

Influence of climate changes (Winds, vapour pressure) on Sulaimaniyah Governorate, stricture and sustainable Agro ecosystem.

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Abstract

Since the beginning of 1985, the importance of recording and documenting meteorological information, especially the subject of research (wind speed, vapour pressure) has become very important Sulaimaniyah (north of Iraq) over 34 government-sponsored wind speed and vapour pressure as well as the other climate parameters like Rain, heat, Relative Humidity and Sun Shine gauge sites have operated on Sulaimaniyah.

The few wind speed recorders show a high level of speed that never have been seen in these 34years, in January and February 2017 the wind speed get 8 and 9m.sec⁻¹ but in months 4,5,6 ,9 lower speed recorded in Sulaimaniyah (0.1m.sec⁻¹). However, as an average in the 1985 and 1992 we got the highest rate 3.1and 2.2m.sec⁻¹ in the other hand in 1991 we record the lower rate 1m.sec⁻¹ The average changes throw the 34years it 0.04 and.

The main target for this study is to estimate the available data, then use the accepted data to create a 34-year database

Changes in wind speed and in vapor pressure systems are likely to have a particularly strong impact on arid and semi-arid ecosystems and may reflect historical regime changes there for from the climatology data the vapour pressure increased clearly throw these years.

Results from a decade of climate change data's that winds and vapor pressure are seasonality, timing, variability, and magnitude are all involved and these may be altered in future climates.

Keywords: Climate Change, Winds speed, Vapour pressure, Sustainable Agro ecosystem.

Introduction

The city of Sulaimaniyah is located in the northeastern part of Iraq. It is characterized by the general nature of its surface. It is mountainous and is surrounded by valleys and some small plains. The city is located on the western slopes of the Azmur Mountains and at an elevation of 850 m above sea level and between latitudes 30° 44' and 20° 46' east and latitude 35° 850' and 30° 36' north. The city is surrounded by several mountain ranges from north-west to south-east.

Sulaimaniyah is furnished on sloping land with a slope of 3.5%. The northern end of the city is 885 meters above sea level, while the southern end is 800 meters above sea level. There are several plateaus on the southern and western sides of the city, which are usually not noticed on the topographic map, and also on the map. Sulaimaniyah as well as the rest of the cities in the Kurdistan Region of Iraq enjoys a mild summer because of the rise from the level of sea level and this is different from what it is in the rest of Iraqi cities. Winter is particularly cold during the night with snow falling sometimes.

An important challenge that faces current land management practices is to raise food production and soil conservation to meet expecting direction in food production while look after flexibly to climate change (1). To improve crop yields and reduce greenhouse gas emissions under future climate change scenarios (2). 'Sustainable agroecosystems could relieve the climate change effect on bridging our current knowledge gaps and recognize the contribution of sustainable agricultural practices as a way forward to reduce the global footprint of carbon and nitrogen(7).

It will suitable and beneficial for the researcher's concerned interested in mitigating the influence of climate change on any ecosystem and to get the information that need to get such a target(8) Wind is primary to transport precipitation, critical for all types of plantation in ecosystems (4).

In this article we will try to find answers for some questions like: -

To study the respond of climate change what procedures could be taken?

For better understanding the effectively reply to climate changes there will a requirements for a new technology and advanced research.

The climate change influence's on ecosystems elements as well as individual kinds are Have caused serious difficulties on the natural resources managing. Lander and Guard (10) conservation of ecosystems in the past has been largely dependent on the supposing of a stable climate and has focused on the protection of existing individual species as long the conservation of species populations meanwhile conserved areas (11). Gardiner *et al.* (6) Types of harms because of wind speed in any ecosystem are classified from little to no death, for example the microscopic harm of breakdown of total leaf, breaking branch, tree leveling.

As climate change forces species to migrate to more suitable climates, ecosystems will be disassembled and reassembled in new locations, often outside the bounds of protection, and with new casts of characters. Some species will be lost, while other species will appear in new locations where they may become invasive and add to the pressures on existing species (12).

Factors of Wind speed can conceder as an important disorder dynamics and ecological factors in ecosystems (5).

To understand how climate change impacts on individual species in a hand and entire ecosystems in the other hand there will be a need to do a research, Climatic transport of elements or newly gathering ecosystems can continue to supply the ecosystem services Which may be dependent on civil societies (13). Factors of Wind speed impact on air temperature, moisture relative evaporation, and transpiration and snow distribution in an ecosystem (9 and 17).

Researches in research social science are important for soils, natural resources, and conservation experts Administration of risk adaptation guidance to face the constantly changing climate (14). Moreover, a little is known about the social agreed for new advanced approaches to species conservation and land protection.

