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معامل التأثير العربي 1.63
العدد 23

مجلة التربوي

مجلة علمية محكمة تصدر عن كلية التربية

جامعة المرقب

العدد الثالث والعشرون
يوليو 2023م

- المجلة ترحب بما يرد عليها من أبحاث وعلى استعداد لنشرها بعد التحكيم .
- المجلة تحترم كل الاحترام آراء المحكمين وتعمل بمقتضاها .
- كافة الآراء والأفكار المنشورة تعبر عن آراء أصحابها ولا تتحمل المجلة تبعاتها .
- يتحمل الباحث مسؤولية الأمانة العلمية وهو المسؤول عما ينشر له .
- البحوث المقدمة للنشر لا ترد لأصحابها نشرت أو لم تنشر .

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ضوابط النشر:

يشترط في البحوث العلمية المقدمة للنشر أن يراعى فيها ما يأتي :

- أصول البحث العلمي وقواعده .
- ألا تكون المادة العلمية قد سبق نشرها أو كانت جزءا من رسالة علمية .
- يرفق بالبحث تزكية لغوية وفق أنموذج معد .
- تعدل البحوث المقبولة وتصحح وفق ما يراه المحكمون .
- التزام الباحث بالضوابط التي وضعتها المجلة من عدد الصفحات ، ونوع الخط ورقمه ، والفترات الزمنية الممنوحة للتعديل ، وما يستجد من ضوابط تضعها المجلة مستقبلا .

تنبيهات :

- للمجلة الحق في تعديل البحث أو طلب تعديله أو رفضه .
- يخضع البحث في النشر لأولويات المجلة وسياستها .
- البحوث المنشورة تعبر عن وجهة نظر أصحابها ، ولا تعبر عن وجهة نظر المجلة .

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2- The research articles or manuscripts should be original and have not been published previously. Materials that are currently being considered by another journal or is a part of scientific dissertation are requested not to be submitted.
3- The research articles should be approved by a linguistic reviewer.
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Environmental study for Cyanobacteria Blooms using Envisat data at the western coastal of Libya

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Abstract:
Cyanobacteria are branched from algae family, and they are a source of oxygen for many marine organisms and it is important for their photosynthesis processes, and becomes danger when it multiplies in the aquatic environment. Where it hinders sunlight into subsurface layers of sea. In this research, Cyanobacteria were observed during 2022 , in the western coastal of Libya,using Envisat techniques by MERIS data. Data obtained were not clear because of dust, clouds and fog in some months. Cyanobacteria blooms was more dense in winter than rest of seasons, with a value more than 5mg/m^3, and it was less dense in summer with a value not exceeding 2 mg/m^3. while in autumn and spring seasons recorded a discrepancy between increase and decrease in blooms with rates did not exceed 4 mg/m^3.
Key words: Cyanobacteria,blooms, Envisat,MERIS,Khoums,Libya

1. Introduction:

Cyanobacteria branched from Algae, and they live in salty and fresh water. Cyanobacteria are the first organisms to produce oxygen, as a by-product of photosynthesis. It lives and reproduces in biomass form, which is an indicator of it. Cyanobavteria are smallest organisms that depend on photosynthesis for their energy, with a size of 0.5 to 0.8 microns. A cubic millimeter contains about 10000 cyanobacteria cells (Carmicheal, 2001).

Cyanobacterial Algae harm the surrounding environment in the event of their agglomeration and presence in large quantities that hinder the important photosynthesis process of marine plants and coral reefs and produce a group of toxins up to 84 species, these toxins are dangerous to marine organisms and humans such as cytotoxins (microcystins) and hepatotoxic (anatoxina) and neuropathy (cylinderospermospin), (Carmichael,.2016).

Cyanobacterial toxins cause many diseases in humans and animals, such as diarrhea, intestinal colic, cirrhosis , kidney failure, and acute skin infections. Also it leads to death of small free organisms such as diatoms, crustaceans, crabs and oysters (Paerl, H. & Huisman, J. 2009).

Cyanobacteria are found in aggregations, the most famous are filamentous species that are found in brackish water. Cyanobacteria are primitive single-celled organisms, and they are among the oldest living organisms on earth, and they are one of the most important sources of global carbon and nitrogen(Paerl, H.& Huisman,J,.2009).

