Sea Water Parameters Analysis from 2005 to 2017 of all Seas of the World Using Real Time Data

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Abstract:

In this paper we use real time data from 2005 to 2017 of all sea of the world and found the Parameters of sea water, these parameters are mean temperature, mean salinity, mean conductivity and mean permittivity of all seas water from surface of sea to depth of 5500 m. These parameters are dependent on each other as we move from surface of sea to depth of 5500 m using this real time data, we use Mat lab as a simulation tool to find these water parameters from surface of sea to depth of 5500 m, the real time data we used from National centers for environmental information in shape of salinity and temperatures from surface of sea to depth of 5500 m, this data is available from 2005 to 2017 duration for all months of this duration. In this article we used Ellison et al model 1998 on real time data to generate sea water parameters through Mat lab simulation in past scientists used this model on fixed data to generate sea water parameters which is not possible because water are not fixed they vary with depth of sea water.

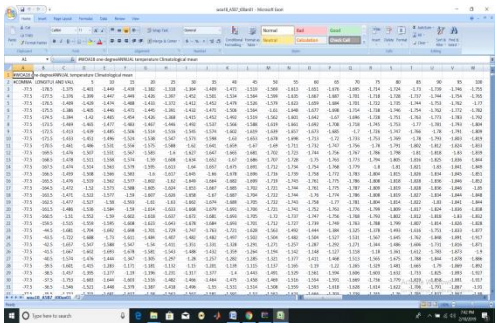
Keywords: ppt. ,s/m, F/m, average salinity, average permittivity, average temperature, average conductivity.

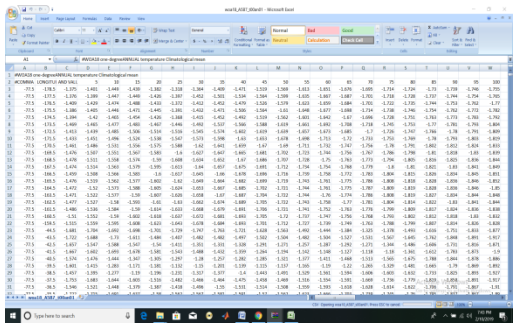
Introduction:

The sea water characteristics and sea water parameters changing with respect to time it is constant some time and some time it varies according to the sea water depth. In this paper we used real- time data and analyzed the varying behavior of sea water parameters like mean temperature, mean salinity, mean conductivity and mean permittivity from surface of sea to depth of 5500 m from duration of 2005 to 2017. The sea water parameters have different response during all weathers of the year. The sea water salinity origin is volcanoes and salty mountains because volcanoes releases different types of gases which releases different types of chemical gases which makes different types of salinity or inorganic compounds, the other source is rain which falls on salty mountains and which make different types of salts in sea water, which causes varying sea water parameters. The sea water temperatures also vary according to different weathers in the year in winter its minimum, while in summer it is high. The variation of sea water temperature also affects the sea water parameters. The organic compounds have no effect on sea water parameters which has a major component carbon dioxide like animals of sea water, amino acid and plants of sea water.

1) Real time data:

The real time data is taken from National centers for environmental information in form of salinity and temperatures in the duration from 2005 - 2017 as shown below. We employ this real time data to Mat lab simulation tool and find different sea water parameters.





a) Temperature data 2005-2017 **b) Salinity data 2005-2017**

2) 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

$\sigma(s, t) = j(t) + v(t)\, s$ …… (1)

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

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

Mathematically Permittivity

$\boldsymbol{\varepsilon = \varepsilon_r \varepsilon_o}$ **…….. (2)**

Where "ε_r" is the relative permittivity of a substance and "ε_o"is the vacuum permittivity of free space having a value of 8.85*10^-12 F/m.

We used Debye interpolation function to get Mean permittivity, from mean conductivity, mean temperatures and mean salinity using practical data from National centers for environmental information in shape of salinity and temperatures, and we place this data in interpolation function, and we can compute different sea water parameters, the equation is exposed below.

