

Abstract

Global greenhouse gases increase could be a threat for the sustainable agriculture since it might affect both green water and air temperature. Using the outputs of 15 general circulation models (GCMs) under three SRES scenarios of A1B, A2 and B1, the projected effects of climate change on annual, seasonal and monthly precipitation (P), cardinal temperatures (T) and potential evapotranspiration (ETo) were analyzed for five climatic zones of Iran. In addition, the probable effects of climate change on agriculture were studied regarding major crops grown in the country. Data obtained from the GCMs were downscaled using LARS-WG for 52 synoptic stations up to 2100. Also, an uncertainty analysis was done for the projected P, T and ETo associated to GCMs and SRES scenarios. Based on station observations, LARS-WG was capable enough for simulating both P and T for all climatic zones. The majority of GCMs as well as SRES scenarios projects a positive change in the considered climatic variables, ETo and green water deficit (GWD). In all the climatic zones, wet seasons has a higher P increase than dry seasons, with the highest P increase (27.9-83.3%) corresponding to hyper-arid and arid regions. A few GCMs projects a P reduction mainly in the Mediterranean and hyper-humid regions. The highest increase (11.2-44.5%) in minimum T occurred in Mediterranean regions followed by the semi-arid regions regarding the concurrent increase in maximum T by 2.9-14.6%. Rainy seasons as well as the hyper-humid regions had the highest uncertainty in P while summer season and the hyper-arid regions were corresponded to the lowest uncertainty in cardinal T. 5.8-19.8% increase in annual ETo, drier condition of wet seasons as well as 2.3-56.4% increase in ETo during December-March period well represent a probable increase in the hydrological water requirement in Iran under global warming. Regarding GWD, Iran will experience more arid years requiring 113.7×10^3 - 576.8×10^3 Mm³ more water to supply annual atmospheric water demand. Semi-arid and Mediterranean regions will be the most vulnerable part of the country due to 1-38.6 % increase in annual GWD under climate change. In addition, water scarcity for irrigated agriculture will enhance in all climatic zones due to an increase of 0.9-41% in June-August GWD. However, rain-fed agriculture might be less affected in the hyper-humid and Mediterranean regions because of 1.1-105.3% reduction in GWD during wet seasons. Nevertheless, uncertainty analysis revealed that given results for monthly timescale as well as those for times and regions with lower ETo will be the most uncertain. However, since semi-arid and arid regions are responsible for more than 70% of total cereal production in Iran, agriculture sustainability might be threatened under elevated cardinal T. Thus, achieving food and water security in the country highly merit further investigations for developing adaptation solutions to cope with the changing climate.

Key words : Climate change, General Circulation Models Of The Atmosphere, Reference Evapotranspiration, uncertainty analysis ,green water deficit



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