Social acceptance of the screening approach to protect species that may develop where the functions of the ecosystem are affected by climate changes and changes in species previous experience with conservation management (16). There is also a need for combined estimate and decision support tools to help managers and the public understand and agree on the reasonable provisions that will result (15).

Changes in agro ecosystem structure from wind can be classified as follows: (A) Initial injures: that occurs by few hours or days after wind disorder is direct, people and properties may be damaged (B) secondary injures: recorded over a days, weeks, months and years after disorders Consecutive and caused by various harmful factors involved in the process (C) High

damage documented for many years or decades after disorders It is mainly seen in social and economic relations. Changes in the structure of the agricultural ecosystem returned to wind disturbances reflecting the different interactions between the wind speeds. Site features like soil, water content in tree species instillation, hedges of tree (6).

Graphic and map is one of the most effective ways of representing natural phenomena's, including humans like climate elements on ecosystem in general especially if supported by charts and graphs designed on the basis of science technology and acceptable to serve. This research came to emphasize the study of climate and its characteristics to identify these characteristics by graphics and maps using application of GIS (3). Water vapour is a gas and its pressure contribute to the total atmospheric pressure. The amount of water in the air is related directly to the partial pressure exerted by the water vapour in the air and is therefore a direct measure of the air water content. When air is enclosed above an evaporating water surface, equilibrium is reached between the water molecules escaping and returning to the water reservoir. At that moment, the air is said to be saturated since it cannot store any extra water molecules. The corresponding pressure is called the saturation vapour pressure ($e^{\circ}(T)$). The number of water molecules that can be stored in the air depends on the temperature (T). The higher the air temperature, the higher the storage capacity, the higher its saturation vapour pressure. Pure water vapor is said to be saturated when it can exist in stable thermodynamic equilibrium with a plan surface of pure water or ice, at the interface, the water vapor has the same temperature

and pressure as the condensed phase, water vapor over super cooled (below 0°C) water is, strictly speaking not in stable equilibrium but rather metastable equilibrium. The pressure with pure water has in state of saturation, called (saturation pressure) is a function of temperature only.

Material and Methods:

A-Source of Data:

For equipment standardization reasons and calibration, data reliability, only data from directory of metrology and earthquake of Sulaimaniyah were used these governorate directories provide the climate data for 34 years.

B- Evaluation of Database:

Several methods and tools were used to assess the quality of rain data. In cooperation with the Directorate of meteorology in the province of Sulaimaniyah this study used the longest, most winds and vapor pressure records (Fig.1)

To establish baseline relationships, Plant types, patterns and soil permeability characteristics were used to assess relative humidity and drought in order to determine wind speed. Two years, 1992 and 2016, it has large gaps in wind data, and there is a great need to rebuild databases for these years.

Fig. 1, yearly average wind speed (m.sec⁻¹)

