Geophysical Research Abstracts
Vol. 19, EGU2017-13711, 2017
EGU General Assembly 2017

Short-term variability of gamma radiation at the ARM Eastern North Atlantic (ENA) site (Azores)

Susana Barbosa (1), Pedro Miranda (2), and Eduardo Azevedo (3)

(1) INESC TEC, CSIG, Porto, Portugal (susana.a.barbosa@inesctec.pt), (2) University of Lisbon, Instituto Dom Luiz, Lisboa, Portugal, (3) Center of Climate Meteorology and Global Change, University of the Azores

Naturally-occurring radionuclides, and radon and its progeny in particular, can be used as a sensitive atmospheric tracer and an indicator of dynamic processes in the lower troposphere. Radiation from gamma-emitting radionuclides (including Rn-222 progeny) is being continuously monitored since May 2015 in the framework of an ARM campaign 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 Government of the Autonomous Region of the Azores and University of the Azores. The resulting time series of 15-minute gamma ray counts radiation is characterized by occasional anomalies over a slowly-varying signal. Sharp peaks lasting typically 2-4 hours are coincident with heavy precipitation (> 10 mm/hour) and result from the scavenging effect of precipitation bringing radon progeny from the upper levels to the ground surface. However, the connection between gamma variability and precipitation is not straightforward as a result of the complex interplay of factors such as the precipitation intensity, the boundary layer height, the cloud's base height and thickness, or the air mass origin and atmospheric concentration of sub-micron aerosols, which influence the scavenging processes and therefore the concentration of radon progeny. Convective precipitation associated with cumuliform clouds forming under conditions of warming of the ground relative to the air does not produce enhancements in gamma radiation, likely as a result of the drop growing process being dominated by the fast accretion of liquid water, resulting in the reduction of the concentration of radionuclides by dilution. Events of convective precipitation further contribute to a reduction in gamma counts by inhibiting radon release from the soil surface and by attenuating gamma rays from all gamma-emitting elements on the ground. Anomalies occurring in the absence of precipitation are found to be associated with a diurnal cycle of maximum gamma counts before sunrise decreasing to a minimum in the evening, which are observed in conditions of thermal stability and very weak winds enabling the build-up of near surface radon progeny during the night.