Geophysical Research Abstracts
Vol. 14, EGU2012-10932, 2012
EGU General Assembly 2012

Rainwater chemistry and isotopic content in the French Basque Country

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The Northern Basque Country (Southwestern France) is subject to strong water needs in constant increase because of a rising population. Located 25 km from the Atlantic coast, the shallow aquifer of the Ursuya Mount (680 m ASL) is one of the main water supplies able to meet water needs. Unfortunately, this strategic resource suffers from a lack of knowledge about the recharge processes. A hydrological and hydrochemical survey was carried out since 2010 with the aim of enhancing the understanding of the behaviour of this aquifer, particularly through rainwater chemistry study. Rain gauges were disposed at four locations around and in the centre of the study area. Three collectors allowed the sampling of the total monthly height of bulk precipitation and one sequential collector allowed the sampling of the daily wet precipitation. This rainwater survey (height, majors ions, stable isotopes) was carried out between February 2010 and November 2011, which represents almost two hydrological cycles. The chemical and isotopic content of the 125 daily rainwater samples has been coupled with the corresponding air mass back trajectories to investigate the origin of the components. The trajectories were segregated into 5 main transport patterns by taking into account the regions crossed during the previous 72 h: 1) Northwestern part of Atlantic Ocean (exclusively marine origin); 2) Southwestern part of Atlantic Ocean (marine and Iberian Peninsula origin); 3) Northern Europe (continental origin); 4) Spain (exclusively Iberian Peninsula origin); 5) Southeastern (Southeastern Europe, Northern Africa and Mediterranean origin). Principal component analyses applied on the major ions components have shown that four major factors control the chemical composition of the precipitation at this place. The first factor (HCO_3-, NO_2-, PO43-, NH4+, K+, and Ca2+) is a mixed source of anthropogenic pollution and crustal material. The second factor (Cl-, Na+ and Mg2+) denotes a marine source. The third factor (SO42- and NO_3-) implies an urban source. Factor four (H+) is considered as an acid source. Though, the quantification of neutralizing potentials have clearly revealed below cloud processes in which nss (non sea salt) Ca2+, nns Mg2+, NH4+ and nns K+ are responsible for neutralization of anions. In order to define the global isotopic signal of the studied area, the weighted mean values of δ18O and δD were computed with all the available dataset, including daily and monthly rainwater samples. The calculated weighted means δD and δ18O are respectively -35.40 $\pm$ 0.38 ‰ and -5.80 $\pm$ 0.05‰Ṫhese data are in agreement with those of south-western of France. Meteoric water line of the Ursuya Massif is defined as: δD = 7.33 δ18O + 5.70 (r^2 = 0.94). The weighted mean deuterium excess is about 11.03 ‰ which is close to the value obtained for Atlantic precipitations (d = 10‰ and may show the influences of Mediterranean vapour in some samples (d = 14‰. These data will be confronted with the groundwater chemical and isotopic characteristics in order to improve the knowledge of the flowpaths in the aquifer of the Ursuya Mount.