Debye interpolation function

Mathematically

$$\varepsilon(t, s, v) = \varepsilon_{\infty} + \varepsilon_{o} - \varepsilon_{\infty} / 1\text{-}j2\pi\tau v + j\,\sigma / 2\pi v\,\varepsilon^{*} \ldots\ldots(3)$$

Where in equation (3) "ε" is the permittivity of ocean water, and "ε_{∞}, ε_{o}" are the static and frequency dielectric constants depends on temperatures of ocean and salinity of ocean water while "σ, v" are conductivity of ocean water and angular frequency of ocean water and "τ, ε^{*}" are the relaxation time and the permittivity of free space. We used Mat lab as a simulation tool and used equation (3) on practical data; we can compute the mean permittivity of ocean water as exposed in below figures, on analyzed mean data and on statistical mean data**. [13]**

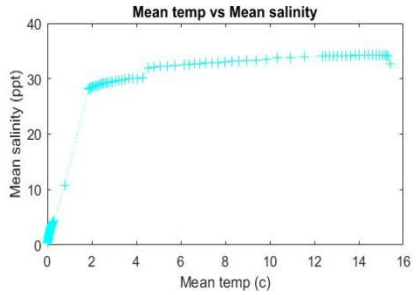
3) Mean Salinity of sea water:

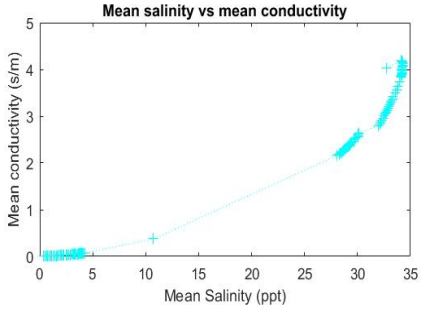
The salinity of sea water is the salt which solved in ocean water. It is measured in parts per thousand denoted by ppt. We used Mat lab simulation on real time data to find salinity versus different components of sea water parameters as shown below.**[1,2,3,4,5].**

a) **Mean Salinity of sea water Mat lab simulation results vs. different sea water parameters on Analyzed mean data from 2005 to 2017 from National centers for environmental information**.

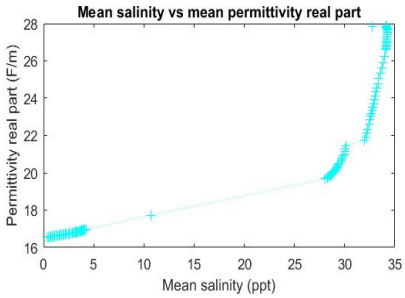
The below fig 1 and fig 2 shows that the mean salinity from surface of sea to depth of 5500 m is a function of mean temperature and mean conductivity, in fig 1 at minimum temperature of sea water e.g. at zero centigrade (c^{o}) the salinity concentration have a minimum value and, it's the depth of sea water at depth of sea water the sea water inorganic compounds are found in minimum form as we move further from depth of sea towards the surface of sea water the graph increases linearly and in some places shift a little which shows that at some places the salinity concentration increases quickly and at some place it increases slowly it also shows that at depth of sea water the salinity concentration is minimum while at surface of sea water it is maximum the graph also illustrates that sea water mean temperature is a function of sea water salinity, the sea water temperature is minimum at depth of sea water while it is maximum at surface of sea water as shown in fig 1 below. The fig 2 shows that mean salinity increases linearly with respect to mean conductivity of sea water in depth of sea water the as we discussed in fig 1 that the mean salinity have minimum value, the fig 2 also shows that at depth of sea water the salinity concentration have minimum value and it's the depth of sea water at depth of sea water the mean conductivity have a minimum value because the mean conductivity is the function of salinity concentration and temperature of sea water. As we move further from depth of sea to surface of sea water there is a significant change in mean salinity and mean conductivity of sea water as shown in fig 2 the mean conductivity is maximum at surface of sea water. The Mean permittivity real and imaginary part, mean salinity,mean temperature and mean conductivity are directly proportional to each other as shown in fig 3 and in fig 4. The real part of mean permittivity showed the energy stored by sea water and imaginary part showed energy released by sea water, in fig 3 and fig 4 the salinity is minimum at depth of sea water for example at zero salinity concentration and it showed the depth of sea water as we shift towards the surface of sea water

