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Sector: Hydraulics

Specialty: Water Resources

Theme

Test for determining the relationship between evaporation and soil temperature in the Ouargla region

Publicly the: …/…/…….

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DEDICATIONS

Thank God and we have been and would not have been able to come to him without a favor God has on us.... Having said

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The Man found it simply and didn't live in isolation from other people.

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I dedicate my study for you to graduate, calling on God Almighty to prolong your life and bless you with good deeds

S.ACHWAK

Summary

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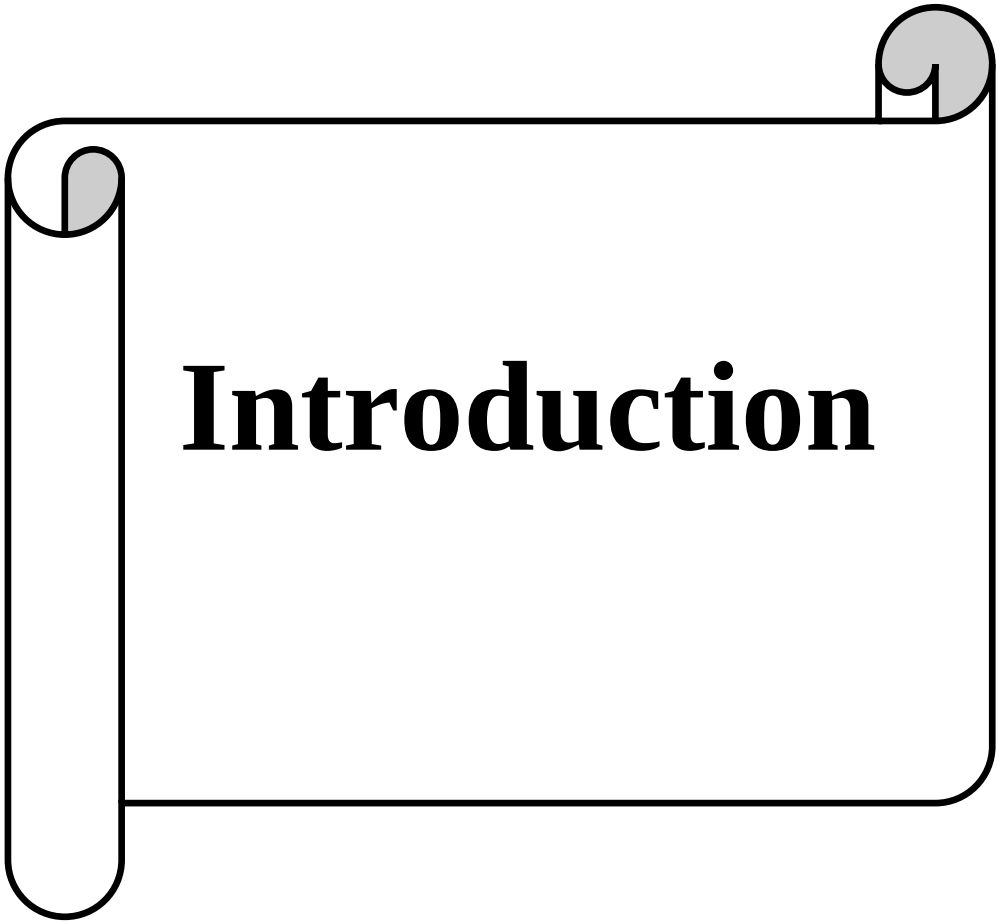
Introduction

INTRODUCTION

The theoretical study of the diffusion of water vapor under natural conditions is very complex; it is far from reaching perfectly satisfactory solutions. **(RIOU 1975**)

Arid zones are characterized by low precipitation and strong evaporations which are due to the meeting of the parameters that favor this phenomenon such as: temperature, insolation, winds and low humidity suffer from a severe shortage **(Bensaadia- Ghebbache, 2014).**

The methods for estimating and / or determining evaporation are generally; either by instruments or by calculation using meteorological variables **(WMO, 1997)**

In arid areas characterized by often high air temperature during dry seasons, strong sunstroke almost continuous throughout the year and a considerable presence of dry winds (high speed) especially during autumn and spring

In Algeria, the measurement of evaporation is entrusted to the services of the National Meteorological Office (ONM) and to the services of the National Agency for Hydraulic Resources (ANRH). The determination of the evaporation value of water bodies in Algeria is therefore carried out from meteorological stations equipped with evaporation trays from these two organizations (ONM and ANRH) In the absence of trays

Our document is structured as follows:

- A first chapter: generality on evaporation and as a measure of the latter and evaporation in Algeria
- A second chapter: which deals with the presentation of the region, giving the geographical location of the region, its climate and an overview of water resources.
- A third chapter: which is an experimental one and which includes the materials used during the period of the experiments as well as the experimental protocol adopted in this study and we expose the results obtained, with some interpretations and a criticism of the results obtained

Chapter I:

Generalities

1/WATER CYCLE.

Earth's water is always in movement, and the natural water cycle, additionally called the hydrologic cycle, describes the continuous movement of water it's miles the invisible procedure of evaporation that modifications liquid and frozen water into water-vapor gasoline, which then floats up into the skies to turn out to emerge as clouds.

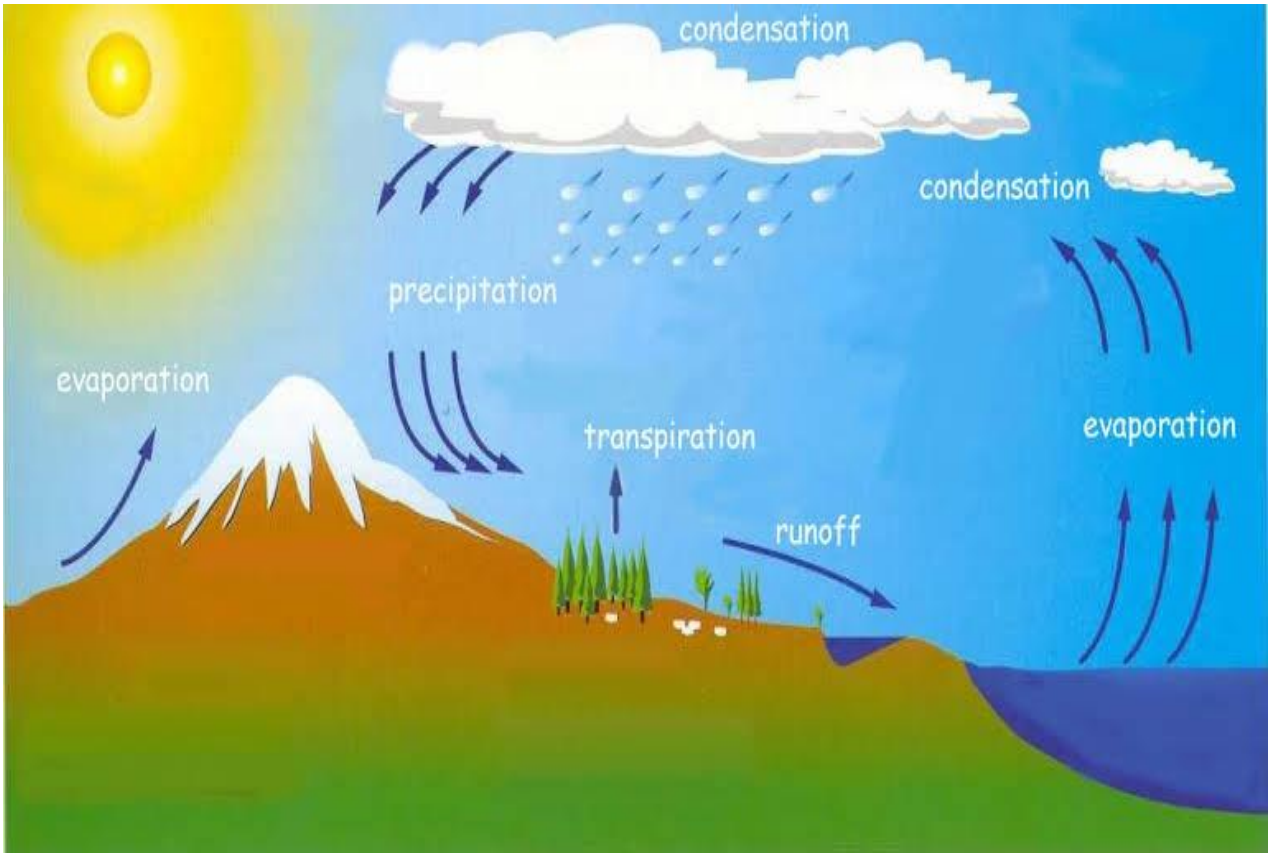

Figure 1: The evaporation stage of water cycle.(Photo from Google)**.**

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2/WHAT IS EVAPORATION ?

The term "evaporation" is generally the loss ofwater, in excess of condensation, to the atmospherefrom water surfaces, snow and soil. It also requires that the humidity of the atmosphere is less than the evaporating surface (at 100 % relative humidity there is no more evaporation)**(Blaney1956)**.The evaporation process requires large amounts of energy. For example, the evaporation of one gram of water requires 600 calories of heat energy. **(Ritter and Michael,)**.

The evaporation is an important manner in water cycle as it foundation approximately of 70% to 75 % of total annual precipitation which back to the ecosystem by evaporation. also the evaporation in hot climates is loosed from rivers canals and open water garage equipment is an essential depend, it takes a signification proportion of all water supplies that maximum of the water withdrawn for useful makes use of in the end returns to streams and aquifers and will become available for reuse even as the loss of water because of evaporation is absolutely lost from the usable supply. Even in humid areas, evaporation loss is sizeable

although the cumulative precipitation has a tendency to masks it in order that it is primarily not diagnosed besides at some point of rainless intervals.

Solar radiation is the ultimate source of heat with portions used in evaporation, heating of the earth's surface and air . Radiation takes a prominent place in methods to estimate evaporation by the heat-balance method The exact role of temperature has not been firmly established, but it is known that the emission of molecules from liquid water is a function of temperature the higher the temperature, the greater the rate of emission. Due to the interrelation between temperature and other climatic factors, it has been used in many empirical relations to represent evaporation. **(Russell Hamon1960)**.

Figure 2: water evaporation. (Photo from Google**).**

https://www.google.com/search?q=Water+Evaporating+from+hot+springs.

