



Fine Increment Soil Collector (FISC): A new device to support high resolution soil and sediment sampling for agri-environmental assessments

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Soil and sediment related research for terrestrial agri-environmental assessments requires accurate depth incremental sampling of soil and exposed sediment profiles. Existing coring equipment does not allow collecting soil/sediment increments at millimetre resolution. Therefore, the authors have designed an economic, portable, hand-operated surface soil/sediment sampler – the Fine Increment Soil Collector (FISC) – which allows extensive control of soil/sediment sampling process and easy recovery of the material collected by using a simple screw-thread extraction system.

In comparison with existing sampling tools, the FISC has the following advantages and benefits: (i) it permits sampling of soil/sediment samples at the top of the profile; (ii) it is easy to adjust so as to collect soil/sediment at mm resolution; (iii) it is simple to operate by one single person; (iv) incremental samples can be performed in the field or at the laboratory; (v) it permits precise evaluation of bulk density at millimetre vertical resolution; and (vi) sample size can be tailored to analytical requirements.

To illustrate the usefulness of the FISC in sampling soil and sediments for ^7Be – a well-known cosmogenic soil tracer and fingerprinting tool – measurements, the sampler was tested in a forested soil located 45 km southeast of Vienna in Austria. The fine resolution increments of ^7Be (i.e. 2.5 mm) affects directly the measurement of the ^7Be total inventory but above all impacts the shape of the ^7Be exponential profile which is needed to assess soil movement rates.

The FISC can improve the determination of the depth distributions of other Fallout Radionuclides (FRN) – such as ^{137}Cs , $^{210}\text{Pb}_{ex}$ and $^{239+240}\text{Pu}$ – which are frequently used for soil erosion and sediment transport studies and/or sediment fingerprinting.

Such a device also offers great potential to investigate FRN depth distributions associated with fallout events such as that associated with nuclear emergencies. Furthermore, prior to remediation activities – such as topsoil removal – in contaminated soils and sediments (e.g. by heavy metals, pesticides or nuclear power plant accident releases), basic environmental assessment often requires the determination of the extent and the depth penetration of the different contaminants, precision that can be provided by using the FISC.