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# Soils as sinks or sources for diffuse pollution of the water cycle

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Numerous chemical compounds have been released into the environment by human activities and can nowadays be found everywhere, i.e. in the compartments water, soil, and air, at the poles and in high mountains. Examples for a global distribution of toxic compounds are the persistent organic pollutants (PCB, dioxins, PAH, fluorinated surfactants and flame retardants, etc.: "the Stockholm dirty dozen") but also mercury and other metals. Many of these compounds reached a global distribution via the atmo¬sphere; others have been and are still directly applied to top soils at the large scale by agriculture or are released into groundwater at landfill sites or by discharge of treated or untreated waste waters. Sooner or later such compounds end up in the water cycle – often via an intermediate storage in soils. Pollutants in soils are leached by seepage waters, transferred to ground¬water, and transported to rivers via groundwater flow. Adsorbed compounds may be transported from soils into surface waters by erosion processes and will end up in the sediments.

Diffuse pollution of the subsurface environment not only reflects the history of the economic development of the modern society but it is still ongoing – e.g. the number of organic pollutants released into the environment is increasing even though the con¬centrations may decrease compared to the past. Evidence shows that many compounds are persistent in the subsurface environment at large time scales (up to centuries). Thus polluted soils already are or may become a future source for pollution of adjacent compartments such as the atmosphere and groundwater.

A profound understanding on how diffuse pollutants are stored and processed in the subsurface environment is crucial to assess their long term fate and transport at large scales. Thus integrated studies e.g. at the catchment scale and models are needed which couple not only the relevant compartments (soil – atmosphere – groundwater/surface waters) but also flow and reactive transport. Field observations must allow long-term monitoring (e.g. in hydrological observatories, TERENO etc.), new cross-compartment monitoring strategies need to be applied, and massive parallel numerical codes for prediction of reactive transport of potential water pollutants at catchment scale have to be developed. This is also a prerequisite to assess the impact of climate change as well as land use change on future surface and groundwater quality.