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Study Ionospheric Plasma Turbulence for Pakistan Air Space

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ABSTRACT

This concept has been studies using behavioural statistical analysis that includes mean deviation and probabilistic models are developed to explore the ionospheric plasma turbulence. These models provided a comprehensive description of the underlying process. The information attained from these forecasts by analyzing these models can be further employed to very possible parameters and variables in the open system to achieve result. Such an approach is well explained within the likelihood of data analysis. The models presented in this work along with their physical interpretations are very useful for different related organization.

INSPEC Classification : A9420R, A9420T, A9420V

Keywords : Ionosphere, probabilistic, open system, plasma, turbulence

1. INTRODUCTION

The ground base research of ionospheric plasma turbulence have been carried out by DGS-256, provided us important information insights into the interplanetary relation between earth and space (Dieter Biskamp, 2003). The ionospheric region lies between sun and earth. The sun is continuously radiating energy to upper atmosphere, ionosphere and lower atmosphere of the earth in the form of ultraviolet UV, extreme ultraviolet EUV, and x-ray of the electromagnetic spectrum. The rate of radiation of sun energy from the sum is $3.80x10^{26}$ watt power and the rate at which the mass of the sun diminishing per year 1.33 x 10^{17} Kg / year (Adrian Graham, 2011)(Peter.O.Taylor, 1991). One year consist of 3.16 x 10^{7} seconds per year. In special theory of relativity total energy and mass are related by $\mathbf{mc^2}$ (S. Makridakis, 1983). These radiation have cyclic and seasonal variation, variation provide many types of perturbation in upper atmosphere (Allan H. Murphy and Richard W. Katz, 1985).

Upper atmospheric variables of ionosphere such as concentration, perturbation concentration, parcel velocity and perturbation parcel velocity at Pakistan air space it is important to considered probabilistic models that allow for variability and association such models are

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important for characterizing ionospheric plasma turbulence in term of parameter. To explain the descriptive statistics about these dependent ionospheric observations, the decomposition theory for time series will be considered (Daniel S. Yates, David S Moar and George P Mc Cabe, 1996). It will provide a concise characterization of underling system in time series models (J. K. Hargreaves, 1979).

Turbulence the interaction between plasma and electromagnetic wave are known as plasma turbulence. The mixing of two gases at upper atmosphere is turbulence phenomenon.

Computation Descriptive Statistics Regarding ionospheric plasma turbulence data for Pakistan air space referring histogram and probabilistic plot to fig 1 and fig 2 and using the parametric values given in table 1

Table 1
Descriptive statistics for ionospheric plasma turbulence*10^{12}, at Pakistan air space

A-Squared	3.78
P-Value <	0.005
Mean	2.5
St Dev	0.77
Variance	0.58
Skew-ness	1.09
Kurtosis	2.5
N	365
Minimum	0.80
1st Quartile	1.92
Median	2.34
3rd Quartile	2.85
Maximum	5.7
95% Confidence Interval for Mean	
2.4	2.5
95% Confidence Interval for median	
2.3	2.5
95% Confidence Interval for St. Dev	
0.72	0.83

Fig. 1
Histogram of plasma turbulence *10^{12}, normal at Pakistan air space

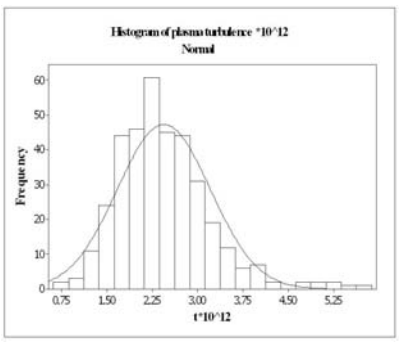
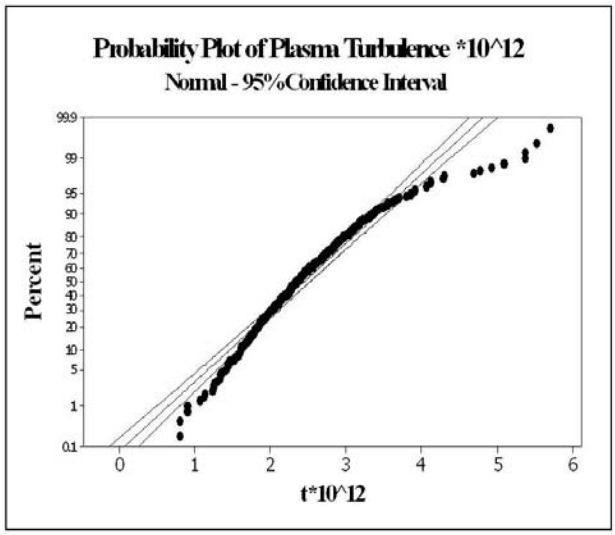


Fig. 2
Probability Plot of Plasma Turbulence *10^{12}, Normal - 95% Confidence Interval at Pakistan air space Decomposition



