Session IV – "The First Rule of Intelligent Tinkering Is To Save All the Parts"
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Study on Ground Water/Surface Water Hydrochemical Interactions Under Baseflow Conditions Within a Headwater Tropical Catchment, Houay Pano, Lao PDR

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Abstract

Many streams among tropical headwater catchments are almost exclusively fed by groundwater discharge. Hence, the study of interactions between river courses and aquifers is of particular interest. The aim of this work was to define the main processes controlling the hydrochemical behaviour of solutes in stream-water within mountainous environments. To do this, measurements were conducted both on surface water and on groundwater of the Houay Pano catchment, Luang Prabang province, northern Lao PDR.

The field surveys were performed from May to August 2005, i.e. during the transitional state between dry and rainy seasons. Topographic (slope gradients), hydro-morphological (stream discharge) and physico-chemical parameters (electrical conductivity (EC), pH and temperature) were assessed monthly at 80 waypoints along the mainstream path. In addition, daily surveys were carried out in the stream and in three piezometer transects, and two specific monitorings focusing on temporal and spatial variations of EC, temperature and pH were conducted.

EC and alkalinity appeared to have a similar pattern of variation along the flow path, decreasing gradually in the downstream direction. EC and alkalinity behaviour was mainly related to carbonate precipitation enhanced by CO_2 degassing. pH variations were more complex; we hypothesized that 3 factors contributed to these multifold pH fluctuations: (i) the process of mixing of the stream-water with CO_2-enriched groundwater influx induced pH drops; (ii) the process of CO_2 degassing along steep streambed reaches with high shear stress induced pH rising stages; and (iii) the release of acidic compounds by biological activity along the stream lead to generalized pH decreases, with smooth diurnal and seasonal variability observed.

The cost-effective method using pH as a qualitative indicator shows high potential for detecting groundwater exfiltrating areas, particularly in streams where inflows are strongly heterogeneous.