EGU2020-17319
https://doi.org/10.5194/egusphere-egu2020-17319
EGU General Assembly 2020

Producing solar flare predictions using support vector machine (SVM) applied with ionospheric total electron content (TEC) global maps

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Ground and space-based remote sensing technology is one of the most useful tools for near-space environment studies and space weather research. During the last decade, a considerable amount of efforts in space weather research is being devoted for developing the ability to predict the exact time and location of space weather events such as solar flares and X-rays bursts. Despite the fact that most of the natural factors of such events can be modeled numerically, it is still a challenging task to produce accurate predications due to insufficient detailed and real□time data. Hence, space weather scientists are trying to learn patterns of previous data distribution using data mining and machine learning (ML) tools in order to accurately predict future space weather events. Here, we present a new methodology based on support vector machines (SVM) approach applied with ionospheric Total Electron Content (TEC) data, derived from worldwide GPS geodetic receiver network that predict B, C, M and X-class solar flare events. Experimental results indicate that the proposed method has the ability to predict solar flare events of X and M-class with 80-94% and 78-93% accuracy, respectively. However, it does not succeed in producing similar promising results for the small-size C and B-class flares.