It has been observed that cyanobacterial algae bloom increases in the coasts of the world due to climatic changes, the increase in surface water temperatures above the normal rate, and the lack of precipitation. As well as increasing human activities with water, such as increasing sewage and ship waste. All these reasons reduce the water quality and create a suitable environment for the flourishing of cyanobacterial algae.

Whose very large aggregations lead to a lack of oxygen in those colonized waters (Stumpf,R., et al,.2012)
To assess the water quality, a biological, chemical and physical survey is cond ucted every five years by sampling according to the American method for wat er sitews exposed to pollution. But all these studies are costly and take a long time and more effort so the studies based on satellite monitoring and analysis were the most successful, accurate and credible. And it was less expensive in money, time and effort with its continuous and comprehensive monitoring ever y day of the year on a routine basis. Cyanobacteria are the main source of ox ygen in salty and fresh water, and they have a major role in absorbing carbo n dioxide in the oceans and seas. The oxygen feeds on the rest of the marine organisms that are higher in the diversity scale of marine organisms, and the t herefore they depend entirely on what the Cyanobacteria produce. Also Cyanob acteria can help a beneficial role in slowing climate change by absorbing nitro gen and carbon dioxide resulting from the rise in temperature in ocean waters and seas, and thus plays a major role in our ability to predict climate change and adapt to it. (Duan,H, et al,.2012).
Cyanobacteria are a major component at the base of the ocean food chain, and oceanographers have assumed a link between them and the abundance of fish, crustaceans, shellfish, molluscs, and marine plants. This depends on the number of food links in the food chain, and the efficiency of each link. Recent research indicates that positive relationships can be modeled with cyanobacteria and aqueous oxygen production. Others have found that oxygen concentration is closely related to the Pacific Ocean due to its warm currents that rich in cyanobacteria (Clark, J. M. 2017).
The photosynthesis process carried out by single-celled cyanobacteria is an indicator of the biomass activity of cyanobacteria in the water. When water is exposed to more sun, cyanobacteria have greater presence in water, and low quality of that water. By comparing the ratio of blue light to green light, the scientists were able to use different ratios of the reflected colors to estimate the cyanobacteria concentration. Visible light has wavelengths from 400 to 700 nanometers (Tomlinson, M. C. 2016).
There are no previous studies of the study area in the western region of Libya or the Libyan coast, but some studies in southern Italy and Egypt dealt with st udies of density of cyanobacteria gatherings and the resulting high concentratio ns in the ports of Sicily and Genoa in Italy, the port of Algiers and the Nile River Delta and its huge deposits that helped in the intensificaction and emerg ence of algae colonies and phytoplankton in Port Said and Cairo. All of these studies dealt with climate and biomass changes in the Mediterranean Sea (Isla m and Elham, 2008).
The Mediterranean Sea, of which the study area is part, it is a oligotrophic ba sin, where primary production is limited by the availability of inorganic nutrien ts such as nitrogen (N) and phosphorous (P). In this basin, the cyanobacteria c oncentrations decreases from west to east. Cyanobacteria concentration increasin g by estuaries providing nutrients loads from phosphorus and nitrogen, that gen erated from human activates along the Mediterranean sea coasts,including fertili zers used in agriculture and livestock, while phosphours from the industrial dis charge and urban waste water (Vidussi, F,. et al,2010).

1. 2 Envisat techniques:
Technological advances allowed the development of Envisat space based sensors such as the Color Coastal Scanner, Moderate Resolution Imaging Spectroradiometer and MERIS Wide Field of View Sensor. This development allowed the researchers to conduct pioneering studies on the Mediterranean sea color throughout the study years, and this sensor had high spatial and temporal resolution. It is used in many fields of research by digital tomography of Envisat color satellite images, with studies including the temporal and spatial of Cyanobacteria distribution. The Envisat satellite data pre-processing includes different wavelengths (as shown in Table 1), providing a clear description of the Cyanobacteria variations(rDoerffe.Rand Schiller .H.,,2007).

Table(1): Cyanobacteria concentrations according to their wavelengths in Mediterranean coasts

wavelength	color	Cyanobactera(mg/m^3)
412nm	blue	0.01-0.1
488nm	cyan	0.1-0.5
517nm	green	0.6-1.0
532nm	yellow	1-2
588nm	orange	2-3
621nm	red	3-6

Source: NASA (2002)

In satellite images, the optical properties depend on two factors: first, absorpation, wich occurs as a result of the phytoplankton presence , and usually, appears in green. The scond factor resulting from dissolved and crumbled substances, and usually appears in blue. For red, orange and yellow colors, they occurs due to light scattering degrees by different Cyanobacteria aggregations(McClain,2009).

