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Monitoring radiation belt particle precipitation - automatic detection of enhanced transient ionisation in the lower plasmasphere using subionospheric narrow band VLF signals

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Signals of naval VLF transmitters, propagating long distances along the Earth-ionosphere waveguide (EIWG) have been widely applied as effective tools for monitoring transient ionization at mesospheric altitudes. Perturbations in recorded amplitude and/or phase data series of stable frequency signals may refer to the effect of transient enhanced ionization in the EIWG, due to e.g. loss-cone precipitation of trapped energetic electrons (Carpenter et al., 1984, Dowden and Adams, 1990), burst of solar plasma particles (Clilverd et al., 2001). The contribution of precipitating particles are thought to be substantial in certain Sun-to-Earth energy flow processes in the upper atmosphere (Rodger et al., 2005).
Narrow band VLF measuring network has been set up, developed and operated in Hungary, running in the last decade almost continuously, dedicated to monitor ionization enhancement regions along numerous transmitter-receiver paths. This setup is based on Omnipal and Ultra-MSK equipment, logging amplitude and phase data of received signals, sampled at frequencies of selected VLF transmitters. Signal trajectories, selected for recording represent proper configuration to survey transient ionization caused by energetic particles in the sub-polar region, such as effect of scattered particles of the inner radiation belt.
Reprocessing of the mass archived recordings has been started using a newly developed signal processing code, detecting and classifying different sort of perturbations automatically on narrow band VLF series. Occurrence rates, daily and seasonal variation, statistics of transient ionization enhancements, their geographic distribution within the surveyed range and time period, and correlation with intense geomagnetic and/or Solar event is yielded by this analysis.

References:
Carpenter, D.L., Inan, U.S., Trimpi, M.L., Helliwell, R.A., and Katsufrakis, J.P.: Perturbations of subionospheric LF and MF signals due to whistler-induced electron precipitation burst, J.Geophys.Res., 89, A11, 9837-9862, 1984.
Clilverd, M. A., Seppälä, A., Rodger, C.J., Thomson, N.R., Verronen, P.T., Turunen, E., Ulich, Th., Lichtenberger, J., and Steinbach, P.: Modelling polar ionospheric effects during the October-November 2003 solar proton events, Radio Sci., 41, RS2001, doi:10.1029/2005RS003290.
Dowden, R.L., and Adams, C.D.D.: Lightning-induced perturbations on VLF subionospheric transmissions, J. Atmos. Terr. Phys., 52, 5, 357-363, 1990.
Rodger, C.J., Clilverd, M.A., Thomson,N.R., Nunn, D., and Lichtenberger, J.: Lightning driven inner radiation belt energy deposition into the atmosphere: regional and global estimates, Ann. Geophys., 23, 3419-3430, 2005.