Integrating Climate Change in the Urban Planning Process

A Case Study

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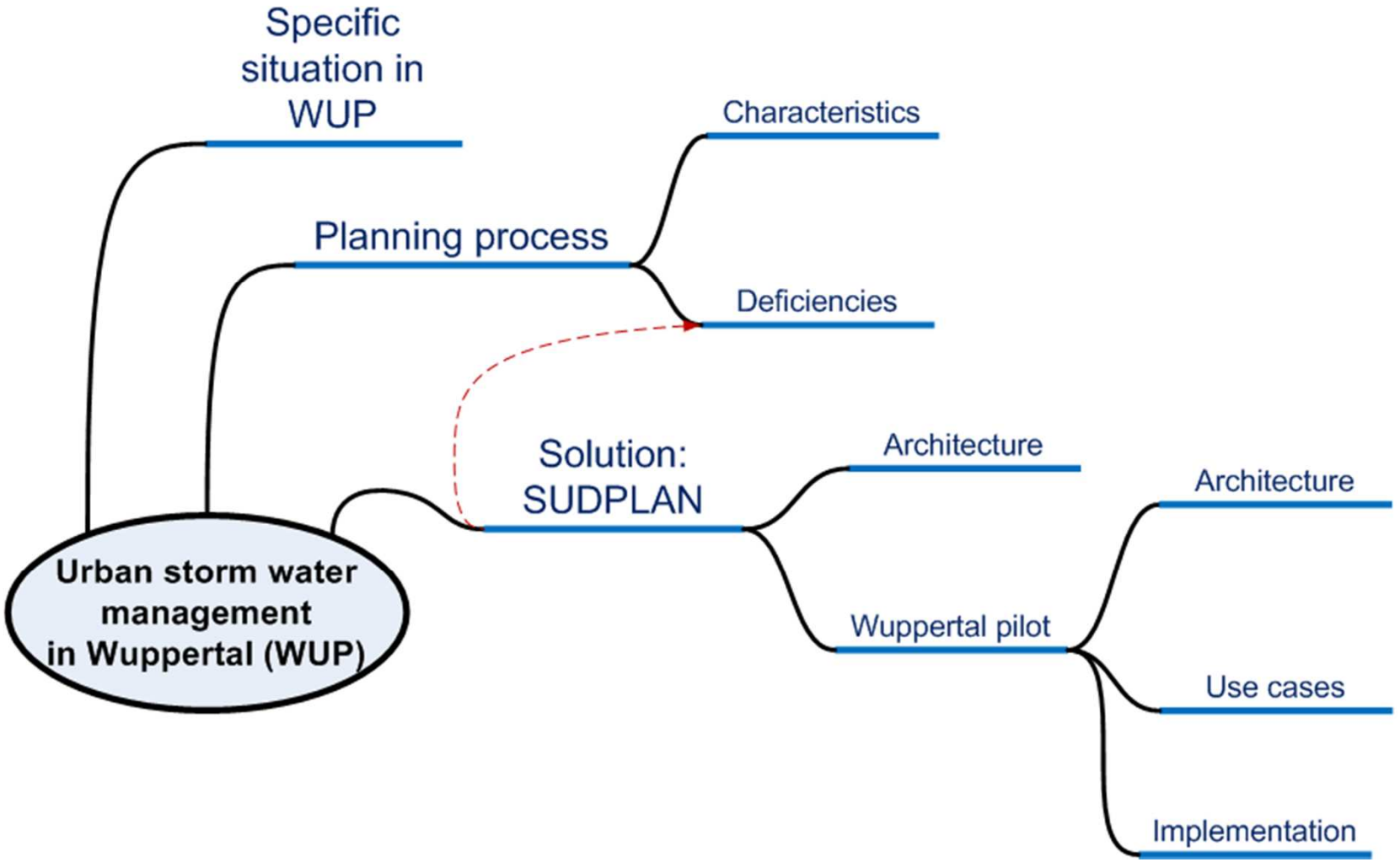
Specific situation in WUP
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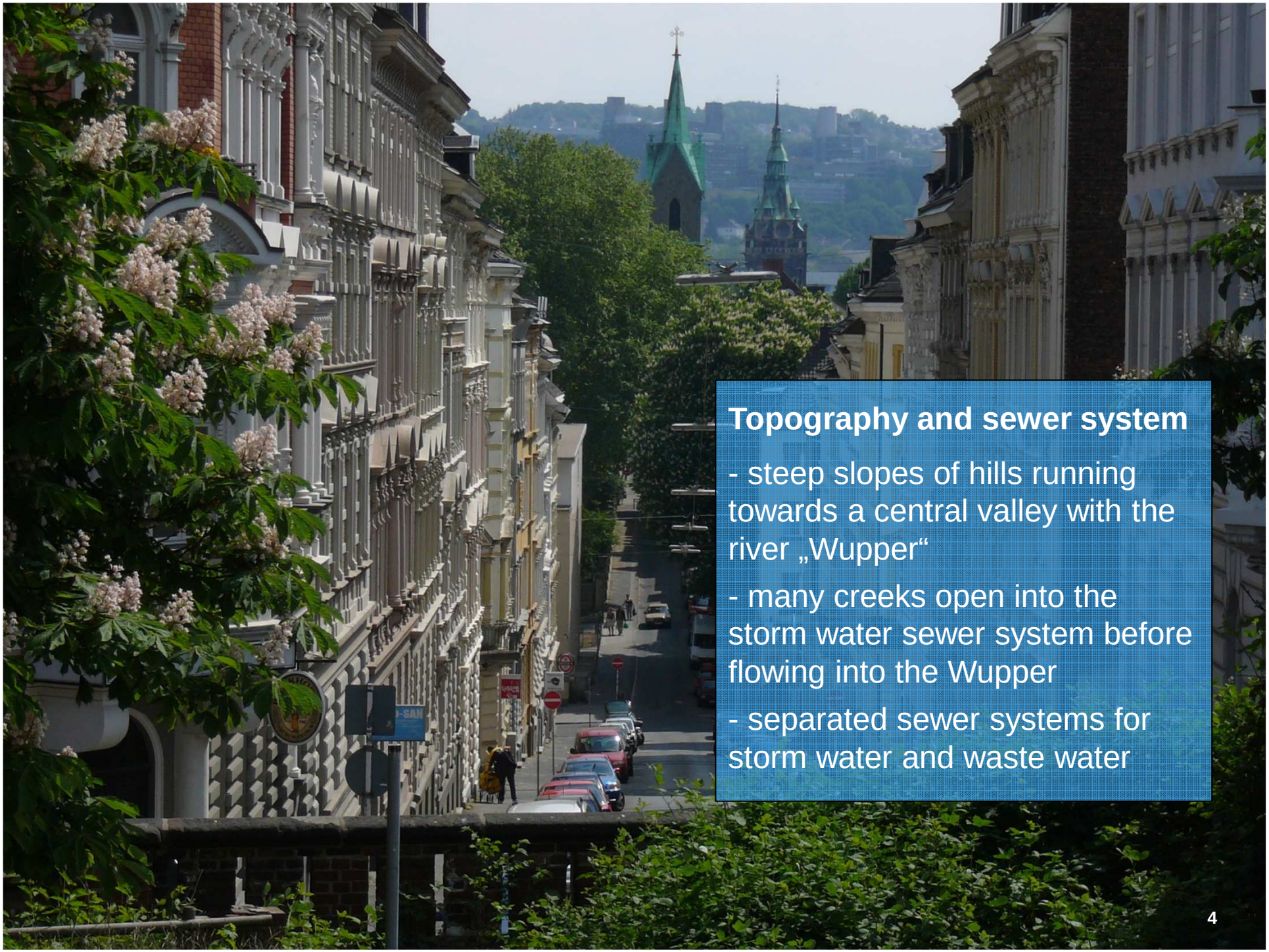
Urban storm water management in Wuppertal (WUP)

Wuppertal

- 350,000 residents
- area: 169 km²
- situated in hill country (from 98 up to 353 m above mean sea level)