We predicted ionospheric plasma turbulence for the next 12 points using data collected over 365 points, we used the residuals from trend analysis to combine both trend analysis and decomposition for forecasting. Fig 3 shown time series decomposition plot for plasma turbulence, additive models and table 2 shown seasonal indices (John R. Herman and Richard A. Goldberg, 1985). Fig 3 Component analysis for plasma turbulence, additive model original data and seasonally adjusted data, Table 3 Forecasts next period for ionospheric plasma turbulence

Table 2
Seasonal Indices for ionospheric plasma turbulence *10^{12},

Period	Index
1	0.088746
2	0.183830
3	-0.139507
4	0.096122
5	-0.007830
6	-0.089409
7	-0.002020
8	0.011679
9	-0.067880
10	0.097894
11	-0.189293
12	0.017669

Table 3
Forecasts next period for ionospheric plasma turbulence

Period	Forecast
366	2.35581
367	2.44319
368	2.45689
369	2.37733
370	2.54311
371	2.25592
372	2.46288
373	2.53396
374	2.62904
375	2.30571
376	2.54134
377	2.43738

Fig. 3
Time Series Decomposition Plot for ionospheric plasma turbulence $*10^{12}$, additive models

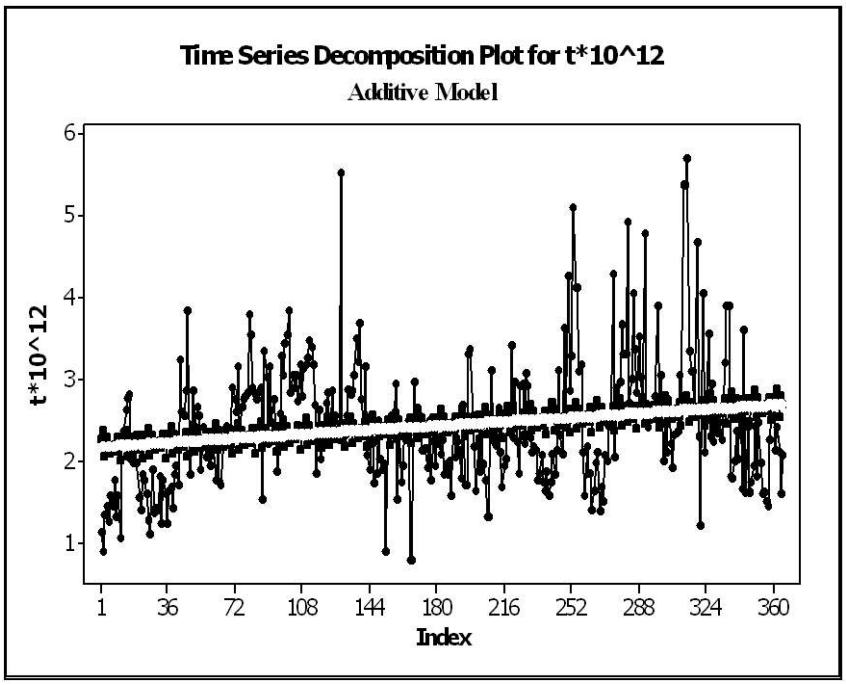
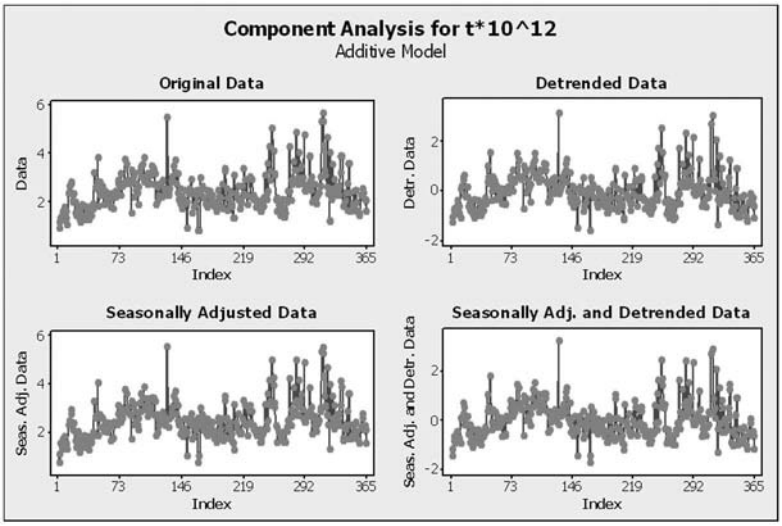


Fig 4
Component analysis for plasma turbulence *10^{12}, additive model original data and seasonally adjusted data



The three accuracy measures MAPE = 25.8568, MAD = 0.5677 and MSD = 0.5812.

2. Conclusion

In this paper we have described physical behavior of ionospheric turbulence at Pakistan air space using descriptive statistics and decomposition method. These models provide comprehensive description of process this approach is well explain within the omputational analysis that along with their physical interpretations are very useful for different organization

3. Acknowledgment

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