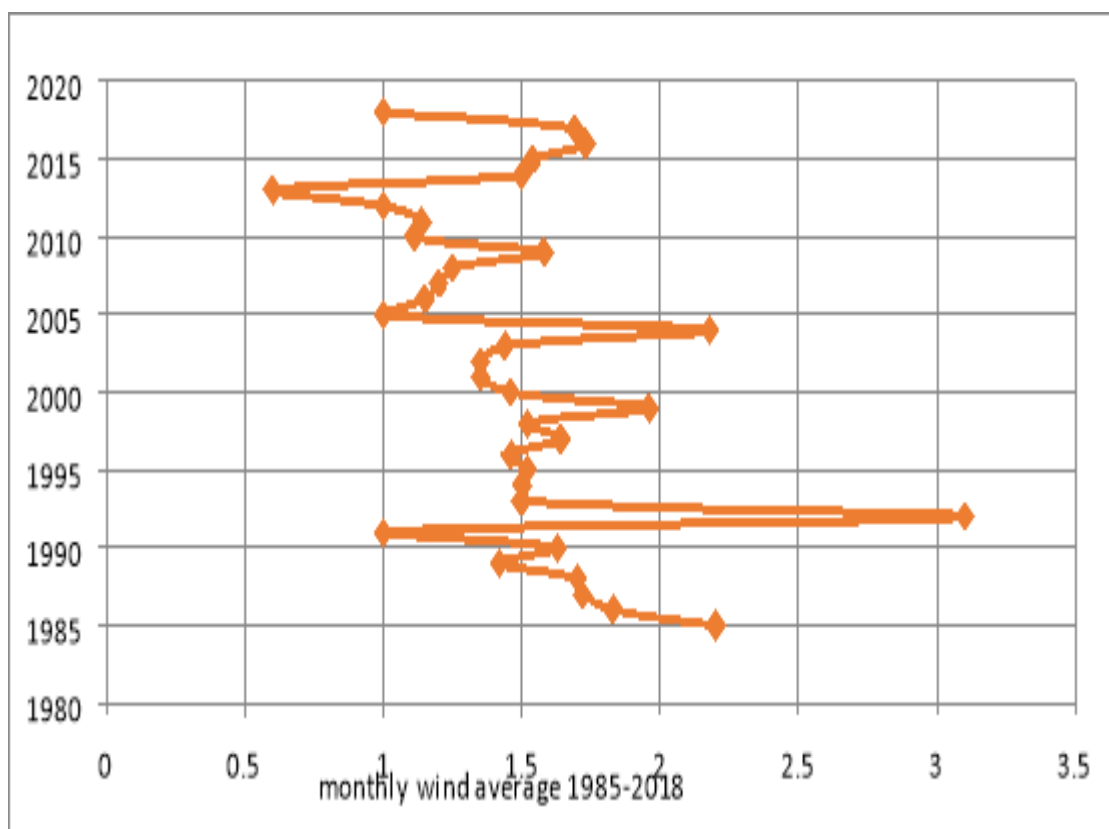
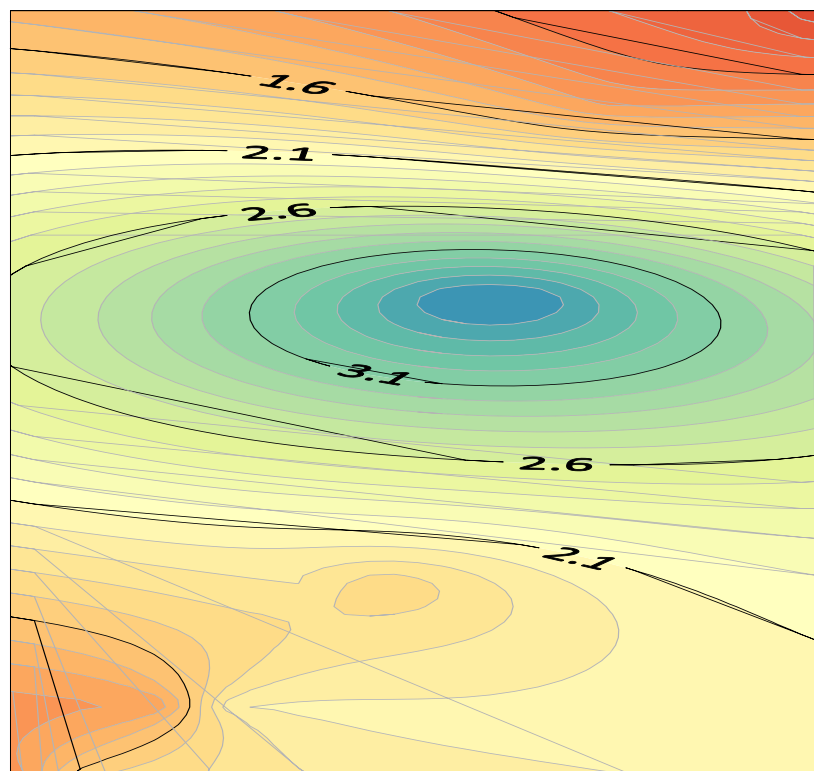


Fig. 2, yearly (1985-2018) wind speed (m.sec⁻¹) just for month of February

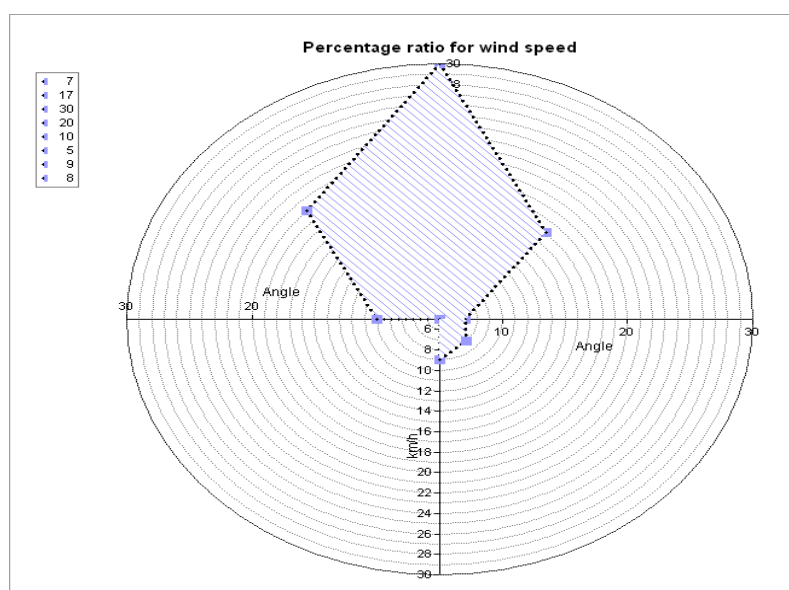


D-analysis:

