Comparing available rainfall gridded datasets for West Africa and the impact on rainfall-runoff modelling results, the case of Burkina-Faso

Gil Mahe[1*], Sabine Girard[1], Mark New[2], Jean-Emmanuel Paturel[3], Agnes Cres[1], Alain Dezetter[3], Claudine Dieulin[1], Jean-François Boyer[1], Nathalie Rouche[1] and Eric Servat[1]

[1]HydroSciences, Case MSE, University Montpellier 2, 34095 Montpellier Cedex 5, France

[2]School of Geography, Centre for the Environment, University of Oxford, South Parks Road, Oxford, OX1 3QY, England

[3]Institut de Recherche pour le Developpement, BP 2528 Bamako, Mali

Abstract

Monthly rainfall data in Burkina-Faso, West Africa, over a period of 77 years are extracted from three different gridded data sets, available either on the web: *CRU* (Climatic Research Unit, Norwich, UK), *SIEREM* (HydroSciences Montpellier, France), or from the National Meteorological Center of Burkina-Faso. With a view to modelling the runoff-rainfall relationship at the monthly time step, these data are used at the 0.5°*0.5° scale. Despite mean, minimum, standard deviation and inter-annual variability being very similar for the period 1922 to 1998, the three gridded data sets used show an important spatial variability of values with time, and some differences are observed which lead to significantly different runoff-rainfall simulations. Comparison of the rainfall grids has shown that differences between the precipitation grids are more pronounced during years when the rainfall is lower; this also applies to areas where the rainfall is lower. The three different rainfall grids produce differences in mean rainfall of 4 to 11%, depending on the grids that are compared. While these results are obviously specific to the station networks and interpolation method used, they provide an indication of the differences that can arise.

It is recommended that as many stations as possible are used to better assess areal rainfall. These biases have a strong influence on the results of the runoff-rainfall modelling (using the GR2M conceptual model): the Nash criteria show differences of about 20% and calculated flow of 30% to 40%. This study illustrates the levels of uncertainty when using available rainfall gridded data sets, for rainfall-runoff studies in West African developing countries, which is important in the context of predicting water resources for the future from the GCM outputs for the 21st century.

Keywords: Burkina-Faso, database, runoff, rainfall, rainfall-runoff modelling, West Africa