[구SE-26] Near-real time Kp forecasting methods based on neural network and support vector machine

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We have compared near-real time Kp forecast models based on neural network (NN) and support vector machine (SVM) algorithms. We consider four models as follows: (1) a NN model using ACE solar wind data; (2) a SVM model using ACE solar wind data; (3) a NN model using ACE solar wind data and preliminary kp values from US ground-based magnetometers; (4) a SVM model using the same input data as model 3. For the comparison of these models, we estimate correlation coefficients and RMS errors between the observed Kp and the predicted Kp. As a result, we found that the model 3 is better than the other models. The values of correlation coefficients and RMS error of the model 3 are 0.93 and 0.48, respectively. For the forecast evaluation of models for geomagnetic storms (Kp ≥ 6), we present contingency tables and estimate statistical parameters such as probability of detection yes (PODy), false alarm ratio (FAR), bias, and critical success index (CSI). From a comparison of these statistical parameters, we found that the SVM models (model 2 and model 4) are better than the NN models (model 1 and model 3). The values of PODy and CSI of the model 4 are the highest among these models (PODy: 0.57 and CSI: 0.48). From these results, we suggest that the NN models are better than the SVM models for predicting Kp and the SVM models are better than the NN models for forecasting geomagnetic storms.

[구SE-27] Solar Flare Occurrence Rate and Probability in Terms of the Sunspot Classification Supplemented with Sunspot Area and Its Changes

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We investigate the solar flare occurrence rate and daily flare probability in terms of the sunspot classification supplemented with sunspot area and its changes. For this we use the NOAA active region data and GOES solar flare data for 15 years (from January 1996 to December 2010). We consider the most flare-productive eleven sunspot classes in the McIntosh sunspot group classification. Sunspot area and its changes can be a proxy of magnetic flux and its emergence/cancellation, respectively. We classify each sunspot group into two sub-groups by its area: “Large” and “Small”. In addition, for each group, we classify it into three sub-groups according to sunspot area changes: “Decrease”, “Steady”, and “Increase”. As a result, in the case of compact groups, their flare occurrence rates and daily flare probabilities noticeably increase with sunspot group area. We also find that the flare occurrence rates and daily flare probabilities for the “Increase” sub-groups are noticeably higher than those for the other sub-groups. In case of the (M+X)-class flares in the ‘Dkc’ group, the flare occurrence rate of the “Increase” sub-group is three times higher than that of the “Steady” sub-group. Our results statistically demonstrate that magnetic flux and its emergence enhance the occurrence of major solar flares.