Annual data were drawn for each year, from (fig. 4) in 2017 we have the highest and lowest speed wind the highest ($\text{m}\cdot\text{sec}^{-1}$) were in February and the lowest were April,

may, Jun, august, and September. Also, in 1992 we have a high degree speed in October ($7\text{m}\cdot\text{sec}^{-1}$) (Fig. 3) wind rose show the main wind direction from north east mostly with speed get to $30(\text{m}\cdot\text{sec}^{-1})$

Fig. 3, wind rose for Sulaimaniyah wind direction.



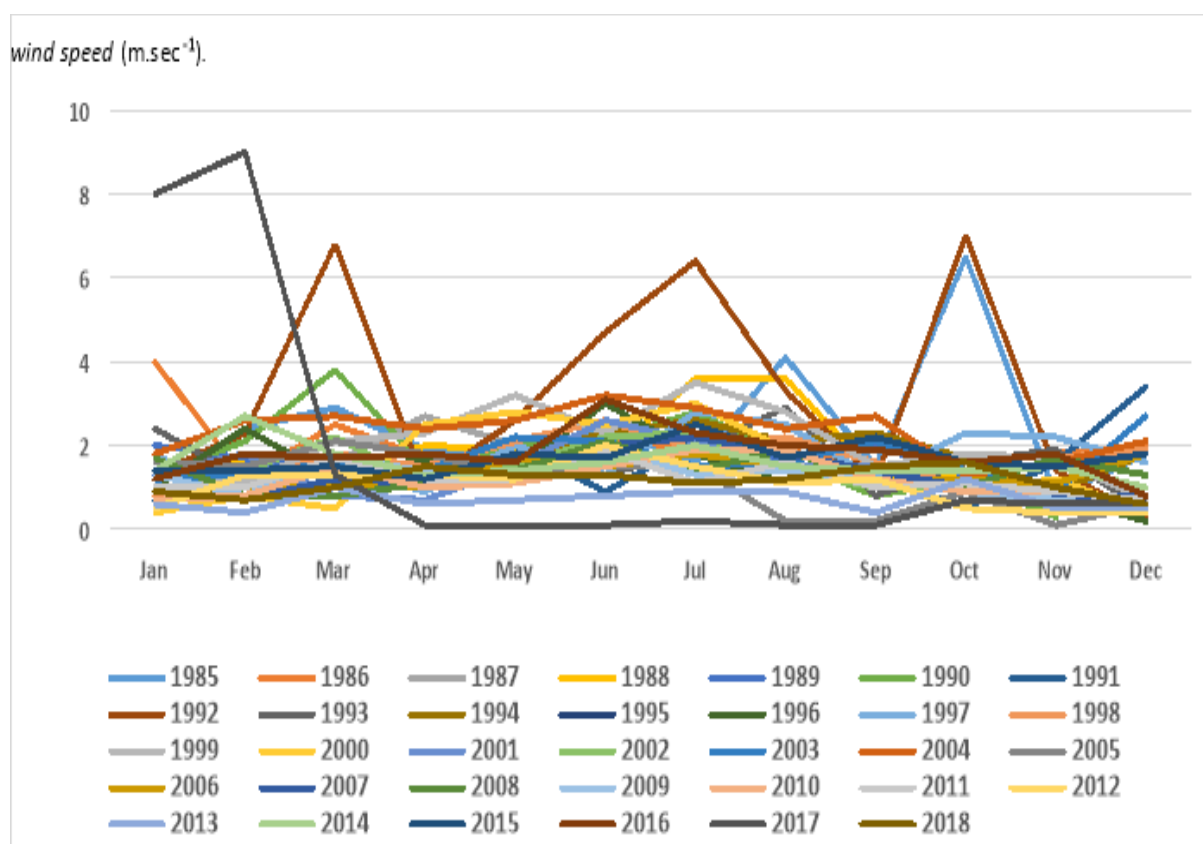
Results and Discussion: -

Two basic databases were developed for this study. The databases were produced by

using the Microsoft excel database program as well matlab and Surfer. The first is a 34-year database of the yearly wind speed. An example of this database appears in Figure 1. The second is a 34-year database consisting of annual data for a given month such as February (Fig. 2).

