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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



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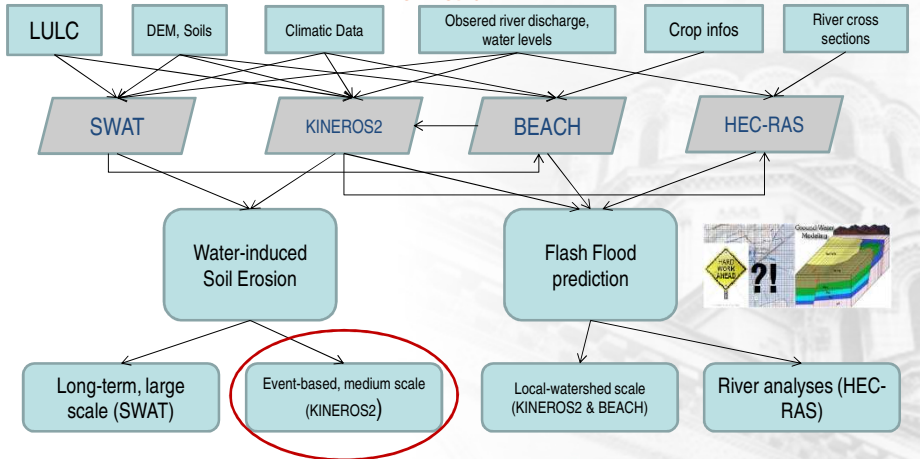




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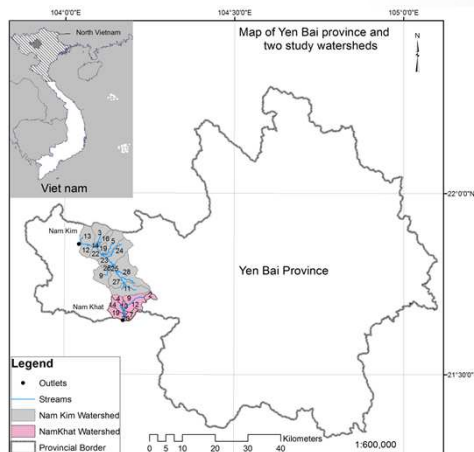
Water Soil Erosion Assessment and Flash Flood Prediction for the Tropics in northern Regions of Vietnam



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Study site



- Nam Kim area is 268 km² Nam Khat is 74 km²
- 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

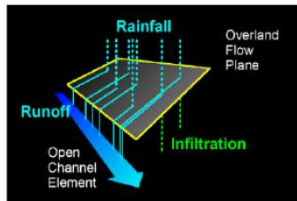




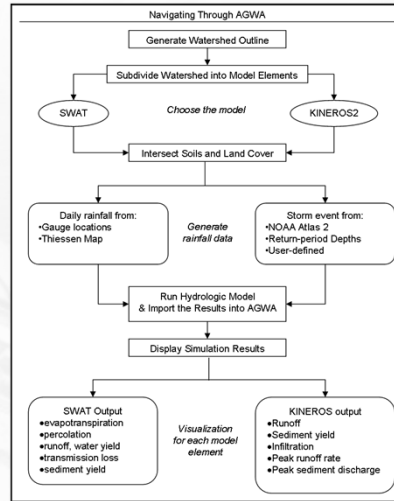
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Method



A schematic representation of the KINEROS2 program



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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



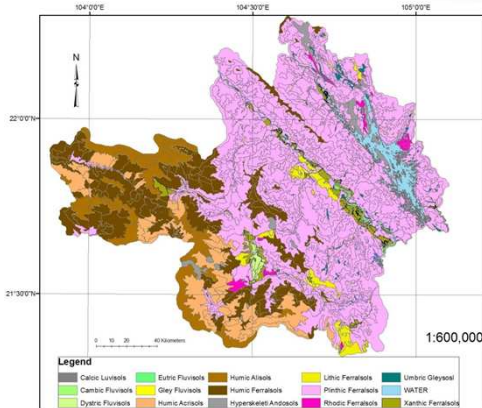


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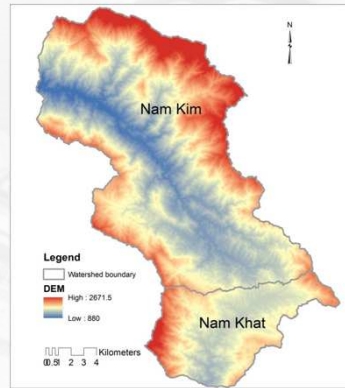
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Parameterizations

- 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



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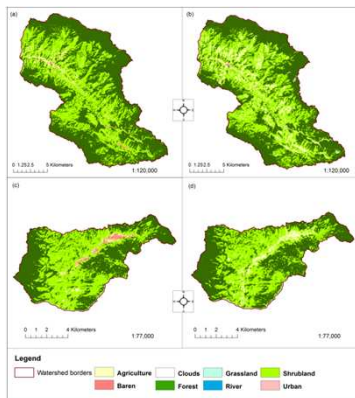


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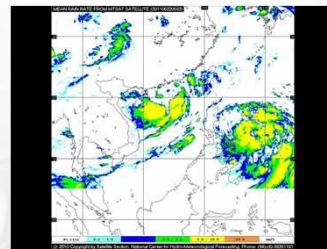
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Parameterizations