Data quality checks are carried out by SeaDAS 8.1.0 Software, to obtain data free of redundancy or noise in some satellite images that include the study area. Time series decomposition is performed on the data from spectral wavelength radiation values, and cancel outliers (unusually values) due to noise in satellite image

SeaDAS 8.1.0 is processing the noise in the Envisat satellite images that is not related by climate and topography of water surface. The sensor scans the earth surface through a rotating mirror system that radiation reflected on the target surface to detect wave bands, where each band have a primary color (red,green, blue). the noise arises due to two factories, firstly, because one of the sensors mirror angels is not identical to the other angles. Secondly, it may be because the wave region detector is not completely uniform when image is captured. The correction is performed by

Ignatov.A &,Feng Xu,(2014) method, which divided the image to affected part by noise and a part without noise. Then passed the affected part by noise through a filter containing on fluorine particles for remove the noise. Image integrity is determined by how gradients of cyanobacteria in color are clear in processed image.

,Legnani E et al(2005) took daily and monthly satellite images to track the concentrations and reproduction of cyanobacteria north Italy coast. They proved that remote sensing methods are an ideal solution to overcome the associated problems with sampling observations in the studied sites, such as the latter's inability to detect erosion patterns affecting the aquatic ecosystem, due to the increase in the size of the biomass of cyanobacteria, as the excess abundance of them reduces The pH of seawater, a process known as ocean acidification.

The satellite are a comprehensive monitoring tool, providing a clear and unique view of the cyanobacteria colonies in the Mediterranean sea due to their integrity and high temporal and spatial resolution. Where it deals with the spatial features of the phenomenon of colonization prosperity of cyanobacteria, which cannot be detected globally or regionally by sampling from the scattered monitoring stations in the study sites. For example, marine buoys are not able to represent the complex spatial pattern of the directions and distributions of those colonies caused by a group of different environmental factors such as coastal currents, bathymetry, river runoff, and human intervention. Moreover, the stations are not available in many cases and thus are not a continuous source of data required over the years (Ferreira et al.,2011).

YilmazA , et al(2013), compared measurements of Cyanobacteria in different pa rts of the Mediterranean, and found that the estimates are similar. Also they te sted four satellite images for each season. According to the results obtained, it was found that the decrease in the blue and green color ratio of Cyanobacteri a in the Mediterranean sea waters was as result to suspended desert dust in up per layer of sea surface.

Volpi et al.(2012) showed that Cyanobacteria concentrations were between 0.02 to 3.0 mg/m^3 in open waters and 2 to 6 mg m^3 in coastal waters to the western and eastern parts of the Mediterranean sea. Satellites discovered that the light penetration into the Mediterranean sea waters ranges from 15 to 40 meters and it is very saline. Also, the blooms periods of cyanobacteria colonies in Mediterranean sea are in spring, summer and autumn seasons, respectively. There are annual spring and autumn blooms (diatoms), followed by summer blooms (dinoflagellates).Western coast of Libya exposed to environmental pressures due to pollutants emitted by sewage operations, ship waste moored in the commercial port of Khuoms city, and that waste coming from fishing boats. These pollutants increase from cyanobacteria concentration, they have environmental effects on fish production, and it is related to climate change, which is an indicator of them. One of the phenomena of the cyanobacteria spread is proliferation of the poisonous jellyfish on the beaches, which is harmful to vacationers and leads to death in some cases. This study aim to assessment cyanobacteria concentrations in the coastal waters to study area, and its importance lies in knowing quality water and pollution extent in targeted area. As well as presenting a new study about cyanobacteria polution extent in search site.

2.Method and Materials:

2.1 Study location:

SState of Libya between tudy site includes the western coast of the 11^{o}740 E & 34^{o}753N west, and 15^{o}276 E & 34^{o}632N east. Study area covers about 72,458 kilometer square,as shown in Figure (1)..

