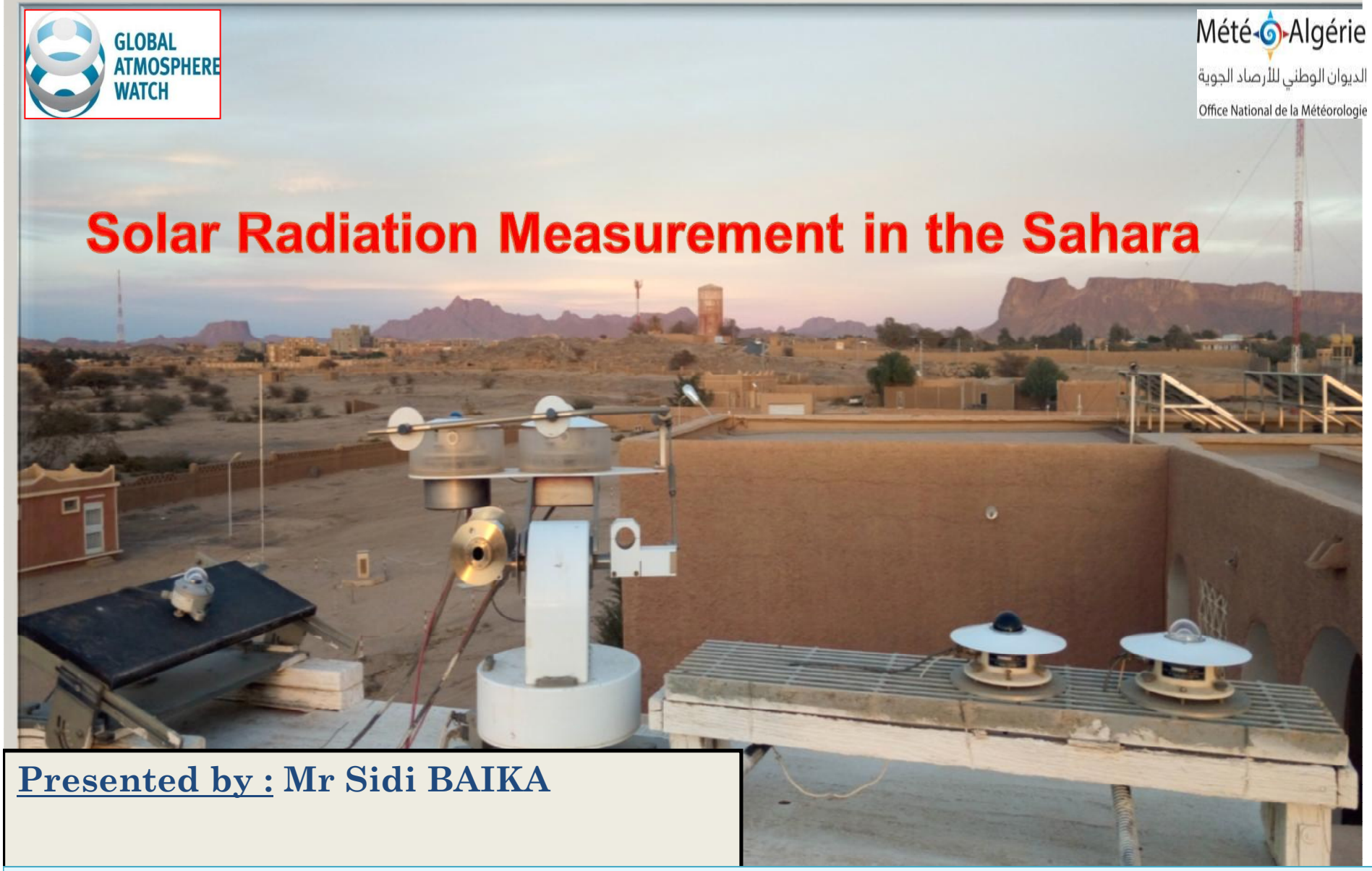

Welcome to the 15th Science and Review Workshop for the Baseline Surface Radiation Network (BSRN)
Photo: Assekrem, Algeria

