Testing the existing and modified CropSyst modelling solutions under extreme weather events with maize in South Africa

[1]Robert Mangani, [2]Eyob H. Tesfamariam

[1,2]Department of Plant Production and Soil Science, University of Pretoria, Private Bag X20, Hatfield 0028, Pretoria, South Africa

Abstract

Extreme weather events are thought to have a significant impact on future agriculture. Given the chance to have more intense and frequent extreme events in the future climate, it is important since now to try to quantify the damage that they will have on future agricultural production through the use of crop models. The objective of this study was to find out if CropSyst modelling solutions (the modified and the existing) are well able to simulate biomass and grain yield under extreme weather conditions. Secondary data from field experiments that were carried out at the East Rand Water Care Works (ERWAT), Johannesburg, Gauteng, South Africa was used to validate the model. CropSyst modelling solution that had been deployed in Biophysical Model Application (BioMA) version 0.3.6 was made use of in carrying out this task. CropSyst modelling solution was in two structures i.e. one with the existing CropSyst modelling solution and the other one with a modified CropSyst component to cater for the extreme weather events. The modified CropSyst modelling solution slightly improved the model performance though both simulations were poorly estimated. The RMSE for model simulations of grain yield using the existing and modified CropSyst modelling solutions were 3.18 Mg ha^{-1} and 3.04 Mg ha^{-1}, respectively. Similarly, the RMSE for aboveground biomass production were 6.12 Mg ha^{-1} and 5.90 Mg ha^{-1} using the existing and modified CropSyst modelling solutions, respectively. The R^2 for both aboveground biomass and grain yield was very low (< 0.1) indicating poor model performance. Generally, there was a 2-4% improvement in model aboveground biomass and grain yield prediction capability by the modified CropSyst modelling solution compared with existing one.