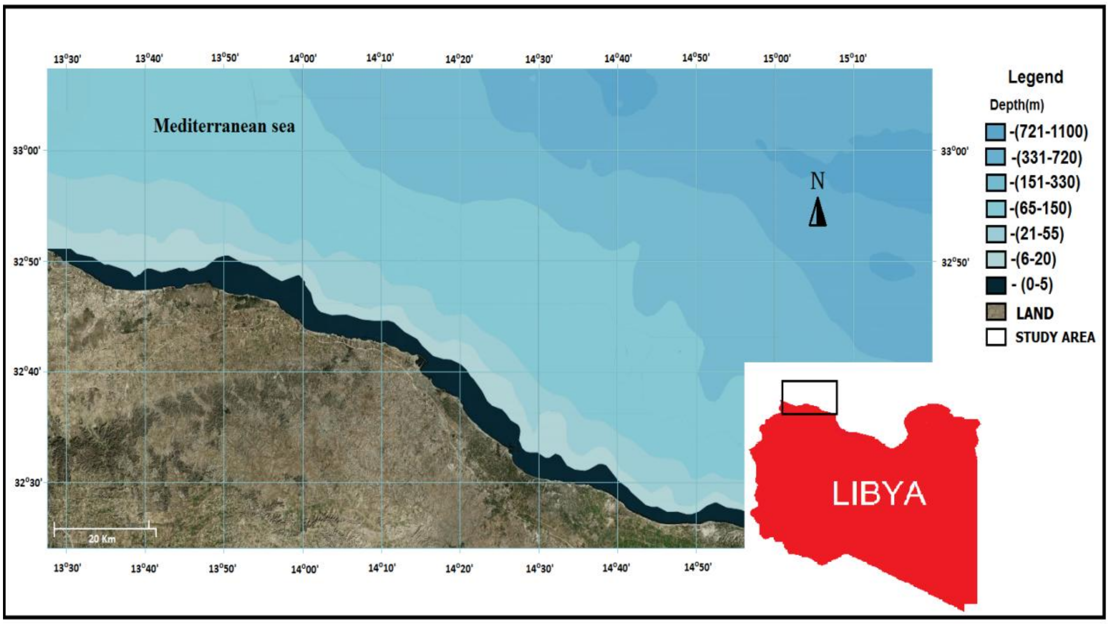

Figure-1: Study location with coastal topography.

There are several industrial activates on this site, such as power plant and commercial port.For human activities such as anchors,traps, and resorts. Waste originating from these activities and it effect on the marine environment of study coast, and they provide it with nutrients from sewage waste, ships and boats. Fishing, power plant and commercial port contributions in these nutrients that increase in multiplication and prosperity of cyanobacteria colonies of study area. Cyanobacteria distribution depends on climate change and nutrients amount. Western coast of Libya had a high population density compared to eastern coast. Which increases the human activity impact on the west side. Hence, this prompted me to study the western side of the Libyan coast. Climate in this region represents the Mediterranean climate, where it is hot and humid in summer, wich starts from mid-May until beginning of September, and it is cold in winter, which extends from mid-November to beginning of March, and it is mild in spring while it is volatile in autumn season in September and October.

2 2. Method:

2.2.1 Envisat data:

In this study MERIS data set was used from Level 2 of Envisat satellite processing system operated by the National Oceanic and Atmospheric Administration (NOAA). To process coastal water color data. The obtained images were analyzed by SeaDAS 8.1.0 program, which specializes in satellite image analytic to observe phenomena seas and oceans. These analysis depend on purity of atmosphere during take periodic satellite imagery.

2.2.2 Cyanobacteria estimation algorithm:

The biomass of cyanobacteria is detected by the spectral profile (SS) algorithm as in the following formula(1):

(−λ−+λ)(−λ−λ){(+λ)sρ−(−λ)sρ}+(−λ)sρ−(λ)sρ=(λ)SS…(1)

Where::

ρs is the top of atmosphere reflectance corrected for Rayleigh radiance,

λ is the central band,

λ+ and λ- are the adjacent reference bands.

Data was obtined from this website:-envisat/catalog/eogateway/int.esa.earth//:https -p2_frs_mer-2-level-swath-full-resolution-full-meris

Through this site cyanobactria concentrations are obtained for a year 2022. fro m those images obtained, data usually deficient by 10-20 percent due to spread of clouds,dust and fog. For time series obtained from this website:gs.neo//:http php.index/analysis/gov.nasa.fc.This series aims to clarify the repeated spatial dist ributions, high and low concentrations of cyanobacteria during study year, and sensor data from Level-2 were high temporal resolution.