Vapor pressure and winds both and together are most important climate factor even they are so different but to gather have a series effect on the earth since winds is a result to the horizontal and vertical differences in vapor pressure causing distribute the pressure. Vapor pressure is forcing that effect on a unite or it is air weight upper any area.

Fig. 4, annual wind speed (m.sec⁻¹) data from 1985 – 2018

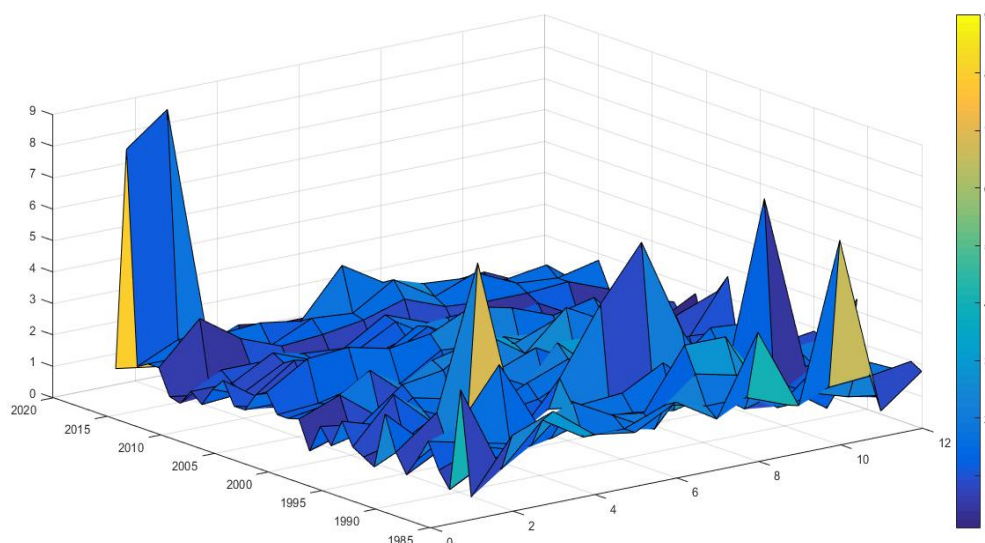


In 2013 we Sulaimaniyah climate live the lowest year in wind speed (0.6m/sec.).

Also, in 1991(1 m/sec.) we a have calm year. As more and more information about wind distribution was revealed, a reanalysis by MATLAB program each map was made to adjust the annual wind speed distribution. This process was carried out through our investigation, the analyzes were very

similar. Differences were discussed and resolved in a single consensus analysis. The mean annual wind speed map was developed by selecting 34year base data on Sulaimaniyah that included all of the wind speed. These34years data are shown in (Figure 4). From (Fig. 2) The 34, 1-year values for each year the mean was then calculated to derive a 34-year value

Fig. 5, annul wind speed data for 34year and 12monthes



The resulting, accurate analysis was produced 34-year annual wind (Figs. 5). The results are somewhat preliminary since only we focused on the data's present and analyzes were completed in this study. More complete monthly and seasonally analysis will be conducted in the follow-up study and we will focus also on winds speed influence on Sulaimaniyah ecosystem. So, wind movement horizontally or (table 1) show that averages winds speed getting higher in study area in Sulaimaniyah starting from January (1.4 m.sec^{-1}) until august in the summer, in the summer winds get the highest speed averages (2 m.sec^{-1}) in July.

The averages winds speed it is higher in summer comparing with winter and that return to low vapor pressure in the summer.

The study area effected each season by some kind of winds moved from different direction but the winds direction are eastern north, these winds effected on the on the air temperature and decreased that make winter colder

The winds that came from west some time brings dusts to study area that increased in late spring and summer in the other hand decreased in winter.

Table1, annual averages monthly, yearly winds speed (m.sec^{-1}) from1985-2018

MON	AVR	MON	AVR
January	1.4	July	2
February	1.58	August	1.7
march	1.64	September	1.29
April	1.33	October	1.42
May	1.63	November	1.15
June	1.93	December	1

February's 2017 Sulaimaniyah ecosystem affected by the highest wind speed ($6 \text{ m} \cdot \text{sec}^{-1}$) from (fig. 6) the vapor pressure getting higher starting from 1985 (7.5MPa) until 2018 (10.33 MPa) in 2015, 2018 and 2016 in levels (10.4, 10.3 and 10 MPa) we record the highest vapor pressure. This increasing is of the vapor pressure could return to the the different Weather styles can have significant impacts on air pressure, the density of cold air is more than the hot air,

because the character's that form hot air have a greater speed and are far apart from the cold air. Ambient air pressure depends on temperature changes. The most obvious change in air pressure occurs twice a day with the rise and fall of the sun. Midnight is the time when the lowest pressure is recorded for air pressure, while the middle of the day is the time when the highest air pressure.

