Geophysical Research Abstracts
Vol. 18, EGU2016-8577, 2016
EGU General Assembly 2016


# Contribution of mountain streamflow to the groundwater recharge in piedmont alluvial plain. The Rheraya wadi case study (Marrakech, Morocco)

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The Haouz basin, located in the Central Morocco, is composed of two parts: the Haouz plain which contains the Marrakech city in the north and the High-Atlas mountains culminating at 4165 m in the South. The plain, covering a surface of 6000 km2, has a semi-arid climate characterized by low rainfall (∼250 mm/year) and high evaporative demand (∼1400 mm/year). The High-Atlas mountains receive more important precipitation either as rain or snow falls and encompasses the drainage basins of several intermittent streamflows (wadis) that cross the plain from south to north. Therefore within the Haouz basin the water resources have two main components: the wadis fed by mountains rain and snow fall and groundwater contained in the alluvial deposits of the plain. The mountains, constituted mainly by impermeable material, generate flush floods. When reaching the piedmont alluvial plain, the more important ones flow onto their floodplains and are partially derived for traditional irrigation. The seepage losses in this area might be an important source of groundwater. The present study aims to evaluate these losses along the Rheraya, one of the main wadis of the Houz basin. This is performed in several steps:
1) Conceptual modeling of the wadi's flows at a daily basis;
2) Several sampling campaigns of groundwater, surface water and rainfall, for hydrochemical and stables isotopes analyses. The sampling was performed along the Rheraya wadi in different places from the mountain valley to the piedmont and in some points within the irrigation area;
3) Continuous recording of groundwater level and electric conductivity in two wells close the streambed.
Results of the hydrologic conceptual modeling allow assessing the role of the snow melt in the hydrological functioning of the Rheraya wadi. In order to estimate the Rheraya streamflow losses to groundwater, firstly analyses of hydrochemical data are performed. According to these analyses, several geochemical end-members are identified both for surface water and groundwater. After that and using the chloride-mass balance method, a combination of some identified end-members gives various values of surface water losses to groundwater, which are explained regarding their hydrological and hydrogeological contexts. Finally the groundwater level and the electric conductivity monitoring are used to understand the direct exchange between flush floods and groundwater into the Rheraya streamflow system.