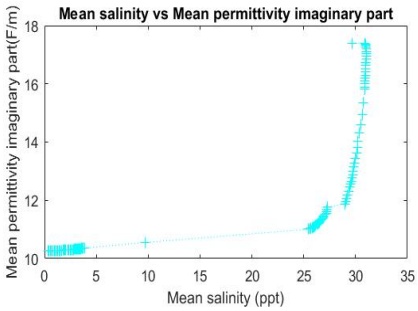
the mean permittivity real and imaginary parts shift and at surface of sea water it is maximum as shown in fig 3 and in fig 4. We analyze that the energy absorb and release by electromagnetic waves is maximum at surface of sea water while it is minimum at depth of sea water the other reason is that at depth of sea water the sea water temperatures and sea water conductivity are also minimum while at surface of sea water it is maximum.





a) Fig 1 Mean salinity vs. mean temperature b) Fig 2 Mean salinity vs. mean conductivity





c) Fig 3 Mean salinity vs. Mean permittivity real part d) fig 4 Mean salinity vs. mean permittivity imaginary part.

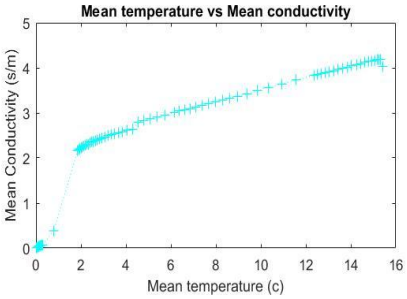
4) Mean Temperature of sea water:

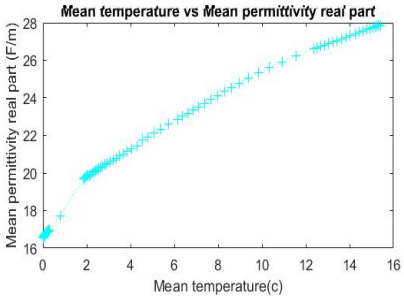
The shows the coldness or hotness of an ocean water, in system international its unit is Celsius denoted by (c^o). The temperature of the sea also vary throughout the year in this paper we used the temperatures of all seas from surface of seas to depth of 5500 m, this temperatures real time data is taken from National centers for environmental information, and we employ this real time data to Mat lab simulation tool and generate different types of sea water parameters versus mean temperature which is shown below.**[6]**

a) **Mean Temperatures of sea water Mat lab simulation results vs. different sea water parameters on Analyzed mean data from 2005 to 2017 from National centers for environmental information**.

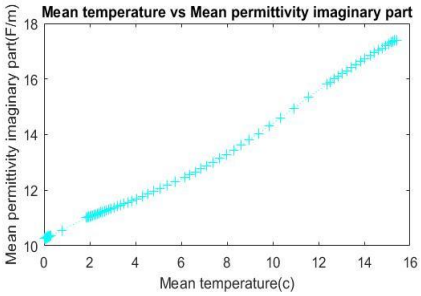
As we have discussed above in fig 1 that mean temperature is a function of mean salinity and salinity is also a function of mean conductivity as we discussed in fig 2 so these sea water parameters are dependent on each other the mean temperature is also a function of mean conductivity as shown in fig 5 at zero centigrade (c^o) the conductivity is minimum as shown in

fig 5 and it's the depth of sea water at this point the sea water parameters have minimum quantity for example at this point the sea water mean conductivity and mean salinity have minimum quantity but as we shift from depth of sea to surface of sea the graph becomes linear and it increases in a linear fashion as shown in fig 5 and at maximum mean temperatures it has a maximum sea water mean conductivity which shows the surface of sea water and at this point the sea water parameters have maximum quantity. The mean temperature also affects the mean permittivity real and imaginary parts as shown in fig 6 and in fig 7 below the mean permittivity real and imaginary parts are minimum at depth of sea water because the sea water parameters for example mean salinity, mean conductivity have minimum values at this point while as we move from depth of sea to surface of sea the sea water mean permittivity real and imaginary parts shifts due to varying behavior of sea water parameters as shown in fig 6 and in fig 7 below.





a) Fig 5 Mean temperature vs. mean conductivity b) Fig 6 Mean temperature vs. mean permittivity real part.