3/HOW TO DETERMINE EVAPORATION ?

3.1-MESURMENT OF EVAPORATION.

One of the simplest and oldest techniques to measure evaporation from a natural surface and from a dam is made, in different countries and in particular in Algeria, is based on the measurement of the water evaporation from a pan. The basic idea in the use of evaporation pans was that these measurements can be assumed to be proportional to evaporation from an open water surfaces, such as lakes or dams.**(World Academy of Science2012).**

A/ Class A evaporation pan.

- A pen of diameter 1210 mm and depth 255 mm.
- Depth of water is maintained between 18 and 20 cm.
- The pen is made of unpainted GI sheet.
- The pan is placed on a wooden platform of height 15 cm above ground level to allow free air circulation below the pen. **(World Academy of Science, 2012).**
- Evaporation is measured by measuring the depth of water in a stilling well with a hook gauge. **(Précis de mécanique, 2012).**

Figure 3:class-A pen. (Photo from Google**).**

B/ Colorado sunken pan.

- 1000mm square pan made of unpainted GI sheet, 450mm deep and buried into the ground within 50mm of the top.
- Main advantage of this pan it's aerodynamic and radiation characteristics are similar to that of a lake.
- Disadvantage, difficult to detect leak, expensive to install, extra care is needed to keep the surrounding area free from tall grass, dust….

Figure 4: Colorado sunken pan. (Photo taken by student).

C/ Floating pan.

- A square pan of 900mm sides and 450 mm depth.
- Supported by drum floats in the middle of a raft of size 4.25m*4.87 m it is set afloat in a lack with a view to simulate the characteristics of a large body of water.

- Water level in the pan is maintained at the same level as that in lake,leaving a rim of 75mm.
- Diagonal baffles are provided, in the pan to reduce surging in the pan due to wave action.
- Disadvantages – high cost of installation and maintenance difficulty in making measurements. **(Evaporation andevapotranspiration2012).**

Figure 5: floating pen. (Photo from Google**).**

3.2-Calculation of Evaporation.

A/ Low of Dalton.

Dalton established that the transfer of masses of water or other material into the phenomenon of evaporation is conditioned by the difference of the partial pressures of existing steam near the surface and in the free atmosphere. This law is expressed by the relation. **(Craig, et al. 2005).**

$$E=f(u).(e_s-e_a)$$

With:

E: Evaporation during a certain period **(mm/s)**.

$\mathbf{e_a}$: effective or actual pressure of water vapor in the air **[kPa]**.

$\mathbf{e_s}$: saturation water vapor pressure at evaporating surface temperature **[kPa]**.

f(u):constant proportionality (with wind speed u **[m^3/s]**.

This relation also expresses that, in theory and under given pressure and temperature conditions, the evaporation process is possible until the effective vapor pressure reaches an upper limit which is none other than the vapor pressure saturating (evaporation ceases as soon as $\mathbf{e_s = e_a}$). Thus, for there to be evaporation, the pressure gradient due to water vapor must be positive.

B/ Energy balance method

The energy balance method is recognized as the simplest method fordetermine evaporation from a surface of water.

$$E=[0{,}615.10^{-2}\ .R-d_{s1}+d_{s2}+d_{s3}]/\ [1{,}55+d_t/d_e]$$

With:

R: Radiation report **(dj/cm^2)**.

$\mathbf{d_{s1}}$: the storage Variation of water mass in a time period **(dj/cm^2)**.

$\mathbf{d_{s2}}$: difference between the recipe and the energy expenditure for the volume of water received and evacuated by the restraint **(dj/cm^2)**.

$\mathbf{d_{s3}}$: energy exchange between soil and the bottom of the reservoir **(dj/cm^2)**.

$\mathbf{d_t}$: difference between the temperature of the evaporating surface and the air **(c °).**

$\mathbf{d_e}$: difference of the partial water vapor tensions existing in the vicinity of the evaporating surface and in the air **(dj/cm^2)**.

However this method is difficult to apply due to the complexity of the necessary field measurements.

C/ Hydro-meteorological method

The formula of evaporation proposed by **BOUTAOUTAOU** is as follows:

$$E = 0.233\ n\ (e_S - e_a)\ (1 + 0.39\ V)$$

With:

E : evaporation **(mm)**.

$\mathbf{e_s}$**:** saturation water vapor pressure corresponding to the temperature of the evaporating surface **(millibar)**.

$\mathbf{e_a}$**:** vapor pressure in the atmosphere **(millibar)**.

V: wind speed **(m/s)**.

n: number of days of the month considered **(**for January **n = 31**, February **n = 28** etc…, for daily calculations **n = 1**).

It is the most widely used method for determining the evaporation of bodies of water. It is based on Dalton's physical law. The numerical values of this method are standard data which are always available in atlases and weather reports from the National Meteorological Office **(ONM)**.
But, the estimation of evaporation by this balance method is very little used from makes it imprecise and difficult to measure most components of the equation.

4 /EVAPORATION IN ALGERIA

In Algeria, water is a valuable resource which is very important in agriculture, industry and drinking water supply for limited water supplies is already on the heels of development efforts in many countries Overall, Algeria receives **100×109 m^3** of rain per year, of which 85% evaporates, the remaining **15%** either flows into watercourses to be stored in dams or dumped into the sea, or infiltrate **(Remini 2010)**.

Algerian arid zones are characterized by high temperatures **(up to 50°C)**, weak precipitation **(less than 200 mm)**,**(D.Dubost,2002)**, low rates of humidity, and high evaporation (2 to 3 or 4 **m/year** in arid zones and 5 to 6 **m/year** in hyper-arid zones according to Rognon.**(2000).**

However the evaporation in Algeria is concentrated not only in the arid regions, but also in the north ,Where we find that the largest amount of evaporation is at the level of dams The overall capacity of the **68 dams** is **7.1×109 m^3(Terra 2013)**. However, most of these dams are subject to a loss of capacity mainly due to natural phenomenon , namely:water leaks which affect around twenty dams **(with 40×106 m^3/year)**, and evaporation **(around 250×106 m^3/year)(Remini2010)**.

Researchers, for several years, have adopted a multitude of physical and chemical methods to reduce losses of water by evaporation in water bodies**(Seggai et al.,2016)** such as:

- Storage of water in the sand (the water stored in the pores) and its level is maintained at 30 cm above the surface**(Frenkeil, 1965)**.
- Wind breezes **(Hipsey 2002)**.
- Mono-molecular films (monolayers) **(Barnes 2008)**.

Chapter II:

Presentation of the area of Ouargla

1/GEOGRAPHOCAL SITUATION

The department of Ouargla **(31°58 N., 5°20' E)** is situated in the south-east of Algeria. It is **800 km** from Algiers. The city of Ouargla is situated at an altitude of **134 m** above sea level (**Rouvillois-Brigol1975)**.A large territory of **163,230 km^2**, ideally positioned in the center of the region South / East.

The Department is bordered:
from North, by departments of Djelfa, Biskra and El-Oued, from South, by departments ofIllizi and Tamanrasset, from East by Tunisia. and from West by Ghardaïa department . **(ANDI 2013)**

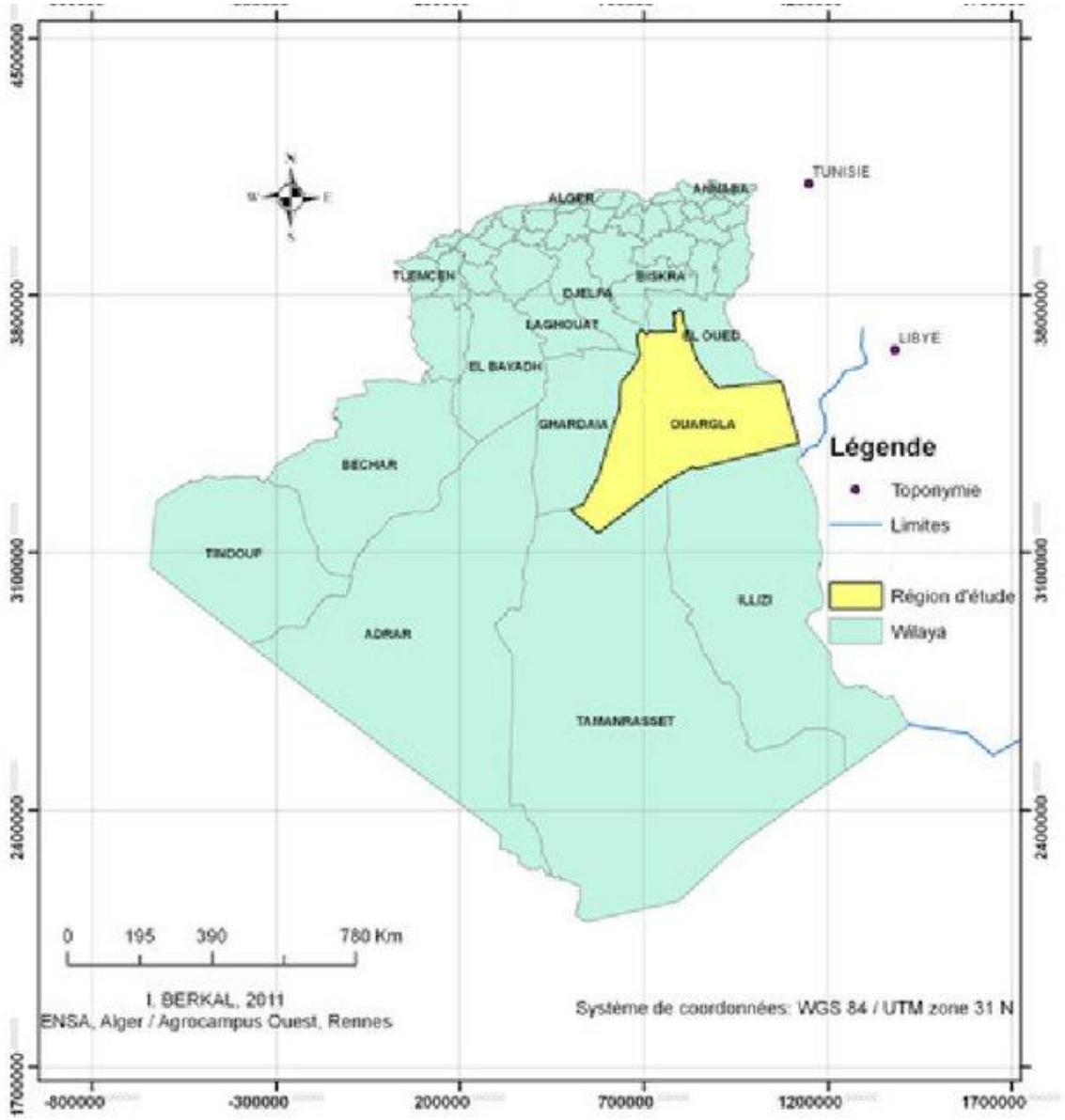

Figure 6 : Geographical location of the Ouargla region.

