Event-based, Water-induced Soil Erosion Modeling for Medium Watersheds in Yen Bai province, Vietnam Using the KINEROS2 Model

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A brief introduction to water soil erosion problem in Vietnam
Water Soil Erosion Assessment and Flash Flood Prediction for the Tropics in Northern Regions of Vietnam

Study site

- Nam Kim area is 268 km$^2$, Nam Khat is 74 km$^2$
- Annual average temperature: 22 °C, humidity: 83 – 87%
- Annual mean precipitation: from 1365 to 1570 mm
- Mean elevation is 900 meters
- The terrain is steep with a dense drainage network
- LULC consist of 37% forest, 28% Shrub, 21% agriculture, 6% barren, 4% grassland and 2% water bodies
- Annual soil erosion: 7.8 ton h$^{-1}$ y$^{-1}$
Method

- The Kinematic Runoff and Erosion model (KINEROS2), Smith et al., 1995
- Splash and hydraulic erosion
- Upland and channel erosion
- For more details see Woolhiser et al., 1990
- Model simulation, sensitive parameter test, model validations and calibration
- Model input preparations, result analyses were done in ArcGIS
Parameterizations

- Yen Bai digital soil map (MapInfo, 1999)
- The Digital Elevation Terrain (DEM) was 10x10 meter resolution provided by the Vietnam Natural Resources and Environment Corporation in 2009

Parameterizations

- LULC: Land Sat TM, 30x30 m resolution, 7 bands reflection
- Satellite rainfall
- Radar rainfall
Results

Model validation

- $K_s$ ranged from 4.3 to 11.5,
- $S$ was set at 0.46
- $N$ ranged from 0.04 to 0.1
- Nash–Sutcliffe efficiency (NSE) of 0.78 for the use of Satellite rainfall and 0.71 for Radar rainfall

Comparing the influences of different rainfall inputs on model’s results of sediment yield rate estimated for the planes and the streams
Results

Peak sediment flow estimated at the outlets of Nam Kim (a) and Nam Khat (b) with variations of Plane roughness (R).

Evaluated total channel discharge for Nam Kim and Nam Khat watersheds with plane Ks alternations and radar rainfall input.
Results

- Bigger CSAs resulted in lower plane sediment yields.
- Channel SeFs dropped more significantly than plane SeF when the CSAs were enlarged.
- The SeF values plunged dramatically in down-stream areas.
- The watershed was simplified due to larger CSAs and might result in less precise outputs.

Discussions

- The use of the KINEROS2 could help better understanding the soil erosion processes.
- The model presents its ability to generate the river discharge closely to field measured data - more reliable results.
- Parameter sensitive test was crucial for model calibration in term of output convergence, model outputs and better understanding model’s behaviors.
- The CSAs defined the spatial watershed modeling was found important for soil lost estimation of the model.
- Reduction of vegetative cover resulted in growing the soil erosion rates.
- Scale problem.
THANK YOU FOR YOUR ATTENTION ANY QUESTIONS?