Fig. 6, vapour pressure (MPa) monthly and yearly average, 1985 -2018

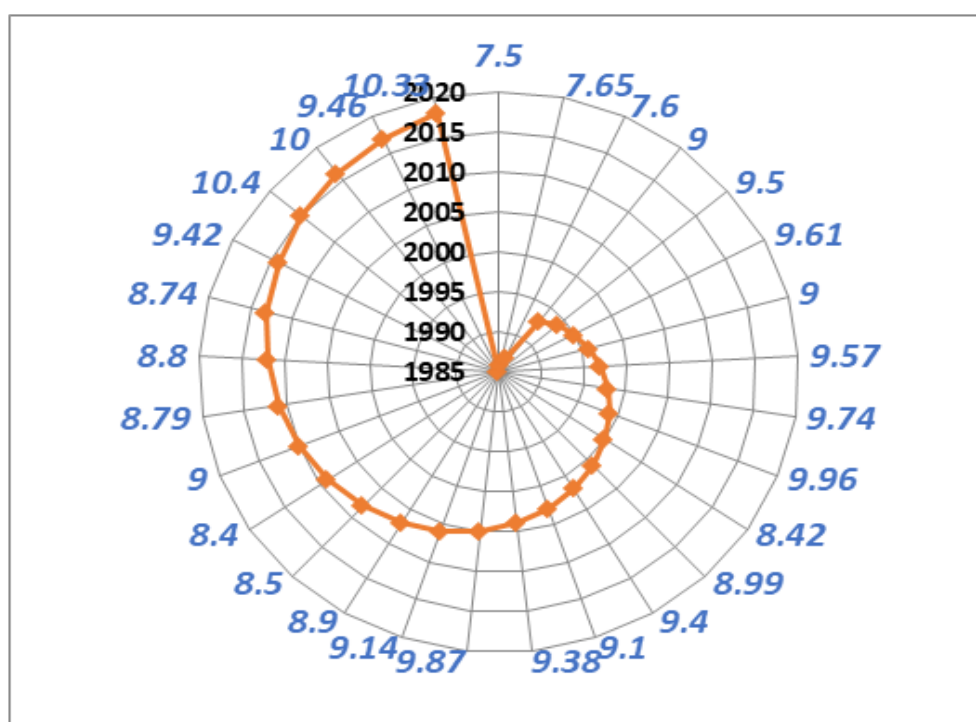
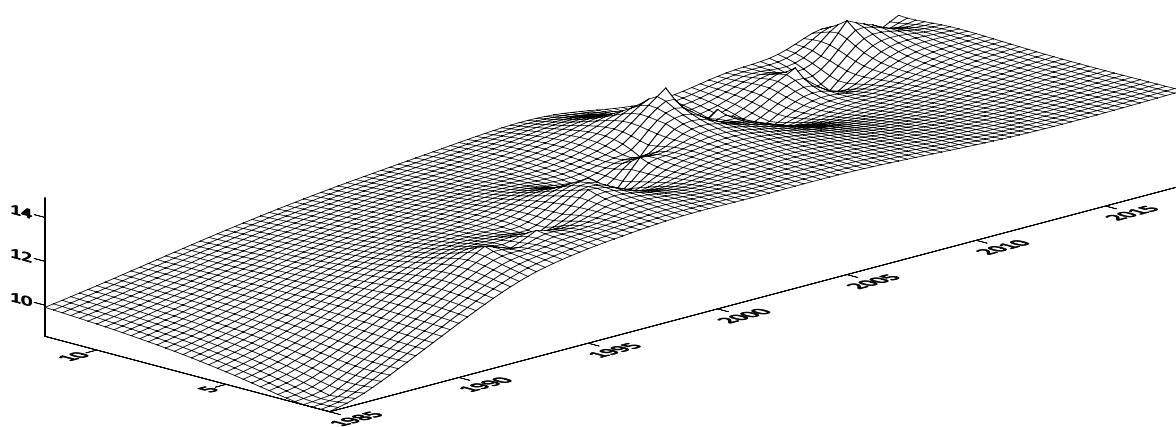