Administratively, Ouargla regioniscomposed of six communes: Ouargla, Rouissat, N'goussa, Sidi-Khouiled, Hassi Ben-Abdellah and Ain-Beida **(DSP Ouargla, 2016)**.

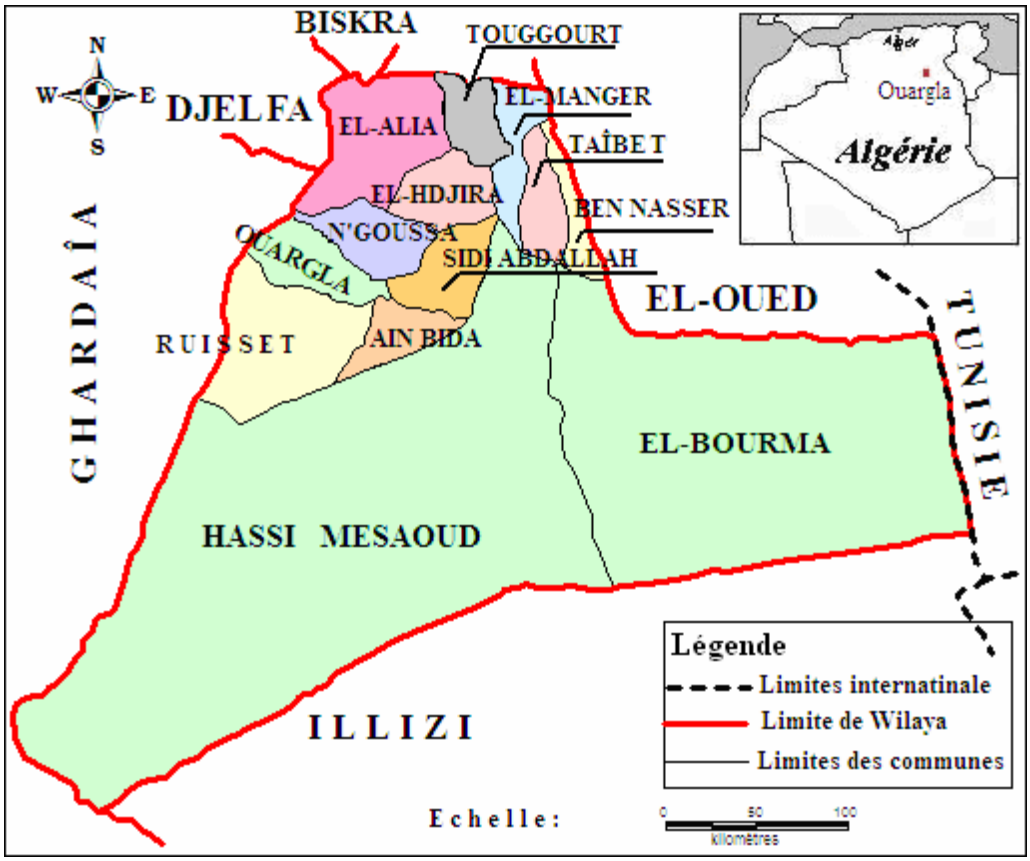

Figure7: Administrative delimitation of department of Ouargla**.**

2/CLIMATE

The climate of Ouargla is typical of Saharan desert, with a mild winter which is characterized by low precipitation, whereas the summer is characterized by intense evaporation, high temperatures and long sunshine periods. (**Toutain1979**).

Table 1 : Averages of meteorological data recorded at Ouargla meteorological station (2007-2018)

Month	Tmin av[°C]	T max [°C]	H avmin [%]	H avmax [%]	W[m/s]	R[mm]	EVA [mm]	INS [Heure]
January	5,2	19,3	35	79	8,2	5.74	90.2	229.17
February	6,7	21,3	28	69	9,5	3.07	125.6	236.70
March	9,8	25,6	23	62	10,4	4.32	189.4	268.2
April	15,3	30,7	20	54	11,5	1.52	240.71	279.36
May	20,1	35,4	17	46	15	1.74	313.99	302.56
June	24,8	40,4	15	40	10,4	0.675	371.25	237.92
July	28,0	44,1	13	34	8,8	0.291	408.32	290.19
August	27,3	42,5	15	40	9,3	0.54	393.35	336.6
September	23,8	38,3	20	52	9,6	5.21	281.33	266.02
October	19,0	31,7	25	61	9,5	3.15	187.39	242.61
November	10,3	24,3	31	73	7,5	2.30	124.10	251.50
December	5,7	19,6	36	81	7,4	3.675	87.37	232.80

ONM 2019

T av_{max}: Maximum average temperature in C°.

$H_r av_{min}$: Minimum average relative humidity in %.

$H_r av_{max}$: Maximum average relative humidity in %.

Wav max: Max average wind in m/s.

R: Accumulation of rain in mm.

EVA: Total evaporation in mm.

INS: Duration of Insolation in Hour.

2-1. The Temperature.

Temperature is an important invoice governing the climatic conditions, it is mainly involved in the evaluation of the slip deficit.

In Ouargla, the minimum annual average temperature is 5.2C° for the coldest month (January), and a maximum annual average temperature of 44.1C° for the hottestmonth (July).

2-2. Humidity.

In Ouargla, the average annual minimum humidity is 13% for the month of (July) and the average annual maximum humidity is 81% for the month of (December).

2-3. Winds.

Seasonal sandstorm blow up on a bimonthly (February and April),peaking in march, often causing loss; and the atmosphere begins to improve from September when the wind is heading out, to be north-east.

The prevailing winds in the state are north-east and south-east continental, sometimes exceeding 15m/s and defining the regionwhich is characterized by heat and dryness.

2- 4.Precipitation

The precipitation chart for Ouargla shows how many days per month a certain amount of precipitation is reached.In tropical rains and monsoon can be underestimated.

The inadequacy of the Saharan rains is accompanied by a very marked irregularity of the rainfall regime and considerable inter-annual variability, which accentuates the drought. Precipitation is very rare, especially in the month of January 5.74mm.

2- 5.Evaporation

Evaporation in the Ouargla region is very strong especially during the warmest months. The maximum observed of July (408.32mm).The minimum of December (87.37mm).

2- 6.Sunshine

The region of Ouargla is characterized by a strong insolation. With a maximum of (336.6hours) in August and a minimum of (229.17hours) in January.

3. Climatic synthase of Ouargla Region

3-1.Diagramme ombrothérmique.

The umbrothrmic diagram was developed by Bagnouls and Gaussen (1953) to identify dry and wet periods in a given area. This is a graphical representation of the climate of a region, and in particular of periods of drought (DAJOZ, 1970). According to BAGNOULS-GAUSSEN (1953), drought occurs when the temperature curve falls below the precipitation curve.Ouargla is characterized by a particularly contrasting climate despite the relatively northern latitude (ROUVILLOIS-BRIGOL, 1975).

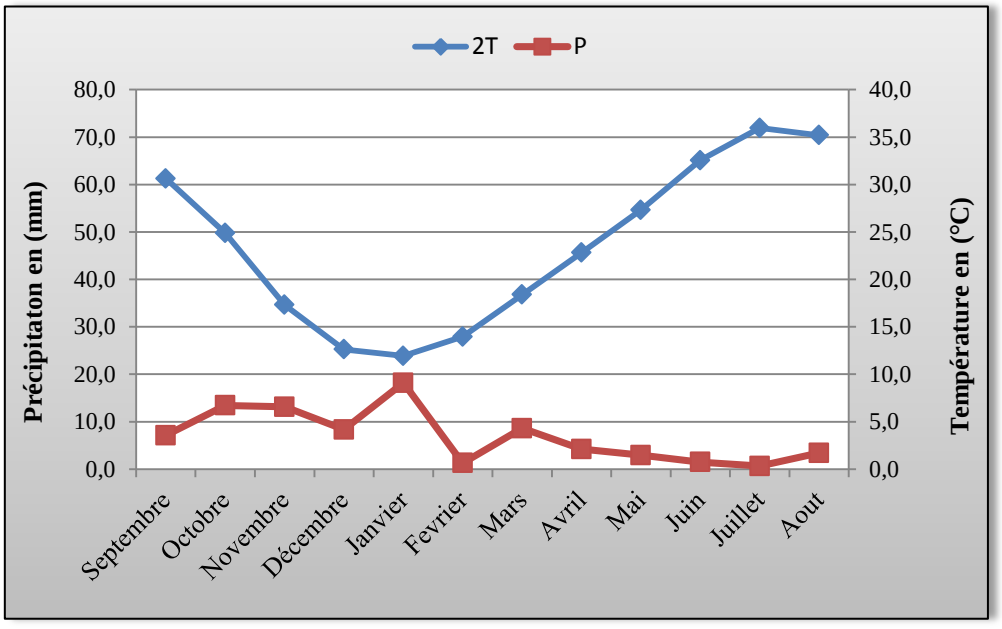

Figure 08:- Ombro-thermal diagram of Bagnouls and Gaussen from the period (2007-2018) of the Ouargla region.

4/Water Resources in Ouargla.

The city of Ouargla is located in a depression called basin of Ouargla which includes theagglomerations of Ouargla, N'Goussa, Rouisset, Ain El Beida and SidiKhouiled.

The basin has a total area of about 95,000 ha that extends over a length

about 55 km south-west/north-east oriented and limited:

-North by SebkhetSafione.

-East by the ergs of Touil and Arifdji.

-South by the dunes of Sedrata.

- West by the east side of the M'Zab ridge.**(Belaid.R.2014)**

4- 1Sebkhas and Chotts

The natural environment consists of the Chotts and Sebkhas who are on the highest levelthe bottom of the Ouargla basin, play the role of depression and decantation. The chott is is siliceous and/or gypsum sand and gypsum surface and sub-surface soils, whereasthe presence of a permanent water table.

