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# All Seawater Parameters Analysis for All Seasons from 2005 -2017 using Real Time Data from National Center for Environmental Information

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## Abstract:

In this research article we used Ellison et al. model 1998 as reference model to find the ocean water parameters for all seasons from 2005-2017 using real time data from national oceanic and atmospheric administration which is a database for real time data of all seas water of the world, we took this real time data in form of salinity and temperatures of all sea of the world from surface of seas to depth of 5800 m approximately , in past scientists used fixed data to find sea water parameters which is not possible in real world because sea water parameters changed with each depth , latitude and altitudes of seas water the scientists also used fixed frequency to find ocean water parameters we used variable frequency to find all ocean water parameters. In this research article we used Mat lab as a simulation tool to find seas water parameters from surface of sea to depth of ocean water for all seasons from 2005-2017.

**Keywords**: average permittivity, ppt, F/m, average salinity, average temperature, average conductivity, S/m.

## Introduction:

The ocean water parameters depend on the weathers. Every sea water parameter changed according to the ocean water temperature. The ocean water comprises on organic and inorganic compounds the organic compound does not depend on the ocean water parameters while the inorganic compounds depends on ocean water parameters if the inorganic compounds concentrations are changed according to weather the ocean water parameters also changed, because it composes salts concentration and its origin is volcanoes which released different types of chemical reactions and form different inorganic compounds, the other source of inorganic compounds are salty mountains the rain falls on these salty mountains and flows to ocean water which increases or decreases the ocean water parameters. The organic compounds have carbon components, so they do not affect the ocean water parameters for examples ocean water plants, ocean water animals and amino acid. The ocean water parameters are mean salinity, mean

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temperature, mean conductivity and mean permittivity and these parameters are changed according to winter, summer, autumn and spring because the inorganic compounds concentrations and ocean water temperatures varied according to each depth, altitude and latitude of sea water.

## 1) Literature review:

## a) Ellison et al model 1998:

We used this model as a reference model to find different sea water parameters by using above real time data. In past scientists and researchers used fixed data of sea water which are not possible in real world because sea water parameters are changed with each depth of sea. We used this model on real time data from National centers for environmental information in form of salinity and temperatures as shown above, and find different sea water parameters on varying frequency. We used different formula from this model to find mean salinity, mean temperatures and mean permittivity using Mat lab as a simulation tool formulas are shown below.

Mathematically conductivity

$$\sigma(s,\ t) = z(t) + v(t)\ s \tag{1}$$

$z(t)=0.08637+.03060t-.000412t^2$ $v(t)=0.07745+.00168t+.0000193\ t^2$

Where in equation (1) "z(t)" is coefficient of time, and "v(t) " are coefficient of salinity.

Mathematically Permittivity

$$\boldsymbol{\varepsilon = \varepsilon_r \varepsilon_o} \tag{2}$$

Where in equation "$\varepsilon_r$" is the relative permittivity of a substance and "$\varepsilon_o$" is the vacuum permittivity of free space having a value of 8.85*10^-12 F/m.

We employ Debye interpolation function to achieve Mean permittivity, from mean conductivity, mean temperatures and mean salinity employing practical data from National centers for environmental information in form of salinity and temperatures, and we put this data in interpolation function, and we can generate different marine water parameters, the equation is revealed below.

Debye interpolation function

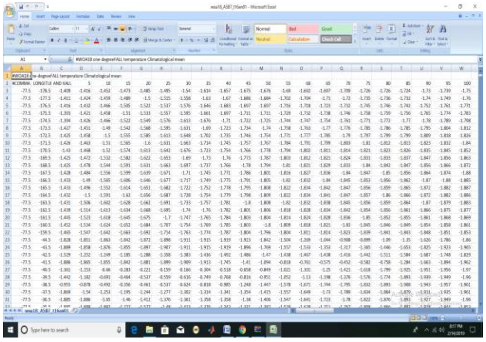
Mathematically

$$\varepsilon(t, s, v) = \varepsilon_\infty + \varepsilon_o - \varepsilon_\infty / 1-j2\pi\tau v + j\ \sigma / 2\pi v\ \varepsilon \tag{3}$$

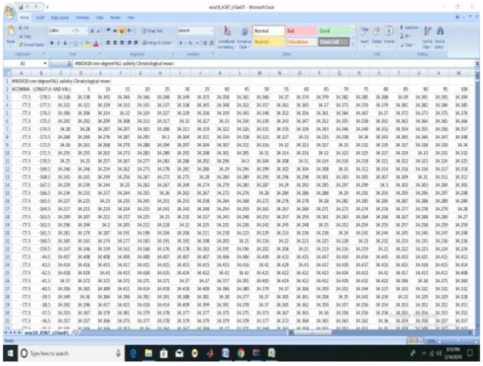
Where in equation (3) "ε" is the permittivity of marine water, and "$\varepsilon_\infty$, $\varepsilon_o$" are the static and frequency dielectric constants depends on temperatures of marine water and salinity of marine water and "σ, v" are conductivity of marine water and angular frequency of marine water and "τ, $\varepsilon^*$" are the relaxation time and the permittivity of free space. We employ Mat lab simulation tool and use equation (3) on real time data; we can generate the mean permittivity of marine water as revealed in below figures, on analyzed mean data and on statistical mean data.

### 2) Real time data for all seasons:

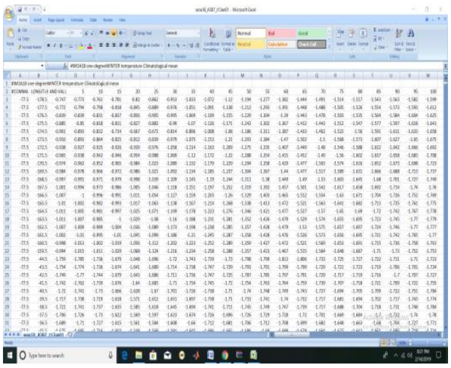
This real time data is taken from National centers for environmental information in form of salinity and temperatures for different weathers, and we put this real time data in Matlab simulation code and generate different marine water parameters. The real time data is shown below.



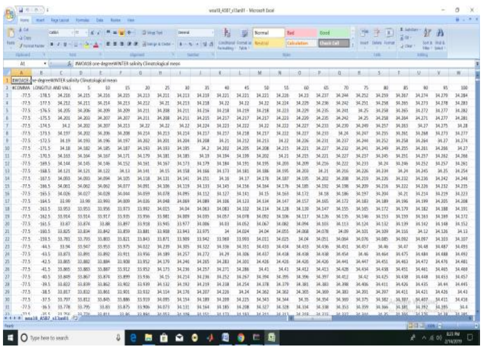
a) Autumn Temperature data 2005- 217



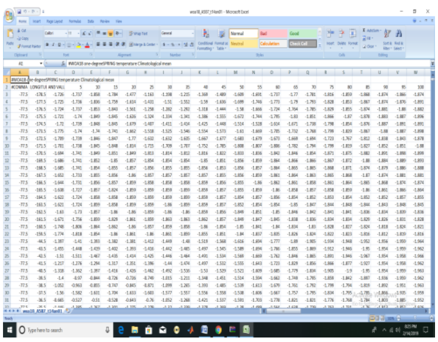
b) Autumn salinity data 2005-2017



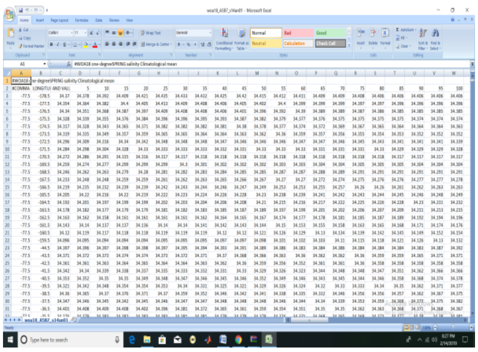
c) Winter Temperature data 2005-2017



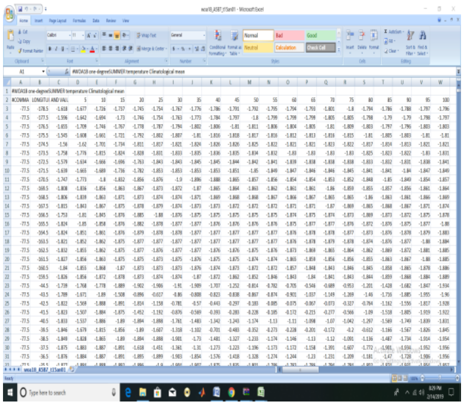
d) Winter salinity data 2005-2017

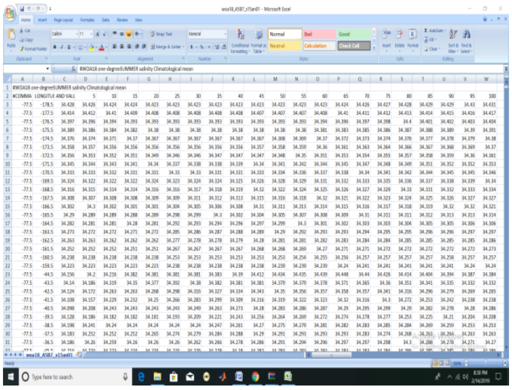


e) Spring Temperature data 2005-2017



f) Spring salinity data 2005-2017





**g) Autumn Temperature data 2005-2017 h) Autumn salinity data 2005-2017**

### 3) Mean salinity of ocean water for all autumns 2005-2017 ,all winters 2005-2017, all Springs 2005-2107 and all summers 2005-2017, Matlab simulation results:

Mean salinity mean the average salinity of ocean water it determines the salts solved in ocean water it is measured by part per thousand represented by PPT. In this research article we find the mean salinity for winters, summers, and autumns and for all springs from 2005 to 2017 using real time data from National centers for environmental information. The Mat lab simulations results of mean salinity are shown below for all weathers**. [1,2,3,4,5,6,7,8,9,10,11,12]**

#### a) Mean salinity for all autumns seasons 2005-2017 Matlab results:

The fig 1 illustrates that the mean salinity increases linearly with mean temperatures of ocean water the zero temperature and zero salinity concentrations means that it is the depth of ocean water and the maximum limits of mean temperatures and mean salinity concentrations shows that it's the surface of ocean water as shown in fig 1 the graph shows as we move from depth of ocean water to surface of sea water the salinity concentration and mean temperatures are increased and at some points it is a little constant, from fig 1 we observe that the sea water parameters are not constant in past scientists imagined that it was constant. We also observed from fig 2 that mean salinity also dependent on mean conductivity of ocean water as shown in fig 2 in the graph the zero mean salinity concentration and zero conductivity means it is the depth of ocean water and it increases linearly as we shift towards the surface of ocean water from which we observed that mean salinity is a function of mean conductivity as shown in fig 2.

