

First results of ionospheric tomography of beacon TEC data from a network experiment along 135°E longitude over Japan

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Satellite radio beacons have been used for ionospheric observations for more than three decades. The coherent beacon transmissions from Low Earth Orbiting Satellites (LEOS, at an altitude of ~1000 km) provide the simplest way to measure the Total Electron Content (TEC) from satellite to ground. The ground based receivers basically measure the relative phase of 150 MHz with respect to 400 MHz, which is proportional to the slant relative TEC along the line of sight. These TEC data obtained from a chain of ground-based receivers aligned along a particular meridian can be effectively used for the tomographic imaging of the latitudinal distribution of electron densities in the meridional plane. The main advantage of such a technique is its very good spatial coverage. Hence, the beacon experiments have emerged as a potential tool to investigate the large-scale features in the ionosphere. In this context, a new digital receiver was developed for receiving the beacon transmissions from the LEOS (Yamamoto, SGPSS fall meeting report, 2007). Recently, a chain of these digital receivers has been established over Japan, mainly for the tomographic imaging of the ionosphere over this region. Three receivers were installed at Shionomisaki (33.5°N, 135.8°E), Shigaraki (34.9°N, 136.1°E) and Fukui (36.1°N, 136.2°E), which continuously track the LEOS, mainly the OSCAR, COSMOS and FORMOSAT-3/COSMIC satellites, to obtain simultaneous TEC data from these three locations. These line-of sight relative TECs are then converted to the absolute TECs by a two station method (Leitinger et al., 1975) and used for tomographic reconstruction. In the present paper, the first results from this experiment conducted during the period July-August 2008 will be presented. This investigation, using beacon-based tomographic technique is first of its kind from the Japanese longitudes. The tomographic images reveal the temporal evolution as well as the day-to-day variability of the mid-latitude ionosphere. The main objective of this experiment is to study the medium-scale traveling ionospheric disturbances (MSTID) that is known to be frequently occurring in the summer nighttime over Japan. In the first phase of our experiment itself we have observed few events of wave-like perturbations in TEC from all three receivers, which could be the signatures of MSTIDs. These TEC perturbations are sometimes associated with scintillations of both 150 and 400 MHz signals, too. The features seen in the beacon-tomographic images will be compared with that obtained from the GPS-based tomography using the GEONET TEC data, and supplemental observations with the MU radar (46.5MHz radar being operated at Shigaraki) in the ionospheric mode. The results will be discussed in detail in the presentation.