Comparison of two MPSIAC and MMF models in soil erosion mapping of Ardebil Agh Gouni watershed

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Extended abstract

1- Introduction

Soil erosion is the most important cause of land degradation and the cause of water loss, soil loss, sedimentation in water resources, and maximum flood intensification (Liu et al., 2019). Models are the most important tools for estimating and mapping of erosion at the watershed level. As the experimental models are dependent on used coefficients and region conditions, physical models based on the soil erosion process more accurately predicting soil erosion development (Yuan and Yu, 2017). The MPSIAC model is one of the most important experimental models that is widely used to estimate soil erosion in Iran's watersheds, also reported in literature the Morgan Morgan Finney (MMF) is one of the most efficient physical models in soil erosion estimation. In this study, MPSIAC experimental model and MMF physical model were used to estimate the erosion and determine its distribution at Ardebil Agh Gouni area and compared the efficiency of two models in estimating soil erosion.

2- Methodology

Agh Gouni watershed with an area of 1800 hectares located at 10 km south of Ardebil city was selected as the study area. At 100 points of the watershed with 300m intervals, soil sampling and field measurements of vegetation, soil and rock cover percentage were done and field data required for MPSIAC and MMF models were obtained. Soil erodibility index was determined by Williams et al (1983) by measuring the percentage of sand, silt and clay particles as well as the percentage of organic carbon, bulk density and particle density of soil samples. Precipitation and hydrology data were also obtained using meteorological data and estimated runoff using curve number (CN) method. Geological and topographic information was also obtained from the maps. Field visit, interpretation of aerial photos, and satellite imagery were performed to identify the watershed and determine the status of erosion. With soil, runoff, topography, geology and meteorological data, required inputs for the two models were obtained and soil erosion estimation was performed for 100 selected points at the watershed. Then, soil erosion interpolated between the points by inverse distance weighting (IDW) method and prepared soil erosion map of watershed.

3- Results

The results showed that the means of soil erosion in the studied area was estimated by MPSIAC and MMF model of 5.06 and 3.79 ton/ha/year, respectively. Also, the erosion map obtained from the estimation of MPSIAC model showed that higher erosion rates occur in areas with high slope and greater gully erosion density. The erosion map obtained from the estimation of MMF model also showed that there is more agreement between surface runoff

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flow and annual erosion estimation with this model. In the MMF model, only surface erosion caused by runoff and raindrops is modeled, while in MPSIAC, in addition to surface erosion, gully erosion is also considered as one of the 9 factors in the scoring model. Therefore, the estimated result by this model is higher. In the erosion map of the MMF model the least estimation of erosion is related to the upstream of the watershed in the south and west of the watershed, which has minimal runoff flow in these areas and has relatively flat topography with respect to the slope map, so in this area the kinetic energy of the raindrops is the domain reason of soil erosion. As the outflow portion of the watershed gradually increases the effect of runoff to soil erision. It was also observed that the kinetic energy factor (E) of the MMF model was uniform in most parts of the watershed and did not vary significantly, while the surface runoff volume factor (Q) from the upstream to the downstream and outlet of watershed gradually increased, which is the result of an increase in volume and velocity of runoff to outlet side.

4- Discussion & Conclusions

It was generally observed that the estimation of soil erosion with MPSIAC model is more than MMF model and due to the use of gully erosion as one of the factors of erosion, the erosion distribution with this model is very consistent with the gully erosion distribution. Therefore, although the MPSIAC model can be used to estimate long-term erosion in the region, estimating the annual erosion that usually results of sheet and rill erosion the MMF model is more accurate. As well as observed to obtain annual erosion distribution map, using the MMF model that is the basis of estimating rainfall and runoff energy is more accurate.

Key Words: Agh Gouni, Erosion Estimation, Erosion Map, Physical Model.