The mean salinity also affects the mean permittivity real and imaginary parts as revealed in fig 3 and in fig 4 below the mean permittivity part showed that the ocean water absorbed how much energy and imaginary part showed how much energy released by ocean water which we revealed in fig 3 and in fig 4 which shows that the energy absorbed and released of electromagnetic waves are less at depth of ocean water because at depth of ocean water the inorganic compounds and mean temperatures and mean conductivity are less while the energy absorbed and released are maximum at surface of ocean water due to abundant amount of ocean water parameters as revealed in fig 3 and fig 4 below.

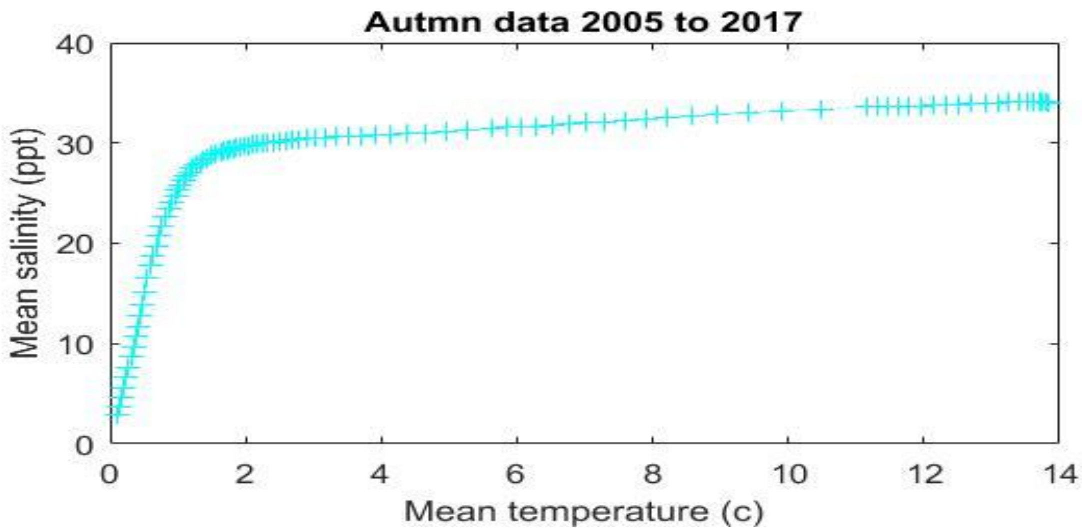



**Fig 1 Mean salinity vs. Mean temperature**

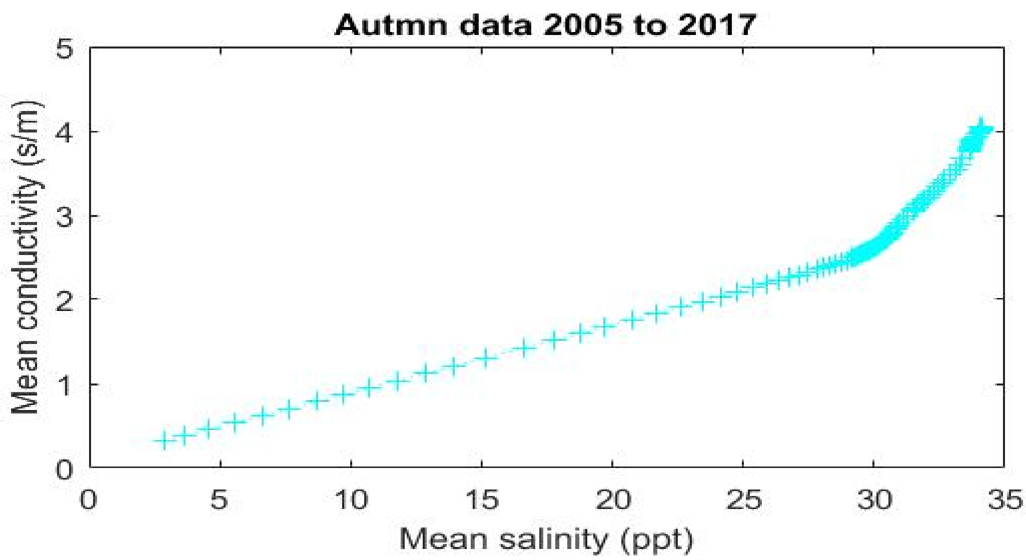



**Fig 2 Mean salinity vs. Mean conductivity**

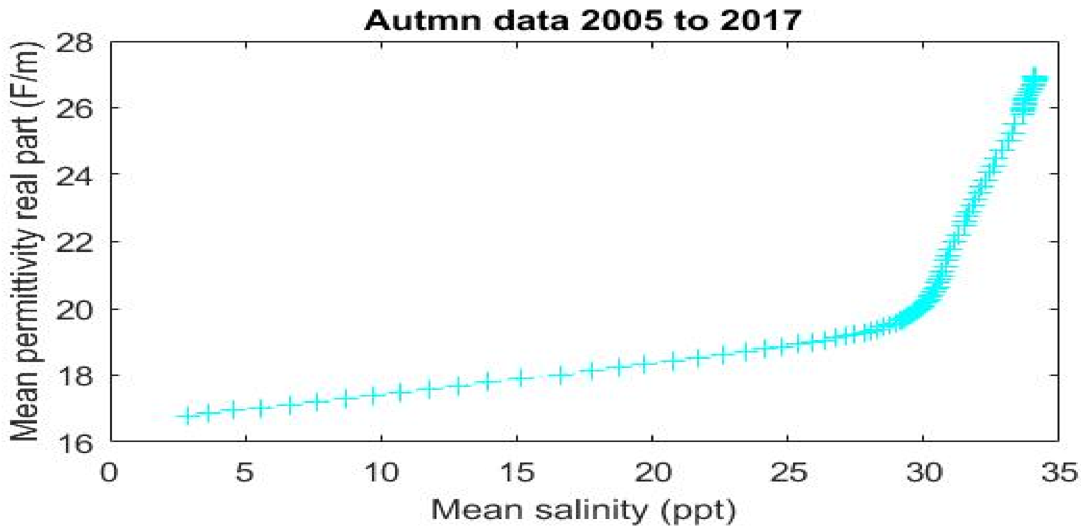



**Fig 3 Mean salinity vs. Mean permittivity real part**

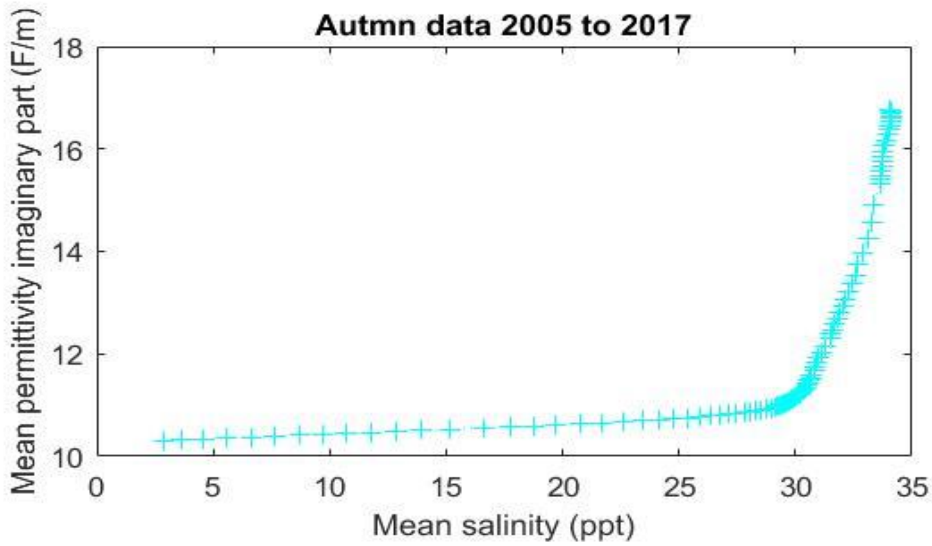



**Fig 4 Mean salinity vs. Mean permittivity imaginary part.**

### b) Mean salinity for all winters seasons 2005-2017 Matlab results:

The ocean water mean salinity, mean temperatures, mean conductivity and mean permittivity real and imaginary parts shifts a little in winter season as compared to Autumn season as shown in fig 5, fig 6, fig 7, and fig 8, the reason is the ice formation also affects the salinity by the process of brine rejection, which means that when the ocean water temperature reaches -1.9 C$^{o}$, the ocean water freeze and salts contents are released from ice crystal, and the ocean water becomes denser and saltier due to this process, which increases the salinity concentration of ocean water.