Topography and sewer system

- steep slopes of hills running towards a central valley with the river „Wupper“
- many creeks open into the storm water sewer system before flowing into the Wupper
- separated sewer systems for storm water and waste water

swollen creeks are blocking the sewer system ➔ storm water is running of on the surface

low-lying assets (natural basins) are flooded

public infrastructure and private property might be damaged or destroyed

The Planning Process: „Generalentwässerungsplanung“ (GEP) (General Drainage Strategy)

- **Mid- and long-term planning of the storm water sewer system**
  - Continual process
  - Performed one by one for each catchment area

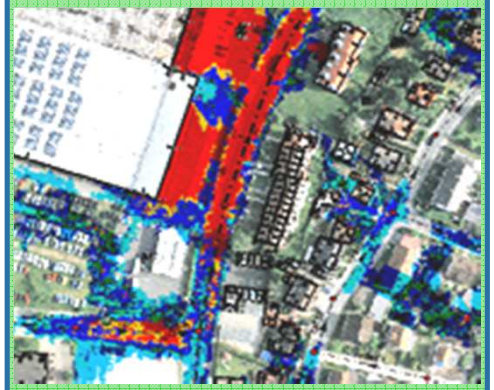
- **Iterative use of hydrological model (creeks) and hydrodynamical model (sewer system), not before 2003**

- **Additional modelling of surface runoff during heavy rainfall events, not before 2010**
  - Bi-directional connected models of the sewer system (software: *DYNA*) and surface runoff (software: *GeoCPM*)
  - DYNA and GeoCPM are components for ++*SYSTEMS*, a GIS for the urban water management domain by *Pecher Software* and *tandler.com*

sources
&
sinks

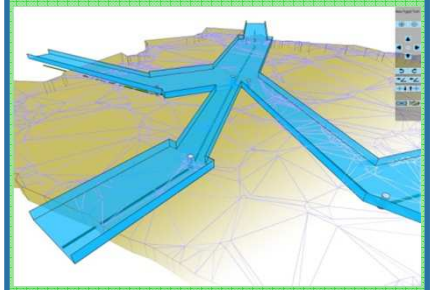
rainfall
model or
historical
record

hydrodynamic surface runoff GeoCPM



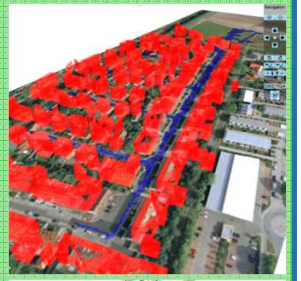
hydrologic surface runoff DYNA

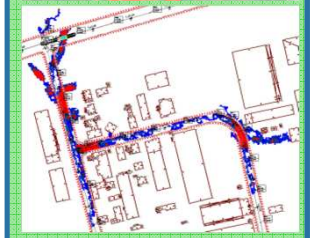
hydrodynamic run-over calculation (optional) GeoCPM



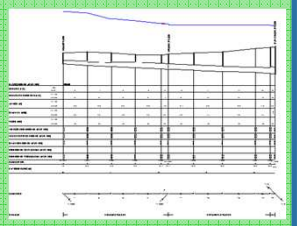
hydrodynamic analysis of sewage system DYNA

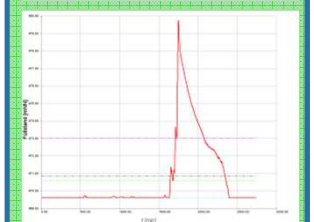
classic runover calculation DYNA





results





Objectives of surface runoff modelling

- **Detection of critical spots**
  - High risk of flooding
  - Valuable and vulnerable facilities

- **Mitigation of flood risk for the detected critical spots**
  - Traditional (expensive!) strategies: enlargement of the sewers or construction of retention basins
  - Alternative strategy: localised structural measures, e. g. higher road kerbs or mobile / stationary walls

- **Identification of most cost-efficient measure for each critical spot**

- **Public involvment**
  - Decision makers (city politicians / managers)
  - Property owners of endangered assets
  - General public

Deficiencies of GEP

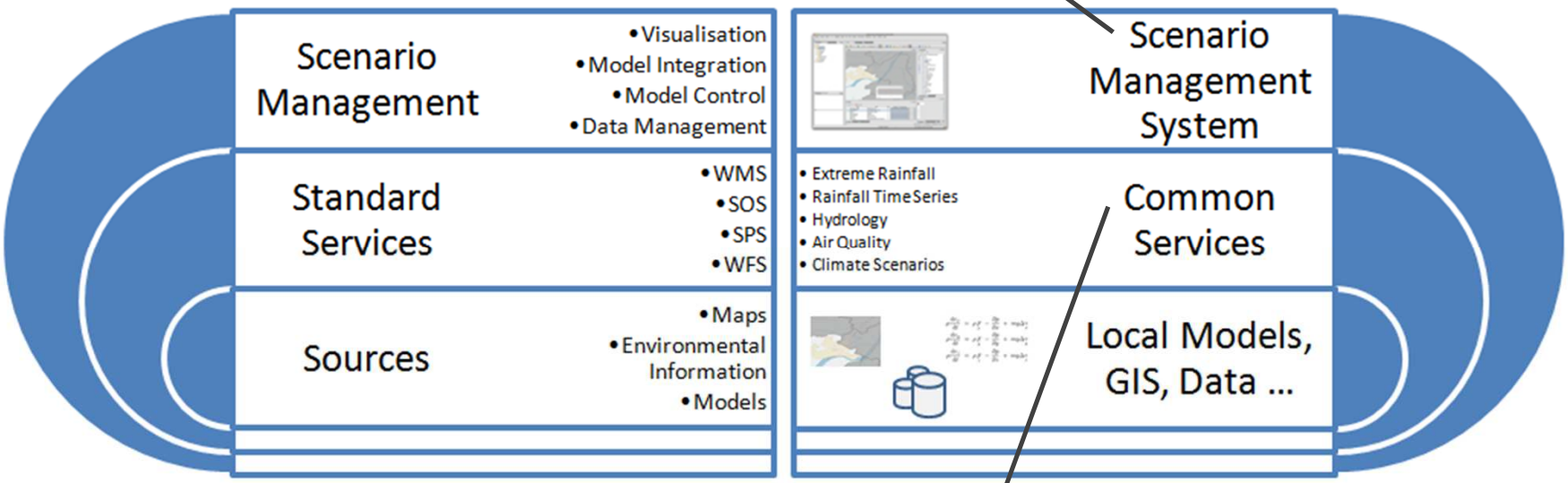
- **No consideration of climate change**
  - Climate change has increasing impact on the frequency of heavy storm water events (possibly on their maximum intensity as well)
  - Suggested structural measures possibly not effective in the long run!

- **No easy to use tool for running simulations**
  - DYNA and GeoCPM are for experts only
  - Difficult to share results (software licence required)

- **Only simple visualisation of model results**
  - Static
  - 2D or simple 3D

Solution: FP7 ICT project SUDPLAN (Sustainable Urban Development Planner for Climate Change Adaption)

"a highly interactive, easy to use, graphics-based decision support environment"

