Challenges for AI application in the identification of VIPIR anomalous transient signals

Dmitriev A.V.[*1]

[1] *Moscow State University*

The previous efforts in the application of AI deep learning technique for identification of ionospheric signals detected by VIPIR in Taiwan have provided very promising results. It was constructed and trained various convolutional neural network (CNN) models, which were allowed recovering of ionospheric signals from various layers with a high confidence despite of very low signal-to-noise ratio SNR ~ 1.4. The best performance was found for the signals from the F2 and E layers with an average accuracy around 0.8. The F1 layer is recognized with a good performance of >0.7. It was found that the CNN model can effectively identify a sporadic Es layer with an accuracy of 0.75. The lowest performance (<0.4) was found for the reconstruction of the F3 layer. The training of the models was based on a typical pattern of the ionospheric layers. However, various transient features were not taken into account, namely, a splitting of the F2 echo related to transient ionospheric disturbances (TID) as well as a complex structure of the Es layer. In the sense of Space Weather, it is important to identify these anomalous signals in the first turn. The present report is devoted to formalization of various transient patterns observed by VIPIR for further AI applications. Various techniques for identification of the anomalous signals are discussed.

Keywords: Ionosphere Remote Sensing, Advanced HF Techniques, Ionospheric Transients