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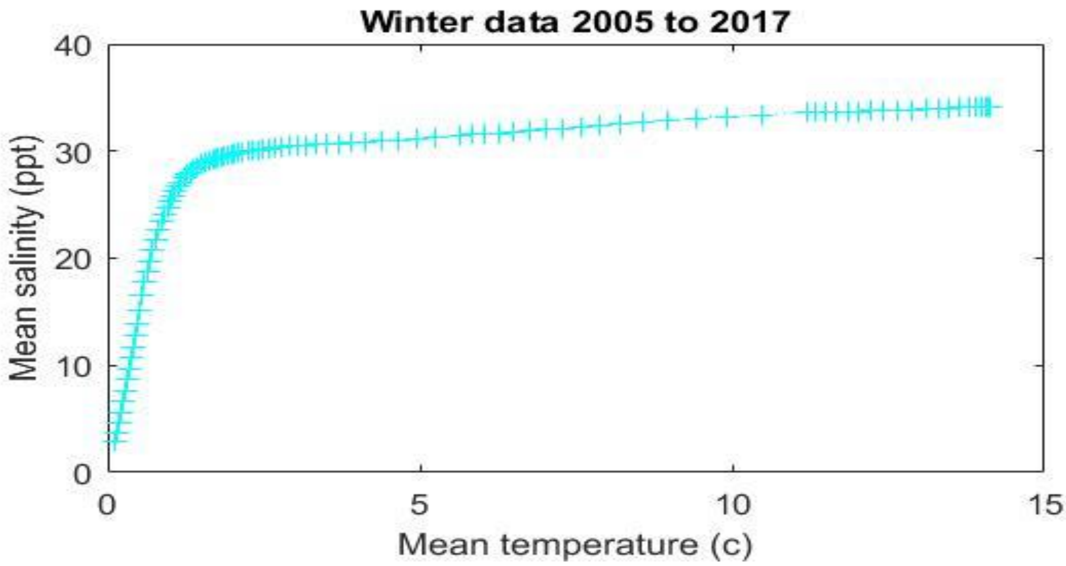


**Fig 5 Mean salinity vs. Mean temperature**

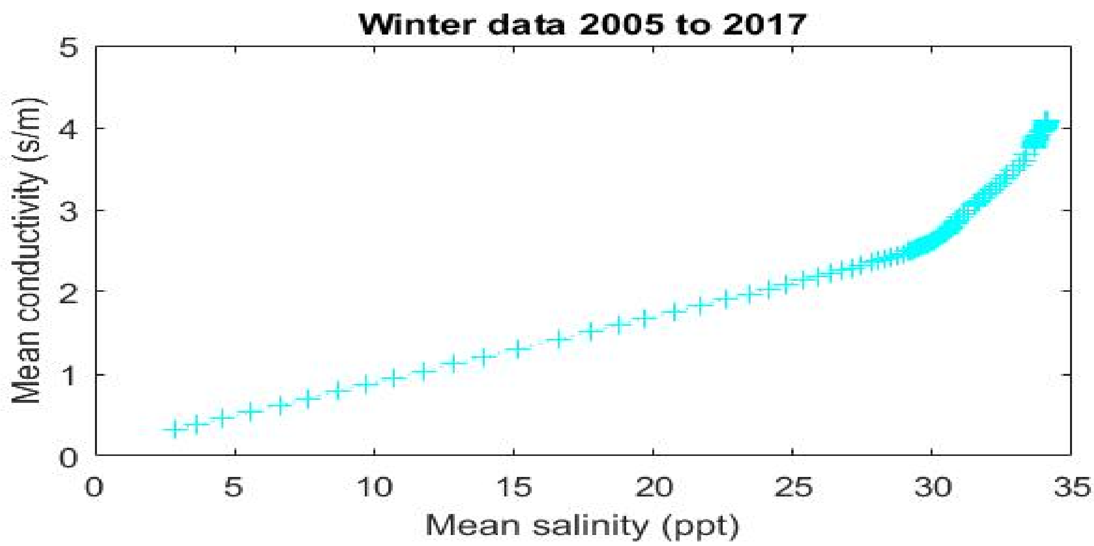


**Fig 6 Mean salinity vs. Mean conductivity**

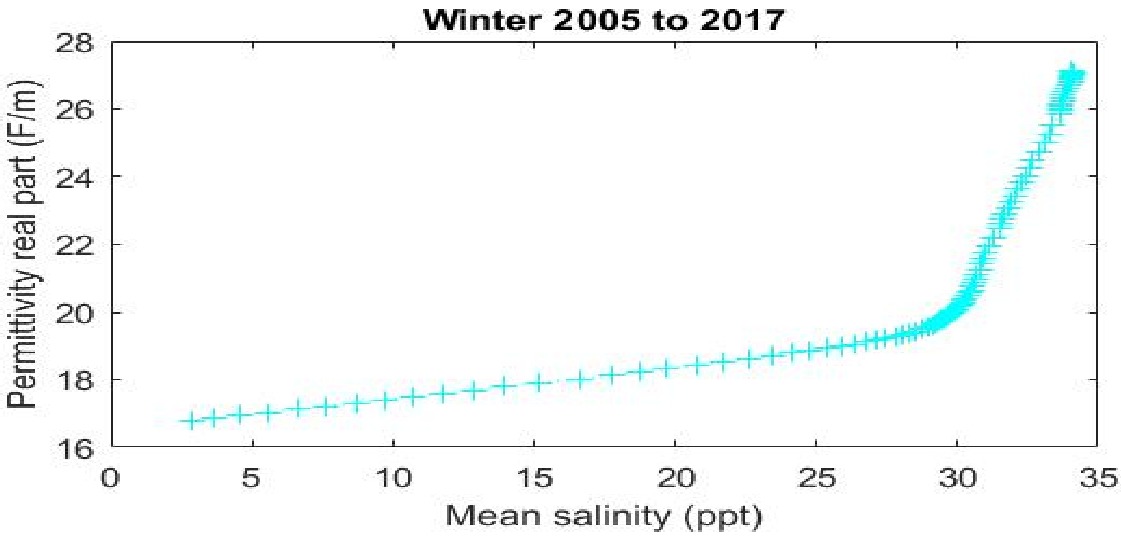


**Fig 7 Mean salinity vs. Mean permittivity real part**

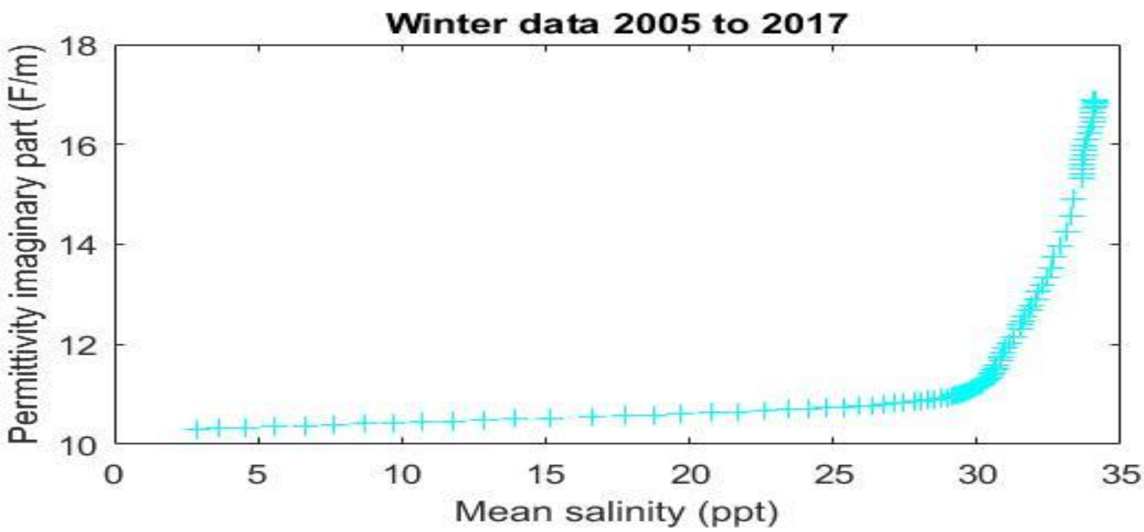


**Fig 8 Mean salinity vs. Mean permittivity imaginary part.**

### c) Mean salinity for all springs seasons 2005-2017 Matlab results:

The ocean water spring mean salinity is same like autumn mean salinity concentration but it is different from winter mean salinity concentration, it means that the inorganic compounds concentrations at depth of ocean water and at surface of ocean water are less in spring and in autumn as compared to winter season the results of mean salinity versus different ocean water parameters are shown below in fig 9, fig 10, fig 11 and in fig 12.