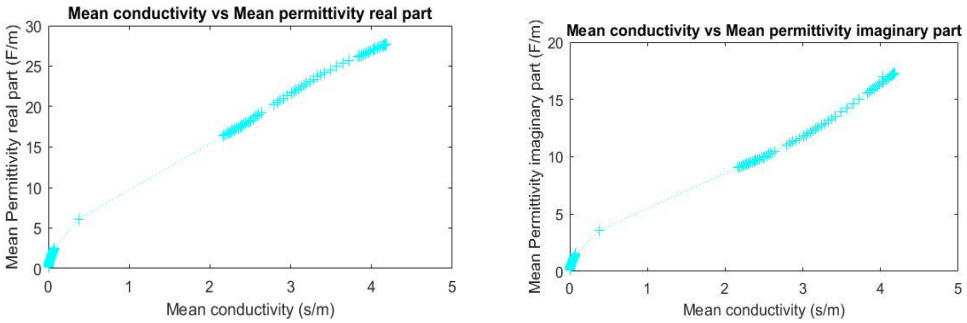
c.) Fig 7 Mean temperature vs. mean permittivity imaginary part.

5) Mean Conductivity of sea water:

The mean conductivity measures the ability of sea water to pass electric current in sea water in system international it is measured in Siemens per meter denoted by (s/m). In this article we find the mean conductivity of sea water from mean salinity and mean temperatures of sea water using real time data as we know that mean conductivity is a function of mean salinity and mean temperatures as we discussed above the mean conductivity versus mean permittivity real and imaginary parts are shown below**.[7,8,9,10,11,12,13,14]**

a) **Mean conductivity of sea water Mat lab simulation results vs. different sea water parameters on Analyzed mean data from 2005 to 2017 from National centers for environmental information**:

The mean conductivity also affects the mean permittivity real and imaginary parts as shown in fig 8 and in fig 9. The mean conductivity is a function of mean salinity and mean temperatures of sea water so the mean conductivity is the function of mean permittivity real and imaginary parts as shown below in fig 8 and in fig 9 the mean conductivity is minimum at depth of sea water because at depth of sea water the salinity concentration and temperatures of sea water are minimum so the mean permittivity real and imaginary parts are minimum as shown in fig 8 and in fig 9 while the graph increases linearly as we move toward the surface of sea water and at surface of sea water the mean conductivity is maximum due to sufficient amount of salinity concentration and temperatures of sea water which result to increase the mean permittivity real and imaginary parts as shown in fig 8 and in fig 9.



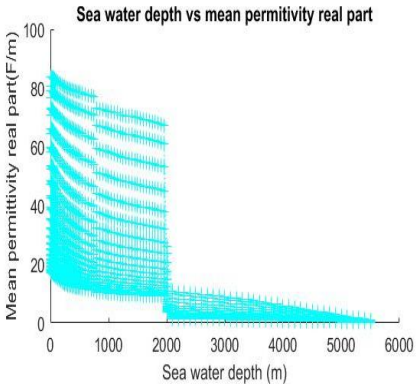
a) Fig 8 Mean conductivity vs. mean permittivity real part b) Fig 9 Mean conductivity vs. mean permittivity imaginary part.

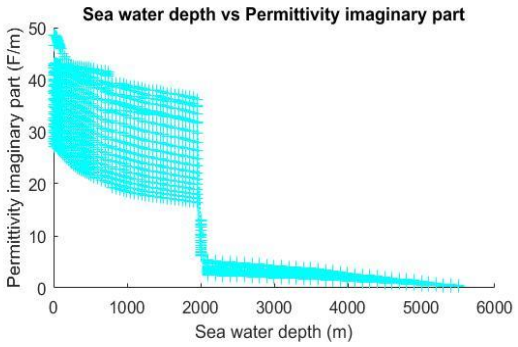
6) Mean permittivity of sea water:

The mean permittivity of sea water shows that the energy absorb and release by sea water it has two parts the real and imaginary parts the real part of permittivity shows the energy absorb by sea water and the imaginary parts shows the energy release by sea water it is measured in farad per meter denoted by (F/m).

a) Mean permittivity of sea water Mat lab simulation results on Analyzed mean data from 2005 to 2017 from National centers for environmental information.

