Uranium and thorium series radionuclides in rainwater samples over several tropical storms

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Most studies of radionuclides in precipitation involve sample collection periods of days or longer, in order to determine long-term average fluxes to the Earth's surface. However, where knowledge of the dynamics of precipitation scavenging is desired, other approaches may prove valuable. In the present study, rainwater samples were collected at two locations, Jabiru and Jabiru East, in the Northern Territory of Australia. The main purpose of the study was to improve our understanding of the dispersion and deposition of airborne dust originating from the nearby Ranger U mine. Collections were restricted to single rainstorm events. The measured $^{232}Th/^{230}Th$ ration in rainstorm samples from the two sites varied between 0.01 and 0.5, implying a contribution from dust originating from the minesite. Concentrations of ^{238}U, ^{234}U, ^{230}Th, ^{226}Ra and ^{210}Pb were generally in the range of 0.5~50 $mBq.l^{-1}$. Concentrations of ^{210}Pb were higher, reflecting the additional contribution of ingrowth from ^{222}Rn in the atmosphere. For six events, sequential intra-storm samples were collected, primarily in an attempt to distinguish the source of radioactivity as being from rainout (activity captured by precipitation below the raincloud) or washout (captured within the cloud). Concentrations of U, ^{230}Th and ^{226}Ra generally decreased over the course of rainstorms, implying rainout from the air column below the cloud, but the results for ^{210}Pb and ^{210}Po are more complex.