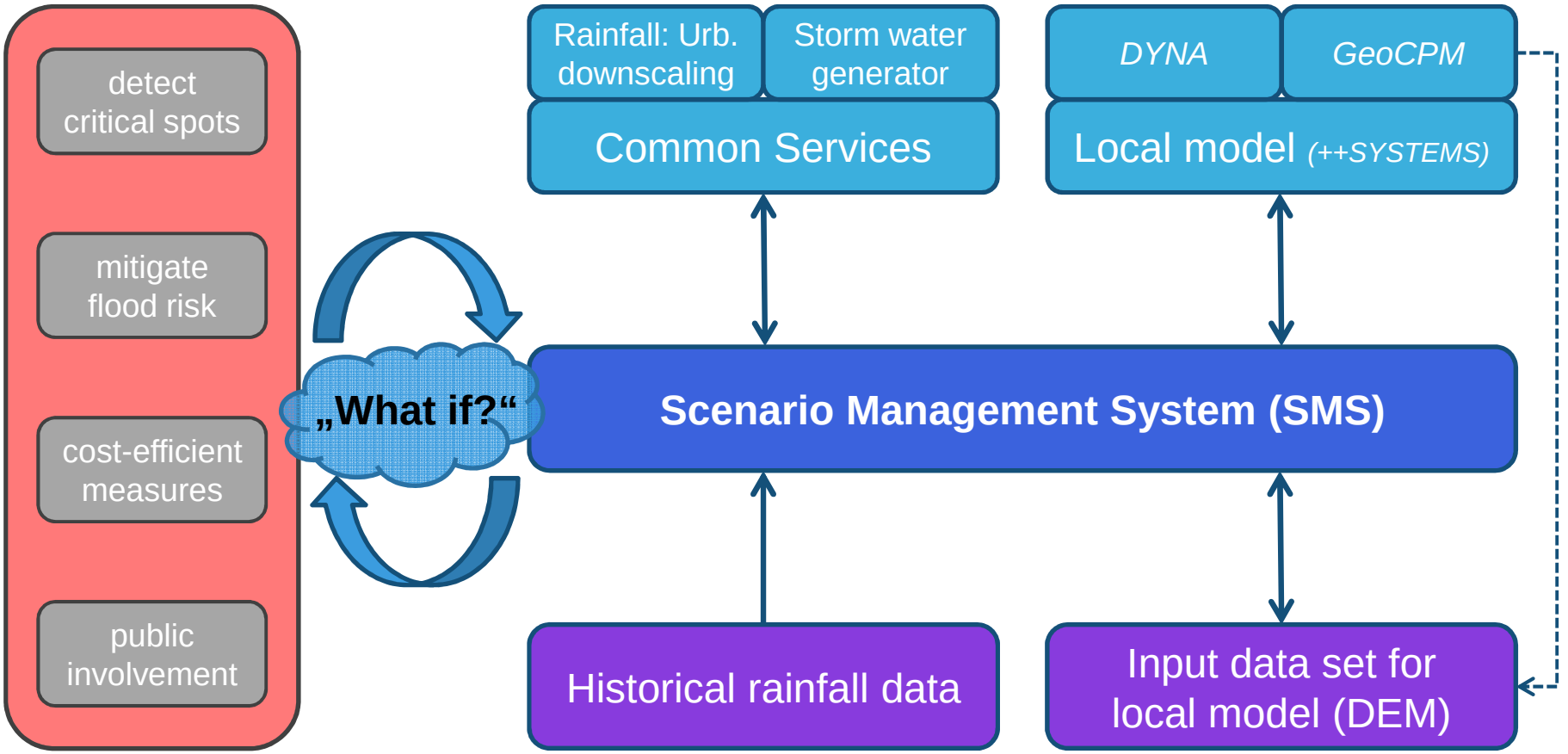


"downscaled environmental information for European cities under present and future climate scenarios"

The SUDPLAN Wuppertal pilot – Urban Stormwater Management

Issues ...

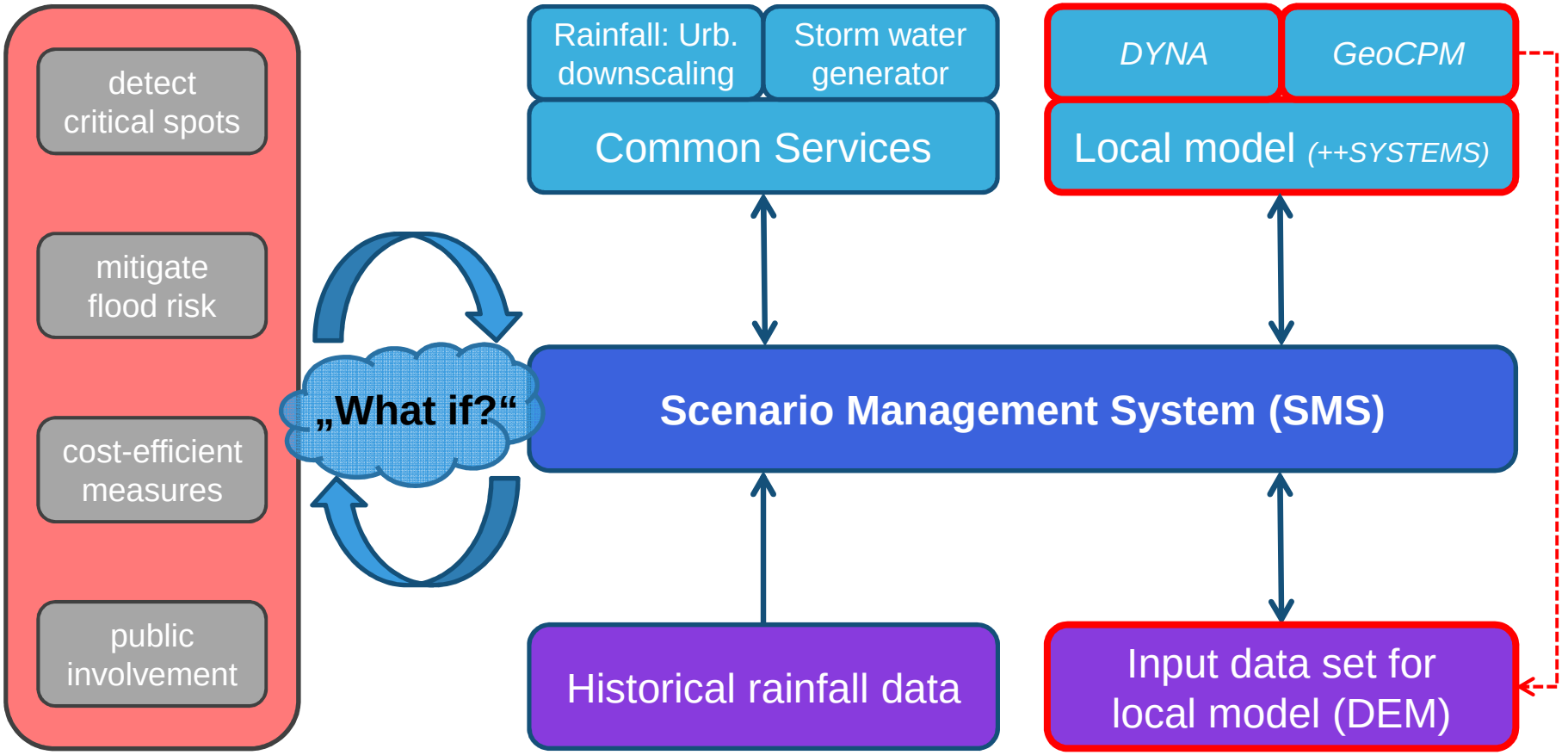
... and the tool to manage them



Preparatory work: Setup of input data set (single task)

Issues ...

