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Temporal variability of the atmospheric electric field and gamma radiation at the SMEAR II station (Hyytiälä, Finland)

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Terrestrial natural radioactivity from radionuclides in soil and rocks, as well as radon gas and its airborne progeny, are a fundamental source of high-energy particles causing air ionization and influencing the local atmospheric electric field. Furthermore, radiation is produced in the atmosphere from the secondary interaction of cosmic rays and upper-atmosphere gases, as well as during thunderstorms and lightning conditions.

Aiming to improve understanding on space-atmosphere-surface interactions influencing the temporal variability of the atmospheric electric field, a campaign for simultaneous monitoring of the electric field and ambient gamma radiation was set-up at the SMEAR II station in Hyytiälä (Finland). The high-latitude location of the site is appealing for addressing the effect of cosmic rays and high-energy ionising particles on the local electric field. Furthermore the meteorological data routinely collected at the station, including basic meteorological parameters, cloud base height and detailed information on aerosols and ions, is extremely important for the identification of fair weather days and the interpretation of local changes in the atmospheric electric field.

The campaign took place from July to November 2017 in the framework of a ENVRIplus project for access to the SMEAR II infrastructure. The electric field was measured with a CS110 sensor every 1-minute, and total gamma radiation was measured with a NaI(Tl) scintillator every 5-minutes. This contribution addresses the temporal variability of the electric field measurements, focusing on a scale-by-scale decomposition based on the discrete wavelet transform, and the identification of fair weather days and corresponding diurnal variability from concurrent meteorological information. The variability of the local electric field is then compared with the gamma radiation count rate for specific time scales and weather conditions.