**Investigating the Changes in the Starting and the Ending of Effective Colds and Freezing in Agriculture under Climate Change Conditions in North - west of Iran**

**Extended Abstract**

**Introduction**

Cold and frost is one of the most important climatic parameters in the agricultural climate, and the damage caused by them reduces the possibility of producing many agricultural and horticultural products in vulnerable areas. Therefore, it is important to check the time of occurrence and predict their future changes. For this purpose, general atmospheric circulation (GCM) models are designed that can simulate future climate parameters. In this study, the output data of the HadCM3 general circulation model under two A2 and B1 emission scenarios was analyzed by the LARS-WG statistical model in 21 synoptic stations located in North-west of Iran, and its results were obtained during the base period (1980-1980) and decades 2020 (2030-2011) for the two climate variables, the minimum temperature and maximum temperature were evaluated. Then the history of the first and last frost and cold of autumn and spring was extracted and their date of occurrence was calculated in the future. The results showed that due to the increase of minimum and maximum temperatures in the region, in all of the study stations, the effects of climate change will be the first frost and the late fall cold, and the last frost and cold weather will occur earlier and the duration of the cold and freezing season in The area will also be reduced. The results of this study can be used to manage different agricultural sectors.

**Methodology**

In this study, in order to determine the start and end time of frost and cold in future periods, first, the temperature changes were studied using the HadCM3 model with the application of LARS-WG microscopic model. To calibrate and verify the accuracy of the LARS-WG model, the model was first implemented for the basic statistical period (2010- 1980); then the model outputs with observational data (1980-2010) of the studied stations Were compared.

After assessing the LARS-WG model and ensuring its appropriateness, the predicted model data was analyzed for the two scenarios A2 and B1 using the HadCM3 model. In order to study the changes in the beginning and the end of the cold and frost period in the study area, the minimum temperature data were used as daily and average two scenarios A2 and B1 of HadCM3 paired oceanarial model (2011-2030-2011)

**Results and discussions**

In this research, the study of the status of frost and snow in 21 weather stations in the northwest of the country is affected by the phenomenon of climate change. First, the climate change situation at the study stations using the HadCM3 global model under two scenarios A2 and B1 with the application of the model The LARS-WG microscopy was investigated. After the model was evaluated for the base period (1980-10107) and the accuracy and accuracy of the model were determined, the minimum and maximum temperature variations in the future period (2011-2030-2011) were considered, which resulted in an increase in the monthly average of the minimum And the maximum daily temperature in the upcoming period is up to about 0.8 degrees Celsius. Accordingly, the study of the condition of glaciers and chimneys in most of the studied stations shows that the first frost and autumn frost in the coming period are earlier than before and that the cold and the frostbite will end earlier. Also, the length of the cold and freezing period is decreasing, which can reflect the consequences of climate change at study stations. In fact, based on A2 and B1 scenarios, the time of the occurrence of the first early glaciations of the fall occurs 2 to 9 days later. Based on scenarios A2 and B1, the last frost of late spring also ends 3 to 10 days earlier in the region, however, the duration of the ice age will decrease in all stations. Based on the scenarios A2 and B1, the maximum changes in the minimum temperature based on the scenarios studied in the study area are based on the average scenarios in this decade related to Abhar, Ardebil, Khoy and Urumieh stations at 0.8 degrees Celsius.  
The results of this study are based on studies (Grasick and Dodwilich, 2015) in Poland (Medela et al., 2016) in Texas (Hosseini and Ahmadi, 1395) in Saqez (Aqa Shariatmadari et al., 1395) in western Iran Sobhani et al., 1396) in Ardebil (Khalili et al., 1396) is in Iran. According to the results of this study, the maximum temperatures will increase in the studied area, which can increase evaporation and, as a result, reduce water reserves and increase the need for aquatic plants, reduce snowfall, spread of pests and diseases , Drought, etc. in the area. Also, with the increase in the average of the minimum temperature, the yield of some products that need to be cold during the period of growth and production decreases. Therefore, the authorities and planners in different sectors of agriculture, natural resources, etc. should adopt the necessary guidelines for the new climate conditions.

**Keywords:** Climate change, Cold, Frost, Lars-WG, Frost and cold, Scenario A2 and B1,