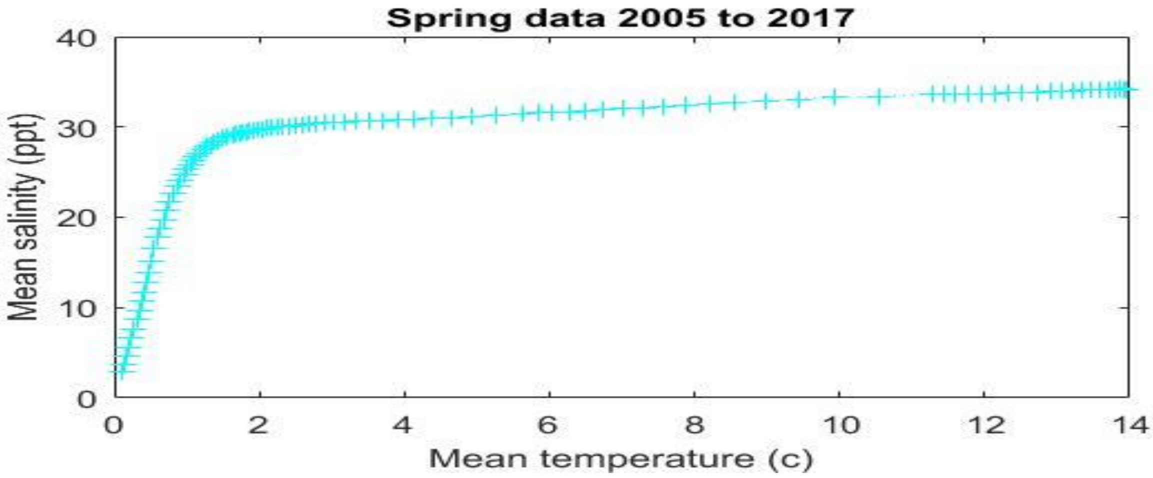


**Fig 9 Mean salinity vs. Mean temperature**

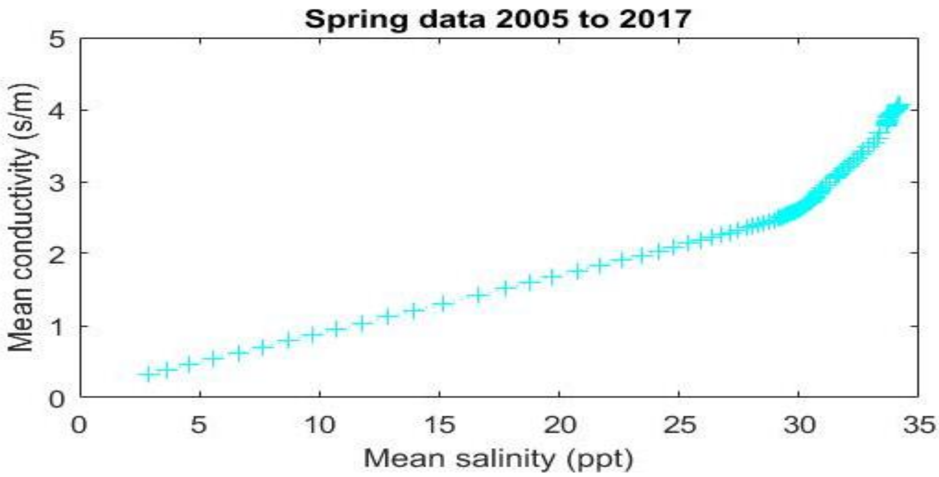


**Fig 10 Mean salinity vs. Mean conductivity**

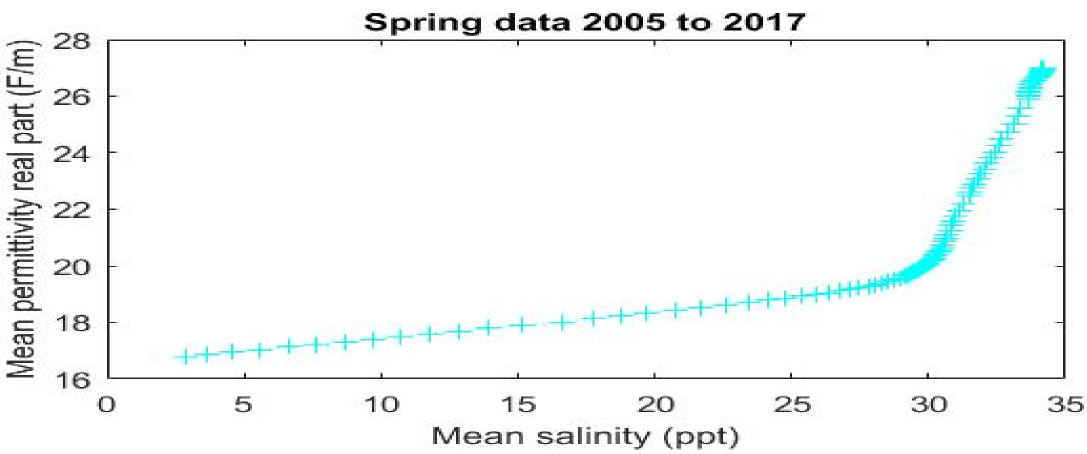


**Fig 11 Mean salinity vs. Mean permittivity real part**

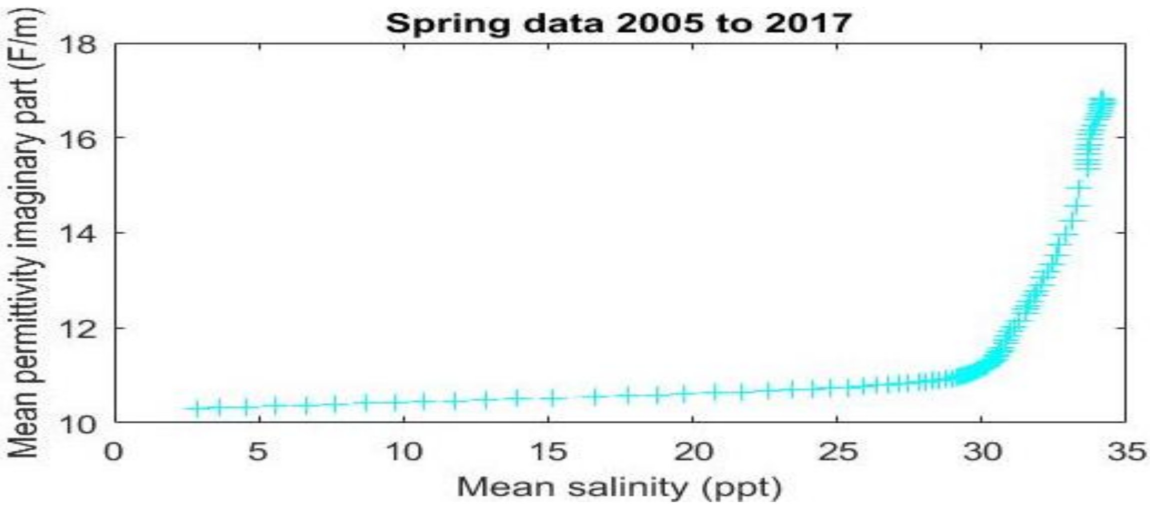


**Fig 12 Mean salinity vs. Mean permittivity imaginary part.**

**d) Mean salinity for all summers seasons 2005-2017 Matlab results:**

The marine water summers mean salinity is same as winters but it differs from springs and autumns mean salinity concentrations it reveals that the inorganic compounds concentrations in summers and winters are same and in autumns and springs are same the results for mean salinity versus different sea water parameters are shown below in fig 13, fig 14, fig 15, and in fig 16 which reveals that the mean salinity is minimum at depth of ocean water and its maximum at surface of ocean water.

