the monitoring period (1975-2018).

III. Data and Methods

1. Methods

His methodology of this work is based on field trips to produce hydrometric data from flow measurements that based on stages next:

1.1 Choice of measurement points: Generally the choice of the points of Measurements is based on the geology of the zone Zone, the slope the visits of ground which shows several things (taking of the water of the wadi by the man), the distribution of the sources which feed the wadi, knowing that we chose other points but their access was difficult.

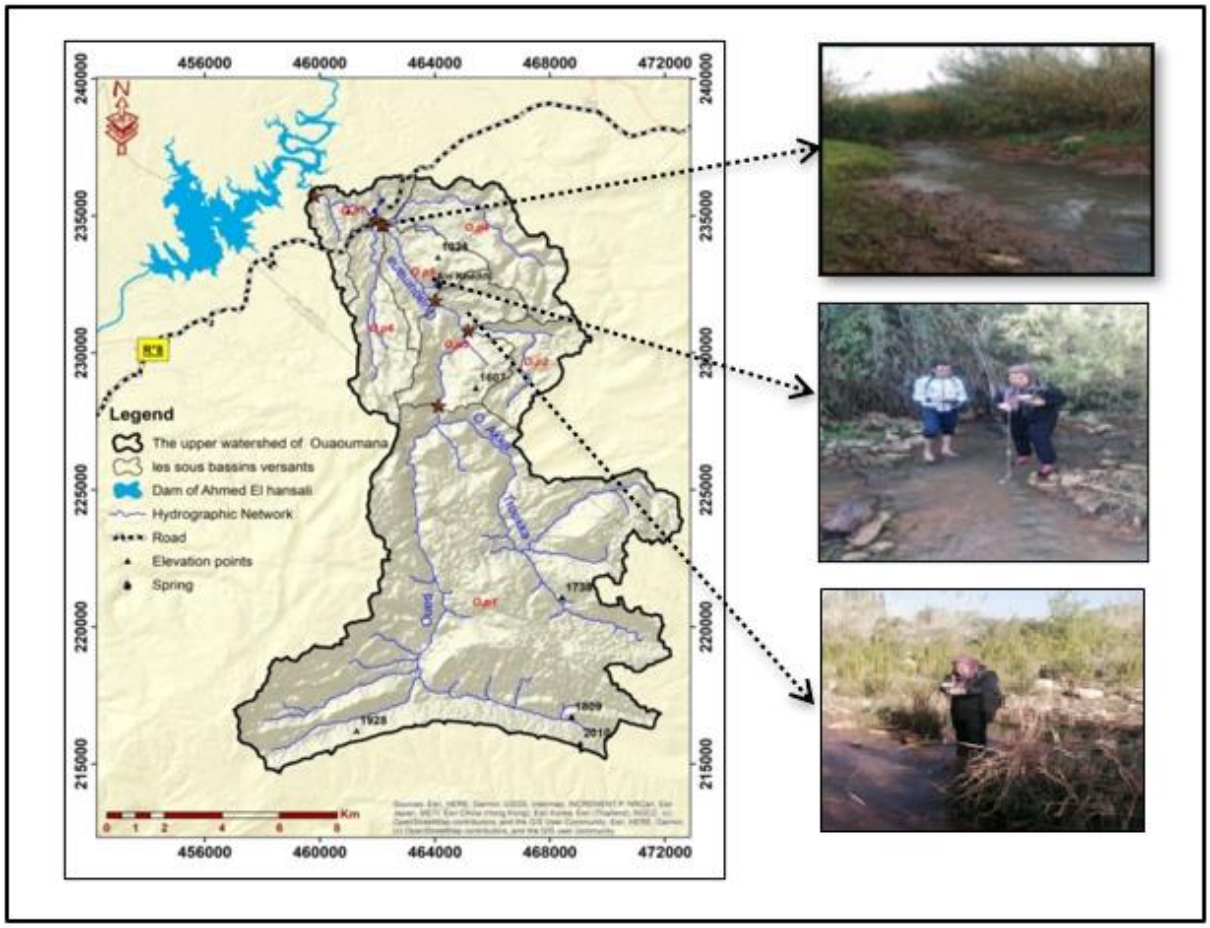

Figure 2: points of flow measurements in the Ouaoumana river basin

1.2 Flow measurement:

To measure the flows in our watershed we used the point by point method (The average velocity is obtained from the point velocities measured at different depths, and then we recorded the data on the gage sheet. For the evaluation of the gauging and to extract the values of the flows we used The Software (Depjau).

This software carries out all the calculations and all the graphic reports starting from the raw data of the gauging. It allows the drawing and the visualization of curves. The curves are calculated starting from the points of measurement using polynomials of interpolation (Ghadbane and all, 2020).