National Office of Meteorology of ALGERIA



Presented by : Mr Sidi BAIKA

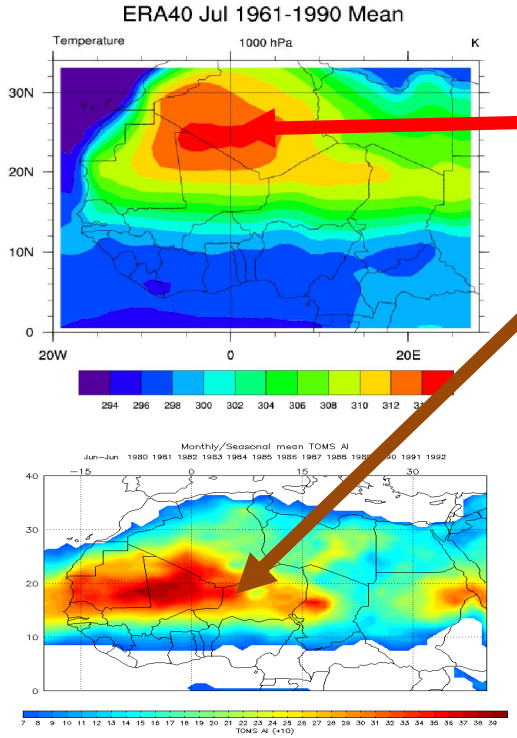
Outline of The communication

I. Introduction
II. Measure and Instruments
III. Application
IV. conclusion

I-INTRODUCTION

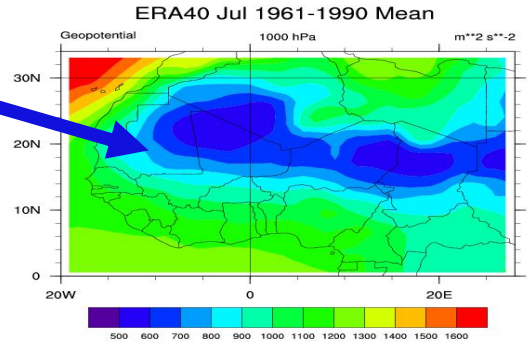
The Sahara is the largest desert in the world. Its lies on 5 thousand kilometres from atlantic ocean in the West to the Red sea in the East

Why the measure is interessante in sahara:



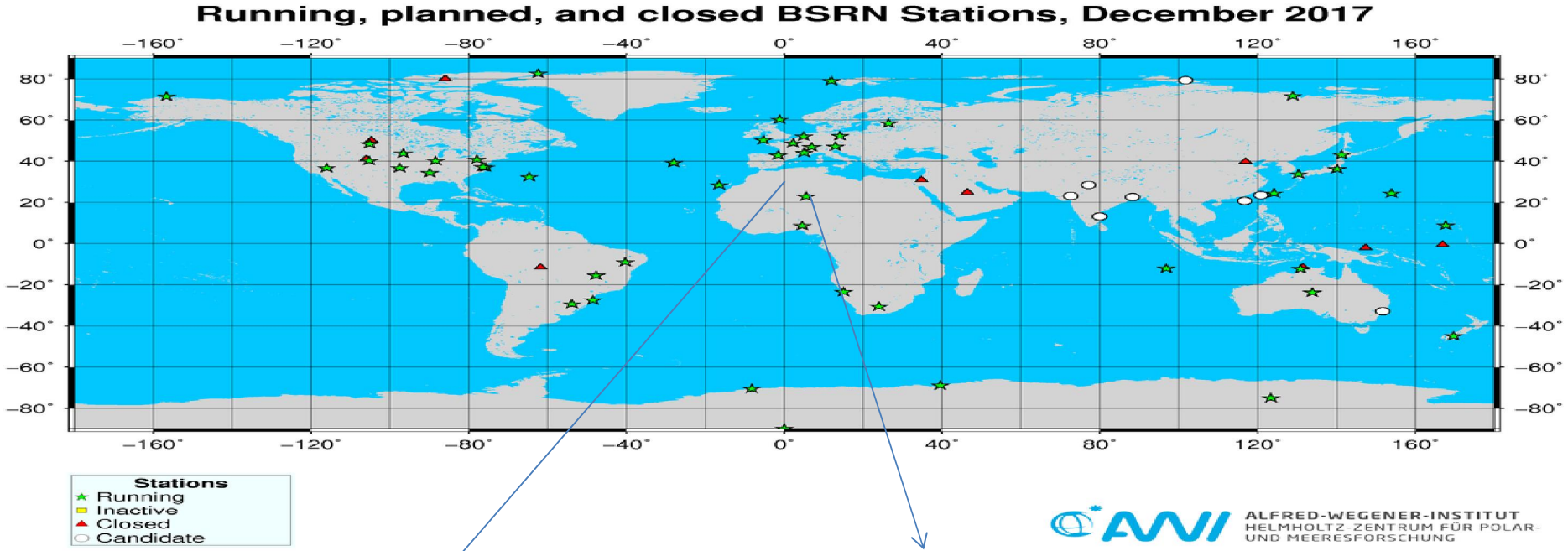
The central Sahara is the locus of numerous extremes in the Earth System(particularly during the summer):

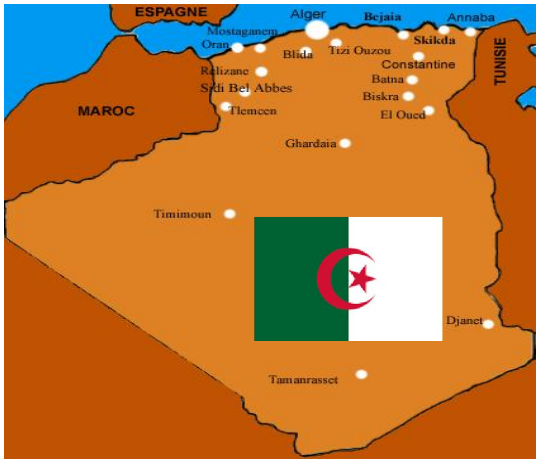
- Saharan heat low(Temperature)
- Mineral aerosols
- **Low Pressure**



The Sahara and its margins are the largest and most continuous dust sources in the world.

