[EE] Evening Poster | P (Space and Planetary Sciences) | P-EM Solar-Terrestrial Sciences, Space Electromagnetism & Space Environment

[P-EM13]Study of coupling processes in solar-terrestrial system

convener:Mamoru Yamamoto(Research Institute for Sustainable Humanosphere, Kyoto University), Yasunobu Ogawa(National Institute of Polar Research), Satonori Nozawa(名古屋大学宇宙地球環境研究所, 共同), Akimasa Yoshikawa(Department of Earth and Planetary Sciences, Kyushu University)
Sun. May 20, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)
The Earth accepts vast input of energy and material from the Sun. The Earth's environment is maintained by the balance between their inputs and outputs. It is important to study energy and material transport of the Earth. This is an international session that discusses studies of the coupling processes in the Sun-Earth system based on the project "Study of coupling processes in solar-terrestrial system" that was approved by the Master Plan 2017 of Science Council of Japan. The facilities and networks included are the Equatorial MU Radar (EMU) in Indonesia to study the whole equatorial atmosphere, the EISCAT_3D radar in northern Scandinavia to study detailed structures and elementary processes of the magnetosphere-ionosphere coupling in the polar region, and global networks of various ground-based instruments and observation data. We will show current status of the project and discuss sciences by soliciting variety papers. This session is open to the world, and we strongly encourage submission of papers related to other facilities and projects, i.e., atmospheric or incoherent scatter radars, observation networks, satellites, and simulation or theoretical studies, etc.

[PEM13-P04]Study on real-time adaptive aircraft clutter suppression using the MU radar

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Strong clutter echoes from a hard target such as a mountain, building, or airplane sometimes cause problems of observations with atmospheric radars. In order to reject or suppress ground clutter echoes, it is effective to use NC-DCMP (Norm Constrained- Directionally Constrained Minimum Power) method, which makes null toward the direction of the clutter, if we can receive signals independently from plural antennas [Nishimura et al., JTech., 2012]. NC-DCMP method suppresses clutter echoes with maintaining the shape of main lobe to add pseudo-noise. It has been demonstrated that the NC-DCMP method is effective to real observation data with the MU (Middle and Upper atmosphere) radar, but it was processed in off-line.
The MU radar is operated in a troposphere-stratosphere standard observation mode for about 100 hours every month. We successfully implemented the clutter rejection by NC-DCMP method into the on-line processing system of the MU radar. It is possible to drastically reduce the recording amount of observation data. Observation data in this mode is obtained once every 8 seconds. Therefore it is necessary to perform all of the signal processing within 8 seconds in order to perform the clutter suppression in real-time. Now we can process the NC-DCMP in 1 second in average. Since the echoes from mountains and buildings do not change so quickly, it showed good results to determine the optimum weight vector using the received signal of the incoherent integration 7 times (about one minute). We have applied the NC-DCMP real-time processing since November 2015.
The NC-DCMP method cannot sufficiently suppress echoes from a moving target such as an airplane. In the previous study, a two-step NC-DCMP method has been proposed as a method to suppress the airplane clutter echoes. First, airplane clutter echoes reproduced using the NC-DCMP method based on the

estimated arrival direction of the airplane echo are subtracted from the original received signal. Next, ground clutter echoes are suppressed using the NC-DCMP method. In the previous study, real time processing was impossible because all directions were searched to estimate the arrival direction. Therefore, we consider limiting the search range of the arrival direction by using ADS-B (Automatic Dependent Surveillance-Broadcast) which is a system in which the airplane broadcasts the information such as position and altitude with high accuracy. The suppression performance of two-step NC-DCMP is improved about 5 dB more than the conventional method.
We can apply the achievement of this study to the Equatorial MU radar (EMU), which is proposed to be constructed at West Sumatera, Indonesia. The EMU system is the similar as the MU radar, but its antenna consists of 1045 Yagi antennas with 55 groups.