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SoilCAM: Soil Contamination, Advanced integrated characterisation and time-lapse Monitoring, an overview

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The SoilCAM project (EU, FP7) is aimed at improving current methods for monitoring contaminant distribution and biodegradation in the subsurface. Currently proven methods, based on invasive sampling of soil, soil water and gaseous phase, are unable to provide sufficiently accurate data with high enough resolution. This causes inability to assess bioremediation progress and quantification of the processes involved in bioremediation at field sites. Geophysical methods provide insight into soil heterogeneity and characteristics and may, when used in time-lapse mode, serve as a monitoring technique for contaminant transport over larger areas than traditional sampling techniques. The presence of a mixture of materials and contaminants in the subsurface, as well as the natural temporal variable conditions such as temperature and water saturation affect the geophysical signature of the subsurface and hence causes ambiguity of interpretation. Some examples of geophysical, conventional methods and lysimeter techniques for contaminant site monitoring and characterisation from the SoilCAM project will be given and insight to more specific challenges both practical and scientifically will be provided for a the two test sites; Oslo airport in Norway with annual loads of de-icing chemicals each winter, and the Trecate site in Italy where there was a blow out of crude oil in 1994. Both contaminants are degradable and the subsurface heterogeneous glacio-fluvial deposits. Examples of characterisation using multiple geophysical and invasive sampling techniques will be illustrated, and examples of time-lapse measurements conducted throughout the infiltration period will be shown together with flow and transport simulation results to help interpretation of geophysical measurements at the Oslo airport site. The time lapse survey at the Trecate site has been focused on the analysis of the water content distribution in the vadose zone according to the water infiltration from the surface and to the seasonal fluctuations of the ground water level. The results confirm that recharge mainly occurs as focussed infiltration in sink-holes distributed in the area. This reduces the flushing effects and the biodegradation of the hydrocarbons under aerobic condition in the vadose zone. Georadar, electrical resistivity and polarisability measurements in cross-hole configuration have been correlated to the presence of residual hydrocarbons which have been found in free phase of the smear zone in between the vadose and the saturated zone. For both sites practical limitations of various methods and validity of the preliminary results will be discussed as well as theoretical improvements and managerial aspects required for the applicability of the tested monitoring techniques.