The only measuring BSRN station in all the sahara desert is Tamanrasset





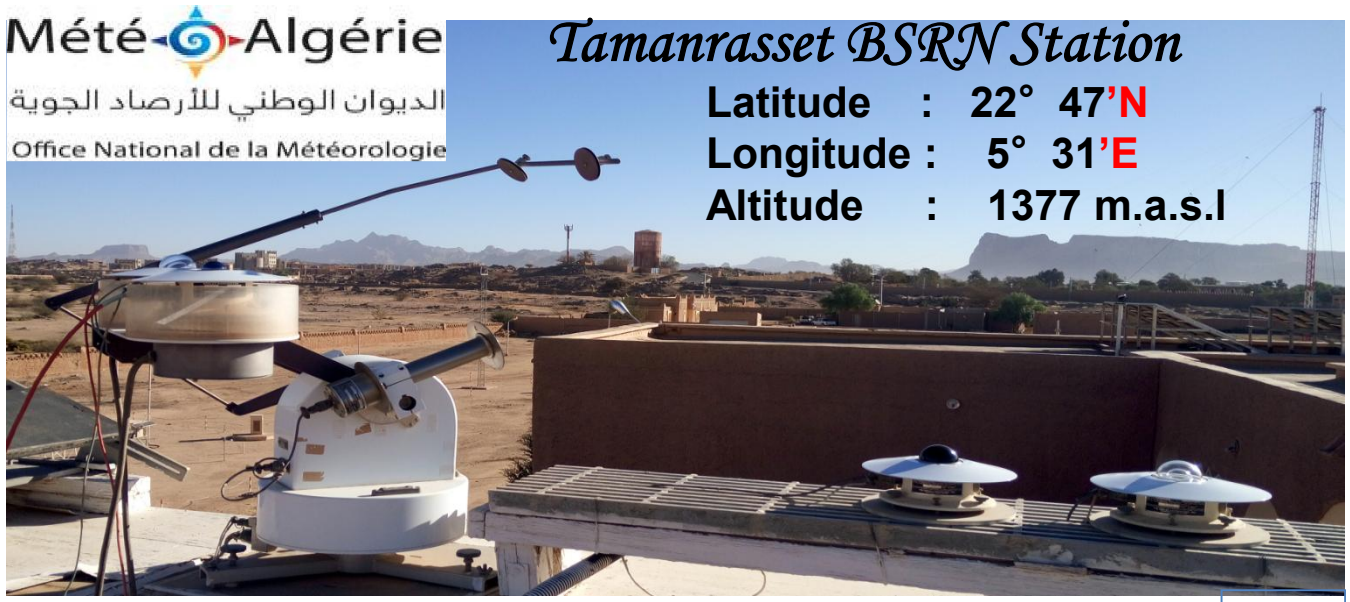


Fig.1. Location of Tamanrasset BSRN Station

History and Information :

The station is located in a desert rock (Hoggar) region between the equator and mid-lattitudes and represent the arid climate. In summer, the climate of Tamanrasset is influenced by monsoon flux.

The site of Hoggar is chosen for its geographical position, high altitude and is excluded from local anthropogenic pollution.

-The first Surface meteorological observation started in 1925.
- The GAW activities began in **September 1994**, with the installation of some instruments at Tamanrasset (solar radiation [Direct, Global, Near infrared RG8, Diffused with a time step every 3 minutes (0.28 - 4 μ m)] and pollution).

-Since **march 1997** , Tamanrasset has became a Part of the GAW (station couple site Assekrem &Tamanrasset).

- The Tamanrasset radiation station has been integrated into the BSRN (Baseline Surface Radiation Network) network since **March 2000** with the acquisition of new measuring instruments including the pyrgeometer (PIR) for the measurement of long-wave atmospheric radiation with 1 minute time step. (with the sponsor and collaboration of CMDL/NOAA (Boulder) .

The data are sent regulary to archive data center (AWI Germany), until now: 219 Monthly files have been already Accepted (March 2000-June 2018).

II-Instruments & measurements

Basic Measurements

-Direct Radiation (Eppley NIP Pyranometer)
-Global Radiation (Epley PSP Global Pyranometer)
-Diffuse Radiation (Shaded Eppley PSP Pyranometer
-Longwave Downward Radiation LWDn Shaded Eppley PIR Pyrgeometer

EXPANDED MEASUREMENTS

-Surface & upper air Meteorological observation(WMO# 60680)
-Total ozone Column(Dobson Spectrophotometer#11)

OTHER MEASUREMENTS:

The site allows some other measurements
-Total Ozone & Spectral UV with Brewer Spectrophotometer (2011).
-Turbidity with Sun Photometer (since1987).
-AOD with CIMEL Photometer – AERONET
- (In cooperation with AEMET-Spain since 2006)

The calibration of the radiation sensors must be carried out each ye
day with the following conditions:
- clear skies,
- very good visibilities, and
-calm wind at low speeds values