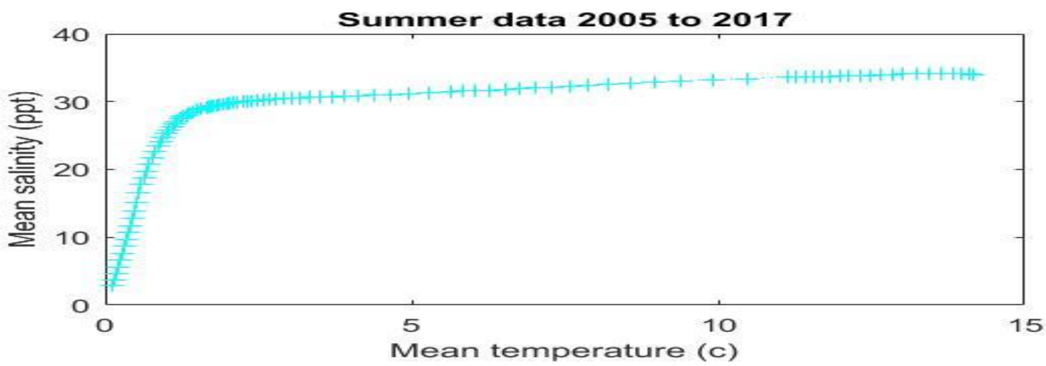


**Fig 13 Mean salinity vs. Mean temperature**

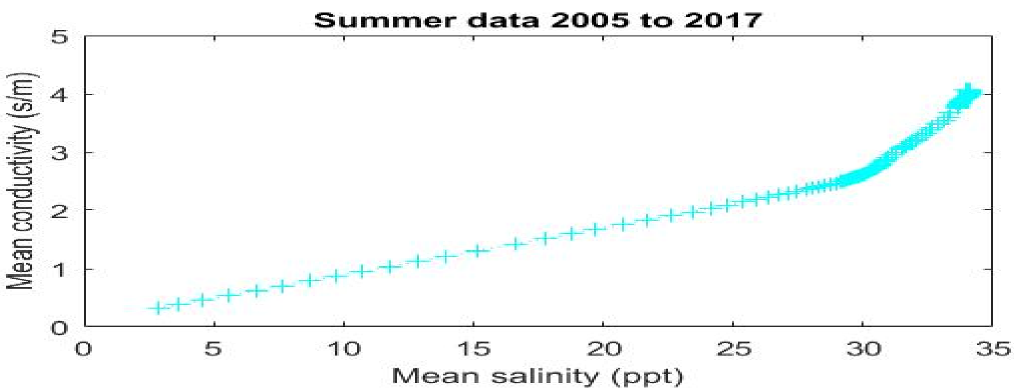


**Fig 14 Mean salinity vs. Mean conductivity**

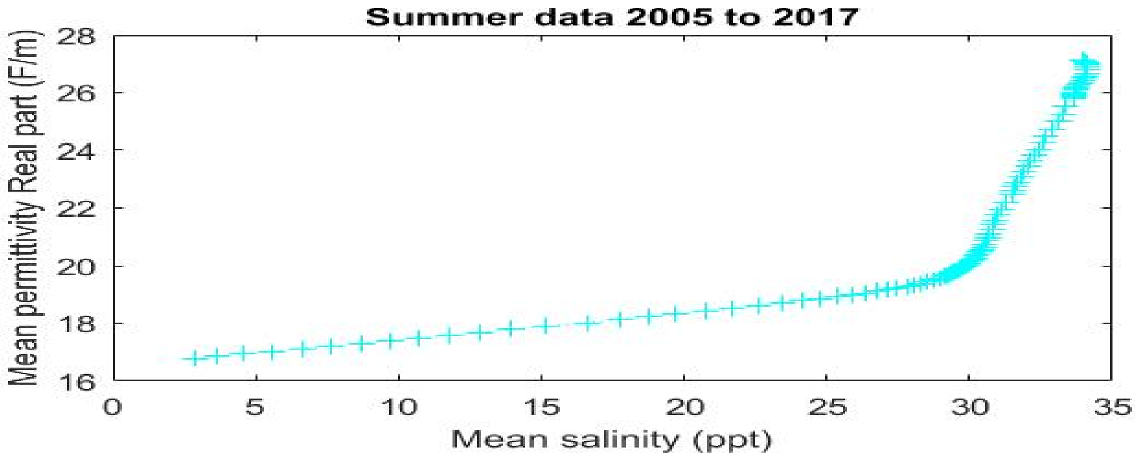


**Fig 15 Mean salinity vs. Mean permittivity real part**

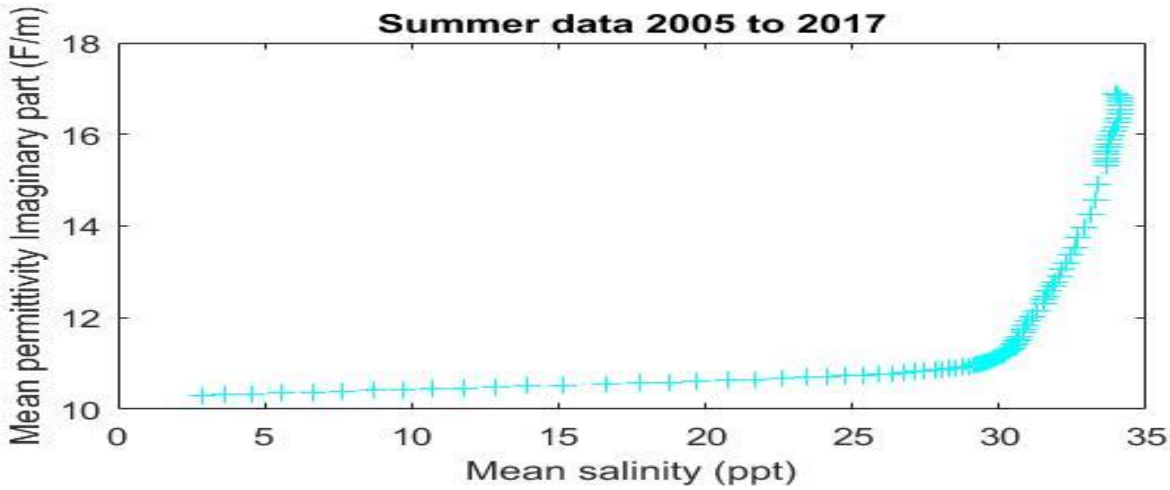


**Fig 16 Mean salinity vs. Mean permittivity imaginary part.**

4) **Mean Temperature of ocean water for all Autumns 2005-2017 ,all winters 2005-2017, all Springs 2005-2107 and all summers 2005-2017, Matlab simulation results:**

The mean temperatures for all autumns, winters, summers and springs determine the marine water hotness or coldness, the temperatures of marine water is not uniform at all surfaces and at all weathers of the year it varies according to depths, latitudes and longitudes of marine water, it is represented by Celsius ($c^o$). In this research paper we find the mean temperature for all weathers of the year versus different marine water parameters using Mat lab as a simulation tool**. [13,14,15,16,17,18,19]**

a) **Mean Temperature for all Autumns seasons 2005-2017 Matlab results:**

The mean temperatures of marine water are also a function of mean conductivity and mean permittivity real and imaginary parts as shown in fig 17, fig 18 and fig 19, the fig 17 zero points shows it the depth of marine water at this stage the inorganic compounds or salinity concentration, temperatures of marine water and mean conductivity are less all these parameters are dependent on each other while at surface of marine water these parameters are maximum as shown in fig 17 which increases linearly from depth of ocean to surface of ocean water these parameters also affects the marine water mean permittivity real and imaginary parts as shown in fig 18 and fig 19, the mean permittivity real and imaginary parts increases linearly with mean temperatures of marines water at depth of ocean water the mean temperatures and mean permittivity real and imaginary parts are minimum while its maximum at surface of marine water as shown in fig 18 and fig 19.

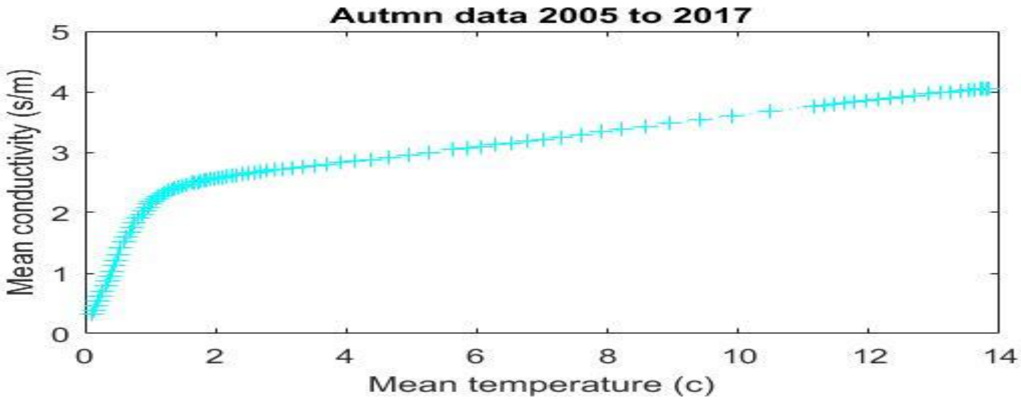


**Fig 17 Mean temperature vs. Mean conductivity**

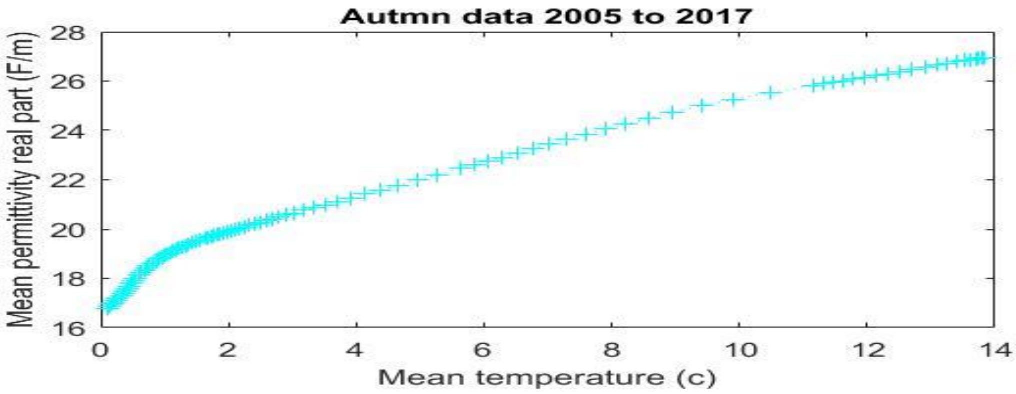


**Fig 18 Mean temperature vs. Mean permittivity real part.**

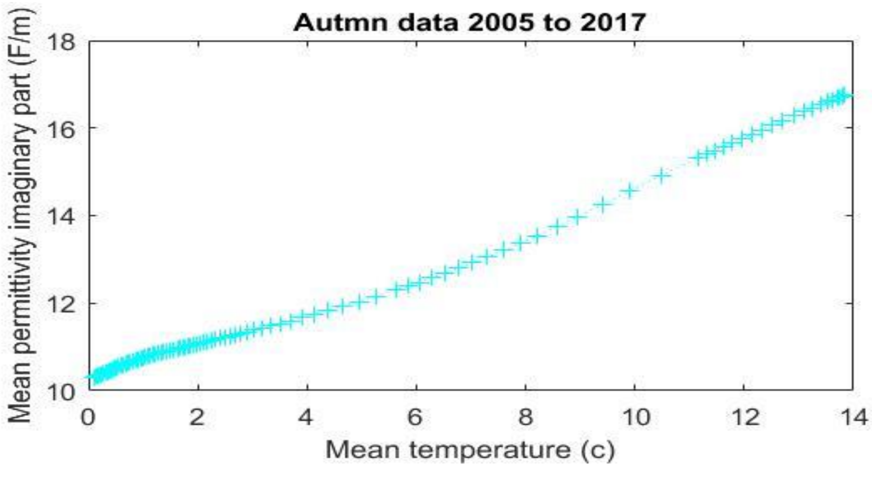


**Fig19 Mean temperature vs. Mean permittivity imaginary part.**

**b) Mean Temperature for all Winters seasons 2005-2017 Matlab results:**

The mean temperatures versus different marine water parameters are more than compared to Autumns as shown in fig 20, fig 21, fig 22 below it means that the inorganic compounds in winter season are more than compared to inorganic compounds in autumns that's mean temperatures, mean conductivity and mean permittivity real and imaginary parts are varied which is revealed in fig 20, fig 21 and in fig 22.

