Complex pollutant transfer in fractured and karstified chalk aquifer systems in Eastern Normandy, France

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ABSTRACT

Chalk aquifer systems often display dual or triple porosity textures leading to complex flowfields, not easily detected through regular groundwater level measuring campaigns which most of the time use available unevenly distributed wells opened at different depths. This often can biased groundwater flow interpretation and lead to partially erroneous flowfields or piezometric maps. This is a real problem when dealing with pollution migration, as finding pollution sources, predicting plume evolution or pollutant concentration trends and setting up corrective measures to protect water resources.

This paper intends to discuss complex pollution transfer in two chalk aquifer valleys in eastern Normandy where pollutants do not seem to only follow flowlines shown on available groundwater level maps; indeed, divergent pollutant transfer also take place along fractured axes and karst developments which can often be associated to geological discontinuities, as was already highlighted through model calibration processes in the Avre river catchment.

In the Commerce valley case, a rare emerging pollutant, N-nitrosomopholine, was discovered to migrate in two opposite directions from a single source point identified in the upper Valley: indeed, this pollutant was both found south and downstream in the fractured and porous aquifer, and way up north in a karst channel system used for drinking water purposes, in what was thought to be a completely different watershed.

In the Iton valley case, the pollutants are volatile organohalogenated compounds (VOH) which are widespread in Normandy and often stem from historical industrial pollutions. Several potential VOH sources were identified in industrial areas in the valley south from contaminated drinking water wells; yet the groundwater flow map suggest an eastern origin for the pollution source...

This situation often encountered in the chalk aquifer systems of eastern Normandy makes it difficult to establish “cause to effect” links between pollution sources and contaminated drinking water wells. To tackle this problem and clarify flowline interpretation, a multi-parameter approach based on geological and hydrogeological criteria has been developed; it is discussed in this paper.