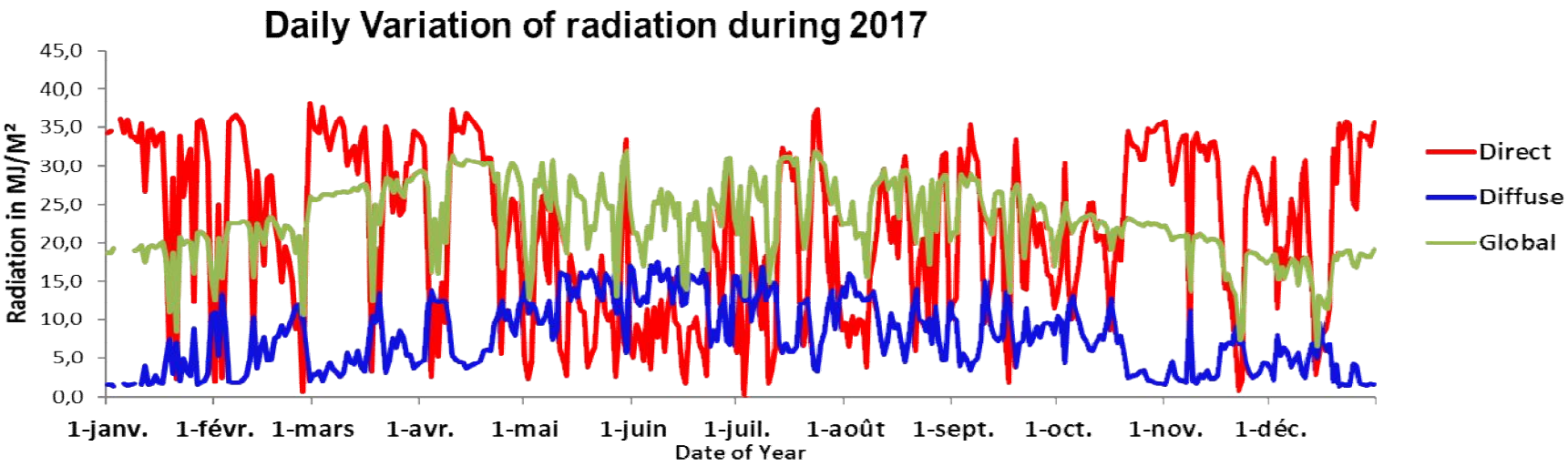
We use a standard (AHF cavity No. 29225) for direct measure

The table below shows last coefficients in 2018:

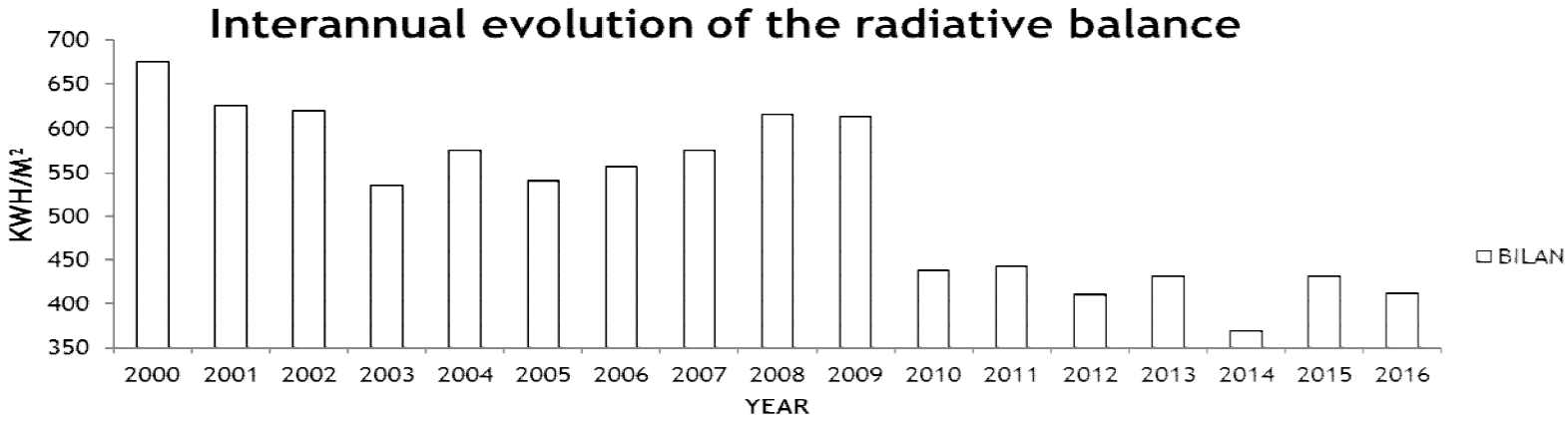
	K_{old}[µV/W/m²]	K_{new}[µV/W/m²]
Direct	7.79	7.76
Global	6.96	6.96
Diffuse	6.78	6.84