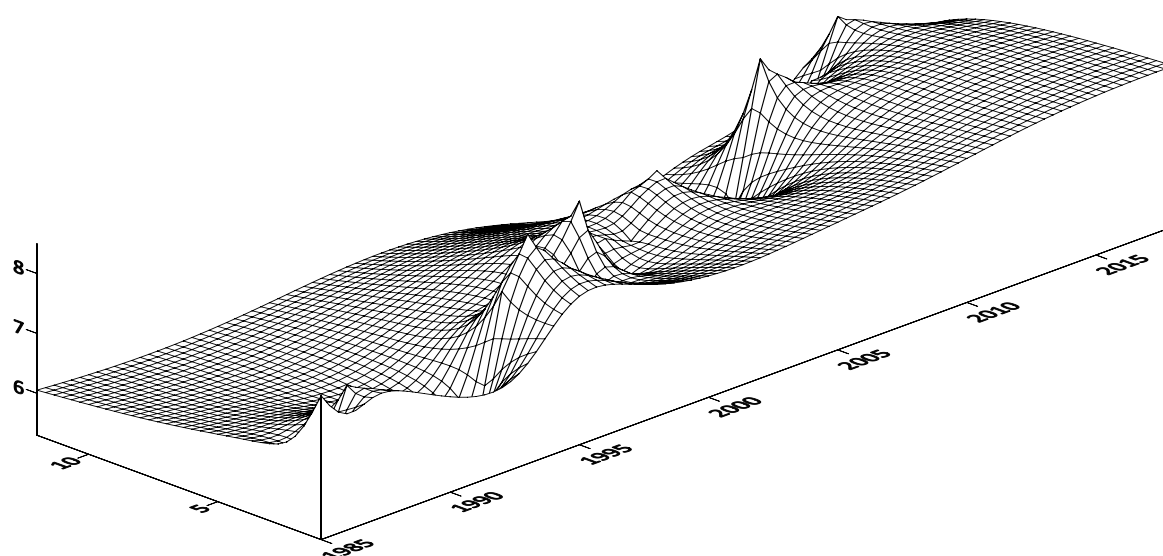
Fig. 7, vapor pressure (MPa) yearly average for July (1985 – 2018)



From (Fig. 7 and Fig. 8) in July have the highest ratios of vapor pressure comparing

to the other month, in this month 2004 we have the highest record (14.9 MPa).

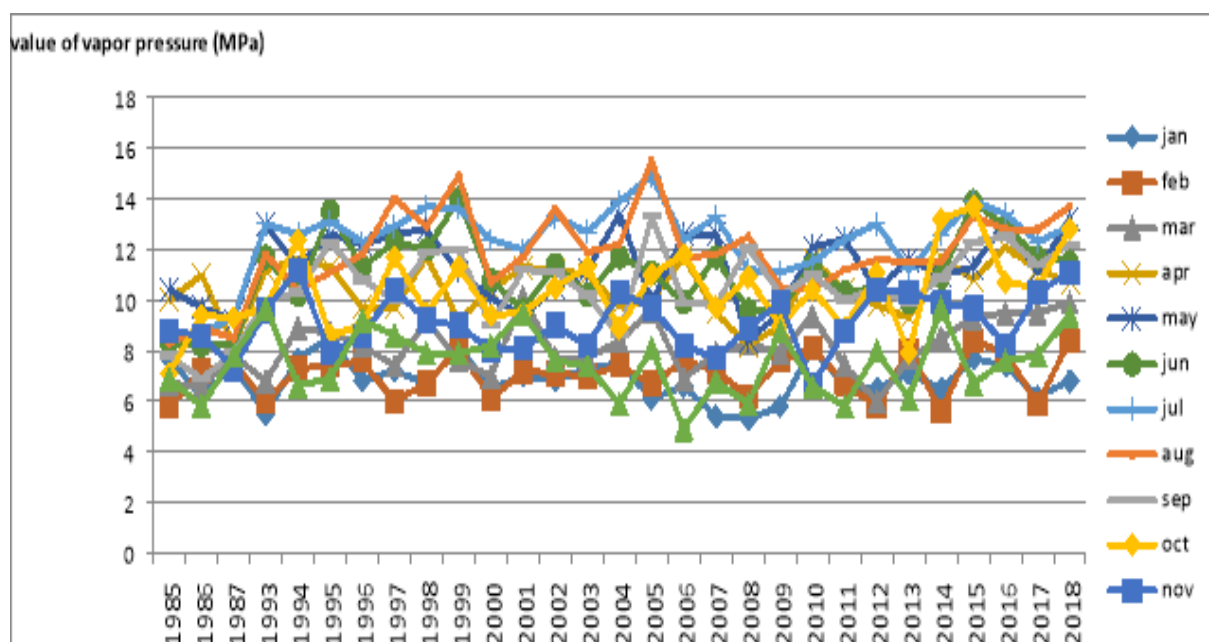
Fig. 8, vapor pressure (MPa) yearly average for January (1985 – 2018)



In the other hand and from (fig 8, fig 9) we record the lowest ratios of vapor pressure, in January 2008 we record the lowest level of vapor pressure (5.3 MPa). So recording a

significant changes starting from 1985 until 2018 in vapors values by increasing these values year to year that's advance about the heating get higher in our reign.