The mean Permittivity real and imaginary parts also affected with sea water parameters for example if the mean temperatures, mean salinity and mean conductivity are minimum the mean permittivity real and imaginary parts are also minimum which we discussed in above figures, the fig 10 and fig 11 shows that the mean permittivity real and imaginary parts are minimum at depth of sea water and its maximum at surface of sea water, the both graphs decayed when we move from surface of sea water towards the depth of sea water as shown in fig 10 and in fig 11 below.





a) Fig 10 Mean permittivity real part vs. sea water depth b) Fig11 Mean permittivity imaginary part vs. sea water depth.

7) Future work:

This work can be improved if we have real time data available for 2018 year on National centers for environmental information for further processing, and then we calculate sea water parameters for 2018 year.

8) Acknowledgment:

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References:

[1] Jonsson , J , Smedfors , K , Nyholm , L , Thornell , G , (2013) , Towards chip based salinity measurements for small submersibles and biologgers , International Journal of oceanography ,pp 1-12.
[2] Zahir , H , Hamadi , F , Mallouki , B , Imziln , B , Latrache , H , (2016) , Effect of salinity on the adhesive power actinomycetes in soil , Journal of J. Mater. Environ.sci , 7(9) , pp 3327-3333.
[3] Wu , J , Vincent , B , Yang , J , Bourafa , S , Vidal , A , (2008) , Remote sensing monitoring of changes in soil salinity a case study in inner Mongolia in china , Open access sensors, 8, pp 7035-7049.
[4] Burt , C , M , Isbell , B , (2005) , Leaching of accumulated soil salinity under drip irrigation , Transaction of the ASAE , 48(6) , pp 1-8.
[5] Moradi , A , Tahmourespour, A , Hoodaji , M , Khorsandi , F , (2011) , Effect of salinity on free living diazotroph and total bacterial populations of two saline soils , African Journal of Microbiology research ,5(2) , pp 144-148.
[6] Lavitra , T , Fohy , N , Gestin , P , G , Rasolofonirinia , R , Eechkhaut , I , (2010) , Effect of water temperature on the survival and growth of endobenthic holothuria scabra(Echinodermata: holothuroidea juveniles reared in outdoor ponds, SPC Beche de mer information Bulletin , pp 25 -28.

[7] Martini , S , A , Shang , J , Q , (2017) , Complex Permittivity to detect lead in soil with various salt forms and combinations , MATEC Web of conference ISCEEE 2016 , 103 , pp 1-7.
[8] Calla , O, P , N , Hasan , S , Ahmadian , N , (2011) , Variability if dielectric constant of saline water in combination with diesel in C j band (5.3 GHz) and KU band (13.4 GHz) , Indian journal of radio and space physics , 40 , pp 153-158.
[9] Bubukin , I , T , Stankevich , K, S, (2013) , Measurements of the reflectivity and permittivity of water in the film layer of the sea surface in the millimeter wave band , Journal of communication technology and electronics , 58(7) , pp 673-681.
[10] Malmberg , C , G , Maryott , A , A , (1956) ,Dielectric constant of water from 0 to 100 c , Journal of Research and national bureau of standards, 56(1) , pp 1-8.
[11] Porretta, R , Bianchi , F , (2016) , Profiles of relative permittivity and electrical conductivity from unsaturated soil water content models , Annals of Geophysics , 59(3) , pp 1-11.
[12] Ajaya , B , Kumar , S , S , (2011) , Effects of concentration and relative permittivity on the transport properties of sodium chloride in pure water and ethanol water mixed solvent media Research Journal of chemical sciences , 1(6) , pp 48-52.
[13] Elllison, W., Balana, A., Delbos, G., Lamkaouchi, K., Eymard, L., Guillou, C., Prigent, C. (1998), New Permittivity measurements of sea water. Radio science, 33(3) pp 639-648.
[14]. Ilelaboye V, Olasoji O O, Y(2015), Effect of sea water conductivity on GSM signal propagation in riverine area of igbikoda,ondo state ,Nigeria. International Journal of advance Research in Computer and Communication Engineering, .4(5), pp.367-372.