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New advanced netted ground based and topside radio diagnostics for Space Weather Program

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To give a more detailed and complete understanding of physical plasma processes that govern the solar–terrestrial space, and to develop qualitative and quantitative models of the magnetosphere–ionosphere–thermosphere coupling, it is necessary to design and build the next generation of instruments for space diagnostics and monitoring. Novel ground- based wide-area sensor networks, such as the LOFAR (Low Frequency Array) radar facility, comprising wide band, and vector-sensing radio receivers and multi-spacecraft plasma diagnostics should help solve outstanding problems of space physics and describe long-term environmental changes. The LOw Frequency ARray – LOFAR – is a new fully digital radio telescope designed for frequencies between 30 MHz and 240 MHz located in Europe. The three new LOFAR stations will be installed until summer 2015 in Poland. The LOFAR facilities in Poland will be distributed among three sites: Lazy (East of Krakow), Borowiec near Poznan and Baldy near Olsztyn. All they will be connected via PIONIER dedicated links to Poznan. Each site will host one LOFAR station (96 high-band+96 low-band antennas). They will most time work as a part of European network, however, when less charged, they can operate as a national network The new digital radio frequency analyzer (RFA) on board the low-orbiting RELEC satellite was designed to monitor and investigate the ionospheric plasma properties. This two-point ground-based and topside ionosphere-located space plasma diagnostic can be a useful new tool for monitoring and diagnosing turbulent plasma properties. The RFA on board the RELEC satellite is the first in a series of experiments which is planned to be launched into the near-Earth environment. In order to improve and validate the large scales and small scales ionospheric structures we will used the GPS observations collected at IGS/EPN network employed to reconstruct diurnal variations of TEC using all satellite passes over individual GPS stations and the data retrieved from FORMOSAT-3/COSMIC radio occultation measurements. The main purpose of this presentation is to describe new advanced diagnostic techniques of the near-Earth space plasma and point out the scientific challenges of the radio frequency analyser located on board of low orbiting satellites and LOFAR facilities.
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