Of the 99,000 hectares in the Ouargla basin, the area occupied by areas of sebkhas is estimated at 21000 ha of which 3500 ha are represented by the chotts (placesof stagnant water), among the most important are the ChottAinBeida,Oum-Er-Raneb and SebkhetSafioune and Lake Hassi Ben Abdallah.(**Boutelli2011)**

A/ChottAïn El Beida.

ChottAïn El Beida is located 6 km east of the Chief Town of the Wilaya de Ouargla and close to the Chief Town of the municipality of Aïn El Beida (longitude 5°22’42’’ at 5°21’52’’ East and latitude 31°57’30’’ at 31°59’02’’ North). The National Highway No. 49 is its lower limit.The chott is a saline depression whose part is flooded by the sebkha with an area of 6,853 hectares, which are located in the middle of the palm grove and in the Ouargla basin.Elongated in a North-West, South-East direction for a length of 5.3 Km, its width varies from 1 to 1.5 Km.The Chott is at an altitude between 142m and 146m. It is traversed by a network of drains that channel the surplus water from the water table of the palm grove of Ouargla as well as the used water of the city of the same name.(**Koull2015**)

Figure 9 : Chott Ain El Baida ouargla

(https://images.app.goo.gl/1ahRvtevTgrfLKw99)

B/ Chott Oum El-Ranneb.

SidiKhouiled is the nearest town to the site, about 2Km, crossed by the road connecting the city to N'Goussa. The village of Oum El-Ranneb, about 500m away, is also adjacent to the site.The Chott shall be longitude 5°22'42'' to 5°21'52'' East and latitude 31°57'30'' to 31°59'2'' North.It is of shallow depth with an area of 7.155 ha and an altitude of 126m on average.

For 23 years, the ChottOum El-Ranneb has been used as an outlet for the agricultural drainage of the surrounding palm groves. In summer, its brackish waters are exploited for their salt.Today, in the face of the rural exodus and the galloping demographics of the city of Ouargla, the chott has become not only an outlet for agricultural drainage water, but also for wastewater from the city of Ouargla.(**BOUTELLI H.2011)**

Figure 10: Chot Oum Raneb Ouargla

(https://images.app.goo.gl/LG4jAbvWtp9ydHSx7)

C/ Lake Hassi Ben Abdallah.

Lake Hassi Ben Abdallah is located at the bottom of a hollow to the west of the commune of Hassi Ben Abdallah (32°01'54'' North and 5°44'66" East), bordered by sand dunes to the north (Erg), by a sebkha to the south and to the east by the national road No. 56. The lake has an area of 4 ha and a maximum depth of 4.7m.**(Halfaoui.2009)**

Figure 11: lake Hassi Ben Abdellah

(https://images.app.goo.gl/hyumnEhL322tYd267)

4-2.The aquifer system.

The aquifer system of Ouargla consists of three aquifers ; the water phreaticaquifer, and two captive aquifers (the complex terminal **"CT"** and the intercalary continental **"CI"**). The water phreaticis not exploited because of the high ratioof salt that contain. It is thick from 1 to 8m and is based on a level sealed waterproof, which occupies the entire bottom of the valley of Ouargla and the isolates of artesian underlying aquifers.(**Rouvillois-Brigol.1975**)

The aquifer system of the CT covers the major part of the eastern basin of northern Sahara on approximately 350 000 km².The reservoir of the CI is contained in the continental formations in the lower Cretaceous (Barremian and Albian), composed mainly of sandstone, of sands and clays. The reservoir extends about 600 000 km², the roof of the aquifer, consisting of clays and of evaporite the Cenomanian, a Continuity on all the basin of Ouargla and Of a thickness of 600m approximately, with a depth from 1200 to 1500m.**(BelhadjaissaBoutaoutaou.2017)**

The Saharan aquifer system has been defined by nearly 8,800 water points, boreholes and sources: 3,500 in the Intercalar Continental and 5,300 in the terminal complex. **(OSS,2003).(Sahara and Sahel observatory)**

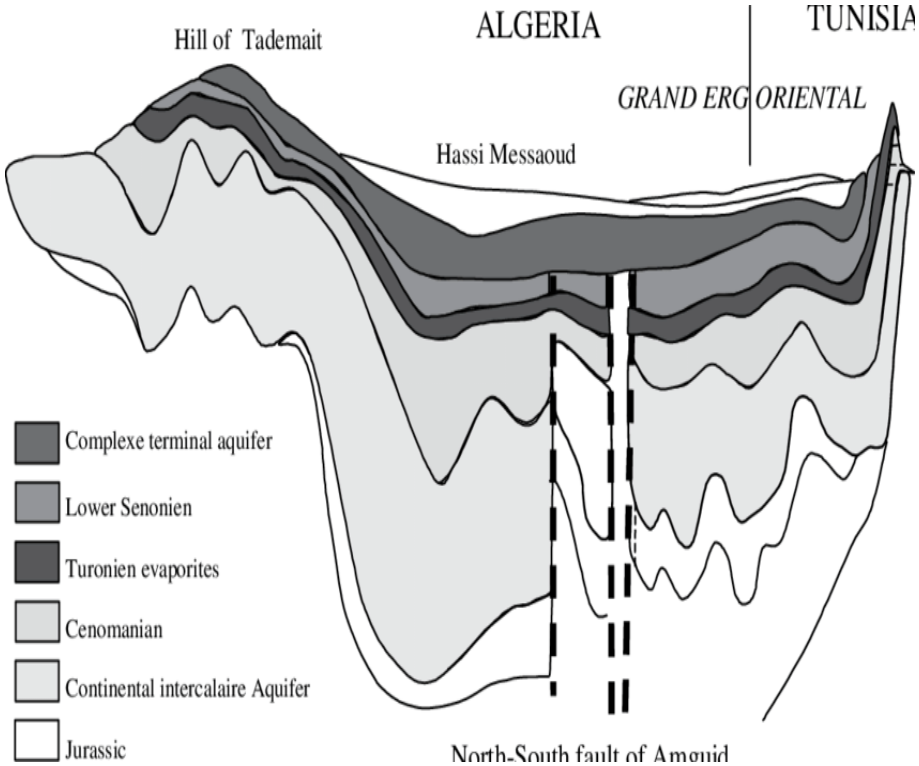

Figure 12: the intercalary continental of Ouargla

(https://images.app.goo.gl/ACVnWaspMbwTisBT8)

The characteristics of the tablecloths of the Ouargla region are shown in Table N°02 below.

Table 2: The given level of static and dry Resides.

Aquifer	**NS (m)**	***RS(g/l)***
Phreatic	***9-16.4***	***6***
Mio-Pliocene	***0.8-38.40***	***1.66-5.1***
Senonien	***Art 29.4***	***1.79-5.11***
Albien	***Art***	**-**
Albo-barrénmien	**-**	**-**

(ANRH,2014)

Chapter III:

Materials and methods

1/Materials and methods:

This experience was carried out at the ITIDAS Hassi Ben Abdellah OUARGLA pilot station , for different periods (July, December, March) , the two adjacent Colorado and Class A bins have been installed, keeping a space of 3m and each bin is 80% full of water. In our work we used two types of pans:

1-1.Colorado pen

It is square, 1 m on a side and 0.5 m deep and made of galvanized iron. As the name suggests, it is buried in the ground to within about 5 cm of its rim. The Reading is done by placing a ruler with the water level, then we take the first value, then we take the second value after 24 hours, and so on until the month ends.

Figure 13:Colorado pen (photo taken by googl)

1-2 Class A pan

It is a circular basin, placed above the ground, with a diameter of about 1.3 meters and a depth of about 0.3 meters , for data determination we Read the water level in the pen, after 24 hours we read the second time level, than we calculate the difference, obtain the evaporation rate

Figure 14: class A pen (Photo taken by students).

1-3. Thermometer

For measuring air temperature and relative humidity air is installed in the weather shelter. He is of the type "English", its base being 1.50 m from the ground. This type of shelter, with double shutters protects very well from solar radiation; but on the other side , its ventilation is poorly assured, which can influence the instantaneous measurements, increasing the inertia of the mass of air contained in the shelter. The air temperature is measured by the dry thermometer (1), the thermograph recorder (2).The measurement is directly by reading on the thermometer

Figure15: Weather shelter (Photo taken by students).

1-4. Relative air humidity

The relative air humidity is measured by a recording hygrometer (3)

1-5. Water Temperature

To measure the water temperature we use the thermometer.The measurement is directly by reading on the thermometer.

Figure 16: thermometer

(https://images.app.goo.gl/zwAHLtffnxjedRs99)

1-6. Soil temperature measuring device

It is made up of 3 thermometers immersed under the ground, each of which is connected to a rope under a depth of 30, 60 and100 cm

1-7. The SPSS software

SPSS is a statistical application that works under the Windows application, and it is a set of lists and tools by which data can be entered by the scientific researcher through questionnaires, interviews or observations, and then do their analysis (statistical analysis), The statistical system SPSS depends on digital information, and the program is characterized by its great ability to process the data that is supplied with it, and it can be used in all scientific research methods.. This software includes several modules:

- **Basic system.**
- **Regression models.**
- **Advanced models.**

- **Tables (tables).**
- **Exact tests.**
- **Categories.**
- **Trends.**

Other specialized modules :

This site is however devoted to the basic system and some statistical procedures. The presentation is based on version 17.0 of the software, but can be used for versions 10.1 to 17.0 available for PC type computers.

The principal role of this program is: When collecting information and data related to the methods of scientific research, the matter requires some tools that contribute to the classification process, and then analysis, and access to the explanatory results of the research assumptions submitted by the scientific researcher. Describing the variables, and thus generalizing the results that are reached on the study community, and it is recognized that obtaining information from all the vocabulary of society is very difficult, and requires large financial sums, in addition to the necessity to include a large number of participants in scientific research, so therefore Using a sample method is the best solution to get results in the shortest period of time and with minimal effort.

ANOVA in SPSS : The acronym ANOVA refers to analysis of variance and is a statistical procedure used to test the degree to which two or more groups vary or differ in an experiment. In most experiments, a great deal of variance (or difference) usually indicates that there was a significant finding from the research.

Working method

Our experimental study is based on the samples of the metrological parameters are: (the water temperature and height, soil temperature (every day), air humidity (every Monday), this parameters were made at the experimental metrological station in ITDAS HASSI BEN ABDELLAH OUARGLA.

