

A Modified RUSLE model to estimate the sediment yield in the Huangfuchuan Watershed

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Abstract:

The sediment transport capacity and check dam trapping efficiency modules were added to the RUSLE model in order to compute sediment yield from soil loss data. The modified model was applied in the Huangfuchuan Watershed in the northern Loess Plateau as a case study. The simulated monthly sediment load showed good agreement with recorded observations at the Huangfu station, with the Nash-Sutcliffe coefficient (NS) and correlation coefficient (R^2) higher than 0.70 during 1991 to 1999 for model calibration. However, model validation from 2000 to 2009 (no measurement data was available in 2005) provided lower NS and R^2 . Seasonal fluctuations in sediment load was well simulated in most cases. However, predicted sediment loads had higher peaks than the observations. This likely indicates insufficient accounting for the sediment-trapping efficiency of the watershed. The following trends were generally noted:

- The area with the highest soil loss was the Pisha stone and sandy region with a mean annual erosion of more than 15000 t/km²/a due to its steeper slopes and low vegetation cover.
- The area with the least soil erosion was the flat alluvial plain with a high vegetation cover where mean annual soil loss was less than 2500 t/km²/a.
- Comparing the mean annual soil erosion for different land use types in the watershed under similar precipitation conditions shows that Pisha stone > sandy region > arable land > grassland > woodland.
- Check dams in the Huangfuchuan watershed trapped approximately 42 million t of sediment, which is almost equal to the average annual sediment load at Huangfu station during 1955-2010.