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Karl Rawer's interest and encouragement regarding new approaches to ionospheric modeling

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Abstract. Professor Karl Rawer encourages, stimulates researchers. He takes initiative and supports researchers in producing papers about new techniques and methods. As a typical case the authors here report their experience with Professor Rawer during the publication of their papers about a Neural Network approach to model near Earth space processes.

1 Introduction

During the 34^{th} COSPAR Meeting, one of the papers that the authors submitted was entitled "Neural Network Based Approach to Model Near Earth Space Processes". Quoting from Tulunay, Y. et al. (2002):

During the COST 238, COST 251 European Union Actions it has become obvious that the space weather related Near Earth Space data are very important to have. Yet, it is almost impossible to have:

- *Uninterrupted data,*
- *Right quantity of data to do nowcasting, forecasting, and prediction,*
- *Analytical models.*

The Near Earth Space processes are highly non-linear and time varying. Most of the time it is impossible to collect data systematically. For example, during high magnetic activity there are important data gaps.

We have demonstrated that the data driven approach such as Neural Network based models are very promising both in modeling the space weather effects on the ionospheric parameters and in filling the data gaps of missing data. Therefore, we propose that the data driven based Neural Network models can be adopted for modeling of physical phenomena. The only basic requirement for this is the availability of the representative data for the phenomena.

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To demonstrate the power of such modeling we choose three typical cases:

i) The ionospheric projection of the Plasma Pause which is known as the mid latitude electron density trough. The trough here represents the unexpected abrupt changes in any data in space and time.

ii) Variability of the HF propagation due to the IMF polarity changes. This represents the magnetically disturbed conditions.

These two phenomena were modelled in terms of time dependence. That is mathematically, they are treated as single variable systems.

iii) The investigation of similar phenomena both temporally and spatially. Therefore, we included spatial dependence in addition to the temporal variations.

The authors submitted the manuscript to be considered for publication in the Advances of Space Research and some time later received several notes from the Editor. For example, the first one read as follow;

".....As your editor I propose to go on in steps. First step would be a new write-up replacing the section "The NN-technique" which is the most important chapter. May I invite you to send me such a write-up. Other steps shall follow afterwards."

The following notes from the Editor were very educational:

" I just had a look into the book Haykin,S., Neural Networks: A Comprehensive Foundation, Prentice Hall, Upper Saddle River NJ., 1994. that was cited in the South African ASR paper I lastly mentioned. I feel this systematic source should appear in the list of references of your paper, if you don't have a more recent and better one. Since Haykin is rather detailed (696 pp.) it might help the "average reader" to find another citation of a shorter introduction to the NN-subject. In the long references list of Haykin a smaller book

shows up that (I have not had in hands but) might possibly be helpful:

Beale,R., and T.Jackson, Neural Computing: An Introduction, Adam Hilger, Bristol UK, 1990. I suppose, however that you know a more recent book along that line.

"..... I propose our chairman that you are allowed two papers, one of ten pages for the general explanation, another one of up to six pages for the example. Hope he agrees"

".....In order to check whether I myself have correctly understood I constructed an ionospheric example concerning sunrise-time in the E-region, with foE as parameter: (A) Primary phase: F- or one European station read the hourly, monthly median foE-values month by month storing them in 12 neurons of the first hidden layer, respively. Therein select hours near sunrise and extrapolate toward foE=0. So 12 monthly sunrise instants are found that are transferred to the output neuron. Approximate the dependence on season of the so found values by a cos(season) function. Two parameters are the final result. (B) Learning phase: Repeat the above for other European stations. Determine the average dependence on latitude. (C) Application: Prediction for any place in Europe. Would this be a correct example?..... "

2 Conclusions

Professor Rawer took great interest in and learned about the NN-technique. He applied it to a foE-modeling problem and he encouraged us to contribute two journal papers describing our new approach as well as first examples. Professor Rawer is so devoted to science that he had studied the paper in much greater detail than expected from an editor. He checked our contribution, its generality and usefulness by kindly acting as a scientist who in a way by "running" the method to model a different parameter (sporadic foE) and by discussing the results with the authors.

This approach resulted in the production of two science papers (Tulunay et al., 2002, 2004) instead of one so that our scientific and technological efforts are well presented to the science community. This is a simple but meaningful demonstration of the scientific leadership charisma, and prolificacy of Professor Rawer.

References

Tulunay, Y., E.Tulunay and Senalp, E.T., Neural Network based approach to model near Earth space processes, 34th COSPAR Scientific Assembly, 10–19 October, Texas, USA, 2002.

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