



***Simulating the Future State of Erosion and Sedimentation under the Influence of
Climate Change
Case Study: Hajiler River Basin***

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1-Introduction

Evaluating and predicting erosion and sediment changes under the influence of climate change and its possible consequences on the basin's natural and human processes will greatly help solve the challenges of managers and environmental planners in future periods. The issue of climate change is so important that the World Meteorological Organization (WMO) in 1987 emphasized the need for research on the impact of climate change on water resources. SWAT and WEPP process models are among the applied models. Many erosion and sedimentation simulation projects have been carried out worldwide using these models. In this research, the SDSM climate model was used for the low scale of climate statistics, and SWAT semi-physical, semi-distributive hydrological models and WEPP distributive model were used to evaluate erosion and sedimentation changes under the influence of

2-Methodology

The study field is Hajilar watershed in East Azerbaijan province, with an area of 106800 hectares, which is located in the geographical coordinates of length 46°01'48" to 46°46'13" east and latitude 38°26'13" to 38°49'39" north. This research used version 5.3 of the SDSM model, three scenarios RCP8.5, RCP4.5, and RCP2.6 from the fifth report of the Climate Change Board to use the large-scale data of general atmospheric circulation models at the point and station scale at the basin level. First, the output of the models was downscaled using station data. Then, erosion and sedimentation changes under the influence of climate change in the Hajiler watershed were simulated using WEPP and SWAT models. Examining the simulation results in the sedimentation rate of the models showed that in the studied basin, the GeoWEPP model with the selection of the domain method has a suitable level in estimating the sedimentation rate compared to

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observational statistics. The final model was selected to predict the sedimentation rate of the mentioned period of the basin. The next step examined the results of changes in the variables in the horizon of 2040 compared to the base period (1986-2005). Finally, the predicted data under the three scenarios RCP8.5, RCP4.5, and RCP2.6 were introduced to the GeoWEPP model, and the erosion and sediment changes under the above three scenarios were estimated and predicted in the model.

3- Results and Discussion

RCP statistical microscale exponential model was used to investigate the temperature changes and predict the temperature of the Hajiler River basin. One of the most important steps of the statistical exponential microscale model is the selection of dominant variables. This issue is because the model's specifications and results are directly affected by the independent variables. All observational statistical data from 1986 to 2005 were assigned for calibration after selecting the best predictors because SDSM5.3 uses a regression relation and calculates all parameters. These calibration results show no difference between the values of the baseline data and the values estimated in the model's temperature data but offer more differences between the precipitation and temperature data. The results show a relative increase in precipitation for the RCP 2.6 and RCP4.5 scenarios and a decrease in rainfall for the RCP8.5 system in the next period compared to the base period. Table 1 shows the estimated values of sedimentation by the mentioned model using the domain method in the future period.

Table (1): Estimated amounts of sediment by GeoWEPP model using the domain method in the future period

Parameters	rcp2.6	rcp4.5	rcp8.5
total precipitation(T/Y)	515587.31	528136.50	492181.48
Specific sediment (T/H/Y)	4.83	4.95	4.61
Changes percentage	1.97	4.45	-2.68

4-Conclusions

This study investigated erosion and sediment changes due to climate change in the Hajiler River basin from 2020 to 2040. Scenarios RCP2.6 and, RCP4.5, RCP8.5 were used for the statistical exponential microscale. Climatic variables of rainfall and temperature were studied as the two main climatic variables of the region. SWAT and WEPP models were used to simulate the sediment of the Hajilar watershed for future periods using the climatic model outputs. The WEPP model determined that the range method is closer to the observed sediment amount by comparing the output results of different sediment

estimation methods. By loading climatic information, the various scenarios mentioned in the proposed models and the estimated sediment rate up to the horizon of 2040 were determined. According to the simulation results, due to these changes, appropriate conservation and watershed management measures should be taken in the basin and thus reduce the rate of soil erosion in the future

Keywords: Erosion and sedimentation, SDSM, WEPP, SWAT, Hajilar River, Northwest of Iran

5-References

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