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Challenges and opportunities for use of natural fallout ^{7}Be as a soil erosion tracer in agricultural systems

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High resolution measurement of soil erosion amounts is difficult to achieve using conventional methodologies without interfering with agricultural practice and hence compromising the representativeness of results. Tracer technologies, both natural and tag-and-trace, offer opportunity to derive soil erosion data under 'real-world' conditions, providing a valuable complement to experimental and modelled data. Beryllium-7 (^{7}Be) is a naturally-occurring cosmogenic fallout radionuclide formed in the upper atmosphere by cosmic ray spallation of nitrogen and oxygen. Its constant production and delivery to the surface via precipitation coupled with its affinity for soil and sediment particles has underpinned its application as a conservative soil and sediment tracer wherein its short half-life (53.3 days) lends itself to tracing soil redistribution dynamics over short time periods. While the radionuclide budget approach to deriving soil redistribution amounts and patterns is conceptually straightforward, important aspects of the tracer's environmental behaviour, especially linked to its physical and geochemical distribution within the soil, remain poorly understood. These contribute to uncertainty in conversion of radionuclide inventory to soil erosion amounts and there is a need to develop a rigorous harmonised approach to application of the tracer, with opportunity to share experience with the tag-and-trace community. Drawing on past studies and recent experimental work within a validation plot experiment, this contribution offers an evaluation of the approach as applied to date and explores the challenges and opportunities for effective use of ^{7}Be as a tracer to support soil conservation and management strategies in the future.