2nd URSI AT-RASC, Gran Canaria, 28 May – 1 June 2018

Radio observations for space weather: space applications from the solar corona to the inner magnetosphere

Viviane Pierrard*[1,2], Yuriy Voitenko[1], Fabien Darrouzet[1], Hervé Lamy[1], and Johan De Keyser[1]
(1) Royal Belgian Institute for Space Aeronomy (BIRA-IASB), Space Physics and STCE, 3 av. Circulaire, B-1180 Brussels, Belgium, e-mail: viviane.pierrard@aeronomie.be
(2) Université Catholique de Louvain, Center for Space Radiations, Earth and Life Institute (ELI), Place Louis Pasteur 3, bte L4.03.08, B-1348 Louvain-La-Neuve, Belgium

In this presentation, we review different radio observations for space weather applications used by the Space Physics team of the Royal Belgian Institute for Space Aeronomy (BIRA-IASB).

To study solar radio bursts and their emission mechanisms, high-resolution radio spectra obtained recently by large radio telescopes UTR-2 and URAN-2 (Ukraine) have been used. In addition to the well-known type III and type II bursts, we focus on Alfvén Velocity (AV) bursts, narrow-band bursts with relatively low frequencies 15-30 MHz and drift rates around 100 kHz/s. A theory has been developed to explain their formation.

Radio observations are also used to study the ionosphere and its extension, the plasmasphere. The instrument WHISPER on board Cluster measures in situ the plasma frequency in the range [2–80 kHz]. The number density of the electrons along the orbit of the spacecraft can easily be deduced from these observations, as well as the position of the plasmapause, the limit of the plasmasphere where sharp gradients can be observed. These measurements have been compared with the 3D dynamic model of the plasmasphere developed at BIRA-IASB which illustrates the plasmaspheric variations during geomagnetic storms. The model is coupled with the ionosphere, for which ground-based radar observation are essential. VLF antennas have also been installed by BIRA-IASB at the Belgian Princess Elisabeth station in Antarctica and in Belgium at Humain. These two antennas are part of the international global network AWDA (Automatic Whistler Detector and Analyzer). The ultimate goal of this network is to provide data to feed a data-assimilative model of the plasmasphere.

At BIRA-IASB, the radio observations are used to compare with the results of kinetic models developed for a better understanding of the physical mechanisms: models for the solar wind, for the terrestrial exosphere and the plasmasphere coupled to the ionosphere. Such models are essential to help the interpretation of the observations and especially the effects of the solar wind on the inner magnetosphere.