1. INTRODUCTION
The current climate change can be defined as an alteration of the climate attributed directly or indirectly to human activity that alters the composition of the global atmosphere and it adds to the natural variability of the climate observed during comparable time periods. Today Science has determined, with a 95% certainty, that human activity is the dominant cause of the warming observed since the mid-20th century. In addition, it has been shown that global climate variations may affect specific systems of water resources. In this study, we analyze these climatic variations on useful rain (surplus of runoff Tt) of the Segura river basin, which currently has the highest rates of overexploitation of aquifers in Europe. Specifically, the statement of Hydrological Planning sets the natural water provisions in the Segura river basin will be reduced by 11% due to climate change.

3. MATERIAL AND METHODS

3.1. The series of monthly data of the hydroclimatic variables that determine the useful rain or surplus of runoff Tt were exported from the Integrated Water System (on MAGRAMA website), in the period 1940-2010 and for the Segura river basin. Then, the correlation between these variables using the software, based R, “Gini-Regression, Econometrics and Time-series Library (Gretl)” was shown. These variables were extracted from the “KNMI Climate Explorer database,” the climate change scenarios set by the fifth report of the Intergovernmental Panel on Climate Change (IPCC), the RCP2.6, RCP4.5, RCP6.0 and RCP8.5, in the period 2005-2050 entering the coordinates of the Iberian Peninsula. These variables were exported as maps that we geo-referenced with the software “ArcGIS10” to indicate therein the groundwater bodies of the Segura river basin. We estimate the average monthly variation of surplus of runoff Tt, over the Segura river basin in the period 2005-2050 under these scenarios of climate change. First, we exported from the “KNMI Climate Explorer” data of precipitation and temperature for the four scenarios. From them we found certain hydroclimatic variables needed to calculation of the surplus Tt. Then, we calculate the potential evapotranspiration (ETP), from temperature, using Haugens and Samani (1982). Finally, we calculated the surplus of runoff Tt with the hydrological model of Timmer (1977).

4. RESULTS

4.1. Analysis of the main components related to the surplus of runoff Tt

Correlation between monthly average total runoff (surplus of runoff) and certain hydroclimatic variables in the Segura river basin (period 1940-2010). The usual specifications were quadratic, cubic, du-Boss, semi-logarithmic quadratic, logarithmic quadratic, linear and quadratic. Best results (looking at p-value and R-squared) in the saturated setting with this setting:

Total runoff = b0 + b1 (P) + b2 (ETR) + b3 (P∙ETR) + b4 (T) + b5 (ETR∙T) + b6 (ETR ∙ T ∙ Mo) + b7 (T ∙ Mo) + b8 (P∙ETR ∙ T ∙ Mo)

4.2. Modification of precipitation, temperature and ETP due to different radiative forcing (global climate scenarios)


5. DISCUSSION AND CONCLUSIONS

5.1. Better correlation between hydroclimatic variables and useful rain or surplus of runoff Tt, saturated quadratic specification.

In the Iberian Peninsula, increase of average (up to 2°C) temperatures in the scenario with higher radiative forcing (RCP8.5), and decrease in average rainfall, with respect to the current, 36 mm/year (even in RCP2.6 scenario).

In the Segura river basin over the next 35 years: rainfall would range between the 438 and 366 mm/year according to different climate change scenarios. ETP will be between 1043 and 1107 mm/year (daily overestimation using Haugens and Samani, 1982) - surplus of runoff Tt in Segura river basin (period 2005-2050). Lower negative values in the scenario RCP8.5, RCP6.0 and RCP4.5. This could affect the recharge of aquifers and worsen the overexploitation of aquifers. Difficult to meet environmental objectives of Directive 2000-60/EC (for the years 2021 and 2027).

Failure research: regional climate change models to scale daily or hourly and rainfall-runoff models distributed as SWAT or RINAS to calculate the reduction in the surplus of runoff Tt (in the Segura river basin) and the recharge of aquifers.

REFERENCES