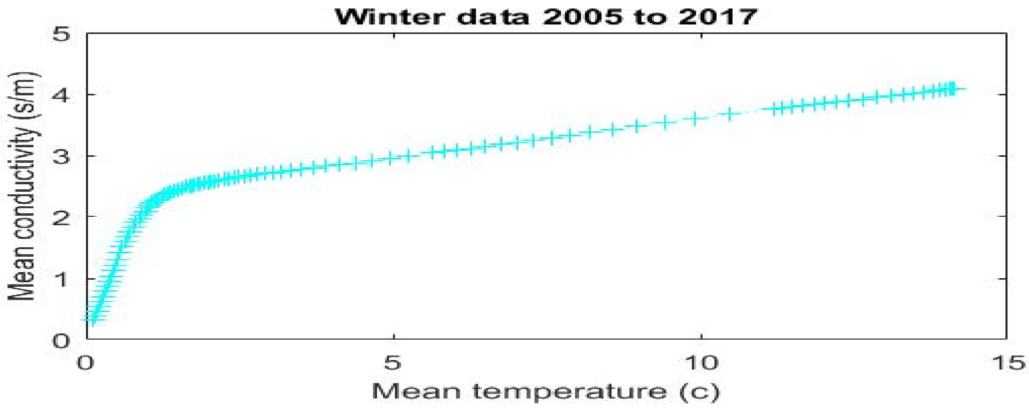


**Fig 20 Mean temperature vs. Mean conductivity**

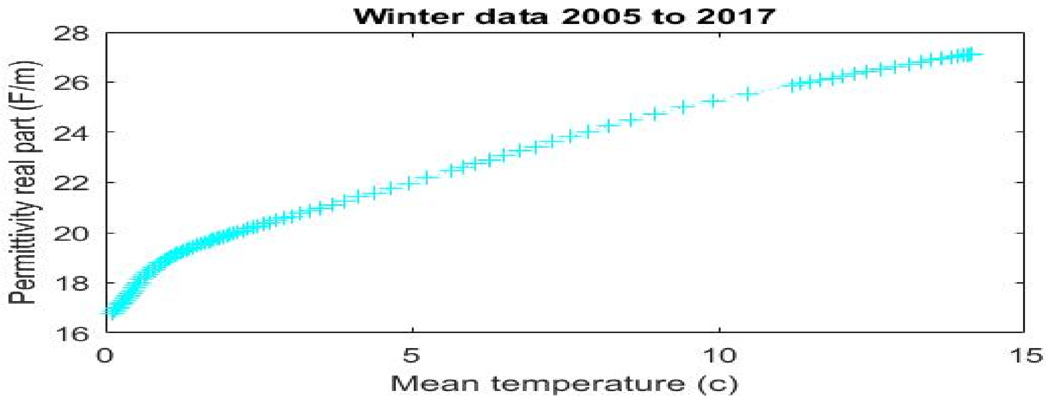


**Fig 21 Mean temperature vs. Mean permittivity real part.**

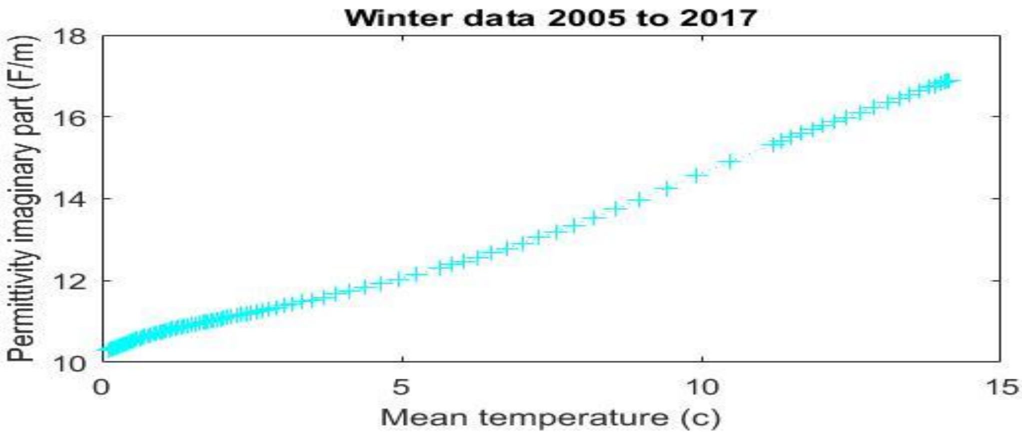


**Fig 22 Mean temperature vs. Mean permittivity imaginary part.**

### c) Mean Temperature for all Springs seasons 2005-2017 Matlab results:

The mean temperatures vary a little in spring seasons as compared to winter seasons as shown in fig 23, fig 24, fig 25 below.

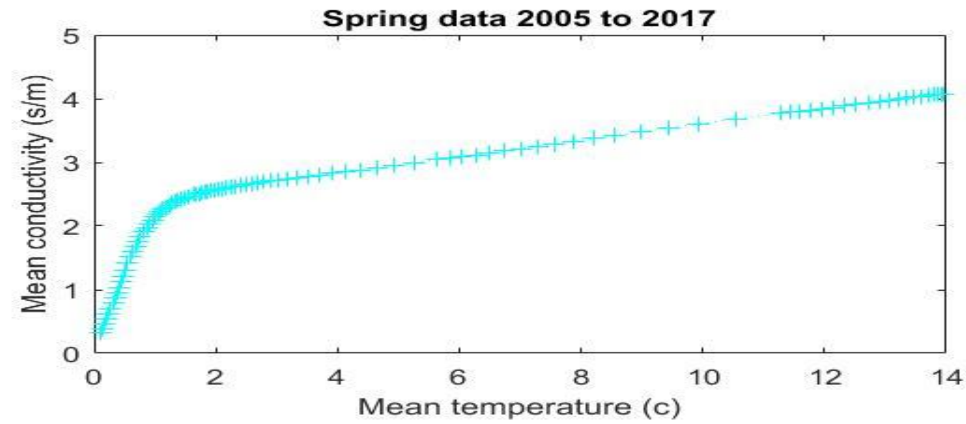


**Fig 23 Mean temperature vs. Mean conductivity**

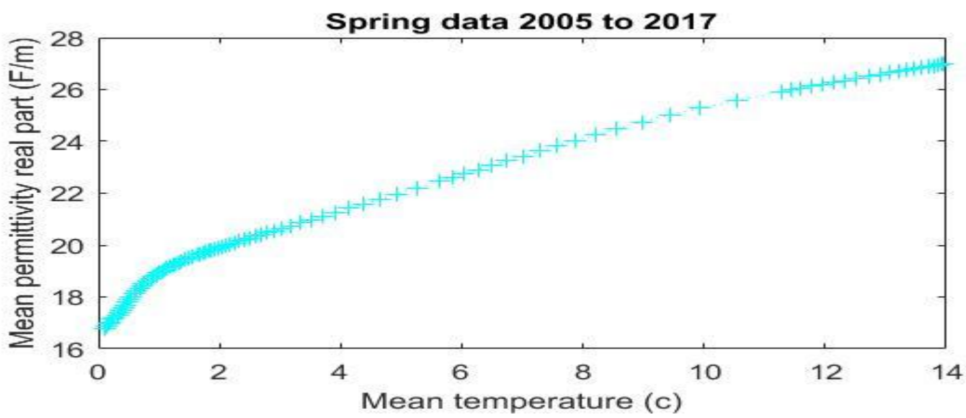


**Fig 24 Mean temperature vs. Mean permittivity real part.**

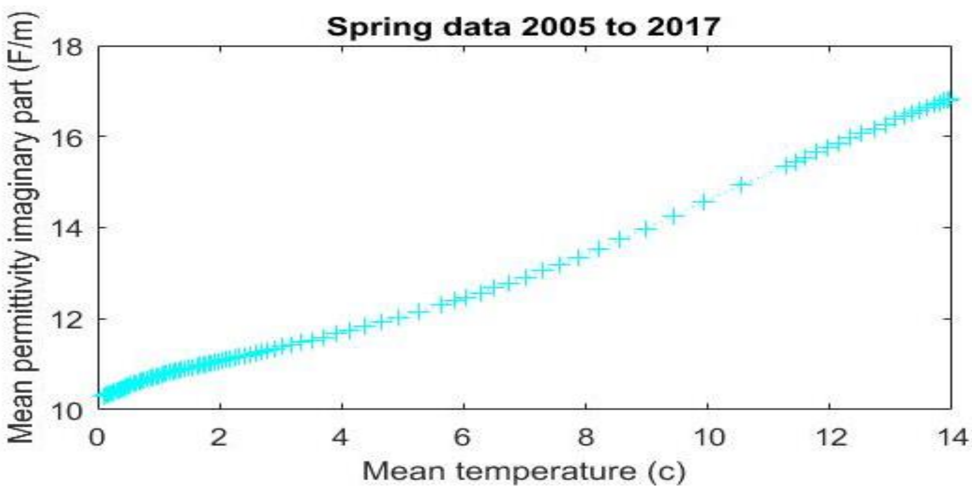


**Fig 25 Mean temperature vs. Mean permittivity imaginary part.**

**d) Mean Temperature for all Summers seasons 2005-2017 Matlab results:**

The mean temperatures vary just like Autumns seasons as shown in fig 26, fig 27, fig 28 as shown below.