-the evaporation measurements and the other parameters were made at **10:00AM** every day of each month (once a day).

Chapter IV :

RESULTS AND DISCUSSION

Analyse statistique des résultats.

Table 03:Correlations 1

		EColorado	Tsol30	Tsol60	Tsol100	Tair
EColorado	Pearson Correlation	1	,648**	,650**	,652**	,648**
	Sig. (2-tailed)		,000	,000	,000	,000
	N	56	56	56	56	56
Tsol30	Pearson Correlation	,648**	1	,991**	,995**	,986**
	Sig. (2-tailed)	,000		,000	,000	,000
	N	56	56	56	56	56
Tsol60	Pearson Correlation	,650**	,991**	1	,998**	,988**
	Sig. (2-tailed)	,000	,000		,000	,000
	N	56	56	56	56	56
Tsol100	Pearson Correlation	,652**	,995**	,998**	1	,991**
	Sig. (2-tailed)	,000	,000	,000		,000
	N	56	56	56	56	56
Tair	Pearson Correlation	,648**	,986**	,988**	,991**	1
	Sig. (2-tailed)	,000	,000	,000	,000	
	N	56	56	56	56	56

Correlation is significant at the 0.01 level (2-tailed).

-After studying the previous table.We note that the relationship between axes is a terminal relationship. We note three results in the table:.

-A perfect end link. for example, comparing evaporation in columns and evaporation in lines....also for other factors (soil temperature at 30cm.60cm.100cm and air temperature).(Results shown in blue).

-A strong correlations between air temperature and soil temperature at 30cm 60cm 100cm. (Results shown in red).

-A medium terminal link to the evaporation link compared to the air temperature. Soil temperature at 30cm 60cm 100cm.(Results shown in yellow).

Table 04 : Case ProcessingSummary of E colorado

		Cases					
		Valid		Missing		Total	
	Periods	N	Percent	N	Percent	N	Percent
EColorado	P1	20	100,0%	0	0,0%	20	100,0%
	P2	20	100,0%	0	0,0%	20	100,0%
	P3	16	100,0%	0	0,0%	16	100,0%

This table represents the size of the samples entered in the program and the percentage of data lost. We note from this table that all data entered for the evaporation rate has been worked on in the program.there are no samples missing or not worked on.

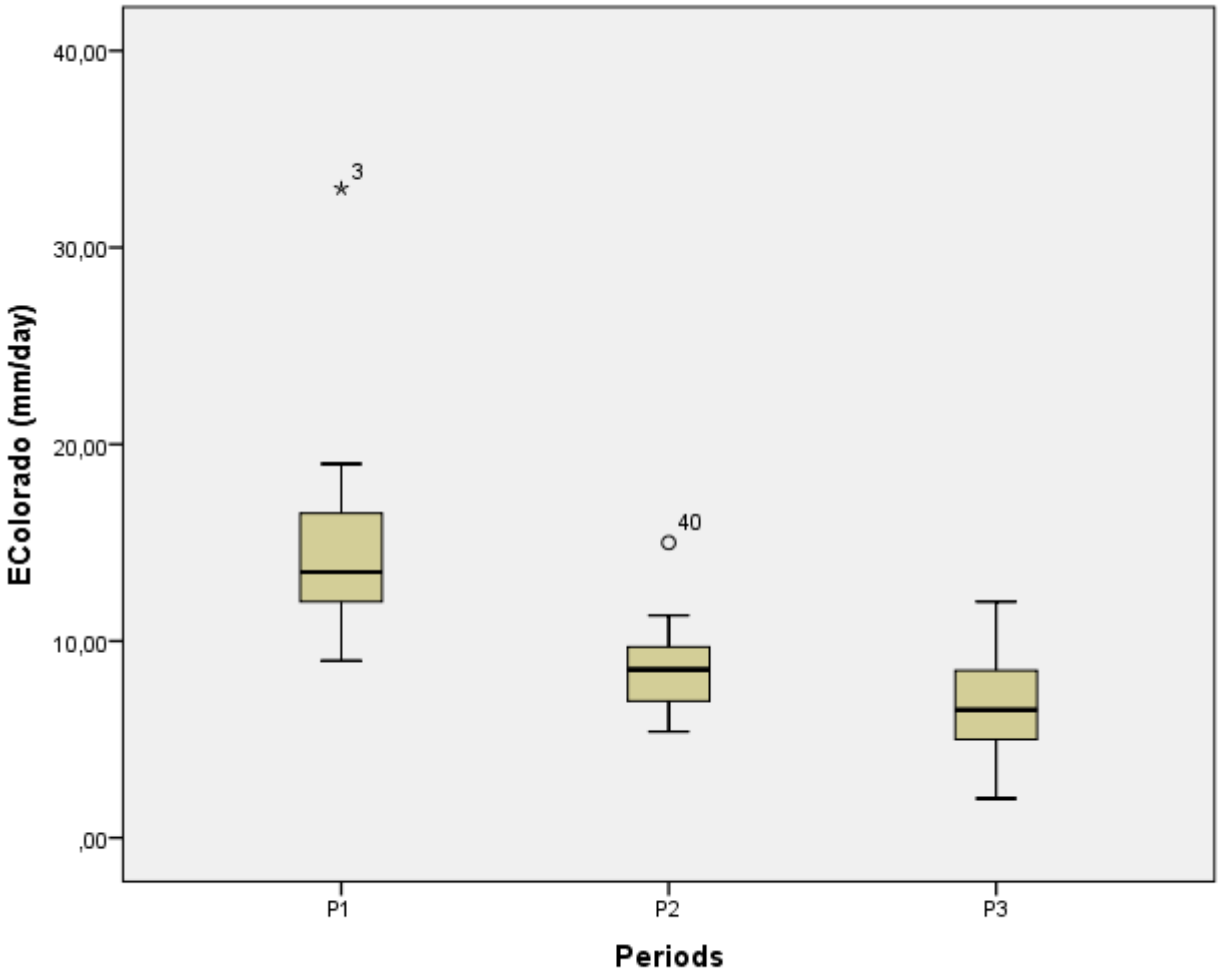

Figure 17: Boxplot evaporation ratio in the three periods

This curve represents the evaporation ratio in the periods studied.

In the first period P1 the air temperature values are higher than the second and third periods P2 and P3,The median for the second period P2 is above and for the third period P3 is in the middle of the square compared

to the first period P1, which was the median at the bottom of the box, This means an uneven distribution of soil temperature values, we also observe severe values for the first and second periods.

Table 05 : Case ProcessingSummary (T soil 30cm)

		Cases					
		Valid		Missing		Total	
	Periods	N	Percent	N	Percent	N	Percent
Tsol30	P1	20	100,0%	0	0,0%	20	100,0%
	P2	20	100,0%	0	0,0%	20	100,0%
	P3	16	100,0%	0	0,0%	16	100,0%

For the 30 cm soil temperature status summary table, 56 samples were generally taken.They are divided into three periods. the first period is 20 samples, Second period 20 samples, the third period is 16 samples. We note that all samples were made in the program and that there are no lost samples.

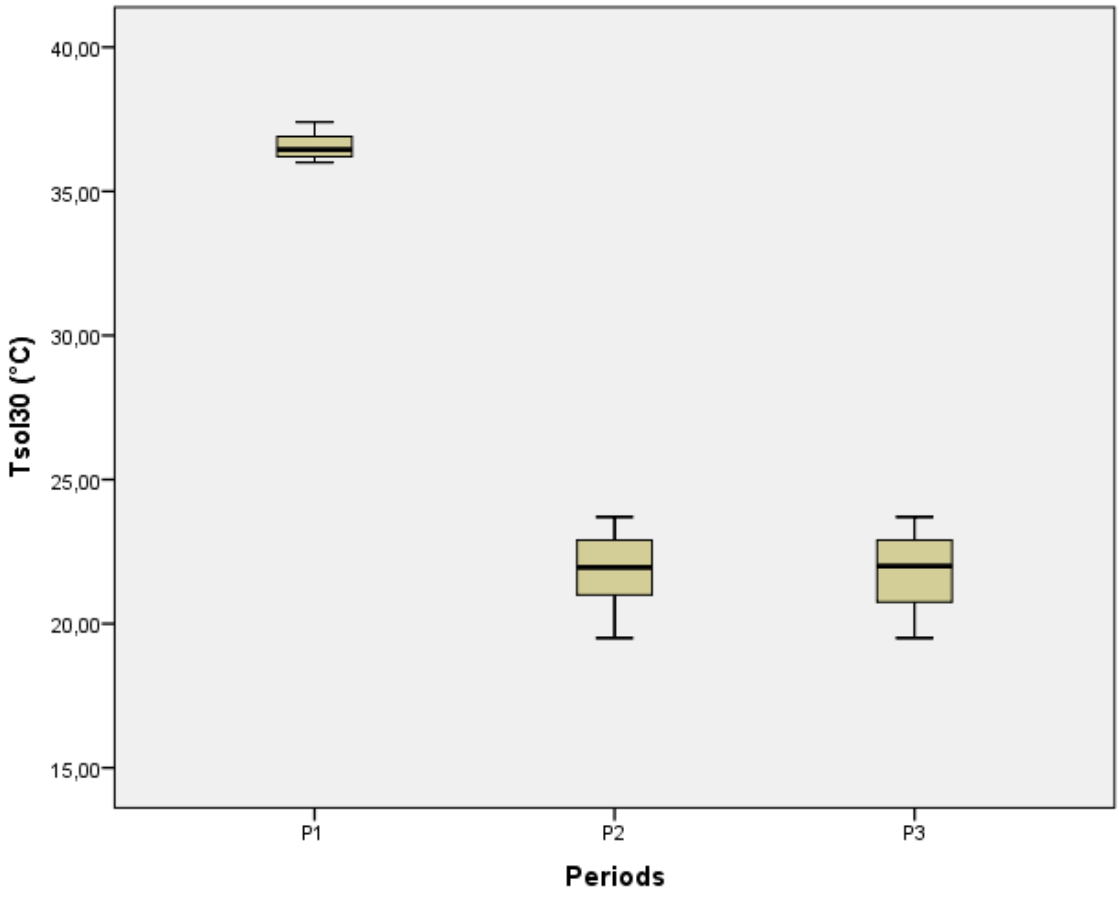

Figure 18: Boxplot soil temperature at 30cm in three periods:

For soil temperature at 30cm in three periods:

In the first period P1, soil temperature values are higher than the second and third periods P2 and P3, Also for the median in periods P2 and P3, the median is approximately above the square compared to the first period P1, which was the median at the bottom of the box, this means an uneven distribution of soil temperature values in 30 cm.