... and the tool to manage them



1. reading all 3D-points

2. removing irrelevant 3D-points

3. calculating TIN

4. generating vertical break lines

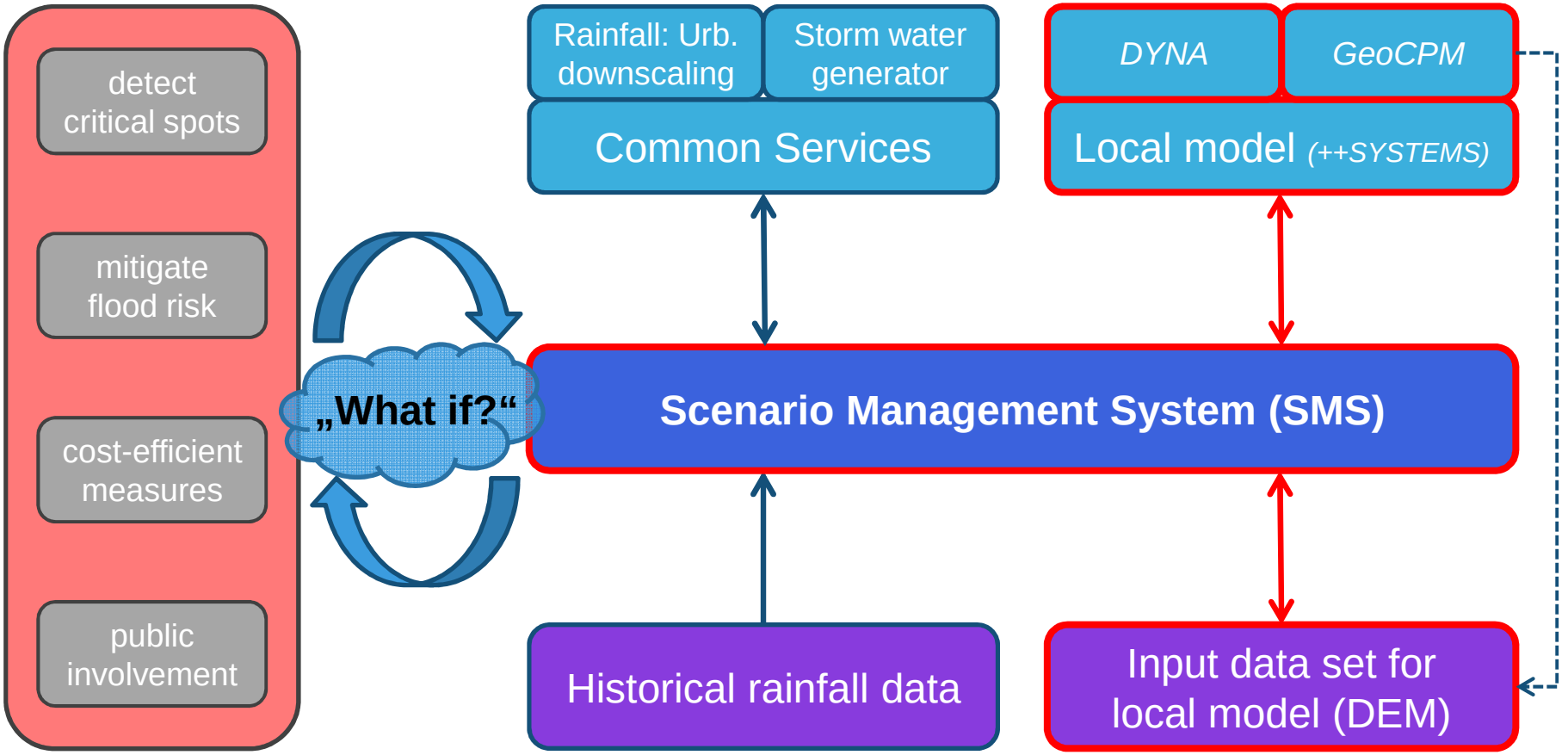
5. reducing number of points

6. connecting with sewage system

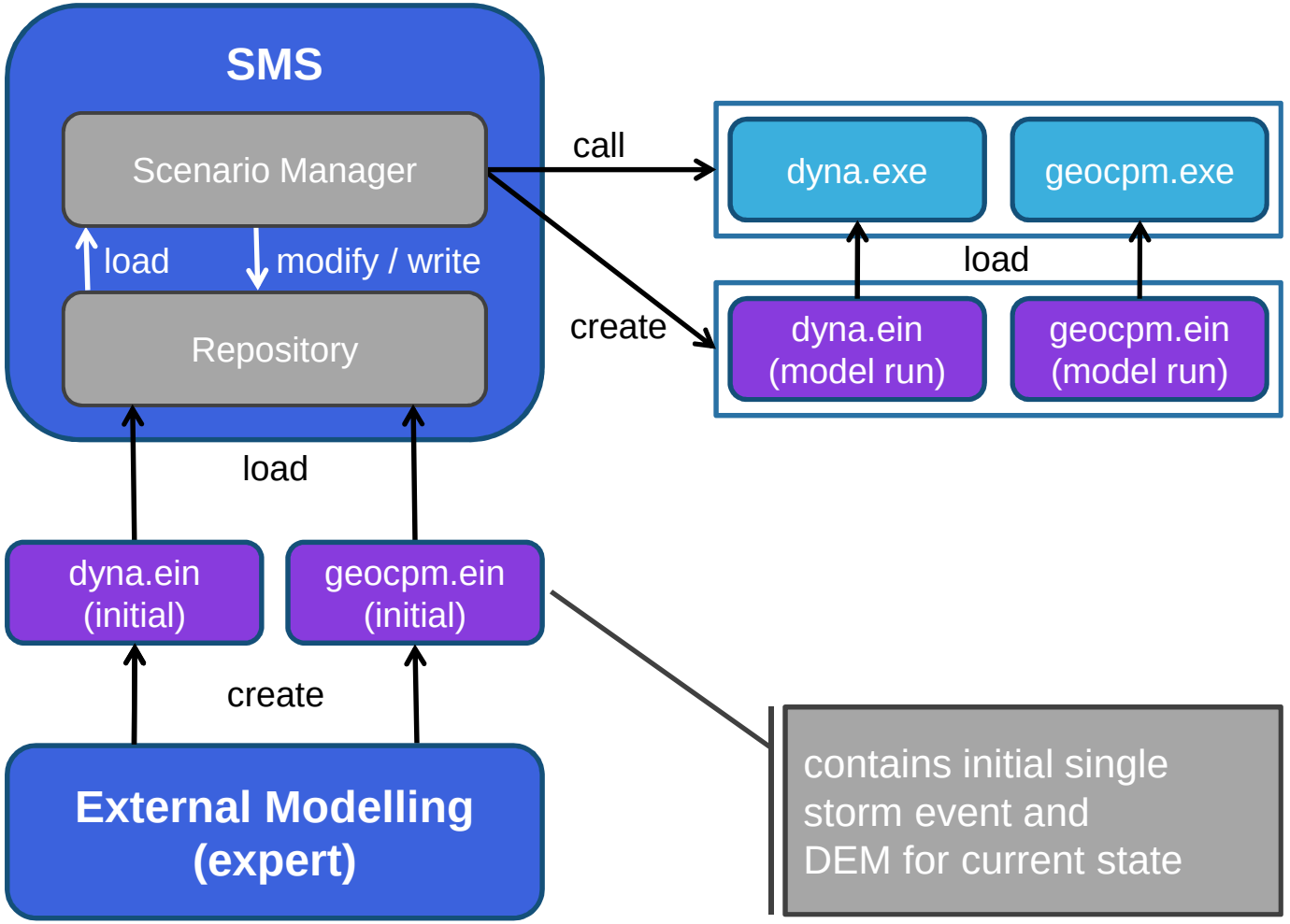
Model execution via SMS

Issues ...

