



Fallout beryllium-7 as a soil and sediment tracer in river basins: current status and needs

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Beryllium-7 is a cosmogenic radionuclide formed in the upper atmosphere by cosmic ray spallation of nitrogen and oxygen. Its constant natural production and fallout via precipitation coupled with its ability to bind to soil particles have underpinned its application as a sediment tracer. The short half-life of beryllium-7 (53.3 days) lends itself to tracing sediment dynamics over short time periods, thus, enabling assessment of the effect of land use change upon soil redistribution. Although beryllium-7 has been widely applied as a tracer to date, there remain crucial gaps in understanding relating to the assumptions for its use. To further support the application of beryllium-7 as a tracer across a range of environments requires consideration of both the current strengths and shortcomings of the technique to direct research needs. Here we review research surrounding the assumptions underpinning beryllium-7 use as a tracer and identify key knowledge gaps relating to i) the effects of rain shadowing and vegetation interception upon beryllium-7 fallout uniformity at the hillslope-scale; ii) the effect of preferential flow pathways upon beryllium-7 depth distribution in soil and overland flow upon beryllium-7 inventory uniformity and iii) the potential for beryllium-7 desorption in saline and reducing environments. To provide continued support for the use of beryllium-7 as a hillslope and catchment-scale tracer, there is an urgent need to undertake further research to quantify the effect of these factors upon tracer estimates.