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A novel method for tracing the movement of multiple individual soil particles under rainfall conditions using florescent videography.

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The importance of developing new techniques to study soil movement cannot be underestimated especially those that integrate new technology. Currently there are limited empirical data available about the movement of individual soil particles, particularly high quality time-resolved data. Here we present a new technique which allows multiple individual soil particles to be traced in real time under simulated rainfall conditions. The technique utilises fluorescent videography in combination with a fluorescent soil tracer, which is based on natural particles. The system has been successfully used on particles greater than ∼130 micrometres diameter. The technique uses HD video shot at 50 frames per second, providing extremely high temporal (0.02 s) and spatial resolution (sub-millimetre) of a particle's location without the need to perturb the system. Once the tracer has been filmed then the images are processed and analysed using a particle analysis and visualisation toolkit written in python. The toolkit enables the creation of 2 and 3-D time-resolved graphs showing the location of 1 or more particles. Quantitative numerical analysis of a pathway (or collection of pathways) is also possible, allowing parameters such as particle speed and displacement to be assessed. Filming the particles removes the need to destructively sample material and has many side-benefits, reducing the time, money and effort expended in the collection, transport and laboratory analysis of soils, while delivering data in a digital form which is perfect for modern computer-driven analysis techniques. There are many potential applications for the technique. High resolution empirical data on how soil particles move could be used to create, parameterise and evaluate soil movement models, particularly those that use the movement of individual particles. As data can be collected while rainfall is occurring it may offer the ability to study systems under dynamic conditions(rather than rainfall of a constant intensity), which are more realistic and this was one motivations behind the development of this technique.