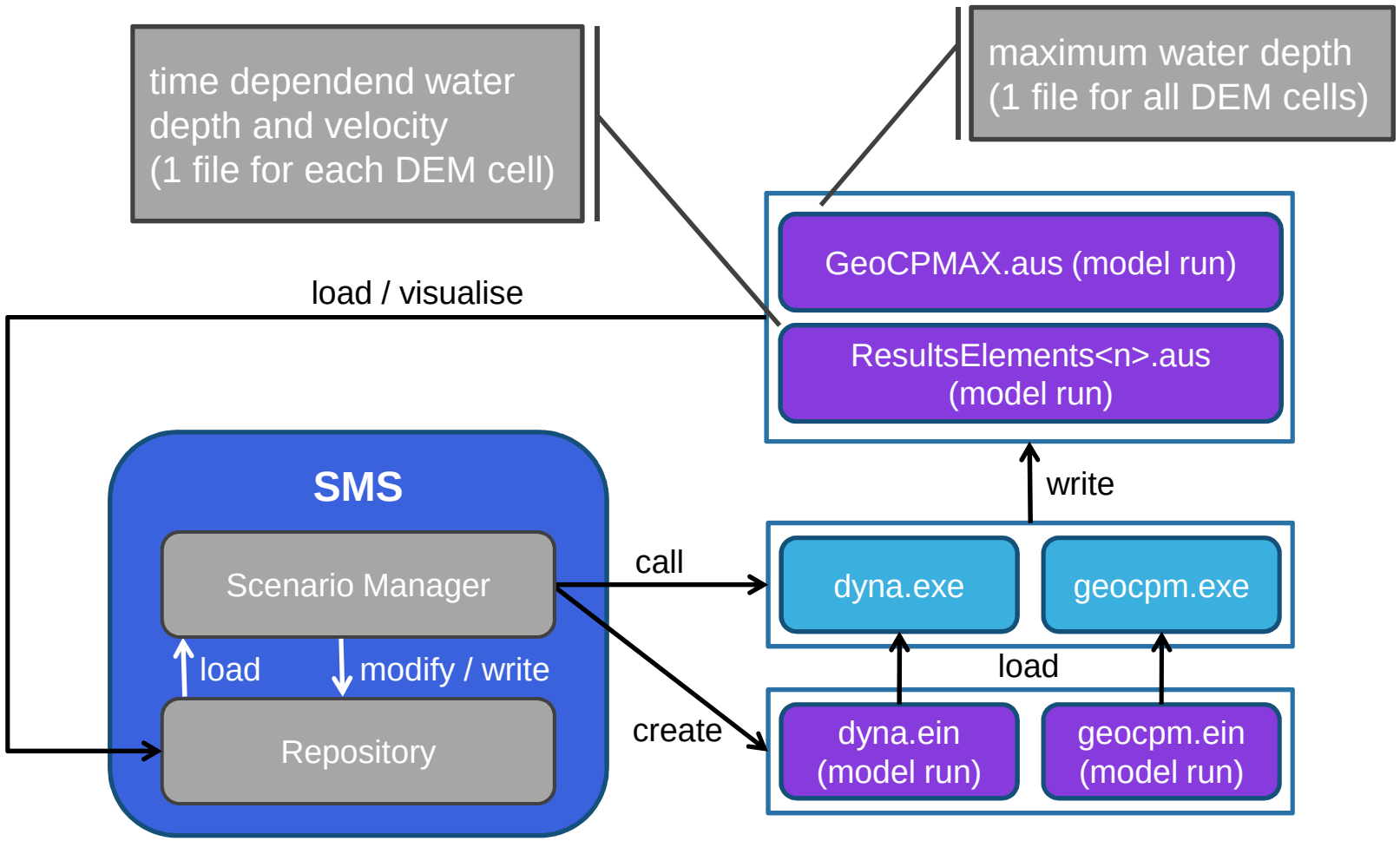
... and the tool to manage them



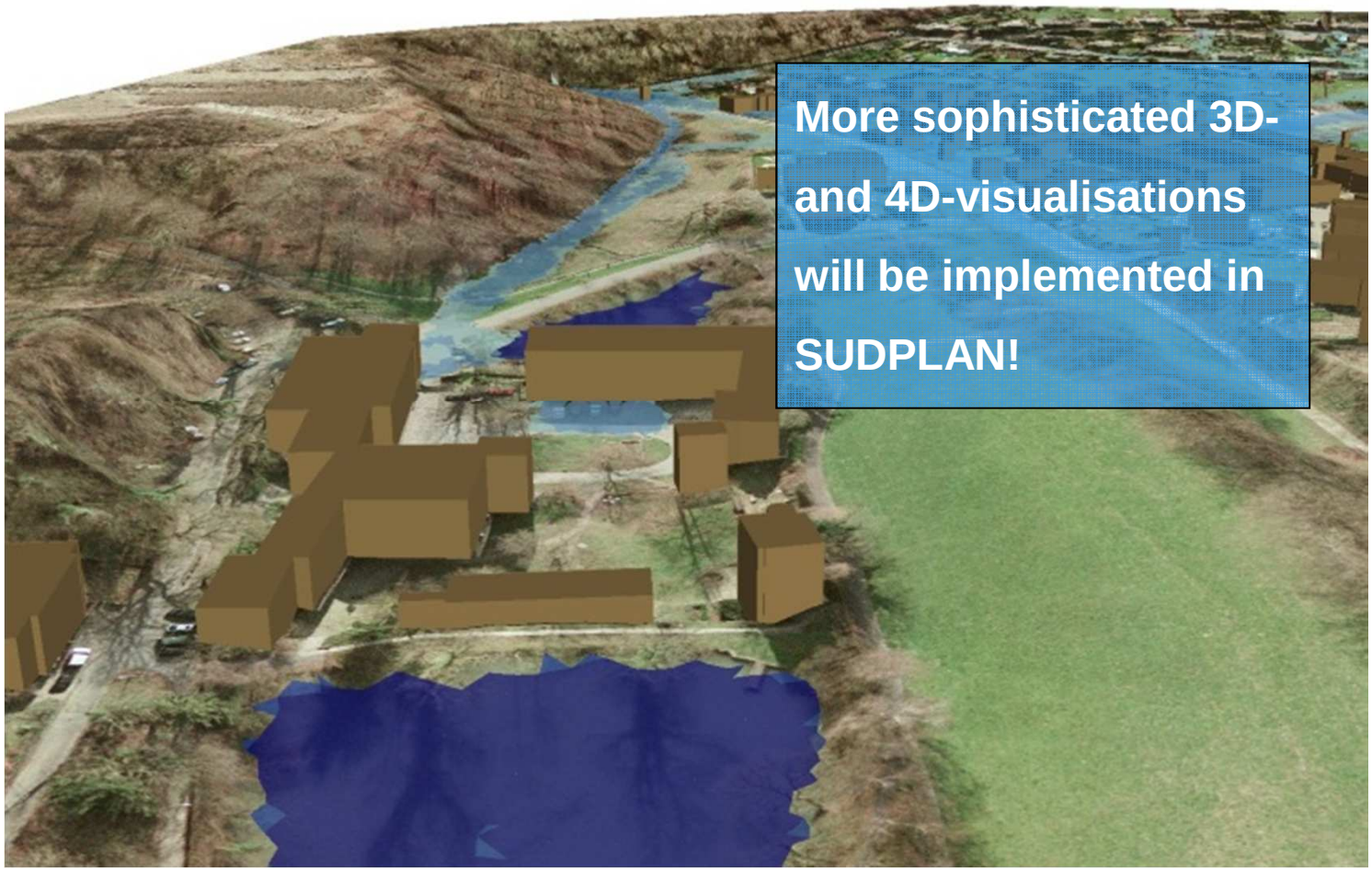
Model execution via SMS – Detailed view



Model results – Detailed view



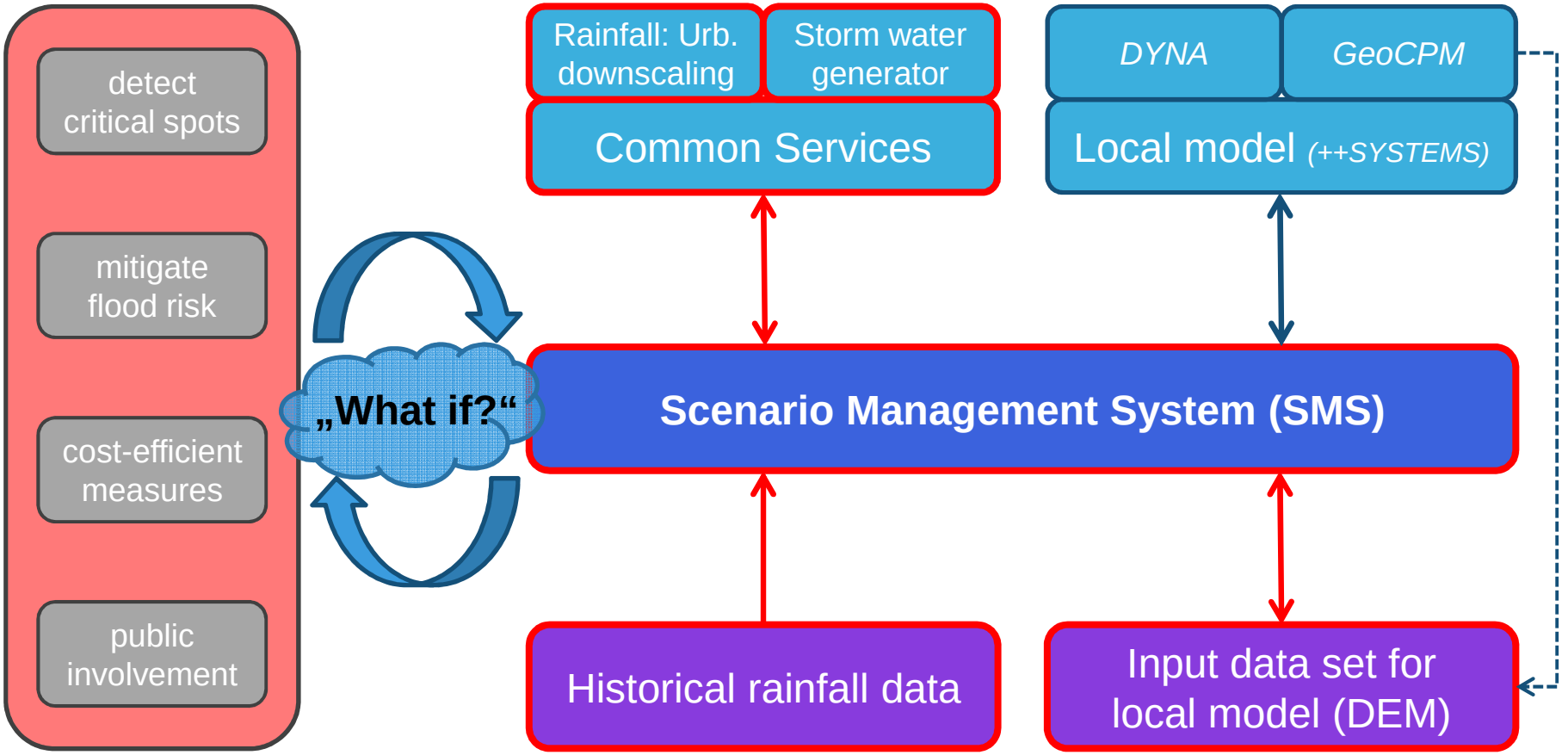
Model results – Rough example of 3D visualisation



