

Title:

Recent advances for monitoring groundwater and contaminants fluxes using single-well applied tracer techniques

Authors:

Pierre Jamin, Philippe Orban, Goedele Verreydt, Frédéric Cosme, Serge Brouyère

Session:

T2 Spotlight on Modeling, Emerging Technologies and Their Applications

T2.3 Novel sampling, analysis, and monitoring techniques

Communication:

Oral

Abstract (300 words maximum):

Quantifying groundwater fluxes is essential in many different hydrogeological investigations but often challenging due to the spatial and temporal variability in hydraulic conditions. Traditional approaches used to estimate groundwater fluxes are based on hydraulic conductivity obtained from short-term field pumping or slug tests that provide only order-of-magnitude estimates and hydraulic gradients that can also vary, especially in areas of active groundwater discharge or pumping.

The Finite Volume Point Dilution Method (FVPDM) is a recently developed applied tracer technology able to accurately measure groundwater fluxes and to continuously monitor their temporal variability. We report 10 years of application of the FVPDM in contrasted hydrogeological contexts, from porous alluvials to fractured-rock aquifers, including strong interactions with surface water and contrasting groundwater flow dynamics. The obtained results prove that the FVPDM is able to measure a wide range of groundwater fluxes from a few centimetres per day to hundreds of metres per day. These results also highlight the variability in groundwater fluxes, (1) with time in aquifers influenced by variable hydraulic conditions such as tidal effects and (2) in space where orders of magnitude difference in groundwater fluxes are observed between nearby monitoring wells at a given site.

Applying FVPDM has given a unique opportunity to assess how transient groundwater flow systems can be. This has not only been the case for those that are known to be anthropogenically-influenced but also when studying natural flow systems. This included the ability to revisit hypotheses resulting in some of these systems from the assumption of steady-state. Recent developments have also investigated the ability to assess groundwater flow directions at the well scale.

Keywords (5 maximum):

Finite Volume Point Dilution Method, Single well tracer experiment, Transient groundwater flow, Contaminant flux.