III- Application

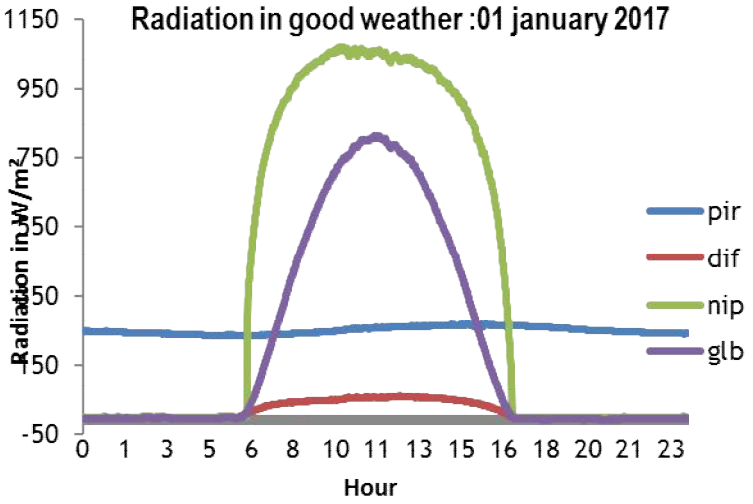
1- Daily variation of Radiation

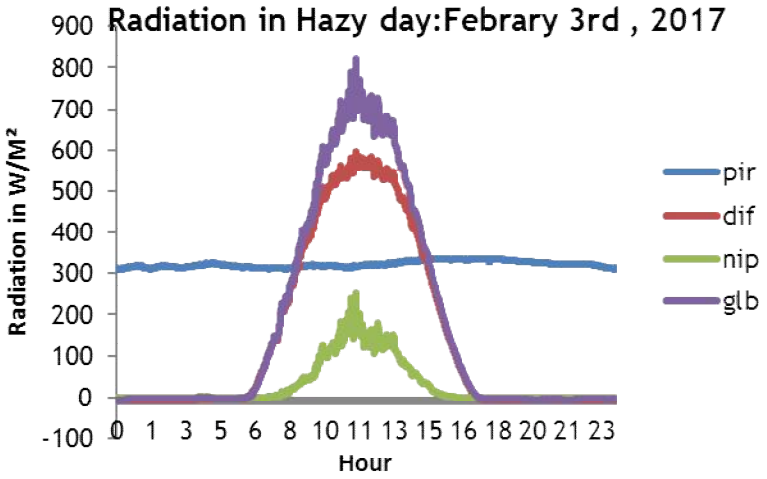


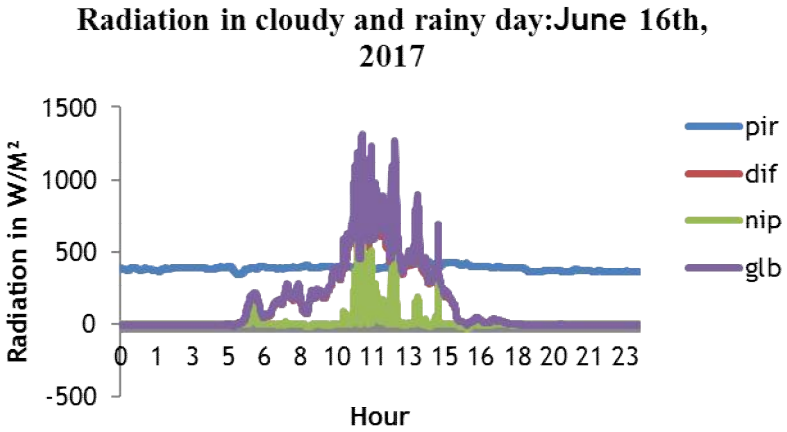
The graphs shows the daily behavior of solar radiation in desert environment. Also, in summer period from May to September, Tamanrasset is influenced by monsoon flux with an important cover sky and haze. Consequently, the direct decrease and diffuse increase rapidly have an opposite reaction to climate variability. In fact, the saisonnal variation of global is more stable.The daily climatic mean are: 23.65MJ(NIP), 6.83MJ(DIF),and 23.16MJ(GLB)

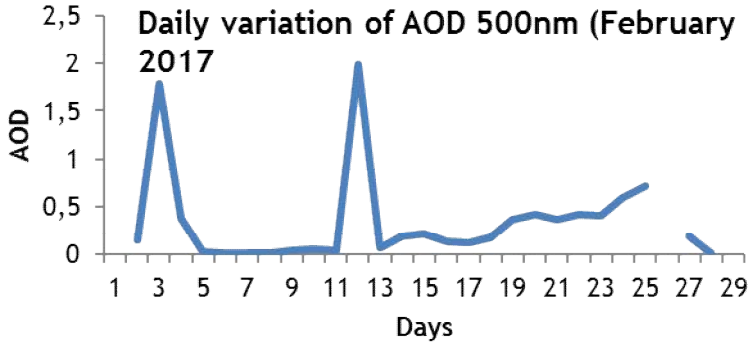


2- Some particulars meteorological situations









1- In good day: the direct is more important : The maximum of irradiance is dir=1072w/m² and Glb=812 w/m²

Total daily : PIR(23.32 MJ) , DIF (1.62 MJ) , NIP (34.32 MJ) , GLB(18.77MJ) the ration DIF/GLB = 9 %

2- In hazy day, with 02km of visibility; The maximum of irradiance is Dif=597w/m² and Glb=820 w/m², and NIP=251w/m². - The total daily are GLB : 15.50MJ,DIF= 13.30MJ, NIP=2.52MJ and Pir=16MJ

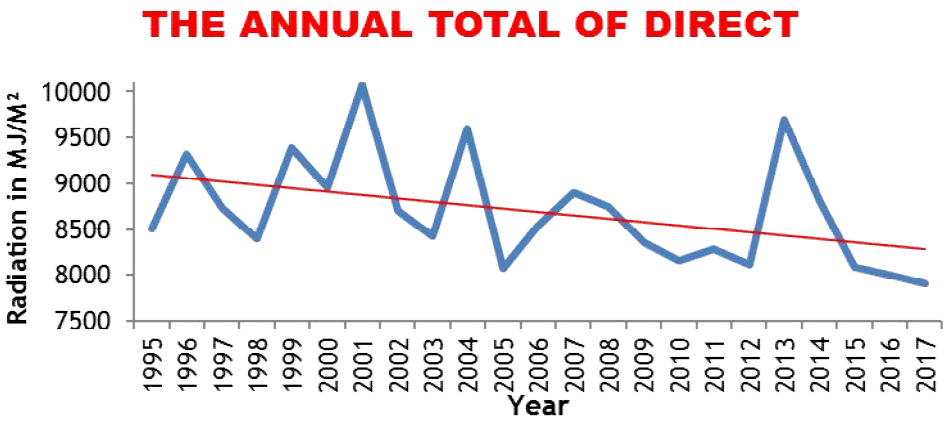
The contribution of the diffuse in global increases during hazy day(DIF/GLB=85%).