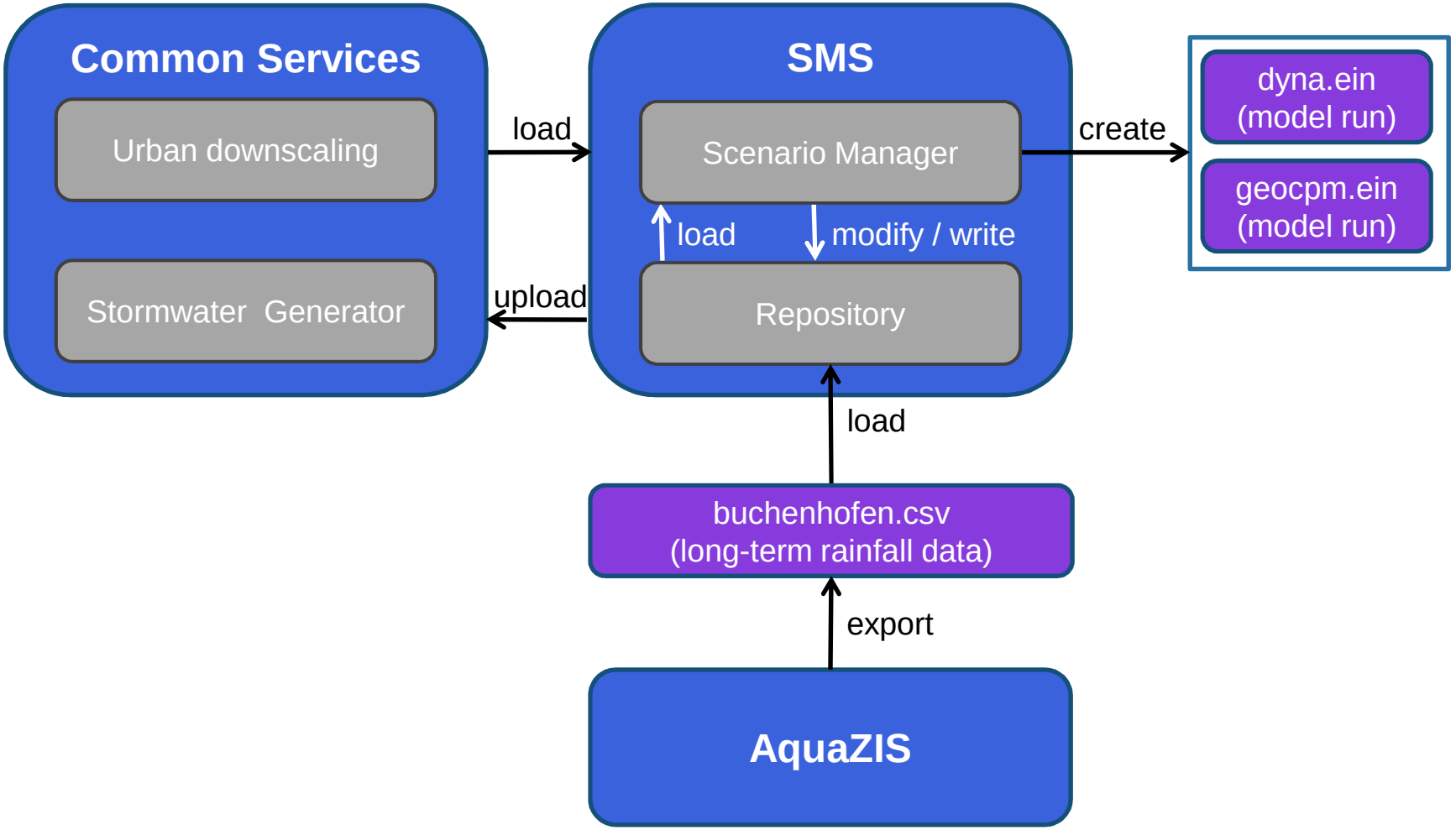
Using the Common Services

Issues ...

