Geophysical Research Abstracts
Vol. 14, EGU2012-9110, 2012
EGU General Assembly 2012

Boron and strontium isotopes to assess water origin and anthropogenic inputs during flood events. The Hérault River, S. France.

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The Hérault River (located in the south of France) is 150 km long and drains a medium-sized basin of 2500 km2 at its outlet in the Mediterranean Sea. The Hérault River has nine tributaries, most of which are located in the alluvial plain. While the head of the basin is covered by oak, beech and fir trees, in the middle part of the watershed typical Mediterranean vegetation prevails, and most of the alluvial plain is covered with vineyards.
The watershed is divided into three geological compartments: (1) The upper part is mainly composed by granitic rocks, schist, metalimestone and metadolomite (Palaeozoic basement); (2) In the middle, Triassic clay and sandstone with some evaporitic layers (anhydrite and gypsum) constitute the Mesozoic cover near the Malines Pb–Zn mining district and around the uraniferous Permian pelitic basin of Lodève. The upper layers are formed by Jurassic limestone with some dolomite, clay and calcareous marl. The Jurassic and Cretaceous limestones are folded, faulted and highly karstified; (3) Downstream, down to the Mediterranean sea, the alluvial plain is composed of tertiary and quaternary deposits.
The climate is typically Mediterranean and characterized by a highly irregular rainfall regime. Rainfall events are often short but very intense; causing flash floods that can be disastrous. The annual mean discharge at the outlet of the watershed between 1952 and 2006 was 44.3 m3/s, with a maximum measured discharge of 1300 m3/s, identified as the 10-year return flood (Gumbel law – September to October over 49 years; Agde Bassin Rond station).
The monitoring site is located at the outlet of the watershed. A water sampler device was automatically activated when the river discharge reaches 35 m3/s. Between October 2001 and December 2002 and then during January 2006, 7 flood events were automatically sampled with a maximum water discharge between 120 m3/s and 1300 m3/s, the latter, corresponding to the 10-year return flood, caused widespread flooding over the alluvial plain watershed.
Among the sampled floods, 3 contrasted events were selected for both Sr and B isotopic investigation. The origin of the water flux all along the flood events were constrained using Sr isotopes (87Sr/86Sr) together with major elements (Petelet-Giraud and Négrel, 2007). This study presents a coupled approach of Sr (87Sr/86Sr) and B (δ11B) isotopes to decipher anthropogenic versus natural inputs and to assess the anthropogenic impact (mainly wastewater effluents and/or fertilizers) during flood events.

Petelet-Giraud, E., Négrel, Ph., 2007. Geochemical flood deconvolution in a Mediterranean catchment (Hérault, France) by Sr isotopes, major and trace elements. Journal of Hydrology, 337, 224-241