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Spatio-Temporal Scales of Plasma Density in Topside Ionosphere

Jaroslav Urbář* (1), Luca Spogli (2,6), Antonio Cicone (5,2) , Lasse B.N. Clausen (3), Yaqi Jin (3), Alan Wood (4), Elizabeth Donegan-Lawley (4), Lucilla Alfonsi (2), Claudio Cesaroni (2), Daria Kotova (3), Per Hoeg (3), and Wojciech J. Miloch (3)

(1) Institute of Atmospheric Physics ASCR, Prague, Czechia; e-mail: urbar@ufa.cas.cz
(2) Istituto Nazionale di Geofisica e Vulcanologia, Italy; e-mail: luca.spogli@ingv.it
(3) University of Oslo, Norway; e-mail: w.j.miloch@fys.uio.no
(4) University of Birmingham, United Kingdom; e-mail: a.wood.1@bham.ac.uk
(5) University of L'Aquila, Italy; e-mail: antonio.cicone@univaq.it
(6) SpacEarth Technology, Italy

Non-linear couplings of the Earth's ionosphere with the geospace environment occur in a largely varying range of spatial and temporal scales. As some radio remote sensing techniques like GNSS measurements suffer from artificial radio frequency interference (RFI) at the smallest scales representing ionospheric scintillation, is it advantageous to have ionospheric scales observations based on in-situ measurements.

We investigated the variability of the in-situ plasma density and magnetic field measured by Swarm satellites [1] now creating the climatology of their scales by leveraging the Fast Iterative Filtering (FIF) technique [2].

FIF is able to provide a very fine time-frequency representation decomposing any non-stationary, nonlinear signals, into oscillating modes, called intrinsic mode components or functions (IMCs or IMFs), characterized by their specific frequency.

The results are obtained by time-integrating the instantaneous time-frequency representations, provided through the so-called "IMFogram" [3]. These IMFograms have the potential to show the greater details of the scale sizes and their variations, illustrating the time development of the multi-scale processes during various disturbances of geospace.

References

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