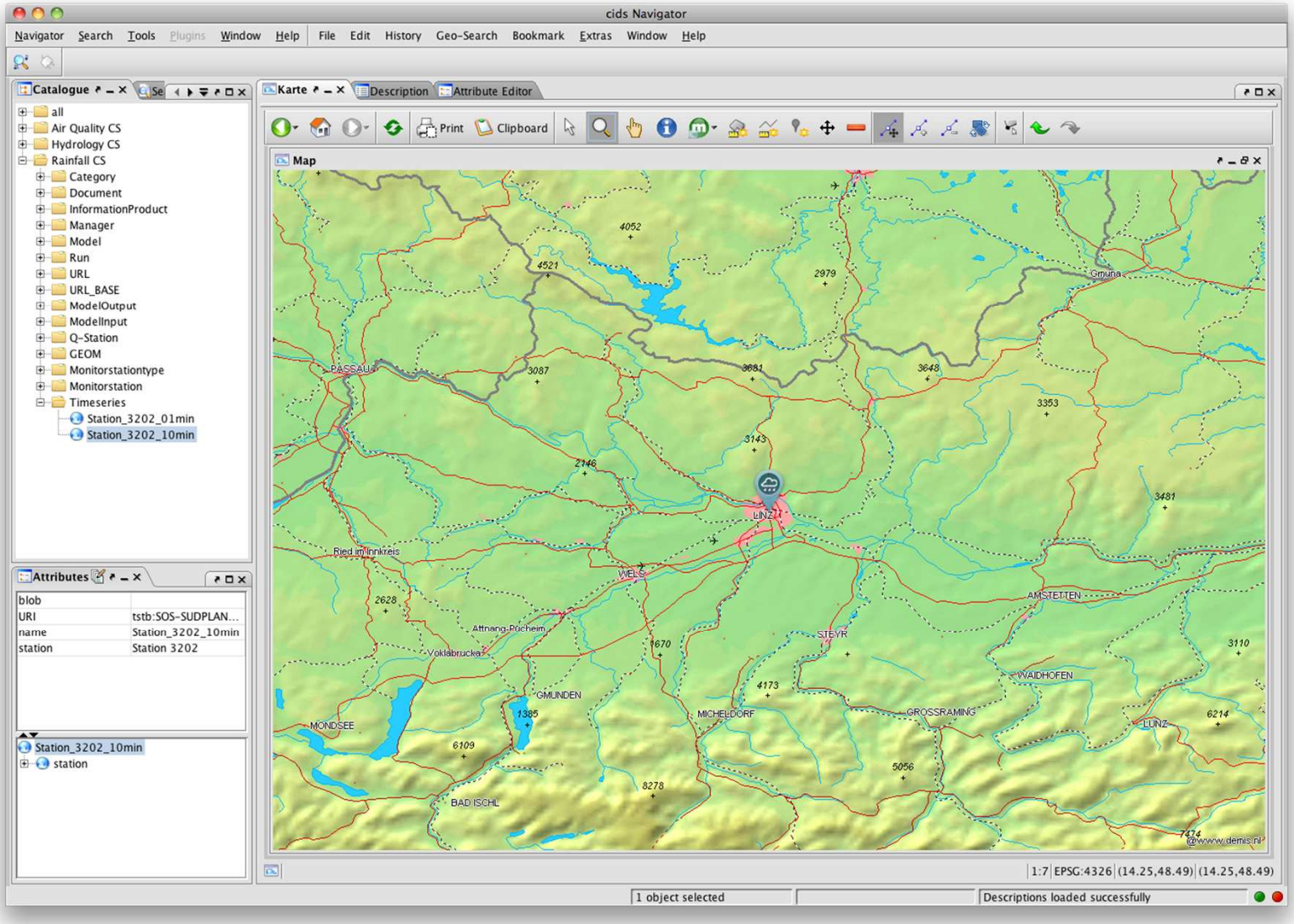
... and the tool to manage them



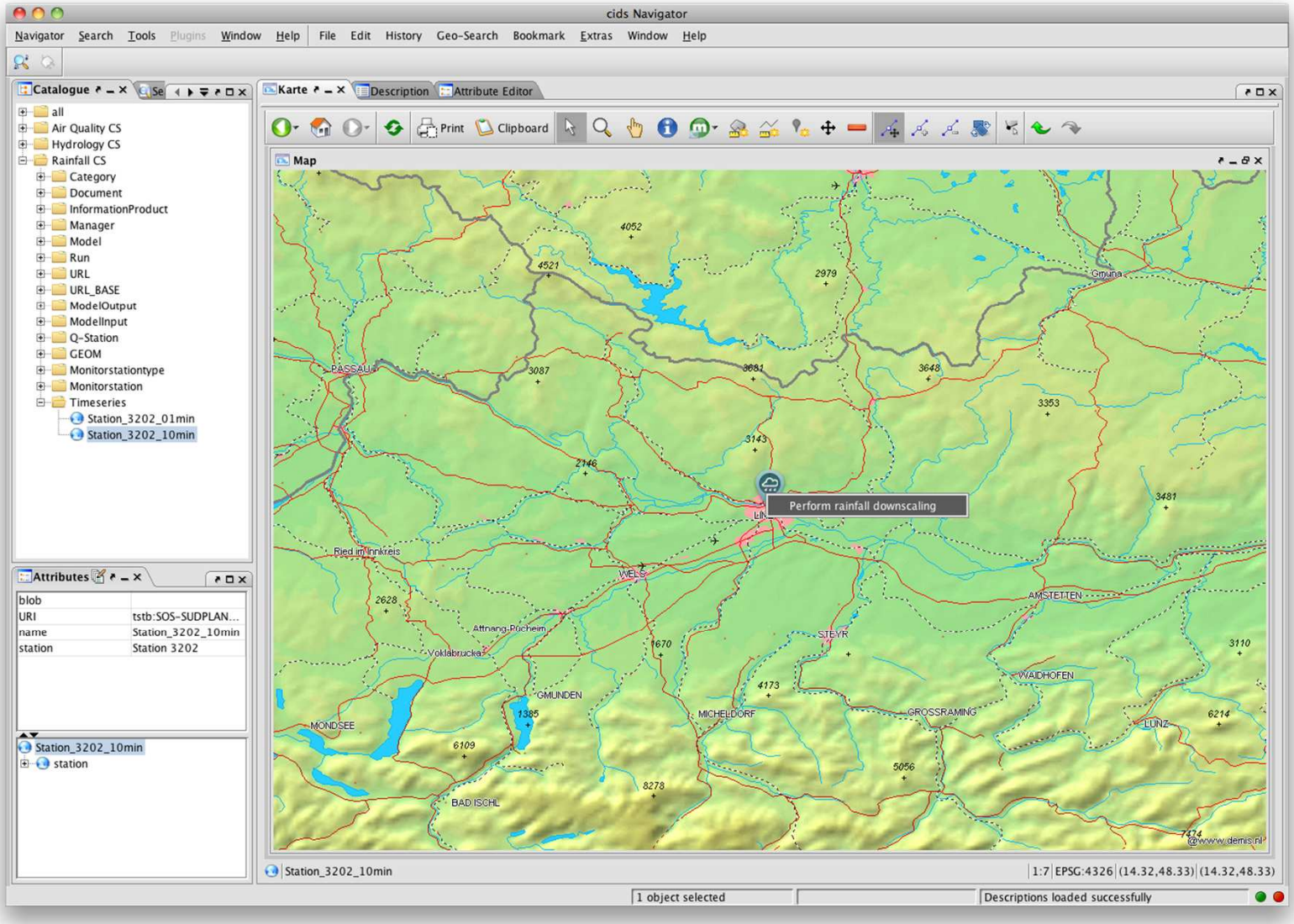
Using the Common Services – Detailed view



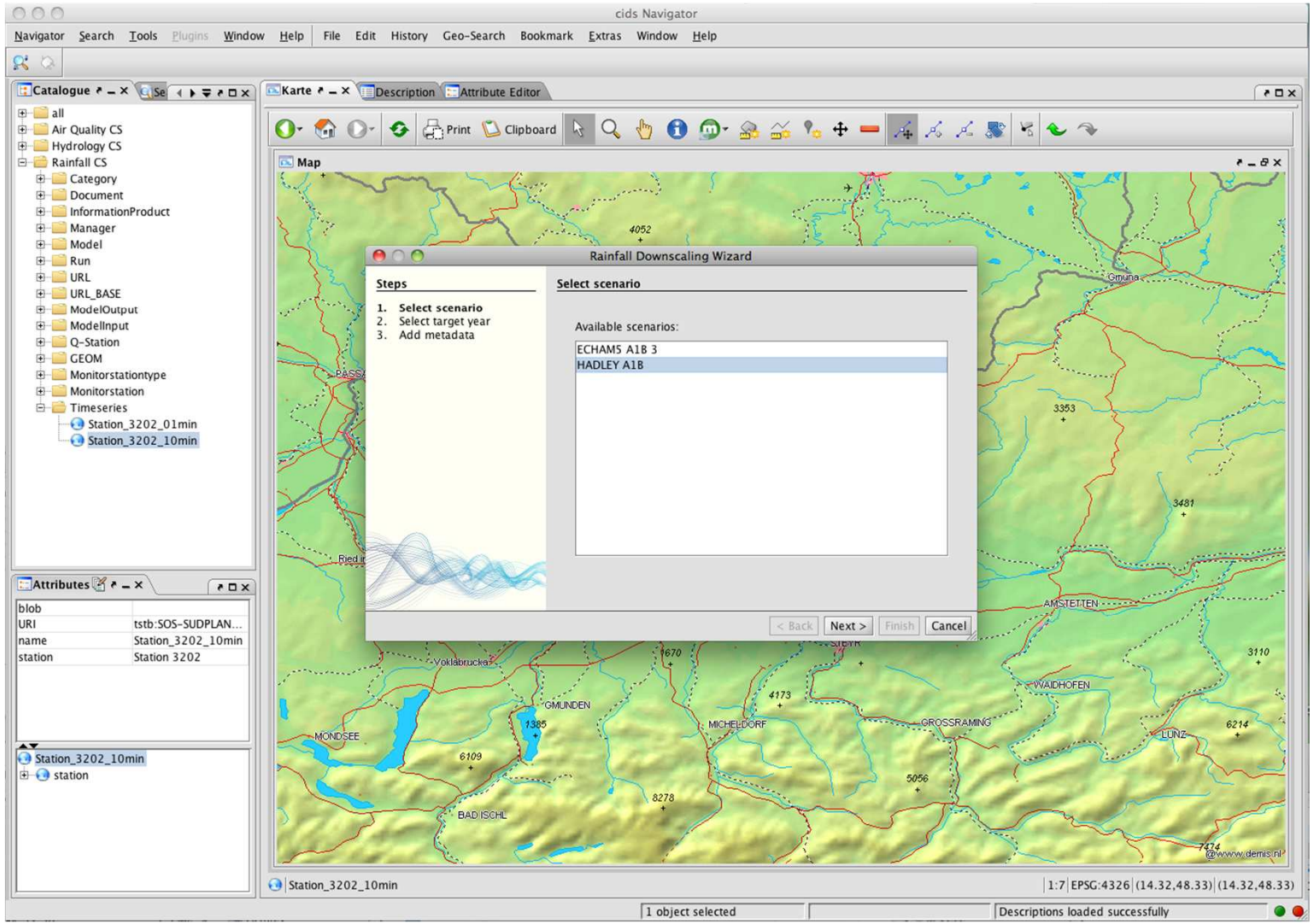
CS Urban Downscaling: 1. Drag and drop timeseries to the map