Table 06 : Case ProcessingSummary (Tsoil 60 cm)

		Cases					
		Valid		Missing		Total	
	Periods	N	Percent	N	Percent	N	Percent
Tsol60	P1	20	100,0%	0	0,0%	20	100,0%
	P2	20	100,0%	0	0,0%	20	100,0%
	P3	16	100,0%	0	0,0%	16	100,0%

For the general condition table at soil temperature at 60cm, 56 samples were taken in three periods, in the first period, 20 samples were taken, in the second period20 samples, and the third period is 16 samples. All samples were worked in the program, and there are no missing or missing samples.

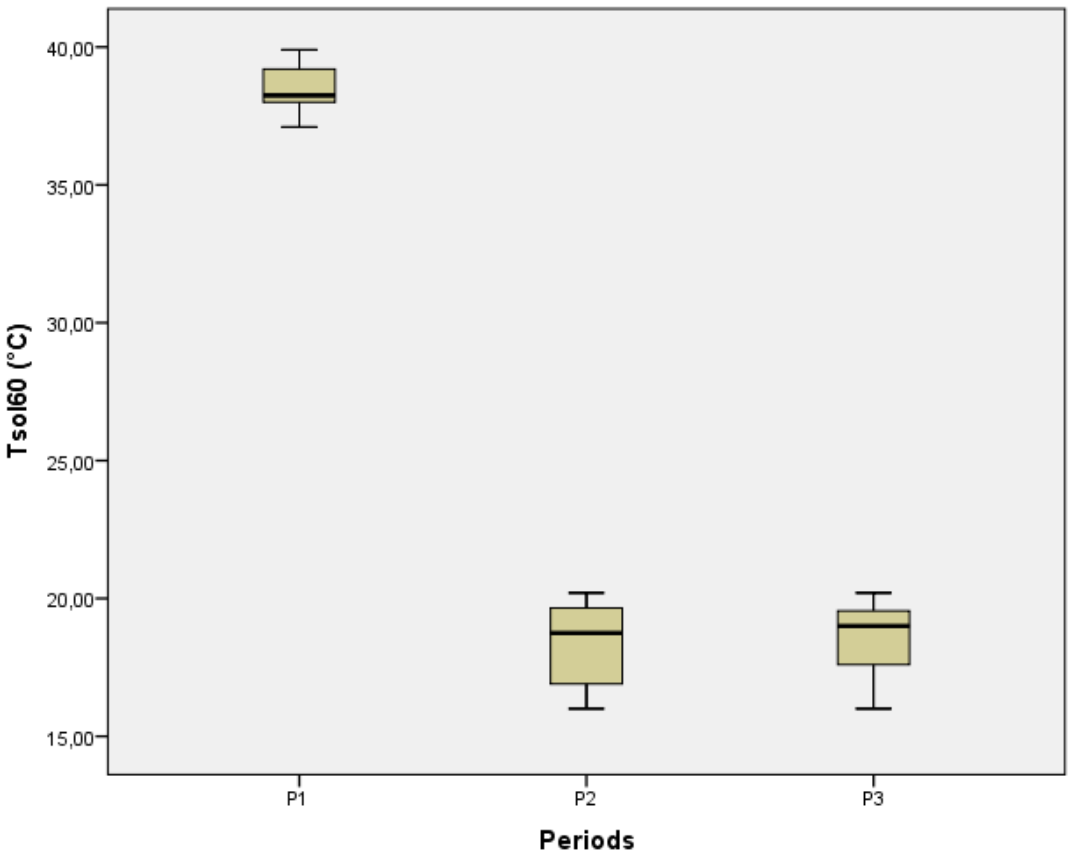

Figure 19: Boxplot soil temperature at 60cm in three periods

In the first period P1, soil temperature values are higher than the second and third periods P2 and P3.and also for the median in periods P2 and P3, the median is about above the square compared to the first P1 period that was the median at the bottom of the box, this means an uneven distribution of soil temperature values at 60 cm.

Table 07 :Case ProcessingSummary (Tsoil 100cm)

		Cases					
		Valid		Missing		Total	
	Periods	N	Percent	N	Percent	N	Percent
Tsol100	P1	20	100,0%	0	0,0%	20	100,0%
	P2	20	100,0%	0	0,0%	20	100,0%
	P3	16	100,0%	0	0,0%	16	100,0%

For the general condition table at 100 cm soil temperature, 56 samples were taken in three periods, in the first period 20 samples, in the second period 20 samples; and the third period is 16 samples. All samples were worked in the program, and there are no missing samples.

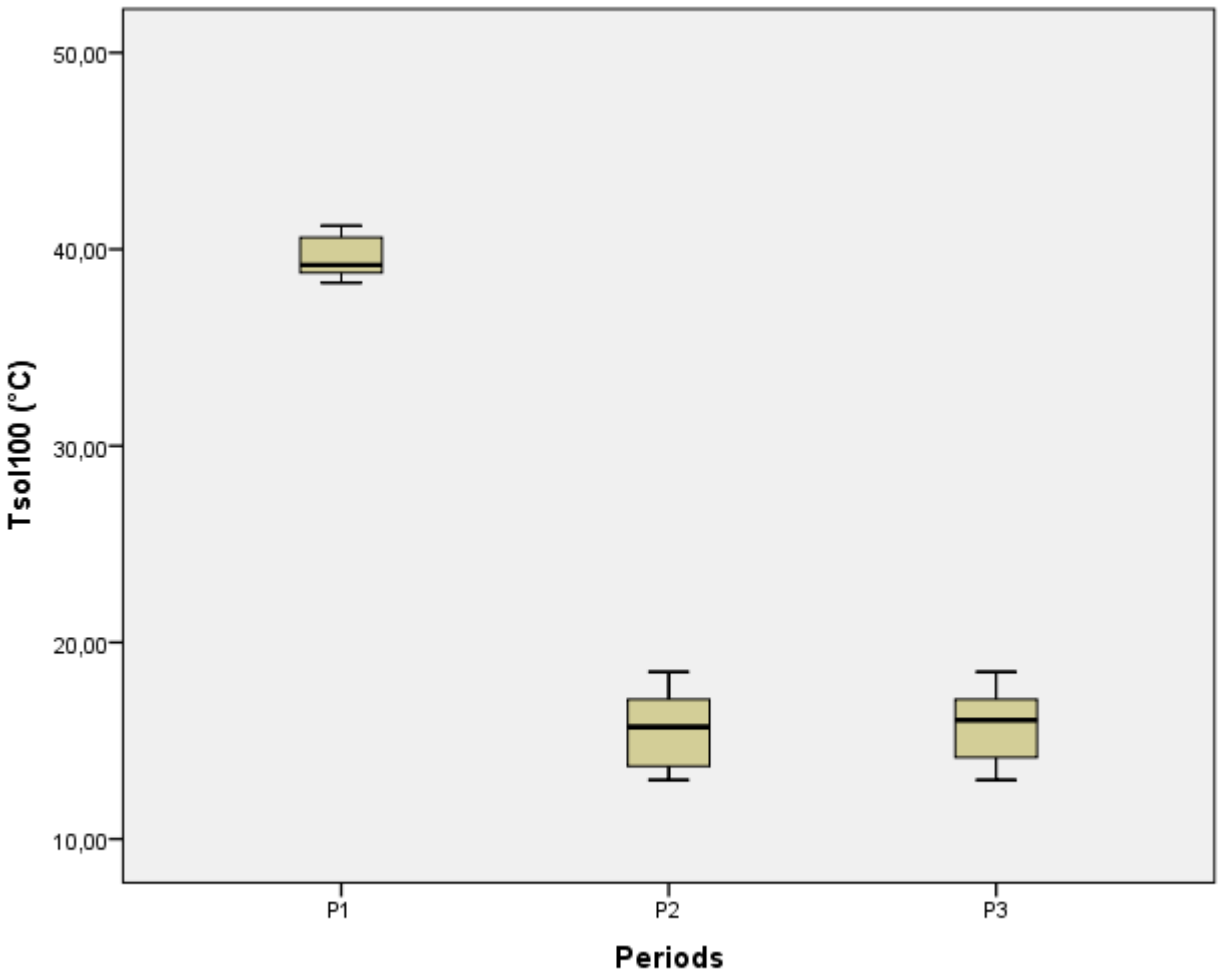

Figure20:Boxplot soil temperature at 100cm in three periods

In the first period P1, soil temperature values are higher than the second and third periods P2 and P3,Also for the median in periods P2 and P3, the median is approximately above the square compared to the first period P1, which was the median at the bottom of the box,this means an uneven distribution of soil temperature values at 100cm.

Table 08 : Case ProcessingSummary (Tair)

		Cases					
		Valid		Missing		Total	
	Periods	N	Percent	N	Percent	N	Percent
Tair	P1	20	100,0%	0	0,0%	20	100,0%
	P2	20	100,0%	0	0,0%	20	100,0%
	P3	16	100,0%	0	0,0%	16	100,0%

For the general condition table at the temperature.56 samples were taken in three periods, in the first period 20 samples were taken, in the second period 20 samples, and the third period is 16 samples.All samples were worked in the program and no samples were missing or lost.

