

# **S-transform view of geomagnetically induced currents during geomagnetic superstorms**

**A. Pulkkinen** (1), R. Kataoka (2)

(1) NASA/GSFC (antti.pulkkinen@gsfc.nasa.gov), (2) National Institute of Information and Communications Technology

Novel time-frequency analysis method (S-transform) capable of handling noisy non-stationary signals is applied to study the properties of geomagnetically induced current (GIC) fluctuations in the Finnish natural gas pipeline during geomagnetic superstorms. New local time- and storm phase-dependent S-transform spectral properties of auroral region GIC fluctuations during geomagnetic superstorms are reported. More specifically, the S-transform spectra have two distinct regions containing the most of the spectral power that persisted from storm to storm: main phase-related wide-band fluctuations driven possibly by substorm-type ionospheric activity centered around local midnight and recovery phase-related narrow-band fluctuations associated with Pc5 range geomagnetic pulsations in the local morning region. Based on this observed "stability", a new S-transform-based statistical approach using, for example, an ensemble of different S-transform responses for known storms is proposed for GIC prediction.