3.Results and discussion:

Satellite images with repeated spatial patterns, shown in Figure ( ) during study year, were indicative of the optical properties of cyanobacteria concentrations, and presence of three main colors for those concentrations, red, green, and blue. There is two colors derived from red color, they are orange and yellow. This known as spectral index of cyanobacteria concentrations. The wavelengths of red color are predominant in winter season, especially, in January and February due to water mixing process that resulting from strong currents, which lead to an increase in cyanobacteria colonies.

Green wavelength prevails in winter because of strong surface currents, which is cause of cyanobacteria distributions over a wide range of study area. This explain warmth water, as well as abundance of nutrients and spread them on large scale due to strong winds in winter season. Beginning with spring season, sea currents decrease as strength of wind decrease, and thus the spatial extent of cyanobacteria decrease a lot during spring and summer seasons.

From Figures 2a,2b,2c &2d, observed that blue wavelength color prevailed by 65 percent in data, with cyanobacteria concentrations ranging from 0.001 to 0.1 mg per cubic meter, as shown in SeaDAS analytical. While cyan color had concentrations ranging from 0.1 to 1 mg per cubic meter. For green color wavelength, it was prevalent during study year by 62 percent, which indicates that cyanobacteria concentrations were not significantly high and dangerous in study.There rates were from 1 to 2 mg/m^3. For red color wavelength, and its branches, it was prevalent at a weak rate of 8 percent with rates ranged from 4 to 6 $mg/m^{3,}$ and it was highest values in this study. Orange color wavelength had weakest rates, amounting to 4 percent, and noted that its rates were high, ranging from 3 to 4 $mg/m^{3,}$ followed by yellow color wavelength, which was recorded as rate of 19 percent, and with high concentrations reaching to 3 mg/m^3.

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العدد 23

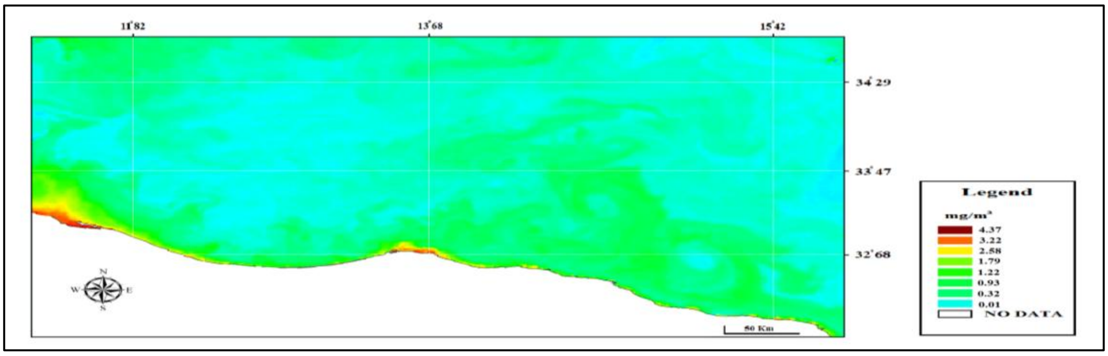


Figure (2a) :Dominant distributions of Cyanobacteria in winter season.

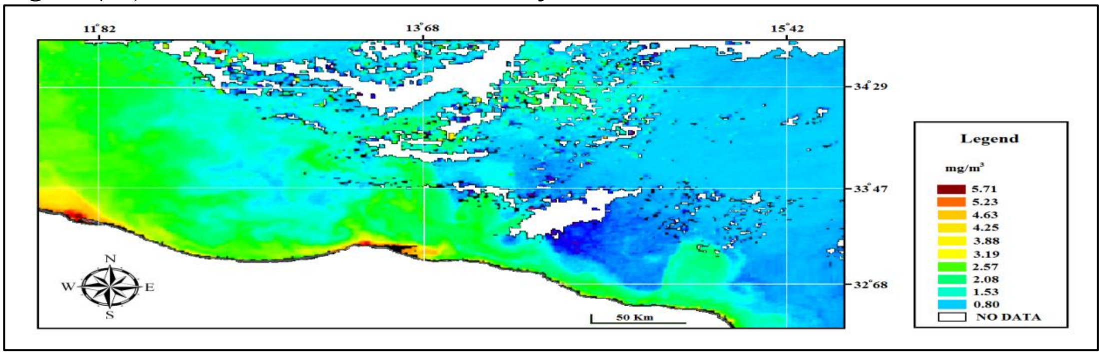


Figure (2b): Dominant distributions of Cyanobacteria in Autumn season.

