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Highlights from the SoilCAM project: Soil Contamination, Advanced integrated characterisation and time-lapse Monitoring

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The SoilCAM project (Soil Contamination, Advanced integrated characterisation and time-lapse Monitoring 2008-2012, EU-FP7-212663) is aimed at improving current methods for monitoring contaminant distribution and biodegradation in the subsurface. At two test sites, Oslo airport Gardermoen in Norway and the Trecate site in Italy, a number of geophysical techniques, lysimeter and other soil and water sampling techniques as well as numerical flow and transport modelling have been combined at different scales in order to characterise flow transport processes in the unsaturated and saturated zones. Laboratory experiments have provided data on physical and bio-geo-chemical parameters for use in models and to select remediation methods. The geophysical techniques were used to map geological heterogeneities and also conduct time-lapse measurements of processes in the unsaturated zone. Both cross borehole and surface electrodes were used for electrical resistivity and induced polarisation surveys. The geophysical surveys showed clear indications of areas highly affected by de-icing chemicals along the runway at Oslo airport. The time lapse measurements along the runway at the airport show infiltration patterns during snowmelt and are used to validate 2D unsaturated flow and transport simulations using SUTRA. The Orchestra model is used to describe the complex interaction between bio-geo-chemical processes in a 1D profile along the runway. The presence of installations such as a membrane along the runway highly affects the flow pattern and challenges the capacity of the numerical code. Smaller scale field site measurements have revealed the increase of iron and manganese during degradation of de-icing chemicals. The use of Nitrate to increase red-ox potential was tested, but results have not been analysed yet. So far it cannot be concluded that degradation process can be quantified indirectly by geophysical monitoring. At the Trecate site a combination of georadar, electrical resistivity and radio magneto telluric provided a broad outline of the geology down to 50 m, there is a good consistency in the data in the overlapping part, and more deep samples would be required to validate the geological interpretation of the data. Anomalies in the Induced polarisation and electrical resistivity data from the cross borehole measurements indicate where the remaining crude oil can be found. Water samples from multilevel samplers reveal crude oil present in emulsion in the zone of groundwater fluctuations, highlighting the importance of colloidal transport. Geochemistry of the groundwater clearly indicates degradation of hydrocarbons under iron- and sulphate reducing conditions. Modflow has been used to simulate the regional groundwater flow and transport in the area. An overview of the work that has been conducted and main highlights of the results so far will be presented.