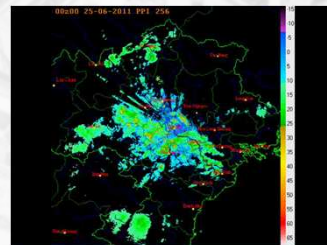
- LULC: Land Sat TM, 30x30 m resolution, 7 bands reflexion



Satellite rainfall



Radar rainfall



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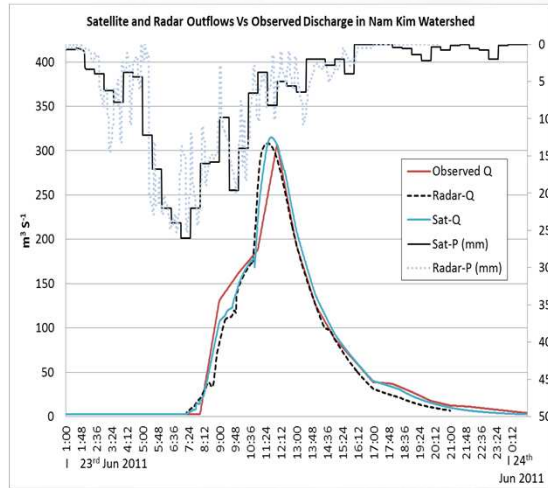
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Results

Model validation

- ❖ Ks ranged from 4.3 to 11.5,
- ❖ the 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



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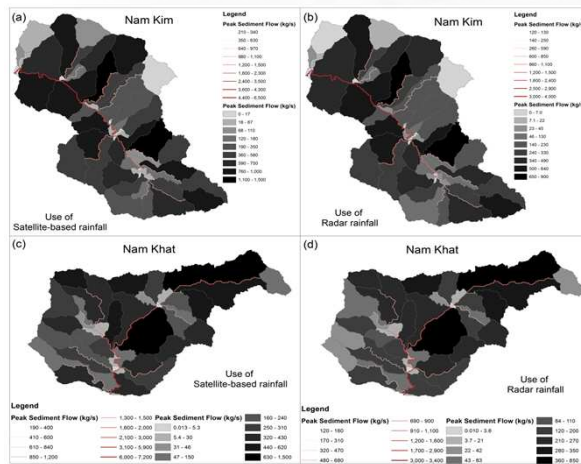


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Results

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



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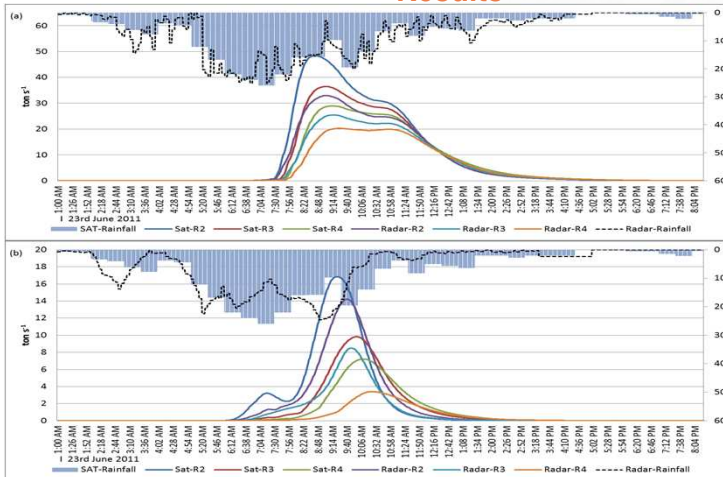




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Results



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



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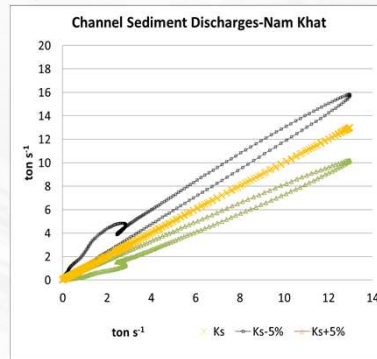
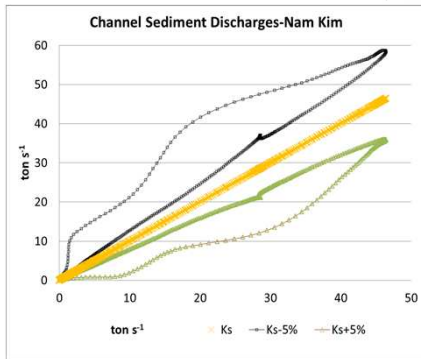


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Results

Base Ksat Vs base Ksat+5% and -5%: Increasing and declining just in SeF volume



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



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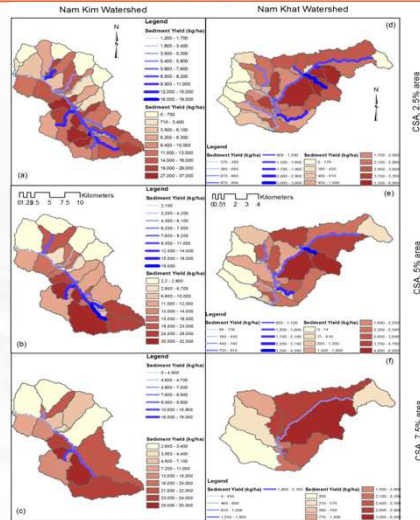


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Results

- 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 werer simplified due to larger CSAs and might result to less pecise outputs



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Discussions

- The use of the KINEROS2 could help better understaning 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





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THANK YOU FOR YOUR
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