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A review of worldwide sediment core dating research including fallout radionuclides to reconstruct erosion and sedimentation processes

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Dating recent sediment archives (<150 years) constitutes a prerequisite for reconstructing soil erosion and deposition processes during the last several decades. Radiocesium (¹³⁷Cs) emitted during thermonuclear bomb testing (~1950 - ~1980) and nuclear accidents (1986 and 2011) was generally used for identifying sediment sources or for establishing sediment core chronology based on discrete time markers. Although this method has been widely used during the last several decades, there is a lack of structured and comprehensive worldwide synthesis of both natural and artificial fallout radionuclides used for dating sediment cores in environmental and Earth sciences. The current literature overview was based on 573 articles published between 1977 and 2020, reporting the collection of 1351 individual sediment cores. This synthesis led to the identification of the worldwide distribution of discrete time markers associated with the thermonuclear bomb testing peak in 1963, the Chernobyl fallout, the Fukushima fallout, and the identification of 25 events induced by local accidents or nuclear tests (e.g., Sellafield, la Hague accidents, Chinese nuclear tests).

With a growing number of studies focusing on the analysis of recent sediment cores and the increasing interest in sediment fingerprinting techniques, this spatialized synthesis provides a unique worldwide for identifying the distribution of ¹³⁷Cs sources across the globe. The potential associated with the analysis of other fallout radionuclides, including excess-lead-210 (²¹⁰Pb_{xs}) and plutonium atom ratios (²⁴⁰Pu/²³⁹Pu), is also discussed to improve the dating of environmental archives for reconstructing soil erosion and sedimentation processes.

Keywords: fallout radionuclides, sediment archives, Anthropocene, golden spike

