

Annual runoff assessment in arid Mediterranean watersheds under the Budyko framework

Francesco Viola (1), Domenico Caracciolo (2), Angelo Forestieri (2), Dario Pumo (2), and Leonardo Noto (2)

(1) Università di Cagliari, Department of Civil, Environmental and Architectural Engineering, Cagliari, Italy

(hydroviolante@gmail.com), (2) Università di Palermo, Dipartimento di Ingegneria Civile, Ambientale, Aerospaziale, dei Materiali, Palermo, Italy

The solution of many practical water problems is strictly connected to the availability of reliable and widespread information about runoff. The estimation of mean annual runoff and its interannual variability for any basin over a wide region, even if ungauged, would be fundamental for both water resources assessment and planning and for water quality analysis. Starting from these premises, the main aim of this work is to show how using the Budyko framework is possible to map the mean annual surface runoff and derive the pdf of the same variable in arid watersheds. As a case study, the entire island of Sicily, Italy, is here proposed. First, time series data of annual rainfall, runoff and reconstructed series of potential evapotranspiration have been combined within the Budyko curve framework in order to obtain regional rules for rainfall partitioning between evapotranspiration and runoff. Then this knowledge has been used to infer long term annual runoff at point scale by means of interpolated rainfall and potential evapotranspiration. More specifically, the long term annual runoff map has been obtained at each point of the drainage network, averaging the upstream runoff using advanced spatial analysis techniques within a GIS environment.

Furthermore, two methods are here proposed to derive the distribution of annual streamflow, under the assumption of negligible inter-annual change in basin water storage. The first method uses Montecarlo simulations, combining random rainfall and potential evapotranspiration extracted from independent opportune distributions. The second method, through a simplification of the Budyko curve, analytically provides the annual streamflow distribution as the derived distribution of annual rainfall and potential evapotranspiration. The latter allowed to derive runoff maps for assigned non exceedance probability even in non-gauged locations. For both the proposed methods, results have been tested at several gauging stations.