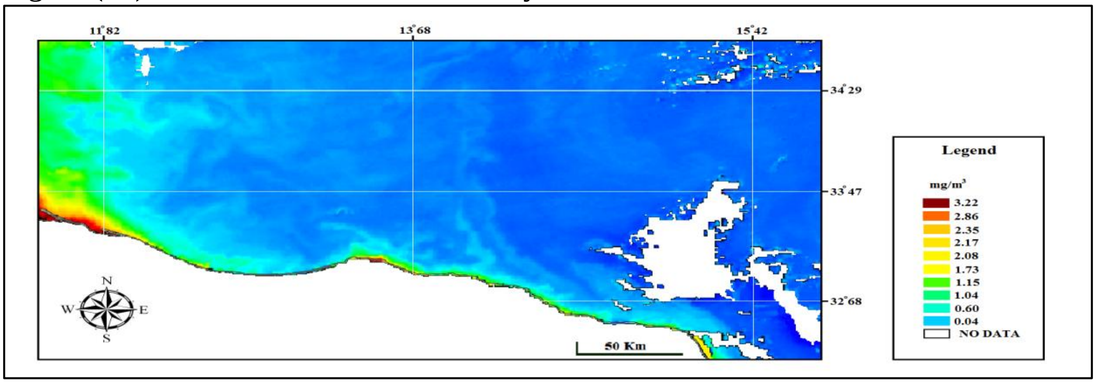


Figure (2c): Dominant distributions of Cyanobacteria in Spring season.

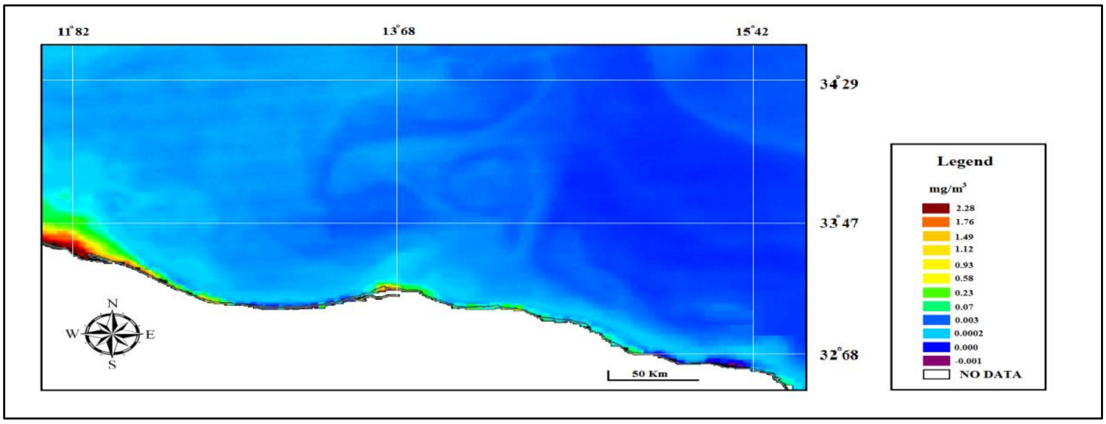
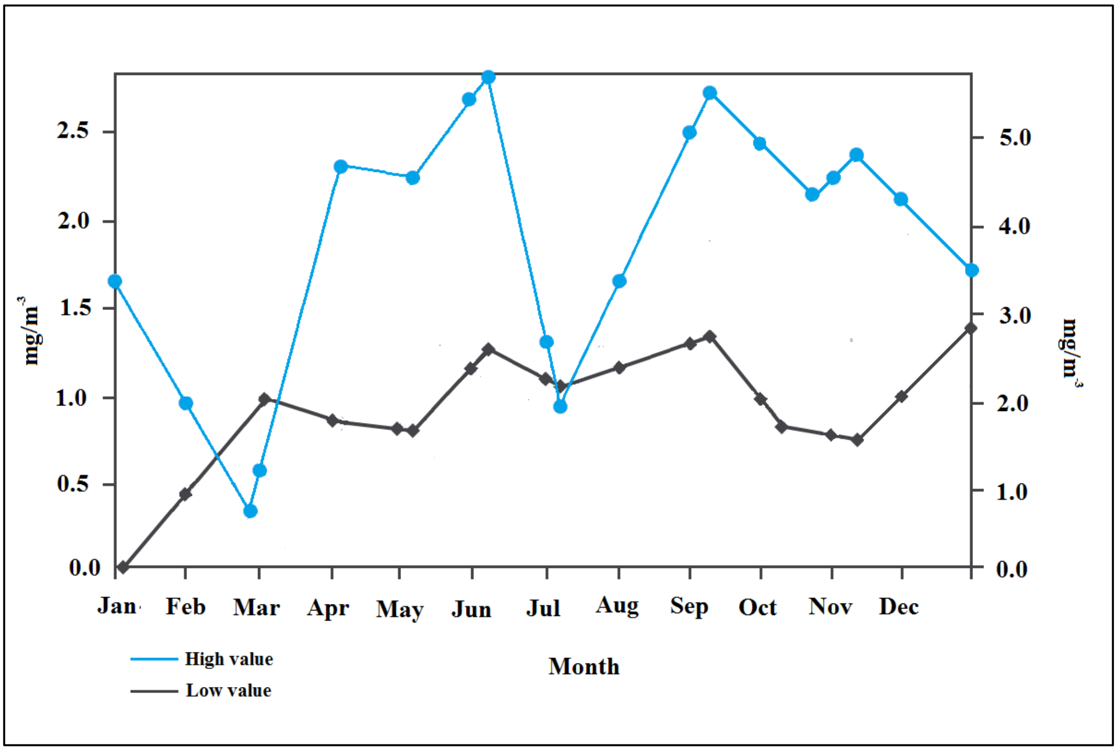


