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Automatic classification of peaks in gamma radiation measurements from the Eastern North Atlantic (ENA-ARM) station in Graciosa island (Azores)

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The automatic classification of peaks in gamma radiation time series is relevant for both scientific and practical applications. From the practical perspective, the classification of peaks is fundamental for early-warning systems for radiation protection and detection of radioactive material. From the scientific point of view, peaks in gamma radiation are often driven by precipitation and consequent scavenging of airborne radon progeny radionuclides to the ground (mainly Pb-214 and Bi-214). Thus measurements of gamma radiation at the earth's surface have the potential to provide information on micro-physical processes occurring high above in the clouds, as the dominant source of radon progeny is thought to be associated with in-cloud processes – nucleation scavenging and interstitial aerosol collection by cloud or rain droplets.

The present study addresses the classification of peaks in high-resolution (1-minute) gamma radiation time series from the GRM (Gamma Radiation Monitoring) campaign, which is being carried out since 2015 at the Eastern North Atlantic (ENA) station of the ARM (Atmospheric Radiation Measurements) programme. In addition to the gamma time series, precipitation information from laser disdrometer measurements is considered, including rain rate, liquid water content, median drop diameter and droplet concentration. Diverse machine learning algorithms are examined with the goal to identify and classify gamma peaks driven by precipitation events, and further examine the association between precipitation characteristics and the resulting gamma radiation peak on the ground.