# Using excess air for the characterisation of recharge processes in karst aquifers. Case of the Durzon karst system (France).

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Vadose zone plays an important role in recharge processes of groundwater. However, the study of the vadose zone is often limited due to a lack of access to this zone.

In the vadose zone of most aquifers, gas dissolution under an increasing hydraulic pressure produces an excess air component (EA). Although there is a link between excess air formation and hydraulic pressure in aquifers, the use of EA as a tracer of recharge conditions has been poorly developed. In addition, in karstic system, were numerous voids are present, the formation and evolution of excess air from the vadose zone to the outlet of the system is still debated.

In this context, the objectives of our project were (1) to give a better comprehension of excess air formation and variation in karst systems, (2) to use excess air as proxy of recharge processes and vertical structure of aquifers.

Regular investigations of dissolved gases were performed in the Durzon karst system. Noble gases (Ne, Ar) were monthly measured over 2 hydrological cycles from 2010 to 2012. In addition vertical variations of dissolved gases concentration in the vadose zone were investigated at 4 depths from -5m to -140m deep in March 2018.

Results show high and variable values of excess air in the system. In the vadose zone, while Ar shows constant concentration at the different depth, Ne increases with depth indicating an increase of EA formation along the flow path.

In addition, dissolved gases show highly variable contents during hydrological cycles. The highest EA values (above 7 ml/l) were measured during low flows while high flows show low EA (3 to 5 ml/l). These high EA values during low flow can not be solely explain by increase along the vadose zone and most probably reflects matrix/conduits exchanges.