3- In cloudy and rainy day: the Total daily : PIR(21.84 MJ) , DIF (11.95 MJ) , NIP (1.71 MJ) , GLB(19.56MJ)

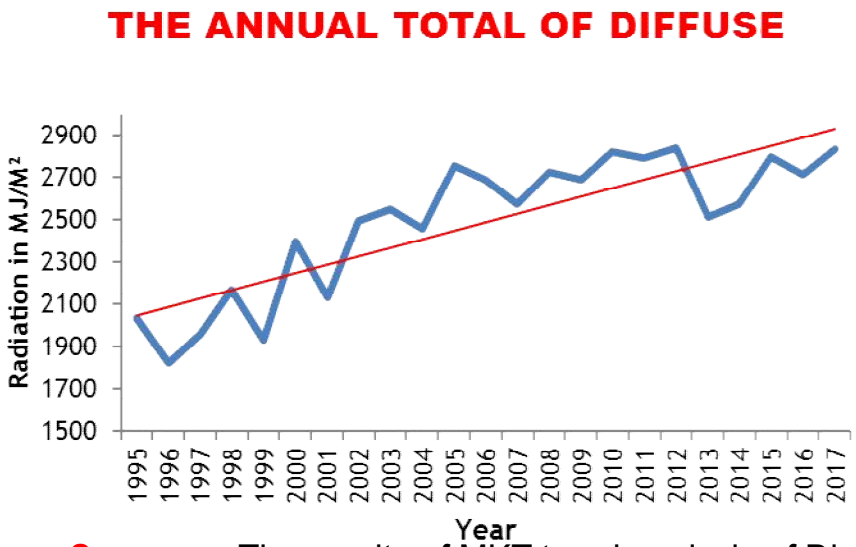
The contribution of the diffuse in global is DIF/GLB = 61 %

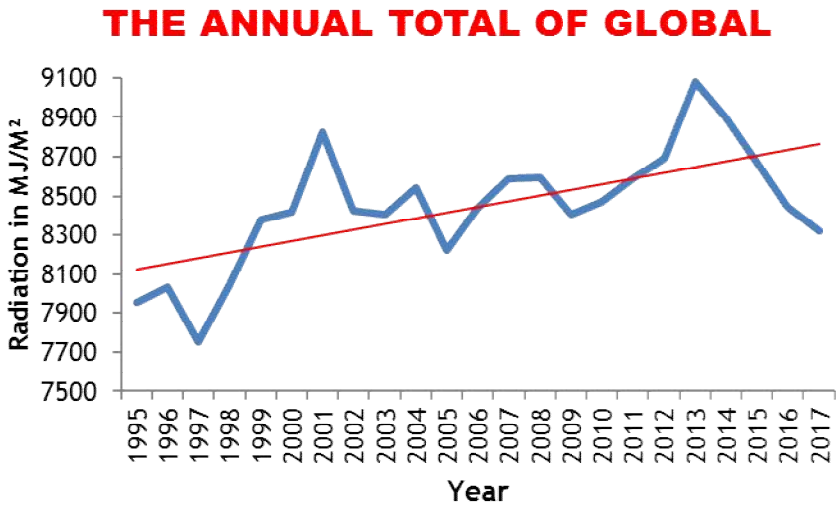
3-Trend analysis using Mann-Kendall Statistical Test

Radiation	P-value	Slope	Test used
Direct	0.01304	-41	Mann Kendall (Non parametric)
Diffuse	1.48e-02	+29	Mann kendall Modified (test of Variance)
Global	9.12e-06	+40	Method of Hamad&Rao (1998)



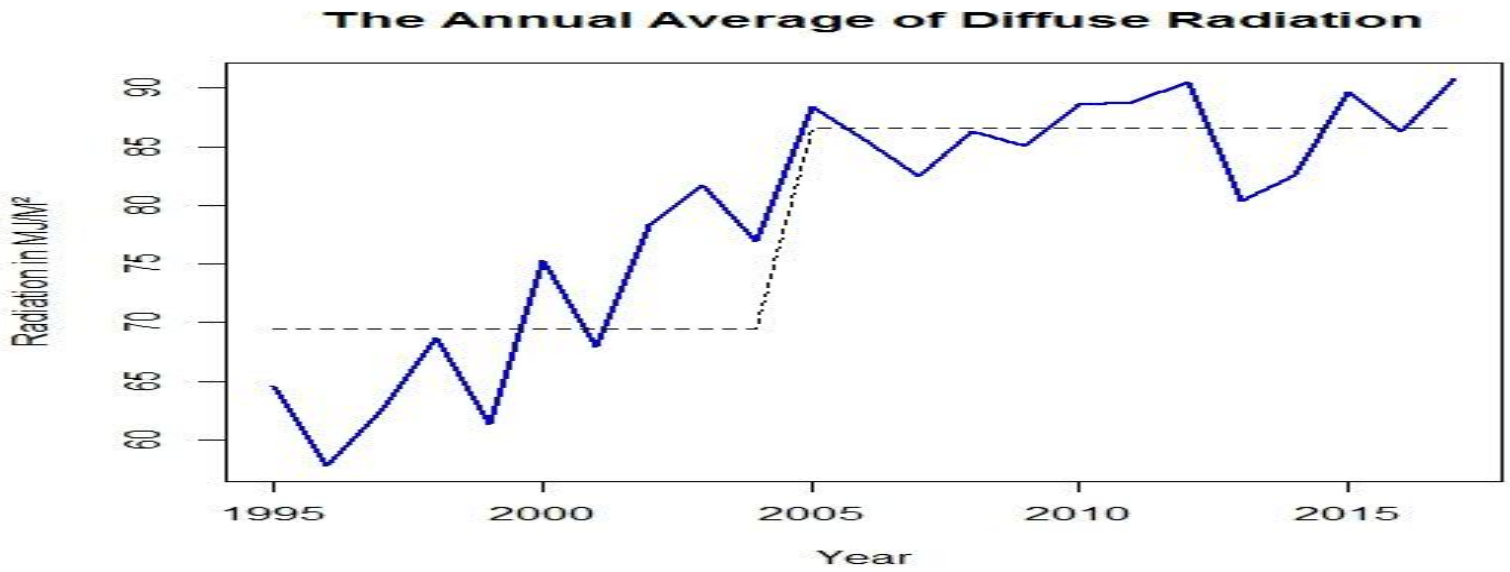
The signifiance of slope has been tested using «Sen's method» at the 95% level of significative (P-value < 0.05)

