GIS 자료를 이용한 용담호 유역의 유사전달률 평가
The evaluation of SDR of Yongdam basin using GIS data

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요 약

This study builds a sediment rating curve using the measured sediment yield and the simulated soil erosion by a GIS-embedded empirical model. Then the structured sediment rating curve is used to determine the SDR on a basin scale in southern Korea. The whole data (year of 2002-2008) are divided into two groups and the first group (year of 2002-2005) is used for calibration, while the other is used for validation.Two cases (rainfall amount and rainfall intensity) are analyzed to consider the rainfall runoff erosivity factor in simulating soil erosion. The results show the derived SDR provides reasonable accuracy and rainfall intensity gives better performance in calculating soil erosion than rainfall amount.

연구내용

Soil erosion is one of the major hazards threatening the productivity of farmlands. The amount of sediment carried in the fluvial system is usually governed by the availability of the upstream supply from watersheds rather than the transport capacity of rivers. Upland erosion pollutes surface waters and often causes serious problems when deposition occurs(Frenette and Julien, 1987). This study selects a RUSLE model that involves GIS data and that is usually used in basins. RUSLE is the advanced experimental equation of USLE (Loss model in existing agriculture area). DEM, soil, land cover and slope data were used to calculate soil erosion in GIS environment.

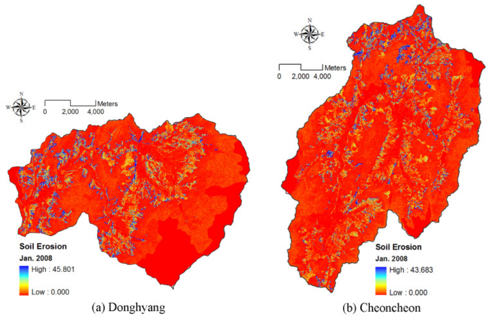

Figure 1. Soil erosion map

Also, a sediment rating curve was built on the basis of field measurement (212 sample points for Donghyang and 234 sample points for Cheoncheon) during the period of 2002~2008. Then sediment yield data for Donghyang and Cheoncheon basins were derived from the sediment rating curves.

The USLE calculated soil erosion for both Donghyang and Cheoncheon basin, and the corresponding soil erosion is shown against measured sediment yield at each site. As mentioned earlier, the effect of rainfall amount and intensity was melt into the rainfall runoff erosivity factor, and compared for estimating soil erosion. The coefficient of determination (R^2) between the simulated soil erosion and the measurement sediment yields with rainfall amount are 0.427 for Donghyang and 0.667 for Cheonchen, but the values with rainfall intensity are 0.873 and 0.927 respectively.

The data are divided into two groups: one for calibration during 2002-2005 (48 months) and the other for estimation during 2006-2008 (36 months). The first data group (2002-2005) was used to derive the SDR with an aid of soil erosion calculated by the USLE and the measured sediment yield. The mean SDR with rainfall amount is 6.273 and 3.353, respectively, while 4.799 and 2.874 for both sites. But the standarddeviation (STD) with rainfall intensity is 0.930 and 0.407, which is much less than that with rainfall amount (3.746 and 2.090) for both sites. Hence the coefficient of variation with rainfall intensity is less (0.19 for Donghyang and 0.14 for Cheoncheon).

Now assuming that the mean values of the SDR during the calibration periods are representative values for each site, the simulated sediment yield is validated against the measured sediment yield during the period of 2006-2008. As shown in figure 8, the R^2 and EI with rainfall intensity are higher as 0.868 and 0.865.

Based on the results, the SDR derived from the sediment rating curve provides reasonable accuracy, and the simulation of soil erosion with rainfall intensity gives better performance.

Obviously, the accuracy of the results shown in this study strongly depended on the model selection for soil erosion, the quality of geospatial data, measurement accuracy, and the basin characteristics. To some degrees, error may be different for every new basin of interest, but the method used herein should work anywhere else.

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