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Spatial distribution of fallout 137Cs and 239+240Pu in Equatorial and Southern Hemisphere soils

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Past nuclear weapons testing and nuclear power plant accidents resulted in the ubiquitous deposition of radionuclides in the environment. While the risks associated with radionuclide contamination are apparent, these fallout radionuclides (FRNs) provide the privileged markers ("golden spikes") of the Anthropocene stratigraphic layers. The onset of their emissions in the 1950s coincided with the "Great Acceleration", which is characterized by large-scale shifts in the biophysical and socio-economic aspects of the Earth System, including an increase in soil degradation, triggered mainly by land-use change. Among the host of FRNs deposited globally, ^{137}Cs has been the most commonly used and $^{239+240}$Pu is a new emerging tracer and chronological marker to assess soil erosion and/or chronology of sediment deposition.

In this meta-analysis, we compiled existing ^{137}Cs and $^{239+240}$Pu data analyzed from undisturbed soils in the literature to get an overview of the spatial distribution and constraints of fallout ^{137}Cs and $^{239+240}$Pu in Equatorial and Southern Hemisphere soils, as well as the possible sources of these FRNs through their isotopic ratios. A database composed of 1087 reference cores was built from the literature published on Equatorial and Southern hemisphere soils.

Aside from the cores collected from the north equatorial regions, high ^{137}Cs inventories were also found in reference soils collected at the 40-50° S latitudinal band, which were mostly from South America. On the other hand, high $^{239+240}$Pu inventories were found at the 20-30° S latitudinal band, but this was influenced by the unusually high inventories measured from the French Polynesia, where many nuclear weapons testing occurred. The $^{240/239}$Pu atomic ratios indicated that sources other than the global fallout ($^{240/239}$Pu = 0.18) contributed to the reference inventories in the

Southern Hemisphere. As some areas lacked measurements, specific points where additional data could be obtained were identified through a GIS-based approach to represent the entire land surface areas of interest adequately. Together with new measurements, the compiled reference soil data will be used to construct a detailed baseline map of ^{137}Cs and $^{239+240}Pu$ fallout mainly for regional soil erosion assessments.