Figure (2d): Dominant distributions of Cyanobacteria in Summer season.

From the spectral signatures of cyanobacteria colonies as shown in Figure (3), the time series of the spatial data found big similar in cyanobacteria distributions into study year. Cyanobacteria colonies recorded values ranged from 0.9 to 5.82 mg/m^3 in this search. It is value were weak in summer, with values recorded 0.01 to 0.4 in May and 0.9 to 1.2 in August, and were high in winter, it recorded 4.5 to 5.82 mg/m^3 in December and 3.8 to 4.6 in November. During autumn season, observed a contradiction in cyanobacteria values, where was not exceeded 2mg/m^3,at the beginning of September,while they were exceeded 3mg/m^3 at the same month.. In October, the average values ranged from 2 to 4 mg/m^3 into different days to same month, was high values in last week. In spring season(March), cyanobacteria concentration was high at the beginning of March, with value ranging from 2.3 to 3.8 mg/m^3. for the end of March and the beginning of April, the values began to decrease until they reached to 1 mg/m^3. This indicates that the nutrients are weak from the end of March to the beginning of September, as well as, the water mixing factor, which decreases with declining in the strength of the surface currents of the winds in study region. Which contributes to the weakness of sizes and distributions to cyanobacteria colonies, and they are concentrated only at the beach, who are source to these nutrients.



Figur-3:Monthly time series of Cyanobacteria values during study year

4.Conclusion:

This study proved the validity of the Envisat satellite data according to NASA standard rates for cyanobacteria blooms in Mediterranean sea, as shown in Table 1. Also this study proved that cyanobacteria colonies did not high to pose a threat to human activity and biomass during study waters.Time series of Envisat satellite data enabled more understanding of cyanobacteria rates into study area and knowing their blooms times. Knowing cyanobacteria blooms extent sdws effect of climate, evaporation, and water quality in targeted region. Spectral gradients of MERIS sensor indicated that data were high accuracy. Few of those images by 12% from data were blurred by clouds,fog and dust. This new study makes possible to routinely monitor of cyanobacteria distributions in other coastal regions in Libya, because MERIS sensor have precise wavelength regions, high spatial resolution, and clear time frames is made available to research community.

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	مجـلـة الـتربـوي Journal of Educational ISSN: 2011- 421X Arcif Q3	معامل التأثير العربي 1.63 العدد 23

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