Geophysical Research Abstracts
Vol. 13, EGU2011-1336, 2011
EGU General Assembly 2011

Water Budget Changes under the A1b Climate Change Scenario for the Tahadart Watershed, Tangiers, Morocco.

Marco Antonellini (1), Eric Masson (2), Pauline Nella Mollema (1), and Abdel Khattabi (3)

(1) C.I.R.S.A. University of Bologna, Environmental Sciences, San Lazzaro di Savena BO, Italy (m.antonellini@unibo.it), (2) Université des Sciences et Technologies de Lille, Villeneuve d'Ascq, Cedex, 59655, France (eric.masson@univ-lille1.fr), (3) ENFI Ecole Nationale Forestière d'Ingenieurs, Rabat, Morocco (ab_khattabi@yahoo.com)

The current as well as the future water budget of the Tahadart Basin (Tangiers, Morocco) was calculated based on land use and climate predictions (scenario A1b, IPCC 2007). The retention basins in the Tahadart provide drinking water for Tangiers, a city of 410 000 inhabitants. Sustainable use of water resources is needed to guarantee the further development of the city and the coast. We used historical climate data series from the year 1945 to the year 2007 from ten weather stations to define the current climate of the Tahaddart. Because seasonal differences are very important in the Mediterranean climate zone, we defined a 'wet-season' (winter) from September through February and a 'dry-season' (summer) from March through August. The PRUDENCE project (2005) provided the climate data for the period 2070-2100. Compared with the reference period 1960-1990, there will be a decrease in annual rainfall from 755 mm to 524 mm, a decrease in wet-season rainfall from 610 to 389 mm, and a decrease in dry-season rainfall from 145 to 135 mm. The temperature changes predicted by the PRUDENCE data (2005) include an increase in average winter temperature from 12,6°C (reference period 1960-1990) to 14,3°C, an increase in average spring temperature from 15,4°C to 17,9°C, an increase in average summer temperature from 22,9°C to 25,9°C, and an increase in average fall temperature from 19,5°C to 22,5°C . We constructed the Tahadart land use map by means of Object-based image analysis (OBIA) defining eight different land uses: forest, horticulture and fruit, agriculture (rain fed), mineral extraction sites, natural areas, open water and wetland. For each different land use, the annual as well as the dry- and wet-season ET or evaporation was calculated using CROPWAT (Smith, 1992) and the Penman-Monteith equation.
The annual average crop evapotranspiration for rain-fed agriculture is going to increase from 816 mm (reference period 1960-1990) to 861 mm, from 61 mm to 64 mm in the wet-season, and from 755 mm to 797 mm in the "dry period". The total annual evapotranspiration for bare-soil and mosaic vegetation increases from 1059 mm (reference period 1960-1990) to 1118 mm (2070-2100 scenario A1b), from 344 mm to 363 mm in the "wet period", and from 715 mm to 754 mm in the "dry period" . The total annual open water evaporation for the reference period amounts to 1309 mm whereas under the A1b scenario it would amount to 1410.
The hydrologic deficit is here defined as the difference between precipitation and evapo(transpi)ration. The spatially varying precipitation and evapo(trans)piration were incorporated in a spreadsheet application that calculates the spatially varying hydrologic deficit. The calculations show that there is a strong increase in water deficit expected during the wet-season, especially in the mountainous central area of the Tahadart, where the retention basin is located. Also along the coast there is an increase in hydrological deficit foreseen for the wet-season. During the dry period, there is a relatively small increase in water deficit foreseen for 2070-2100. The wet season will become much less 'wet' and this may reduce the water supply towards the retention basins causing water shortage for Tangiers. Since surface water evaporation rates are high now and higher still in the future with less rain filling the basins, alternative storage places for water other than the retention basins should be considered.