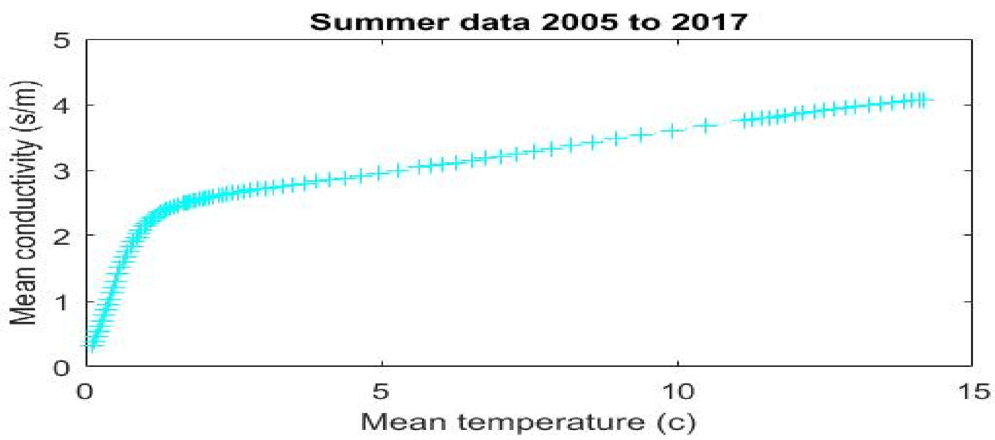


**Fig 26 Mean temperature vs. Mean conductivity**

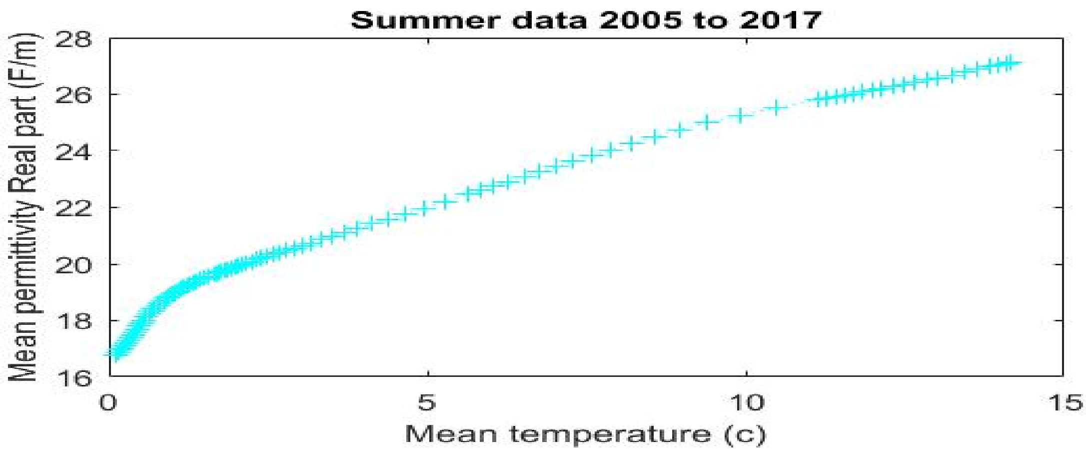


**Fig 27 Mean temperature vs. Mean permittivity real part.**

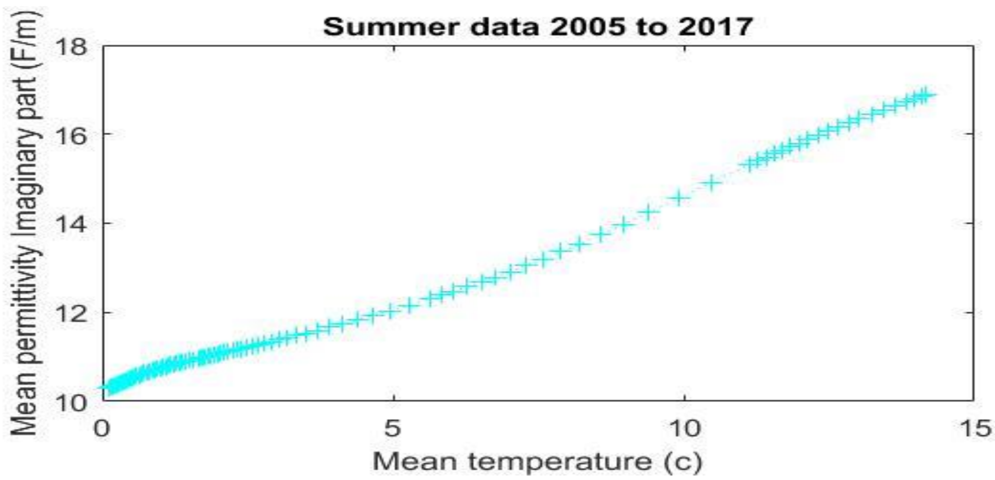


**Fig 28 Mean temperature vs. Mean permittivity imaginary part.**

### 5) Mean Conductivity of ocean water for all Autumns 2005-2017 ,all winters 2005-2017, all Springs 2005-2107 and all summers 2005-2017, Matlab simulation results:

The mean conductivity of marine water shows the ability of marine water to pass electric current, if the inorganic compounds concentration and mean temperatures of marine water are high the mean conductivity of marine water also high and if these marine water parameters are low the marine water conductivity are also low. In this research article we used real time data of salinity concentration and mean temperatures to find mean conductivity of marine water through Mat lab simulation tool using interpolation function of Ellison et al model 1998 and compared it with different marine water parameters, we also calculated the mean conductivity of marine water for four seasons of the weather from 2005 to 2017 using real time data. The mean conductivity is measured in Siemens per meter (s/m). It is represented by a Greek word "σ".

**[20,21,22,23,24,25,26,27,28,29,30,31,32]**

#### a) Mean Conductivity for all Autumns seasons 2005-2017 Matlab results:

The mean conductivity is the function of mean salinity, and Mean temperatures of marine water as we discussed in above figures so the mean conductivity also affects the marine water mean permittivity real and imaginary parts as shown in fig 29, and in fig 30 below the zero mean conductivity and mean permittivity real and imaginary parts shows us that it is the depth of marine water at this phase the inorganic compounds and mean temperatures of marine water are less than we move forward the marine water parameters shifts linearly and at surface of marine water it is maximum which results to increase the mean permittivity real and imaginary parts as revealed in fig 29 and fig 30 below.

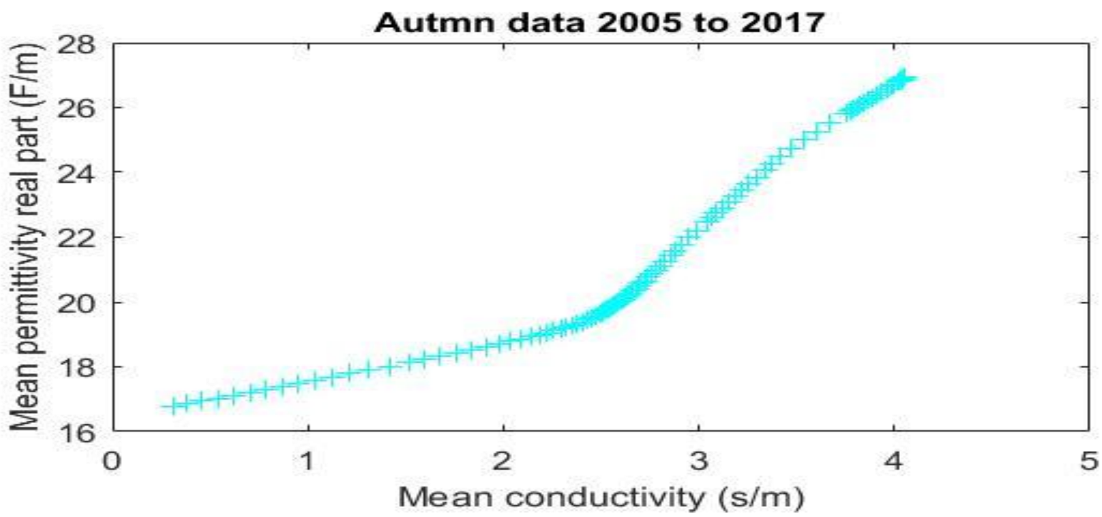


**Fig 29 Mean conductivity vs. Mean permittivity real part.**

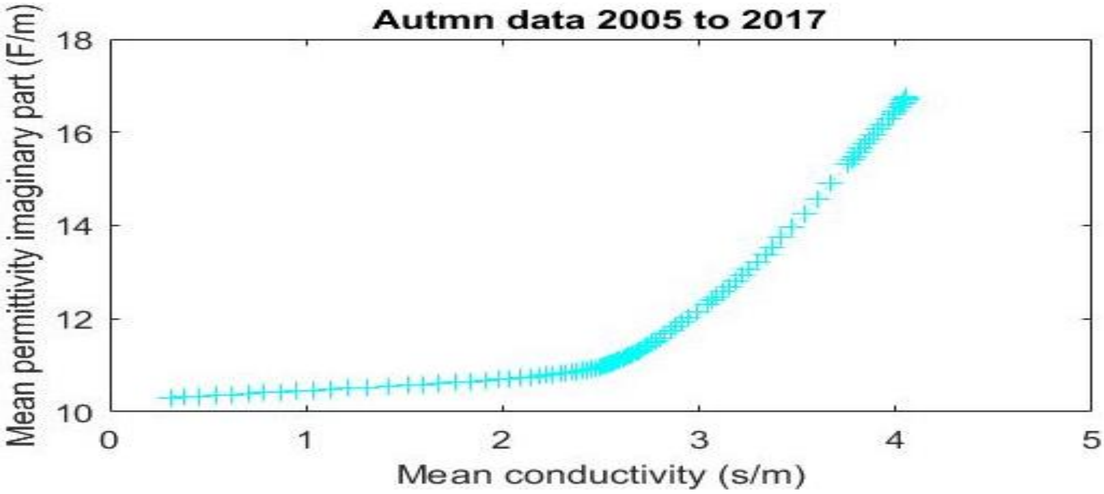


**Fig 30 Mean conductivity vs. Mean permittivity imaginary part.**

**b) Mean Conductivity for all Winters seasons 2005-2017 Matlab results:**

The mean conductivity differs a little as compared to autumn's seasons as shown in fig 31 and fig 32.

