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Hisparc cosmic ray detector's response to heavy rain

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Cosmic ray particles have extreme energies, 10^{16} eV/nucleon and up. Upon arrival at the higher atmosphere and collisions with the gas molecules there, the cosmic ray particles convert into a cascade of different secondary particles that finally arrive at soil level in the form of an extensive air shower (EAS): high-energy gamma's, electrons and muons. In the High School Project on Astrophysics Research with Cosmics (Hisparc, www.hisparc.nl) about 100 EAS detector stations are distributed over the Netherlands and several neighboring countries. These stations are mostly placed on the roof of secondary schools, where they have been built by pupils to attract them towards STEM studies.

Each station consists of two or four detectors with 0.5 m^2 plastic scintillator plates to record the passage of the EAS. At coincidence, the scintillator signals are individually recorded, accurately timed with GPS. All data are sent to and collected at the NIKHEF institute (www.nikhef.nl) and made available (open-access) for further analysis by pupils and scientists.

The sensitivity of the detectors is commonly adjusted such that each detector records a few hundred hits per second. The number of coincidences within $1.5 \mu\text{s}$ is then about 1 in 3 seconds, in part due to an actual EAS, in part due to random local radioactive processes.

During intense rainfall of a particular summer storm several two-detector systems recorded an increase in the coincidence frequency of up to a factor of 7. When comparing different stations we could follow the associated storm front moving northwards over NL. Within the coincidence interval of $1.5 \mu\text{s}$ the increased individual signals of both detectors were evenly distributed. Actual EAS signals tend to be synchronous to within 100 ns. We therefore attribute the increase to random signals. As possible source we suggest gamma radiation due to radon daughters in the atmosphere that are washed out by the rain and accumulate on the roof close to the detectors. The delay between rain and signal increase is noted and in accordance with the washing process time.