2. Used Data

In this article, we have used the data we produced in the field from flow measurement surveys during the period (November 2021-May 2022) and the table (Table 1) below shows an example of these data.

Table 1: Some results of measurement campaigns

Measurement points	ITEM 1		ITEM 2		ITEM 3		ITEM 4	
	Heights in (cm)	Flow in (l/s)	Heights in (cm)	Flow in (l/s)	Heights in (cm)	Flow in (l/s)	Heights in (cm)	Flow in (l/s)
14/11/2021	20	52	34	70	15	49	10	43
19/12/2021	32	112	43	133	28	109	29	153
26/01/2022	15	47	30	56	11	37	8	35
20/02/2022	18	50	32	61	5	20	9	37
02/03/2022	13	45	28	49	9	30	7	31
01/04/2022	50	246	52	259	36	204	32	181
15/05/2022	43	178	51	238	34	170	29	153

IV. Results and Discussion

Hydrological yield mapping plays an important role in understanding the spatial organization of aquifer discharge in the low water period and then determining the areas of water loss and emergence (the most productive sub-watersheds). mapping of hydrological yields we have divided the Ouaoumana river basin into sub-basins.

We will use the specific flow (the Flow "produced" per unit area of the basin considered). For the calculation we divided the flow by the surface of each sub-basin and the values obtained are in (l/s/km²). Knowing that we have given each point that represents the outlet of each sub-catchment a code for example:

O.p1: O = Ouaoumana; p1 = point 1 (point number)

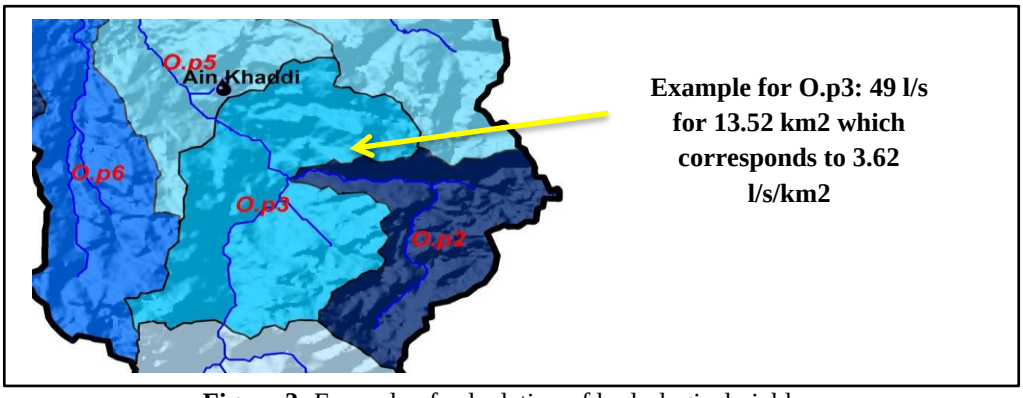

Figure 3: Example of calculation of hydrological yield

1. Yield maps for the Ouaoumana river basin (November 2021-May 2022)

The mapping of hydrological yields, established from specific flows per spatial slice (difference in flow between two consecutive measurement points) reveals areas of abundance, average yield, loss or even no flow (Sary and Devos, 1995). The maps below show the specific yields (l/s/km2) of each sub-catchment during the period (November 2021 – May 2022) The sub-basin (O.p1) which is characterized by Significant slopes and the dominance of permeable rocks, which play a major role in groundwater recharge, Has a low specific yield (0.39 l/s/km2 to 2.15 l/s/km2) and this can be explained by several factors including the movement of this groundwater in the aquifer by gravity from the highest areas to the lowest points.

