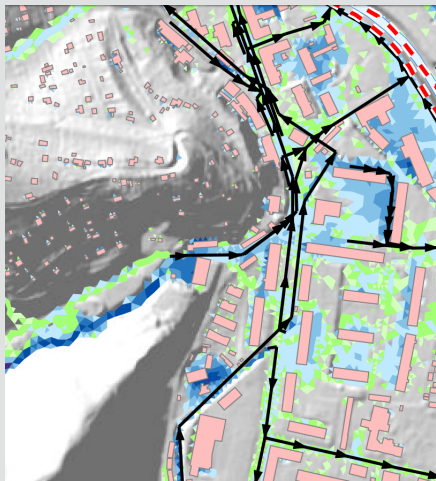


FACTSHEET RISK ASSESSMENT AND MAPPING ACTIVITIES

Heavy rain hazard map (hydrodynamic simulations with Hystem-Extran 2d)

Where was it implemented?		Map example: 
Germany, Saxony, Meißen		
Problem/background		
<p>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.</p> <p>A special situation in built-up and especially urbanised areas is the existence of artificial drainage infrastructure with storm water or combined sewer systems. On the one hand, these structures limit the surface runoff to a certain degree, on the other hand spills and overflows can occur and result in flooding.</p>		
Description of methodological background and outcomes		
<p>With the hydrodynamic rainwater, runoff and pollution load system Hystem-Extran 2d, sewer system simulations with design storms as well as long-term series simulations can be carried out. Besides the classic sewer system simulations, Hystem-Extran 2d can be used even in other related fields, thanks to its flexible structure. Combined with the rule interpreter CONTROL, control strategies for sewer systems, for example, can be developed and checked.</p>		
Area and event characterisation		
Area type	Topography	
Rural and urban	Hilly	
Land cover/land use distribution	Event	
30 % forest, 30 % cropland, 40 % built-up	Observed event (27.5.2014)	
Receptors	Flood type	
Buildings and streets visualised in map; Buildings >50m ² affected by water	Flash flood with mud/debris component	
Specifications of method/measure and data demands and outputs		
Level of complexity	3	
Addressed SPRC element	S/P/R	
Method group	Process-based approach	
Spatial scale(s) of application	Flexible triangulated network TIN (approx. 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 (TIN, derived from 2 m raster DTM and enriched with break lines e.g. building geometries, curbs) Sewer system (points/lines with attributes) Gauckler-Manning-Strickler hydraulic roughness (polygons) Precipitation time series (radar data, raster, 500 m, 5 min)
Output datasets (type and scale/resolution)	Water levels (point/TIN triangle, flexible output time steps) Flow velocities in x and y direction (point, flexible output time steps) Flow and water levels in sewer system elements
Description of implementation	
Implementation <ul style="list-style-type: none"> 3/2018 to 6/2019 	Users (reported/designated) <ul style="list-style-type: none"> City planning department
Initiator/responsible <ul style="list-style-type: none"> IOER/RAINMAN itwh (subcontractor) 	Involved stakeholders <ul style="list-style-type: none"> City planning department Civil security department Building department
Lessons-learned	
Main success factor: <ul style="list-style-type: none"> Sewer system data in the correct format made a relatively quick model setup possible. 	Main challenge: <ul style="list-style-type: none"> Getting sewer system data can be very time consuming and costly when they do not exist digitally and in the right format. The software costs between 5.000 and 7.000 EUR in the Version WITHOUT 2D surface runoff coupling.
Synergies/beneficial aspects: <ul style="list-style-type: none"> The hydrodynamic approach gives the opportunity to simulate the effects of selected measures e.g. dams/barriers, deepening/widening of channels, changes in sewer system. With the flexible mesh approach, small structures can be represented in the surface model. 	Conflicts/Constraints: <ul style="list-style-type: none"> The model results have a strong dependency on the up-to-dateness of the surface and sewer-system data. Future events will differ from the historic as well as from the synthetic events.
Key message to others starting with a similar task	Contact
„If you have reported problems with the sewer system you definitively need a simulation approach that explicitly represents the flow processes in the sewer system.” “If you have large quantities of water coming from undrained areas the role of the sewer system might be less important.”	Dr. Axel Sauer Leibniz Institute of Ecological Urban and Regional Development (IOER) a.sauer@ioer.de

References

<https://itwh.de/de/softwareprodukte/desktop/hystem-extran/>

<https://www.leitstelle-des-bundes.de/Inhalt/AWT/fis/berechnungsprogramme/hystem/>

Jahanbazi, M.; Egger, U. (2014) Application and comparison of two different dual drainage models to assess urban flooding. Urban Water Journal 11(7), 584-595, DOI: 10.1080/1573062X.2013.871041