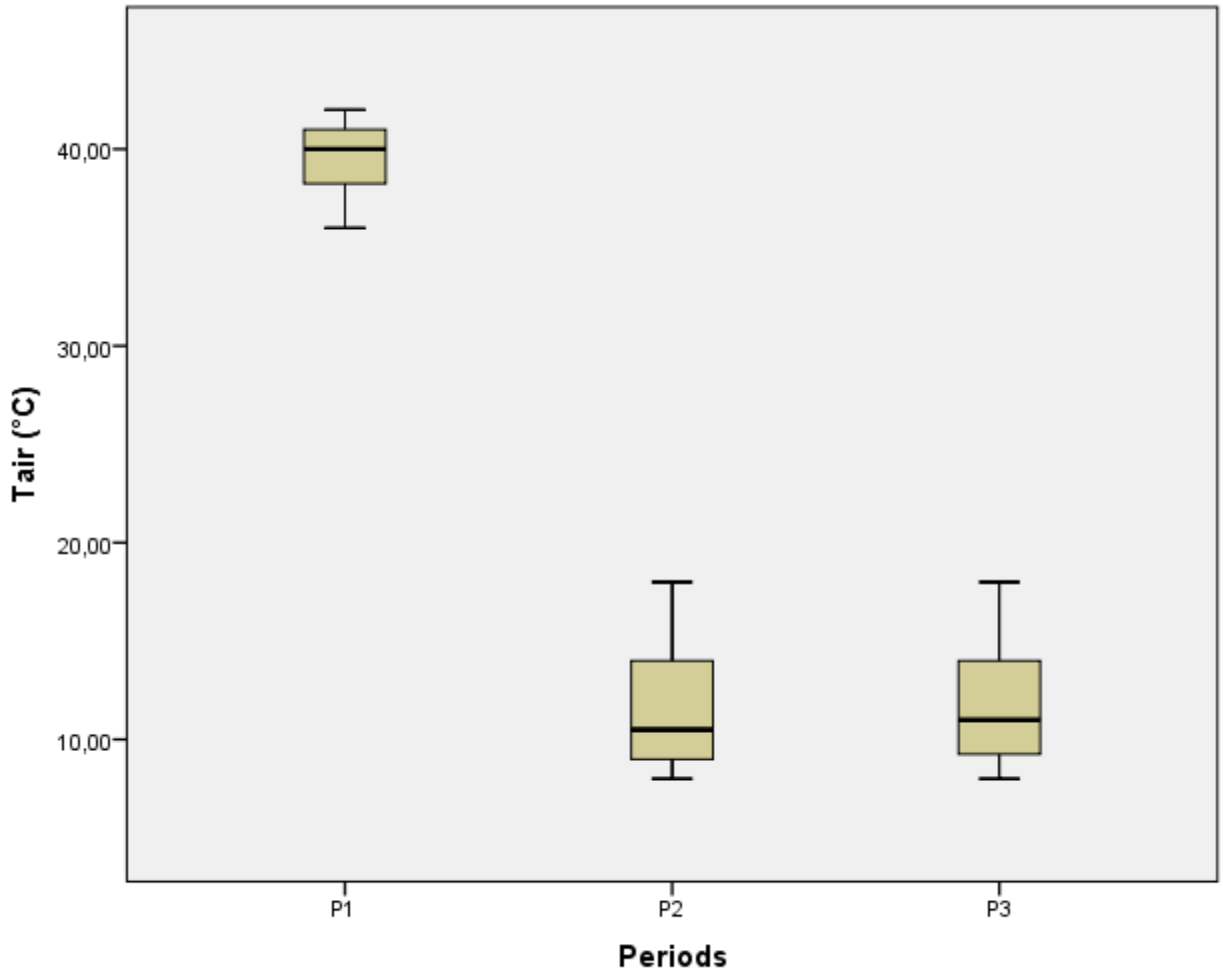

figure 21: Changes of (T° air) in function of preiods

The values for the first period P1 are significantly higher than those for the other two periods P2 and P3. In the last periods P2 and P3, the median is in the bottom of the box, which assumes an asymmetric distribution to the low temperature values. On the other hand, this median is in the top of the box in the period P1, which assumes an asymmetric distribution to the high temperature values.

Table 09: ANOVA (E Colorado)

EColorado

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	681,442	2	340,721	25,507	,000
Within Groups	707,979	53	13,358		
Total	1389,421	55			

According to the table above, the difference between these three groups is significant (F = 25,507; df = 55;Sig= 0,000).

Table 10 : Multiple Comparaisons (Ecolorado)

Dependent Variable: EColorado

LSD

(I) Periods	(J) Periods	MeanDifference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					LowerBound	UpperBound
P1	P2	6,10500*	1,15577	,000	3,7868	8,4232
	P3	8,25000*	1,22588	,000	5,7912	10,7088
P2	P1	-6,10500*	1,15577	,000	-8,4232	-3,7868
	P3	2,14500	1,22588	,086	-,3138	4,6038
P3	P1	-8,25000*	1,22588	,000	-10,7088	-5,7912
	P2	-2,14500	1,22588	,086	-4,6038	,3138

*. The mean difference is significant at the 0.05 level.

After studying the previous table:

The results of the window - the Meaning column- indicate that there is a significant difference between the two P2 and P3 groups on the one hand compared to the P1 group compared two to two (Sig. 5%). But there is no significant difference between groups P12 and P3 compared to two (Sig. 5%).

Table11 : ANOVA (T soil30)

Tsol30

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	2798,286	2	1399,143	1332,053	,000
Within Groups	55,669	53	1,050		
Total	2853,956	55			

According to the table above, the difference between these three groups is significant(F = 1332,053;df = 55;Sig= 0,000).

Table 12 : Multiple Comparaisons (Tsoil 30)

Dependent Variable: Tsol30

LSD

(I) Periods	(J) Periods	MeanDifference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					LowerBound	UpperBound
P1	P2	14,75000*	,32409	,000	14,1000	15,4000
	P3	14,75625*	,34375	,000	14,0668	15,4457
P2	P1	-14,75000*	,32409	,000	-15,4000	-14,1000
	P3	,00625	,34375	,986	-,6832	,6957
P3	P1	-14,75625*	,34375	,000	-15,4457	-14,0668
	P2	-,00625	,34375	,986	-,6957	,6832

*. The mean difference is significant at the 0.05 level.

After analyzingthe results of the table that is above. We note that there is a difference between the data between the first period and the second period, between the first period and the third period. Because the value sig is less than 0.05 and there is no difference between the second and third period because sig is greater than 0.05.

So we conclude that the first period is the one that has a difference compared to the second and third periods.

Table 13 :ANOVA (T soil 60)

Tsol60

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	5184,370	2	2592,185	1682,227	,000
Within Groups	81,669	53	1,541		
Total	5266,039	55			

According to the table for soil temperature at 60c°, the difference between these three groups is significant(F = 1682,227;df = 55;Sig= 0,000).

Table 14 : Multiple Comparaisons (Tsoil 60)

Dependent Variable: Tsol60

LSD

(I) Periods	(J) Periods	MeanDifference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					LowerBound	UpperBound
P1	P2	20,16000*	,39255	,000	19,3727	20,9473
	P3	19,98000*	,41636	,000	19,1449	20,8151
P2	P1	-20,16000*	,39255	,000	-20,9473	-19,3727
	P3	-,18000	,41636	,667	-1,0151	,6551
P3	P1	-19,98000*	,41636	,000	-20,8151	-19,1449
	P2	,18000	,41636	,667	-,6551	1,0151

*. The mean difference is significant at the 0.05 level.

After analyzing the results of the table that is above, we notes that there is a difference between the data between the first period and the second period, between the first period and the third period.Because the value sig is less than 0.05 and there is no difference between the second and third period because sig is greater than 0.05.

So we conclude that the first period is the one that has a difference compared to the second and third periods.

Table 15 : ANOVA (Tsoil 100)

Tsol100

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	7362,604	2	3681,302	1398,778	,000
Within Groups	139,485	53	2,632		
Total	7502,090	55			

We draw from the table above According to the table above, the difference between these three groups is significant; there is a big difference between these three groups (F = 1398,778;df = 55;Sig= 0,000)

Table 16 : Multiple Comparisons (Tsoil100)

Dependent Variable: Tsol100

LSD

(I) Periods	(J) Periods	MeanDifference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					LowerBound	UpperBound
P1	P2	24,02000*	,51301	,000	22,9910	25,0490
	P3	23,81625*	,54413	,000	22,7249	24,9076
P2	P1	-24,02000*	,51301	,000	-25,0490	-22,9910
	P3	-,20375	,54413	,710	-1,2951	,8876
P3	P1	-23,81625*	,54413	,000	-24,9076	-22,7249
	P2	,20375	,54413	,710	-,8876	1,2951

*. The mean difference is significant at the 0.05 level.

After studying the previous table, we note that there is a difference between the data in the first period and the second period. The first period is also between the third period because alpha is less than 0.05. There is a difference between the second period compared to the first period because 0.05 and the second period does not differ from the third period 0.05.the third period is also compared to the first period there is a difference in the genes, while there is no difference in the samples Between the second and third periods. We conclude that the first period has a difference in samples compared to the second and third periods.

Table 17 :ANOVA (Tair)

Tair

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	9990,904	2	4995,452	666,086	,000
Within Groups	397,484	53	7,500		
Total	10388,388	55			

Dependent Variable: Tair

(I) Periods	(J) Periods	MeanDifference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					LowerBound	UpperBound
P1	P2	28,00000*	,86601	,000	26,2630	29,7370
	P3	27,71875*	,91854	,000	25,8764	29,5611
P2	P1	-28,00000*	,86601	,000	-29,7370	-26,2630
	P3	-,28125	,91854	,761	-2,1236	1,5611
P3	P1	-27,71875*	,91854	,000	-29,5611	-25,8764
	P2	,28125	,91854	,761	-1,5611	2,1236

*. The mean difference is significant at the 0.05 level.

In the table above for temperature,the results of the window - the Meaning column- indicate that there is a significant difference between the two P2 and P3 groups on the one hand compared to the P1 group compared two to two (Sig. 5%). But there is no significant difference between groups P12 and P3 compared to two (Sig. 5%).

Table 19 : Correlations 2

		EColo	Ts100	Ts60	Ts20
Ecolo	Pearson Correlation	1	,638**	,649**	,646**
	Sig. (2-tailed)		,000	,000	,000
	N	66	62	62	62
Ts100	Pearson Correlation	,638**	1	,990**	,995**
	Sig. (2-tailed)	,000		,000	,000
	N	62	62	62	62
Ts60	Pearson Correlation	,649**	,990**	1	,997**
	Sig. (2-tailed)	,000	,000		,000
	N	62	62		62
Ts20	Pearson Correlation	,646**	,995**	,997**	1
	Sig. (2-tailed)	,000	,000	,000	
	N	62	62	62	62

**. Correlation is significant at the 0.01 level (2-tailed).

After studying this table, we notice that there is a strong correlation with respect to the Colorado pen and the soil temperature at the point 60 cm (results shows in yellow).

