Real evapotranspiration evolution in the southern of Iberian Peninsula

Matilde García-Valdecasas-Ojeda, Sebastiano de Franciscis, Sonia Raquel Gámiz-Fortis,
Yolanda Castro-Díez, and María Jesús Esteban-Parra
Applied Physics Department, University of Granada, Granada, Spain (mgvaldecasas@ugr.es, sebastdefra@ugr.es, srgamiz@ugr.es, ycastro@ugr.es, esteban@ugr.es)

Abstract

This paper analyzes the evolution of real evapotranspiration in the Guadalquivir basin, located in the south of the Iberian Peninsula in the last 30 years. The different components of the real evaporation are connected to the soil moisture content. These variables can be important when analyzing the intensity of droughts and heat waves, and particularly relevant for the study of climate change impacts.

The actual evapotranspiration data consists of simulations obtained with the hydrological model *Variable Infiltration Capacity* (VIC). This model is a large-scale hydrologic mode and allows the estimations of different variables in the hydrological system of a basin Land surface is modeled as a grid of large and uniform cells with sub-grid heterogeneity (e.g. land cover), while water influx is local, only depending from the interaction between grid cell and local atmosphere environment.

As input variables for VIC model will be used observational data of temperature and precipitation from Spain02 dataset. Additionally, estimates of actual evapotranspiration will be also analyzed using temperature, precipitation, wind, humidity and radiation as input variables for VIC, obtained from a dynamical downscaling of ERA-Interim data with the Weather Research and Forecasting (WRF) model. The simulations have a spatial resolution of about 9 km. The analysis will be done on a seasonal time-scale.

Only significant positive trends are found during autumn in the western part of the basin for the ETR obtained with VIC model.

Data and methods

- Real evapotranspiration data for Guadalquivir River (Figure 1) are obtained through *Variable Infiltration Capacity* (VIC) hydrological model, using as meteorological inputs daily precipitation and maximum and minimum temperature for the period 1980-2008.
- For the same period, ETR has been obtained from WRF simulations using ERA-interim as boundary conditions.
- VIC models land surface as a grid of large and uniform cells with sub-grid heterogeneity (e.g. land cover).
- Water influx is local, only depending from the interaction between grid cell and local atmosphere environment. Streamflow is calculated through a routing model.
- Observational daily streamflow data at different gauge stations and reservoirs in the Guadalquivir River during the period 1988-1997 have been used for VIC calibration (Figure 2).
- Observational precipitation and maximum and minimum temperature data from the SPAIN02 database have been used for calibration.
- Sen's slope and Kendall test are used to estimate trend values and their statistical significance.

Figure 1: Area and analysed gauge stations.

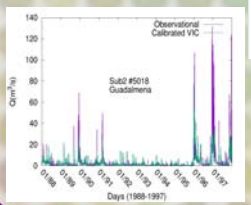

Figure 2: Observational and simulated streamflow for the 1988-97 period, for Guadalmena.

Results: VIC_ETR vs. WRF_ETR

Seasonal ETR

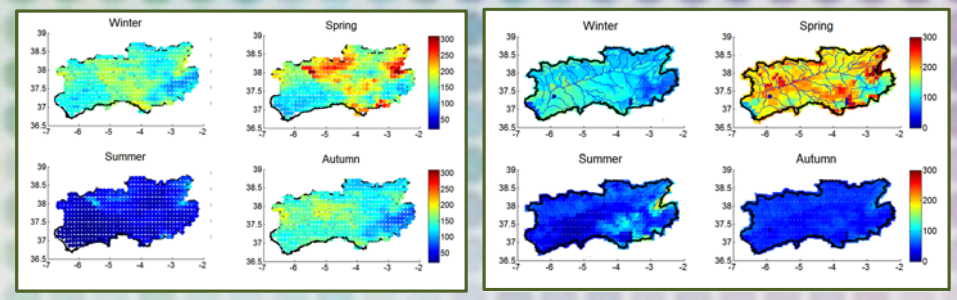

Figure 3: Seasonal mean values for ETR (mm) from VIC outputs (left) and WRF outputs (right) .

Trends

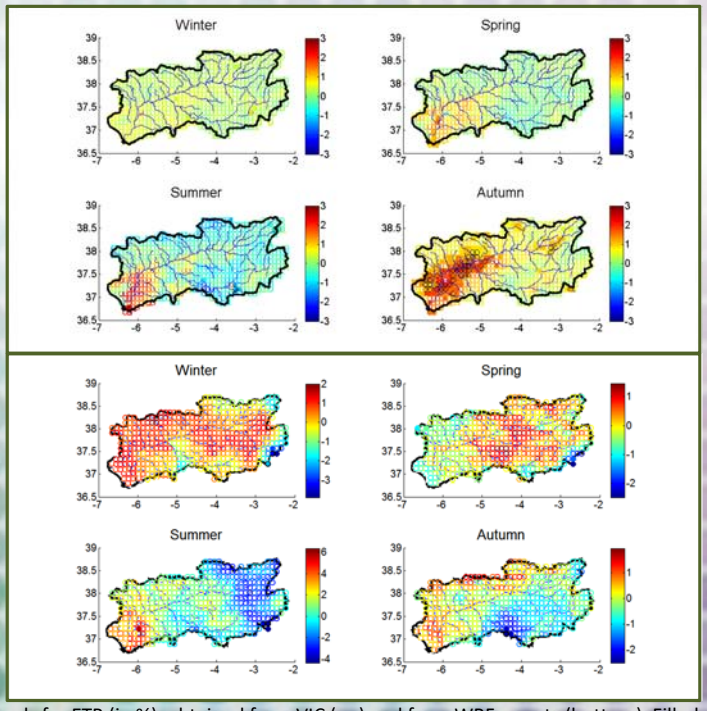

Figure 4: Trends for ETR (in %) obtained from VIC (up) and from WRF ouputs (bottom). Filled circles indicate significant trends at 90% confidence level, and black contour significant trends at 95% confidence level.

Conclusions

- ✓ ETR from WRF seems to show lower values for winter and autumn seasons and higher values during spring than ETR from VIC.
- ✓ Only significant positive trends are found during autumn for ETR from VIC outputs in the southwestern part of the basin, reaching values up to 2%.
- ✓ Opposite trends during winter and spring for VIC and WRF outputs are found.

• **Acknowledgements:** This analysis was carried out in the UGRGrid computer infrastructure (https://alhambra.ugr.es) at the University of Granada. This work has been financed by the projects **P11-RNM-7941** (Junta de Andalucía) and **CGL2013-48539-R** (MINECO-Spain, FEDER).