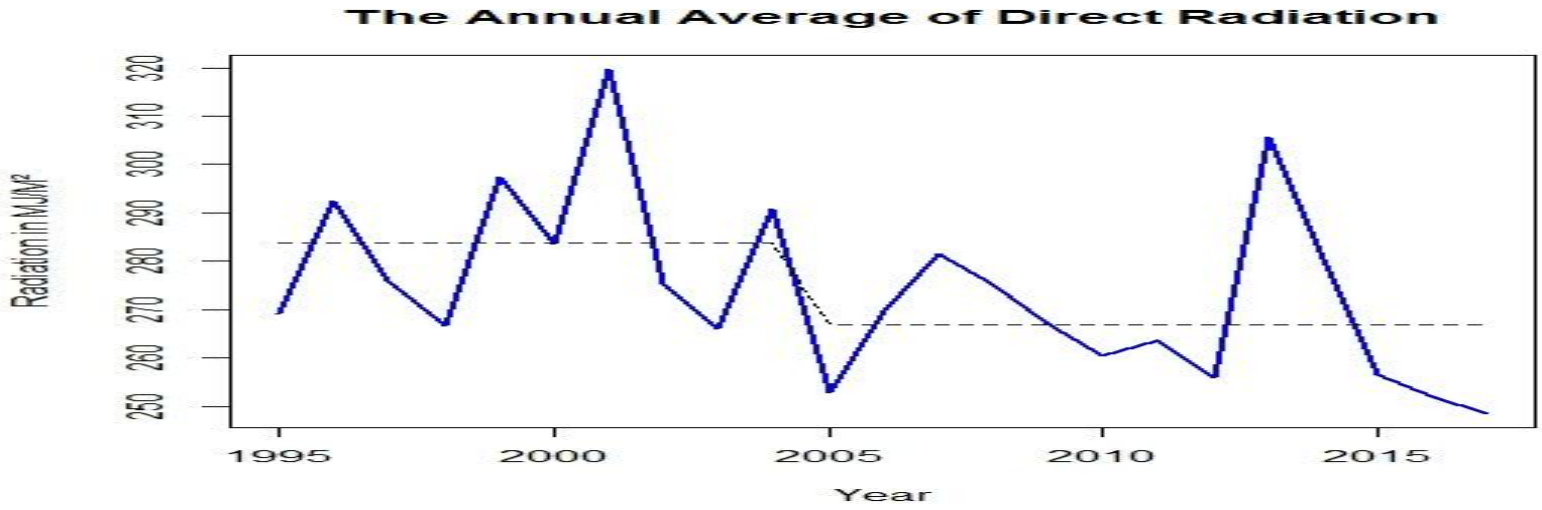




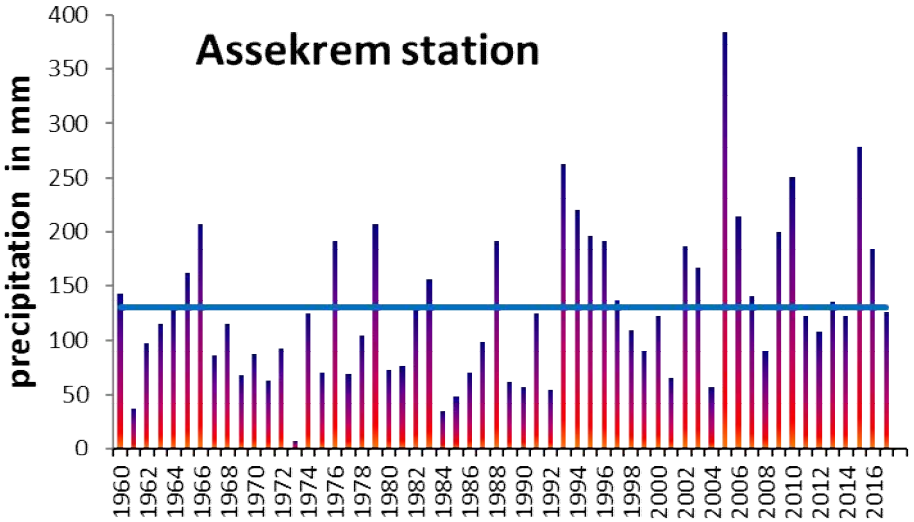
Summary:The results of MKT trend analysis of Direct (NIP) has show the negative slope (**-41/year**),This slope is statistically significant at P< 0.05 an overall decrease in Direct(NIP). The aerosols and clouds are responsible(causes) of solar dimming . Also the arid condition over this region could be causing the atmosphere regime to hold a maximum quantity of dust and sand. Also the annual mean of DIF and GLB has shown positive slope(**+40/year** and +29/year)

