

Field continuous measurement of dissolved gases with a CF-MIMS: Applications to the physics and biogeochemistry of groundwater flow

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In the perspective of a temporal and spatial exploration of aquatic environments (surface and ground water), we developed a technique for precise field continuous measurements of dissolved gases (N₂, O₂, CO₂, CH₄, N₂O, H₂, He, Ne, Ar, Kr, Xe). With a large resolution (from 1×10^{-9} to 1×10^{-2} ccSTP/g) and a capability of high frequency analysis (1 measure every 2 seconds), the CF-MIMS (Continuous Flow Membrane Inlet Mass Spectrometer) is an innovative tool allowing the investigation of a large panel of hydrological and biogeochemical processes in aquatic systems.

Based on the available MIMS technology, this study introduces the development of the CF-MIMS (conception for field experiments, membrane choices, ionisation) and an original calibration procedure allowing the quantification of mass spectral overlaps and temperature effects on membrane permeability.

This study also presents two field applications of the CF-MIMS (Chatton et al, 2016) involving the well-logging of dissolved gases and the implementation of groundwater tracer tests with dissolved 4He. The results demonstrate the analytical capabilities of the CF-MIMS in the field. Therefore, the CF-MIMS is a valuable tool for the field characterisation of biogeochemical reactivity, aquifer transport properties, groundwater recharge, groundwater residence time and aquifer-river exchanges from few hours to several weeks experiments.

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