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Study of spatial distribution of nonlinear anomalous magnetic fluctuations along the orbit of the Swarm spacecraft

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The space and terrestrial magnetic observations exhibit signatures for the occurrence of deterministic nonlinear physical events in the solar-terrestrial system. Within the framework of a project devoted to the scientific exploitation of Swarm data, our goal is to find the nonlinear signatures in the ionosphere and investigate them in connection with local physical processes, such as electric currents, wave activities, anomalous ionization, density inhomogeneity, auroral particle acceleration. The project is entitled 'The study of MHD waves, turbulence and the plasmasphere based on Swarm observations'.
In our study, a statistical analysis is carried out on the high-resolution (50 Hz) VFM time records of Swarm mission in order to discriminate between Gaussian and non-Gaussian magnetic fluctuations in the ionosphere. We apply probability density function (PDF) analysis of incremental magnetic field time-series of the individual Swarm records. Non-Gaussian behaviour of the difference time-series can reveal multiscale intermittent magnetic fluctuation in the studied plasma region. The level of intermittent dynamics is measured by the fourth statistical moments of the incremental time-series, i.e. by their flatness. Our aim is to investigate the variation of the flatness parameter in terms of the positions of the Swarm spacecraft. Swarm data from the years between 2014 and 2016 are analysed by a sliding-window method, and the spatial distribution of the mean flatness values are mapped in geomagnetic coordinates. The magnetic field recorded in VFM frame are transformed to mean-field aligned system so that the intermittent behaviour of the compressional and transversal fields can be separately investigated. It is conjectured that the transversal field exhibits the strongest intermittency in the auroral oval, presumably due to the magnetic effect of intensive field-aligned currents. The geomagnetic latitude of the most intermittent region fluctuates in time and this fluctuation correlates with the geomagnetic activity. On the other hand, for the case of the mean-field aligned (i.e. compressional) magnetic variations the most intermittent region locates at around +-10° from the dip equator. It is argued that the equatorial intermittent events relate to ionospheric plasma irregularities, such as equatorial spread F (ESF) events or substorm induced pulsations. The poster presents clear correlation between the appearances of compressional intermittent fluctuations around the equator and the corresponding plasma bubble indices monitored along the Swarm orbit.