Conclusion

Conclusion

The Ouargla area is one of the arid desert areas characterized by high temperatures exceeding in summer 44°C and decreasing in winter to reach 5°C, especially during the night, as it is characterized by a continental climate with significant temperature differences (daily and seasonal), and rains fall 49 mm/year, and like other desert areas, they are characterized by strong and violent sand winds, which reach their peak in spring.

Knowledge of meteorological parameters such as evaporation allows us to use them in different domains, hydrological balance, and irrigation, modeling deferent hydraulic construction.

This study aims to know the relationship between evaporation and soil temperature in Ouargla, precisely HASSI BENABDALLAH.

The measures were taken for 3 or 4 weeks consecutive each season. Based on data from measurements of the following parameters: evaporation, temperature, humidity, soil temperature; a detailed analysis of the relationship between evaporation and soil temperature.

Results of our study , have shown a link a final relationship. We notice three results:

- A perfect end link. for example, comparing evaporation in columns and evaporation in lines....also for other factors (soil temperature at 30cm,60cm,100cm and air temperature) and There is a general relationship between evaporation and other data (air temperature, humidity etc ….).
- The existence of a correlation relationship between the Colorado pen and the soil temperature, especially at T° 60 cm compared to the temperatures of T° 20 cm and T°1 m deeps.
- A medium terminal link to the evaporation link compared to the air temperature, Soil temperature at 30cm, 60cm and 100cm.

References

References

- **ANDI 2013. wilaya de Ouargla, (**Agence Nationale de Développement de l'Investissement**).**http://www.andi.dz/PDF/monographies/Ouargla.pdf.

- **Bagnouls F.et Gaussen H. ,1953**-*Saison sèche etindicexéro thermique .Bull.soc .hist.nat . ; Toulouse :193-329.*

- **Barnes, G.T. 2008.** The potential for monolayers to reduce the evaporation of water from large water storages. Agricultural Water Management, 95 (4), p339–353.

- **Belaid.R.2014**. Etude hydrogéologique et hydro-chimique de la cuvette de la région d'Ouargla, sud-est d'Algérie .Diplôme de Master Académique .pp.36-38. université Tlemcen.

- **Belhadj aissa.R*D.Boutoutaou.2017**.Characterization of groundwater in arid zones(case of Ouargla basin).Energy Procedia 119. pp 556–564

- **Blaney, H.F, November 1956.** "Evaporation from Free Water Surface sat High Altitudes", Journal of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol. 82.

Boutelli H ,2011. Salinité des eaux et des sols au niveau de la sebkha de Bamendil. caractérisation et conséquences sur l'environnement.

- **Craig, I., Green, A., Scobie, M, and Schmidt**, E.2005, *Controlling Evaporation Loss from Water Storages, National Centre for Engineering in Agriculture Publication 1000580/1*, USQ, Toowoomba.

- **Dajoz R., 1970** – *Précis d'écologie*. Ed. Dunod, Paris, 357 p.

- **Dajoz R., 1971** – *Précis d'écologie*. Ed. Bordas, Paris, 434 p.

- **D. Dubost,2002.** Ecologie, aménagement et développement agricole des Oasis Algériennes. Ed. Centre de Recherche Scientifique et Technique sur les Régions Arides. Algérie.

- **Boutoutaou D. Saker ML, Dadi bouhon M, Saggai S and Ould El Hadj M D.** Détermination de l'évaporation des surfaces des plans d'eau pour les conditions climatiques de l'Algérie , Algerian journal of arid environment , vol. 2, n° 2, Décembre 2012.p94-101.

- **DNRM (Department of Natural Resources and Mines), 2003**. Methods for reducing evaporation from storages used for urban water supplies. Final report No.41/12219/67346. Brisbane, Australia: Department of Natural Resources and Mines and GHD Pty Ltd.

- *Évaporation et évapotranspiration*, sur Système Méditerranéen d'Observation du Cycle Hydrologique, 2 octobre 2001 (consulté le 3 décembre 2012).

- **Frenkiel, J.1965.** Evaporation reduction: physical and chemical principles and review of experiments. Arid Zone Research 27. Paris: UNESCO.

- **Halfaoui.A.2009.** Inventaire de la macro et la microfaune aquatique du lac Hassi Ben Abdallah. Mémoire ingénieur UKM Ouargla. 93p.

- **Hipsey, M.2002.** Using windbreaks to reduce evaporation from farm dams. Farmnote 72/2002. Western Australia: Department of Agriculture and Food.

- **Kemouche.A.2018**.Oléiculture dans la région de Ouargla ; Situation actuelle et perspectives. Mémoire de Master Académique. Gestion des Agro-systèmes. UNIVERSITE KASDI MERBAH-OUAGLA. pp.3-5.

- **KOULL.N.2015**. Etude phytoécologique spatiotemporelle des zones humides du Nord-est du Sahara septentrional algérien (Région de Ouargla et de l'Oued Righ).THESE.p18.

- Précis de mécanique, « *Bac d'évaporation* », Instrument de météorologie et de précision, sur Guillaume Informatique (consulté le 29 décembre 2012).

- Précis de mécanique, « *Bac ORSTOM* » , Instrument de météorologie et de précision, sur Guillaume Informatique (consulté le 29 décembre 2012).

- **Remini, B., 2010.** La problématique de l'eau en Algérie du nord. Larhyss, 08, p27–46.

- **Ritter,MichaelE**. The Physical Environment: an Introduction to Physical; Geography.

- **P. Rognon, décembre2000.**Comment développer la recharge artificielle des nappes en régions sèches. Sciences et changements planétaires/Sécheresse. Vol. 11, N°4, p 1-10.

- **Rouvillois-Brigol..1975**. Le Pays de Ouargla, Sahara algérien: variations et organisation d'un espace rural en milieu désertique. Vol.2.Département de géographie de l'Université de Paris-Sorbonne.

- **S.Seggai ,D.Boutaoutaou, L.Saker 2016** ; Reduction of evaporation of open water reserviors: a strategy for increasing water stocks in Algerian arid areas. HSJ 61(8): pp.1548-1554.

- **S.Seggai**. 2008. Réduction de l'évaporation des plans d'eau par les films mono-moléculaires en zones arides. Mémoire Magister Univ Ouargla.

- **STEWART P., 1969** – *Quotient pluviométrique et dégradation biosphérique*.Bull. soc. hist. nat. agro. : 24-2
- .
- **Terra, M., 2013.** Les réalisations de l'Algérie dans le secteur de l'eau de 1962 à 2012. Journée d'étude, 14 Février 2013.Tamenrasset.

- **Toutain G.1979**. Elément d'agronomie saharienne, de la recherche au développement. Paris: Ed JOUVE.
- **Wikipedia .2019**.https://fr.wikipedia.org/wiki/Ouargla.

  Présent de la wilaya de Ouargla.

- **World Academy of Science,2012**. Engineering and Technology International Journal of Mathematical, Computational, Physical, Electrical and Computer Engineering Vol:6, No:8.

- **W. Russell Hamon.1960**. Submitted in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science at the MASSACHUSETTS INSTITUTE OF TECHNOLOGY January.

Résumé :
. L'évaporation est le passage de l'eau d'un état liquide à un état gazeux, et c'est l'une des composantes les plus importantes du cycle de l'eau dans la nature, et il est important de déterminer le pourcentage d'évaporation du sol, cette caractéristique hydrologique est très nécessaire dans de nombreuses études (irrigation, barrages, etc.).
Cette étude dépend de la détermination de la relation entre l'évaporation de l'eau et la température du sol.Pour cette expérience, on avons mesuré la valeur de l'évaporation de l'eau de surface au moyen d'un bassin de type -A-.Et un bassin de type Colorado et des mesures géothermiques (20 cm, 60 cm, 1 m) ainsi que des éléments climatiques sur une période de 3 mois, où ces derniers ont été mesurés une fois par jour (température maximale et minimale, température de l'air, humidité).
Où ces mesures ont été effectuées au niveau de la station météorologique de l'Institut technique pour le développement de l'agriculture du désert (ITDAS) Hassi ben Abdellah et les mesures sont effectuées au cours d'un mois typique de chaque saison, et une corrélation sera établie entre les différents facteurs .

mots clés : Evaporation, température du sol, corrélation, saison, Hassi Ben Abdellah.

Abstract:
Evaporation is the passage of water from a liquid state to a gaseous state, and it is one of the most important components of the water cycle in nature, and it is important to determine the percentage of evaporation from the soil, this hydrological feature is very necessary in many studies (irrigation, dams, etc.)
This study depends on determining the relationship between evaporation from water and soil temperature. For this experiment, we measured the value of surface water evaporation by means of a basin of type -A-.And a Colorado-type basin and geothermal measurements (20 cm, 60 cm, 1 m) as well as climatic elements for a period of 3 months, where the latter were measured once every day (maximum and minimum temperature, air temperature, humidity)
Where these measurements were made at the level of the meteorological station at the Technical Institute for the Development of Desert Agriculture (ITDAS) Hassi ben Abdellah and the measurements are made during a typical month of each season and acorrelation will be established between the different factors.

keywords: Evaporation, soil temperature, correlation, season, Hassi Ben Abdellah**.**

لملخص:
التبخر هو مرور الماء من الحالة السائلة الى الحالة الغازية وهو من أهم مكونات دورة الماء في الطبيعة ,ومن المهم ان يتم تحديد نسبة التبخر من التربة ,هذه الميزة الهيدرولوجية ضرورية جدا في العديد من الدراسات (الري ,السدود الخ)
تعتمد هذه الدراسة على تحديد العلاقة بين التبخر من الماء ودرجة حرارة التربة ,لهذه التجربة قمنا بقياس قيمة تبخر مياه المسطحات بواسطة حوض من صنف -A- وحوض من نوع كولورادو ومقاييس حرارة الأرض (20 سم ,60 سم ,1 م) وكذا العناصر المناخية لمدة 3 أشهر حيث تم قياس هذه الاخيرة مرة كل يوم (درجة حرارة القصوى والدنيا .درجة حرارة الجو , الرطوبة)
حيث أجريت هذه القياسات على مستوى محطة الأرصاد الجوية بالمعهد التقني لتنمية الزراعة الصحراوية (ITDAS) حاسب بن عبد الله ويتم اجراء القياسات خلال شهر نموذجي من كل فصل وسيتم إجراء علاقة متبادلة بين العوامل المختلفة .

الكلمات المفتاحية:التبخر،درجة حرارة التربة ،العلاقة المتبادلة،الفصل،حاسي بن عبد الله.