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The potential of lithium in stream water to trace changes in the water flow path

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Sites concernés: Sapine catchment, Mont Lozère. Naizin catchment, Brittany.

Instruments Critex concernés:

Résumé :

Water residence times and pathways influence the extent and style of weathering reactions in catchments. As a consequence, the concentration of elements in the dissolved load are affected by different processes whose dominance varies during seasonal changes, and even during single flood events. In particular, our goal here is to use lithium (Li) dissolved in water as a tracer for geochemical processes in the critical zone. Its abundance and isotopic composition is sensitive to secondary mineral formation and dissolution in the subsurface. Therefore, it might reflect the pathway groundwater takes through the catchment and deliver information about water residence time. We analyzed the element concentrations in the stream water of the instrumented Sapine catchment (0.54 km^2) at Mont Lozère (OHMCV). The granitic bedrock of this catchment is overlaid by a regolith layer of at least one-meter thickness. The anthropogenic influence on the catchment is negligible and therefore, the hydrology is the main control for solute export. The element concentrations were measured in the stream water for a monthly sampling period between July 2013 and August 2015. The stream discharge is continuously measured since July 2013, and the groundwater table height has been recorded in three piezometer installed along the groundwater flow direction since October 2014. Results show a quick response of the groundwater table and stream level to rainfall. The Li concentrations vary between 0.6 and 1.1 ppb, and fluxes calculations indicate slow chemical weathering in this catchment. The relationship between concentrations and discharge indicates that the Li dynamics is dominated by processes which do not depend in a first order to variations in the discharge. Our next step to confirm these first-order results is to determine the dissolved Li isotope composition to identify and quantify these processes; and to gain more information about subsurface water flow using geophysical methods (e.g. ERT) and borehole drilling.

Keywords: Lithium, groundwater, concentration-discharge relation, instrumented catchment.