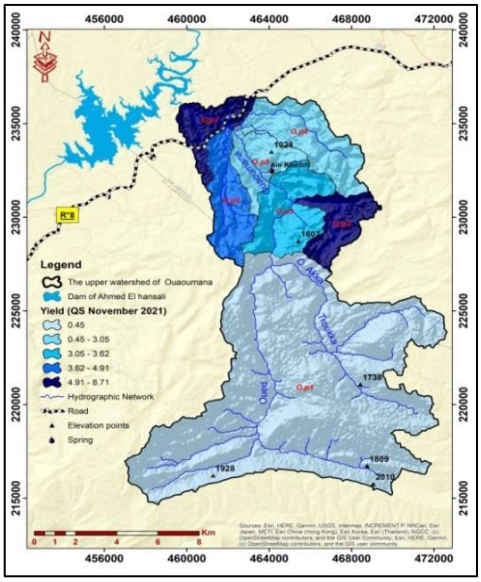

***Figure 4**: hydrological yield per sub-catchment in specific flows (l/s/km2) - November 2021*

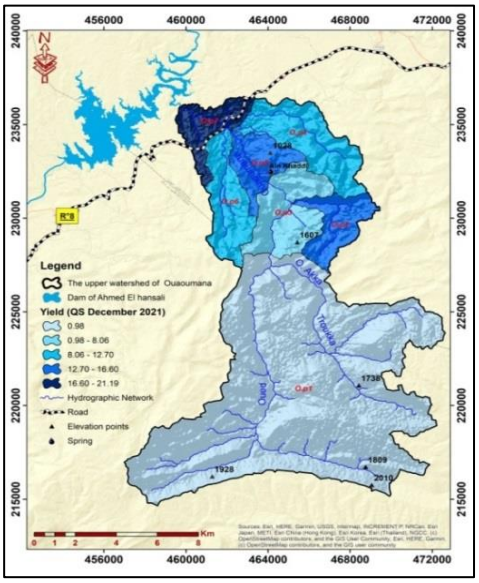

***Figure 5:** hydrological yield per sub-catchment in specific flows (l/s/km2) - December 2021*

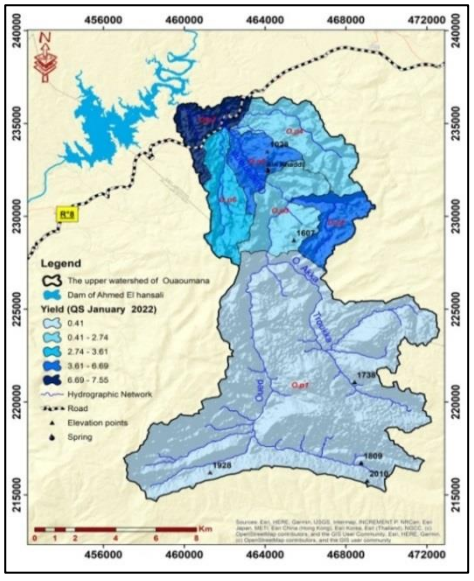

***Figure 6** : hydrological yield per sub-catchment in specific flows (l/s/km2) – January 2022*

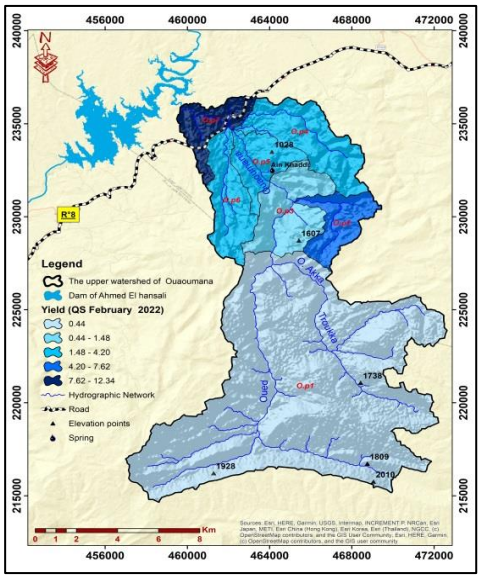

***Figure 7** : hydrological yield per sub-catchment in specific flows (l/s/km2) - February 2022*

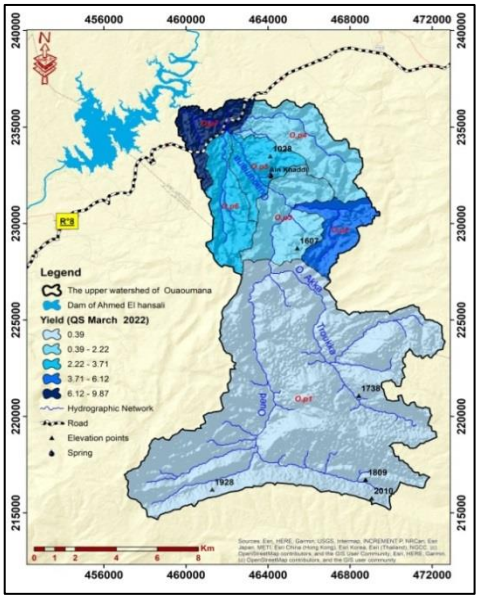

***Figure 8** : hydrological yield per sub-catchment in specific flows (l/s/km2) – March 2022*

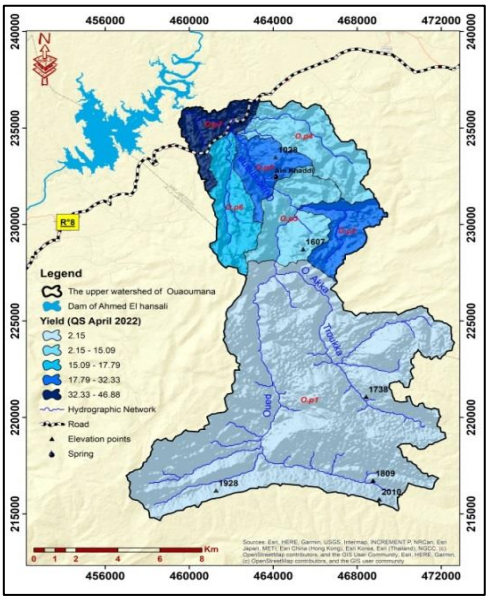

***Figure 9 :** hydrological yield per sub-catchment in specific flows (l/s/km2) - April 2022*

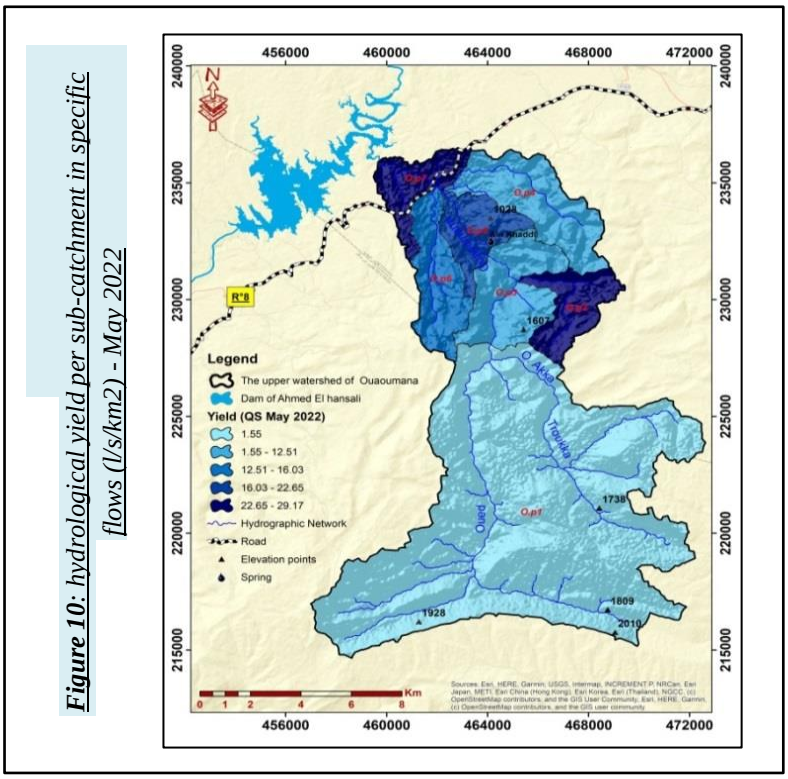

***Figure 10**: hydrological yield per sub-catchment in specific flows (l/s/km2) - May 2022*

The sub-catchment areas (O.p2 to O.p6) which flow in the limestone and marl and shale are characterized by the presence of springs such as the ^Khaddi^ spring. But in this sector there is strong concentration of agricultural activities, and the Population uses a large quantity of Water from the wadi for irrigation (withdrawal from motor pumps...) (Fig 11) which leads to the reduction of surface and groundwater, however we note that the productivity of the aquifer in these sub-catchment areas is still low.

Figure 11: withdrawal of water from the Ouaoumana river for irrigation purposes

