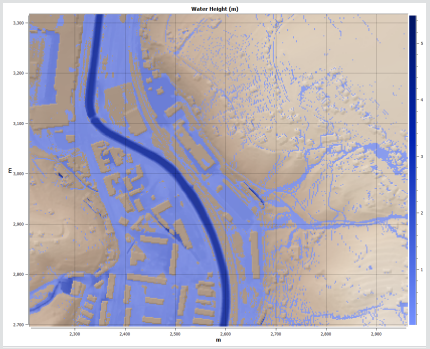
FACTSHEET RISK ASSESSMENT AND MAPPING ACTIVITIES

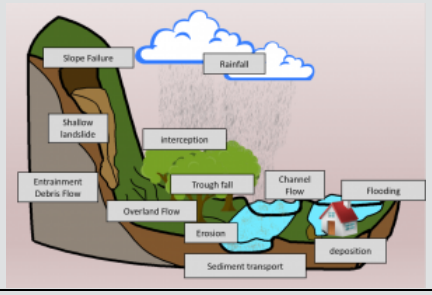
Heavy rain hazard map (hydrodynamic simulations with OpenLISEM)

Where was it implemented?

Germany, Saxony, Meißen

Map example:





Problem/background

Parts of the city of Meißen were affected by an intensive heavy rainfall event on May 27th 2014 that caused damages in the range of more than 4 million €. Future events of a comparable intensity in other parts of the city are possible. Currently there exist no information on the spatial distribution of water levels and flow velocities resulting from a heavy rain event. To help especially the city planning department when dealing with new developments, hazard maps are recognised as useful tools during the planning process.

A special aspect that can be found when urban areas are surrounded by agricultural land, is the erosion of soil by the flood water and its transport to the built-up areas. This topic can be addressed with soil erosion models.

Description of methodological background and outcomes

OpenLISEM is a spatial hydrological model based on raster geometries that simulates runoff, sediment dynamics (erosion, transport and deposition) and shallow floods in rural and urban catchments. It is an event-based model that can be used for catchments from 1 ha to several 100 km². The model is designed to simulate the effects of detailed land use changes or conservation measures during heavy rainstorms. It is a model designed to be used in disaster risk management, not for long-term processes (https://blog.utwente.nl/lisem/).

Area and event characterisation

Area type Rural and urban	**Topography** Hilly
Land cover/land use distribution 30 % forest, 30 % cropland, 40 % built-up	**Event** Observed event (27.5.2014)
Receptors Buildings and streets visualised in map Soil (erosion/deposition)	**Flood type** Flash flood with mud/debris component

Specifications of method/measure and data demands and outputs

Level of complexity	3
Addressed SPRC element	S/P
Method group	Process-based approach
Spatial scale(s) of application	Raster width 1 to 5 meters, total area limited only by computer memory
Time scale/resolution	Calculation time steps: flexible/automatic, output time steps: flexible, minutes to hours

Input datasets (type and scale/resolution)	Digital Terrain Model DTM (raster, 2 m) [Soil/landuse data for infiltration and erosion (raster, 2 m)] Gauckler-Manning-Strickler hydraulic roughness (raster, 2 m) Precipitation time series (point/global, 5 min)
Output datasets (type and scale/resolution)	Water levels (raster, 2 m, flexible output time steps) Flow velocity (raster, 2 m, flexible output time steps) Maximum water levels (raster, 2 m, flexible output time steps) [Soil erosion and deposition]
Description of implementation	
Implementation • 3/2018 to 6/2019	**Users (reported/designated)** • City planning department
Initiator/responsible • IOER/RAINMAN	**Involved stakeholders** • City planning department • Civil security department • Building department
Lessons-learned	
Main success factor: • OpenLISEM is free and open software. • Relatively quick model setup for simplified screening approach.	**Main challenge:** • Finding adequate parameter values for the erosion process is often difficult and time consuming. • Long simulation runtimes (days).
Synergies/beneficial aspects: • The hydrodynamic approach gives the opportunity to simulate the effects of selected measures dealing with changes of surface morphology, e.g. dams/barriers, deepening/widening of channels. • The effects of measures related to infiltration and erosion can be simulated, e.g. changes of surface material or vegetation.	**Conflicts/Constraints:** • The model results have a strong dependency on the up-to-dateness of the surface data. • Small scale structures can only be represented in the raster elevation model by refining the raster width, e.g. from 2 m to 1/0.5 m causing remarkably longer simulation runtimes and requiring large amounts of computer RAM. • Future events will differ from the historic as well as from the synthetic events, especially when taking the cultivation/soil status into account.

Key message to others starting with a similar task	**Contact**
"OpenLISEM is very powerful but also very complex when using the different infiltration and erosion modules." "For screening approaches with no infiltration and no erosion only few parameters are required."	Dr. Axel Sauer Leibniz Institute of Ecological Urban and Regional Development (IOER) a.sauer@ioer.de

References

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