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Potential usefulness of storm events to investigate the influence of the stream-catchment interface zone on stream biogeochemistry. A modelling approach

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We formulate a new mixing model to explore hydrological and chemical conditions under which the interface between the stream and catchment zone (SCZ) influences the release of reactive solutes into stream water during storms. Physically, the SCZ corresponds to the hyporheic/riparian sediments. In the new model, this interface is coupled through a bi-directional water exchange to the conventional two components mass balance mixing model.

Simulations show that the influence of the SCZ on stream solute dynamics during storms is detectable when the runoff event is dominated by the infiltrated groundwater component that flows through the SCZ before entering the stream and when the flux of solutes released from SCZ sediments is similar, or higher, than the solute flux carried by the groundwater.

Dissolved organic carbon (DOC) and nitratedatafrom two small Mediterranean streams obtained during storms are compared to results from simulations using the new model to discern the circumstances under which the SCZ is likely to control the dynamics of reactive solutes in streams. The simulations and the comparisons with empirical data suggest that the new mixing model may be especially appropriate for streams in which the periodic, or persistent, abrupt changes in the level of riparian groundwater exert hydrologic control on biogeochemical connections between the riparian/hyporheic compartment and the stream water.