The sub-catchment area (O.p7) has the highest yield, but the problem is that the inhabitants of this part discharge wastewater, which can increase the flow rates and the pollution of the wadi (the discharged flows are sometimes higher than the natural ones).

V. Conclusion

It can be concluded that the population of this area contributes to the loss of a large quantity of water from the Wadi through the withdrawal for agricultural irrigation, especially between the points (O.p2 and O.p6), and therefore the phenomenon of low water in this basin is influenced by human activities, which reflects the poor management of these water resources and in this case, we can speak about anthropogenic low water.

References

[1] Ghadbane.O , El Ghachi .M , Jaa .F , Lkhidar. A, 2020, Amélioration de la connaissance hydrologique du fonctionnement hydrologique du bassin versant de l'oued srou : mesures des débits et création d'une courbe de tarage pour l'année 2017(bassin de l'oued Oum Er Rabia- maroc), article, (ISBN : 987-9920-39-368-3)10p.

[2] Lang .C, 2007, Etiages et tarissements : vers quelles modélisations ? L'approche conceptuelle et l'analyse statistique en réponse à la diversité spatiale des écoulements en étiage des cours d'eau de l'Est français, thèse de doctorat université de Metz, France 375 p.

[3] Lejeune .O, Devos .A, 2004, Apports des méthodes hydrologiques dans la compréhension des écoulements en pays calcaire : Exemple des bas plateaux jurassiques du haut bassin de la Marne (France), 44/PP.

[4] Sarry .M, Devos. A, 1995, Captures actives et hydrologie entre Marne et Meuse (Lorraine) https://www.persee.fr/doc/rgest_0035-3213_1995_num_35_3_2308.