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Gamma radiation monitoring at the Eastern North Atlantic (ENA), Graciosa Island ARM facility

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Continuous monitoring of gamma radiation is often performed in nuclear facilities and industrial environments as a way to control the ambient radioactivity and give warning of potential accidents. However, gamma radiation is also ubiquitous in the natural environment. The main sources are i) cosmic radiation from space, including secondary radiation from the interaction with atoms in the atmosphere, ii) terrestrial sources from mineral grains in soils and rocks, particularly Potassium (K-40), Uranium (U-238) and Thorium (Th-232) and their decay products (e.g. Radium, Ra-226) , and iii) airborne Radon gas (Rn-222), which is the dominant source of natural environmental radioactivity. The temporal variability of this natural radiation background needs to be well understood and quantified in order to discriminate non-natural sources of radiation in the environment and artificial radionuclides contamination.

To this end, continuous gamma radiation monitoring is being performed at the Eastern North Atlantic (ENA) facility located in the Graciosa island (Azores, 39N; 28W), a fixed site of the Atmospheric Radiation Measurement programme (ARM), established and supported by the Department of Energy (DOE) of the United States of America with the collaboration of the local government and University of the Azores. The site is unique for the study of the natural radioactivity background on one hand due to the remote oceanic geographical location, in the middle of the North Atlantic Ocean and clear of direct continental influence, and on the other hand because of the comprehensive dataset of atmospheric parameters that is available for enhancing the interpretation of the radiation measurements, as a result of the vast array of very detailed and high-quality atmospheric measurements performed at the ARM-ENA facility.

Gamma radiation in the range 475 KeV to 3000 KeV is measured continuously with a 3” x 3” NaI(Tl) scintillator. The campaign started started in May 2015, with gamma rays counts being recorded every 15 minutes. The resulting time series of gamma radiation counts displays a very rich and highly-variable temporal structure, dominated by very sharp peaks lasting a few hours (< 6 hours). Such sharp increases in gamma counts are found to be associated, as expected, with concurrent precipitation events, but quantifying the influence of precipitation in the gamma radiation measured at the ground is a challenging task due to the diversity of inter-related factors, including the precipitation intensity, the characteristics of the hydrometeors (size, number), and the concentration of aerosols.