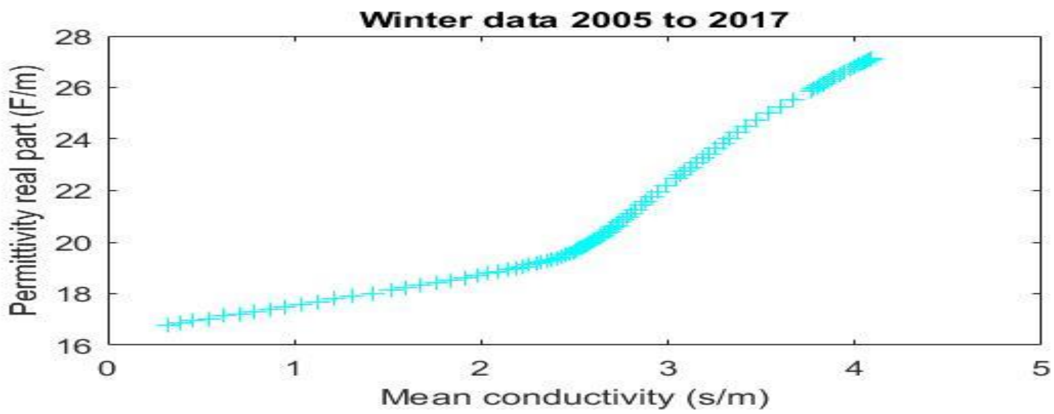


**Fig 31 Mean conductivity vs. Mean permittivity real part.**

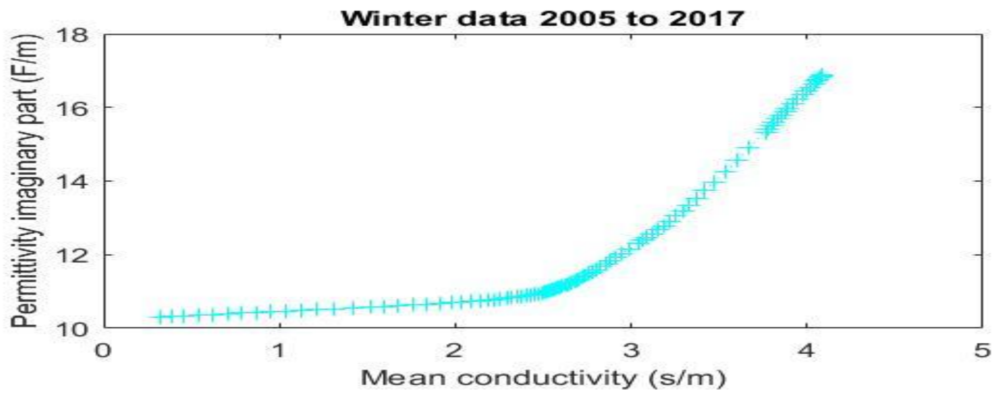


**Fig 32 Mean conductivity vs. Mean permittivity imaginary part.**

### c) Mean Conductivity for all Springs seasons 2005-2017 Matlab results:

The mean conductivity differs a little as compared to winter's seasons as shown in fig 33 and fig 34.

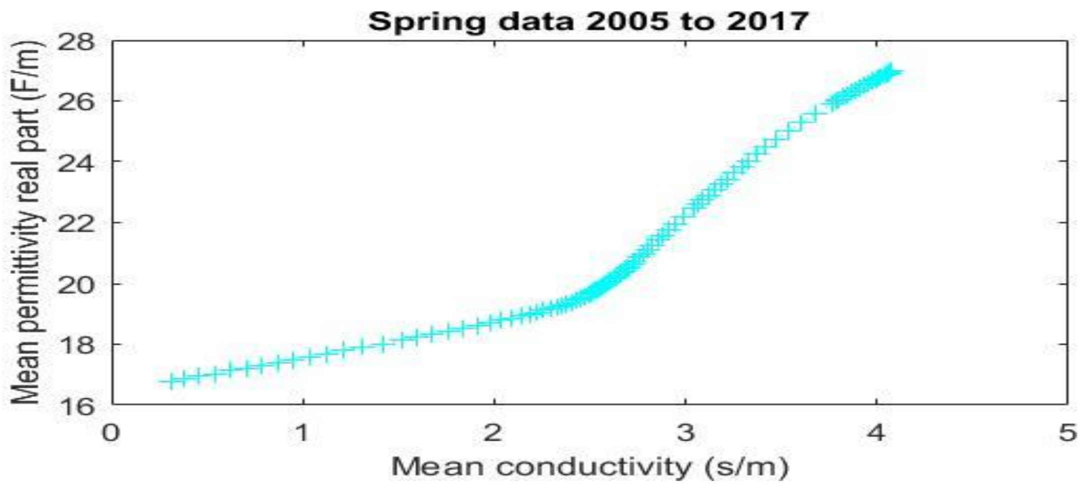


**Fig 33 Mean conductivity vs. Mean permittivity real part.**

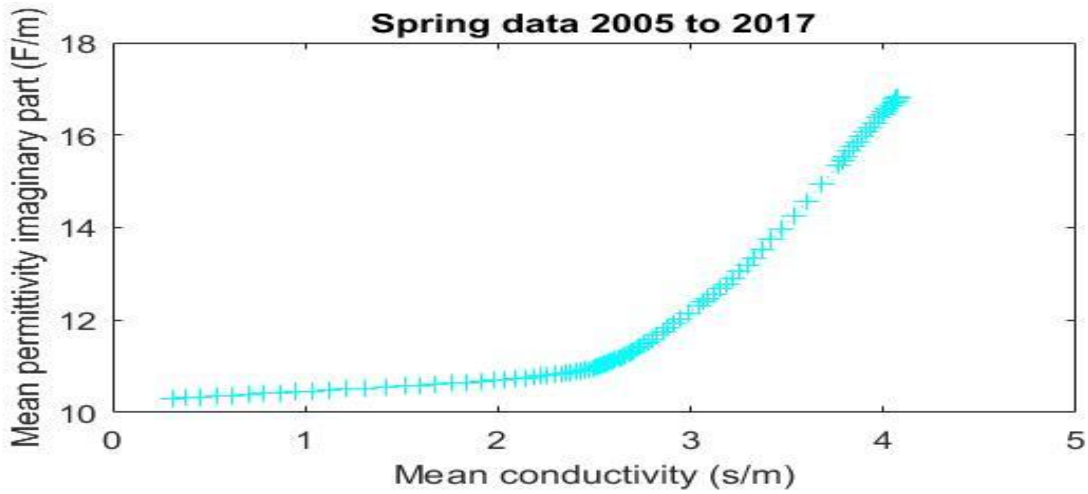


**Fig 34 Mean temperature vs. Mean permittivity imaginary part.**

### d) Mean Conductivity for all Summers seasons 2005-2017 Matlab results:

The mean conductivity differs a little as compared to spring's seasons as shown in fig 35 and fig 36.

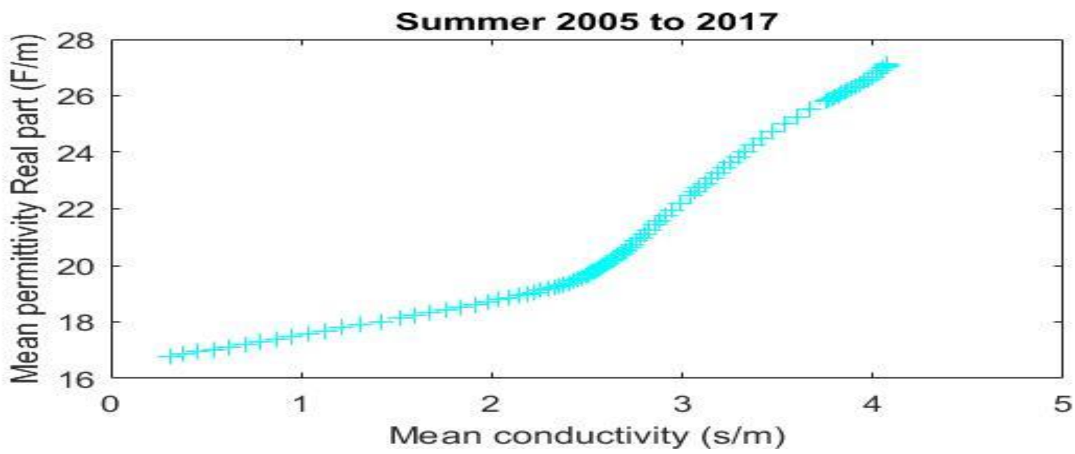


**Fig 35 Mean conductivity vs. Mean permittivity real part.**

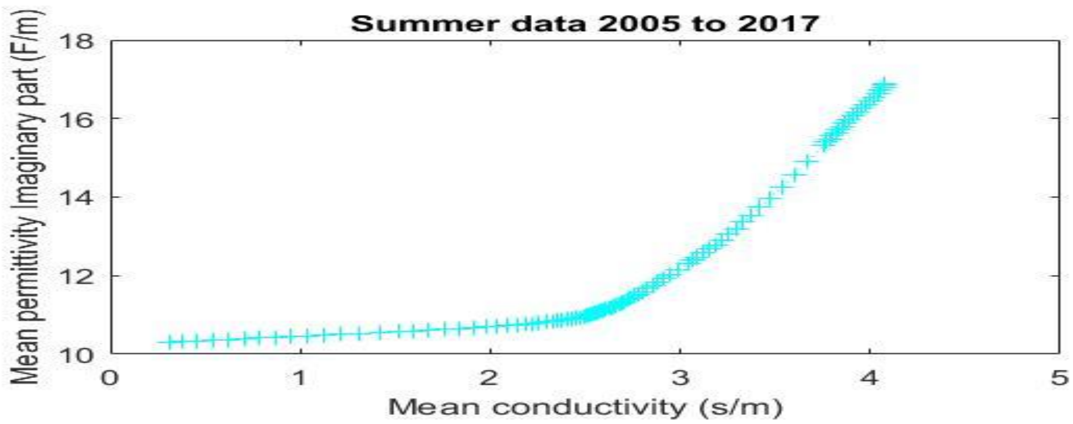


**Fig 36 Mean conductivity vs. Mean permittivity imaginary part.**

## 6) Future Work:

This research work can be improved further if we have real time data available for 2018 year on National centers for environmental information for further processing, and then we calculate marine water parameters for 2018 year, and we can also calculate the marine water parameters for all seasons in the year.

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