EGU21-8087
https://doi.org/10.5194/egusphere-egu21-8087
EGU General Assembly 2021

A neural network-based mid-term prognosis of geomagnetic storms that uses pre-storm effects related to current sheets and magnetic islands

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Mid-term prognoses of geomagnetic storms require an improvement since they are known to have rather low accuracy which does not exceed 40% in solar minimum. We claim that the problem lies in the approach. Current mid-term forecasts are typically built using the same paradigm as short-term ones and suggest an analysis of the solar wind conditions typical for geomagnetic storms. According to this approach, there is a 20-60 minute delay between the arrival of a geoeffective flow/stream to L1 and the arrival of the signal from the spacecraft to Earth, which gives a necessary advance time for a short-term prognosis. For the mid-term forecast with an advance time from 3 hours to 3 days, this is not enough. Therefore, we have suggested finding precursors of geomagnetic storms observed in the solar wind. Such precursors are variations in the solar wind density and the interplanetary magnetic field in the ULF range associated with crossings of magnetic cavities in front of the arriving geoeffective high-speed streams and flows (Khabarova et al., 2015, 2016, 2018; Adhikari et al., 2019). Despite some preliminary studies have shown that this might be a perspective way to create a mid-term prognosis (Khabarova 2007; Khabarova & Yermolaev, 2007), the problem of automatization of the prognosis remained unsolved.