Fig. 9, monthly average for vapor pressure from 1985-2018



Conclusion

Wind and vapour pressure are important pillar in ecological factors that influencing on development, growth and reproduction of growing in ecosystems. Wind factors are one of the harmful agents that cause a composite interaction. So the Interactions between agro ecosystem and wind need to understand the basics for mitigation of the negative affect associated with wind disturbances on plantation in worldwide. There wasn't a direct affect measuring to decrease the associate risk. Early treatment and removal of wind or infected plantation may reduce or eliminate the epidemic locally. Integrated plantation protection been an effective pillar in the agro ecosystem in the conditions of global change. Wind disturbances show that integrated plantation protection against heavy winds in agro ecosystems in Sulaimaniyah need more scientific studying and researches.

References: -

- 1- Allan, R.; J. Lindesay and D. Parker.1996, El Niño, Southern Oscillation & Climate Variability. CSIRO Publishing, Collingwood, Victoria, Australia, pp405 pp.
- 2- Beck, D. A.1980. Rainfall Observations for Guam, 1950-1979. US Geological Survey, Guam Sub-District, Department of the Interior, Washington, DC. USA. pp430.
- 3- Corps of Engineers. 1980.Guam Storm Drainage Manual. U.S. Army Corps of Engineers. Honolulu, HI. USA.
- 4- Coutts, M. P. and J. Grace.1995. Wind and Trees. Cambridge University Press, Cambridge. England. pp485.
- 5- Ennos, A.R.1997. Wind as an ecological factor. Trends in Ecology and Evolution, 12:108-111.
- 6- Gardiner, B.; P. Berry and Moulia, B.2016. Review, Wind impacts on plant growth, mechanics and damage. Plant Science, 245:1–25.
- 7- Jordan, C. L.1955. Some features of the rainfall at Guam. Bull. Amer. Meteor. Soc., 36: 446-455.
- 8- JTWC.1980-1997: Annual Tropical Cyclone Reports. Naval Oceanography Command Center/Joint Typhoon Warning Center, COMNAVMARIANAS, FPO AP 96540-0051. USA. pp45.
- 9- Konôpka, B. and J. Konôpka.2009. Vietor a sneh – najzávažnejšie abiotické škodlivé činitele. Zvolen, Slovakia, NLC, pp11.
- 10-Lander, M. A. and C. P. Guard.1998. High wave events on Guam: NAVSTA Family Housing Project. Prepared for Moffatt and Nichols Engineers. Long Beach. California. USA pp66.
- 11-Minobe, S.1997. A 50-70-year climatic oscillation over the North Pacific and North America. Geophys. Res. Let., 24: 683-686.
- 12- Morrissey, M.L., and N.E., Graham, 1996, Recent trends in rain gauge precipitation measurements from the tropical Pacific: Evidence for an enhanced hydrologic cycle. Bull. Amer. Meteor. Soc., 77:1207-1219.
- 13- Natural Resources Conservation Service (NRCS). 1987.Field Office Technical Guide Archive, Section I: Climate Data. U.S. Department of Agriculture, Natural Resources Conservation Service. See also electronic archives of NRCS for the Pacific Basin: <http://www.nrcs.usda.gov/technical/efotg/>.

- 14- Trenberth, K.E.1997. The definition of El Niño. Bull. Amer. Meteor. Soc., 78:2771-2777.
- 15- Uppenbrink, J.1999. Climate variability - The North Atlantic Oscillation, Science, 283:948-949.
- 16- Ward, P. E.; S. H. Hoffard and D. A. Davis. 1965. Hydrology of Guam in Geology and Hydrology of Guam, Mariana Islands. Geological Survey Professional Paper 403-H. US Government Printing Office, Washington, DC. USA. pp28.
- 17- Zhu, J. J.; Z. G. Liu.; X. F. Li.; M. Takeshi and Yutaka, G.2004. Review: effects of wind on trees, Journal of Forestry Research, 15:153–160.