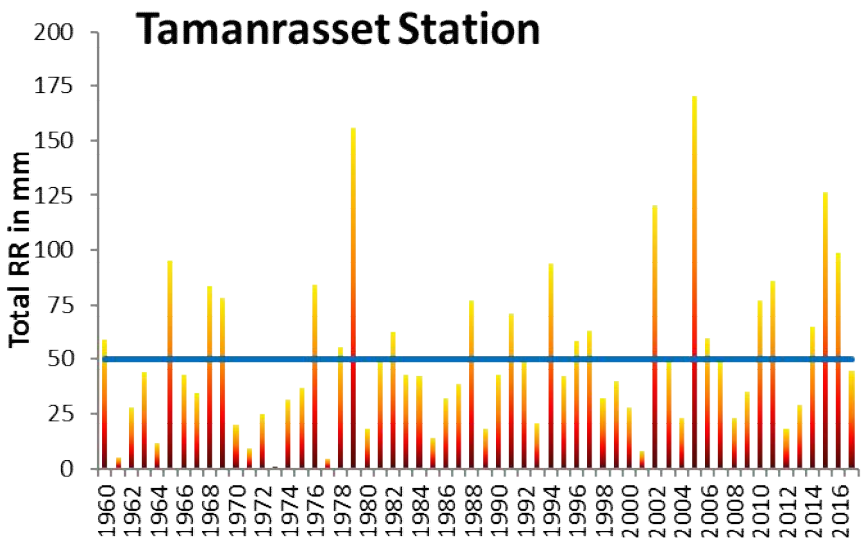
Pettitt's test for single change-point detection

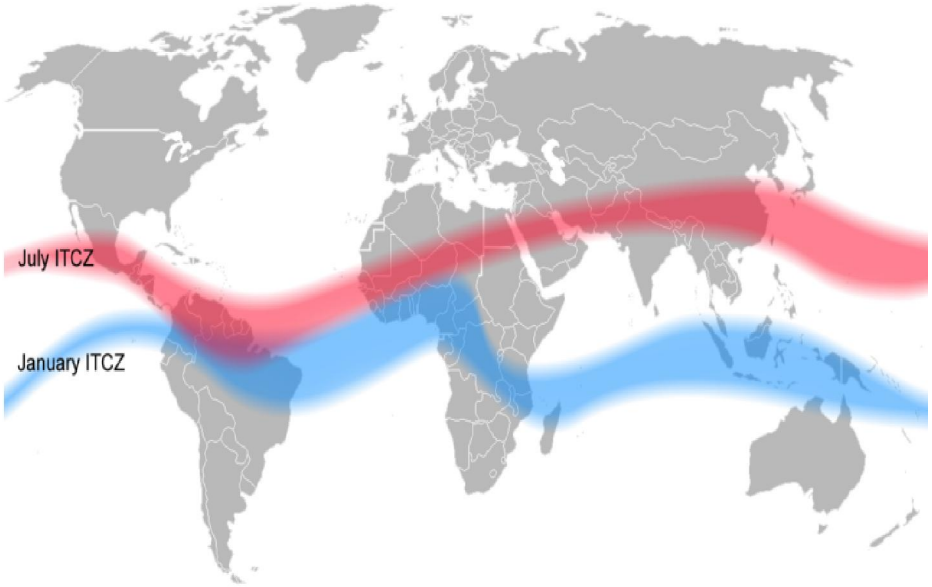




The change point is on: 2005







During the first decade of June 2005, the meteorological equator(ITCZ) reached a more northern position than the average. It is during this period that the first significant rainfall was recorded in the Sahel.

Day: 03 June 2005		
Station	**Precipitation amount**	**Monthly Average**
San (Soutern of MALI) Gaya (Soutern of NIGER) Dori (Northern of Burkina Faso)	25 mm 31 mm 55 mm	100mm 120mm 62mm
Day 13th , June 2005		
Station	**Precipitation amount**	**Annual Average**
Tamanrasset	**61mm**	**50mm**

Summary:

Rainfall record in Tamanrasset : 61 mm : 13/06/2005. A very **exceptional** even since in one day the largest monthly totals recorded during a month of June have been largely overwhelmed.

The summer 2005 is already the 3rd rainiest summer since 1925.

Gaw Station of Assekrem(February 2014)

IV-Conclusion

The Measuring radiation and atmospheric parameters in the desert environment are crucial tools for scientific community to better understand the behaviour of climate in this special area due to its location over mineral sands source area (Hoggar Relief - Central Sahara) which affects the global distribution of aerosols on a large scale.

The solar radiation information acts as an indicator of climate change since its availability on the earth depends upon the atmospheric load and sky conditions.

However, more cooperation and assistance are needed especially in radiation modelling field as well as quality control and maintenance of the specific Measurement equipment in Tamanrasset.


THANK YOU FOR YOUR ATTENTION