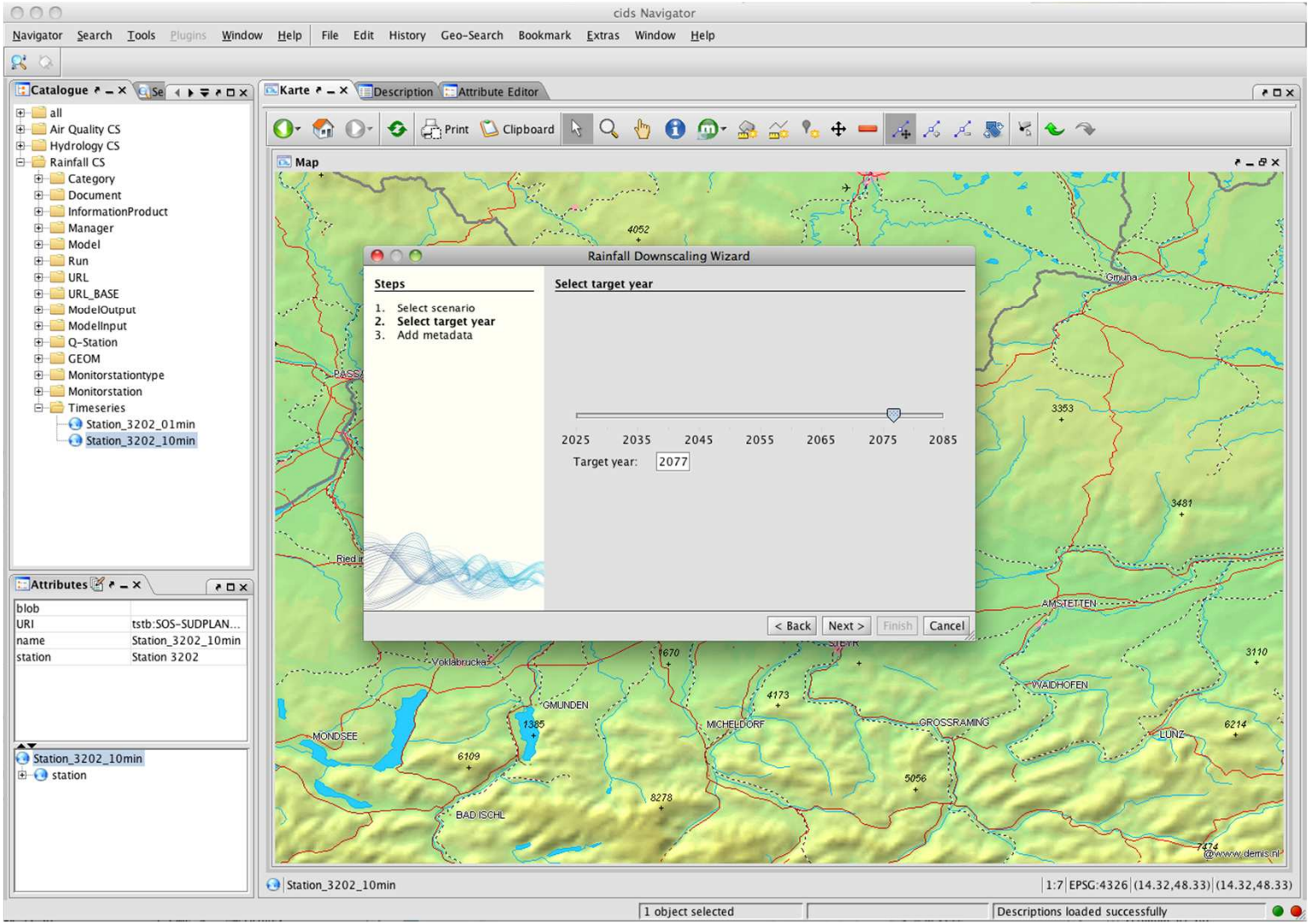
CS Urban Downscaling: 2. Start downscaling from context menu



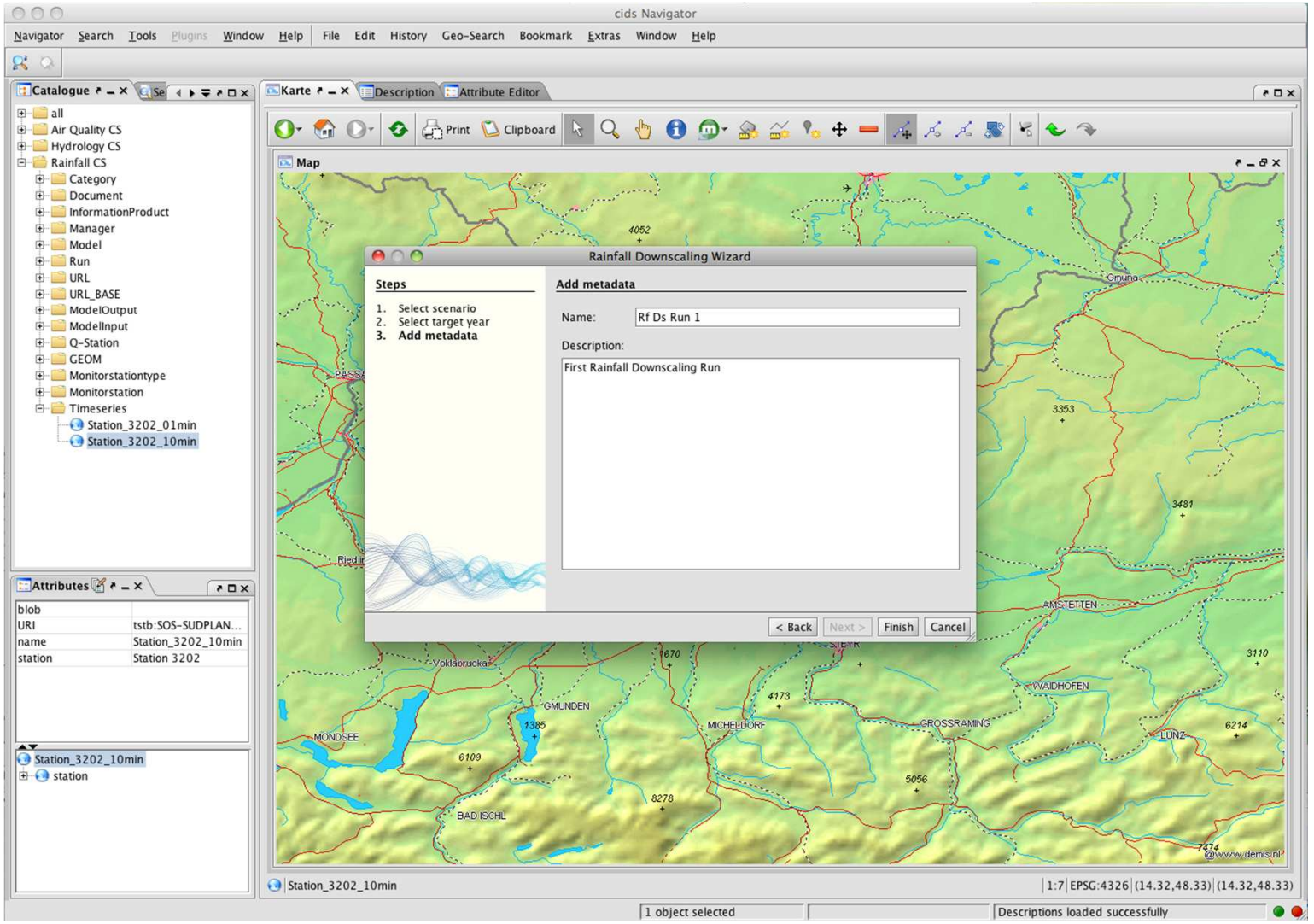
CS Urban Downscaling: 3. Choose climate scenario



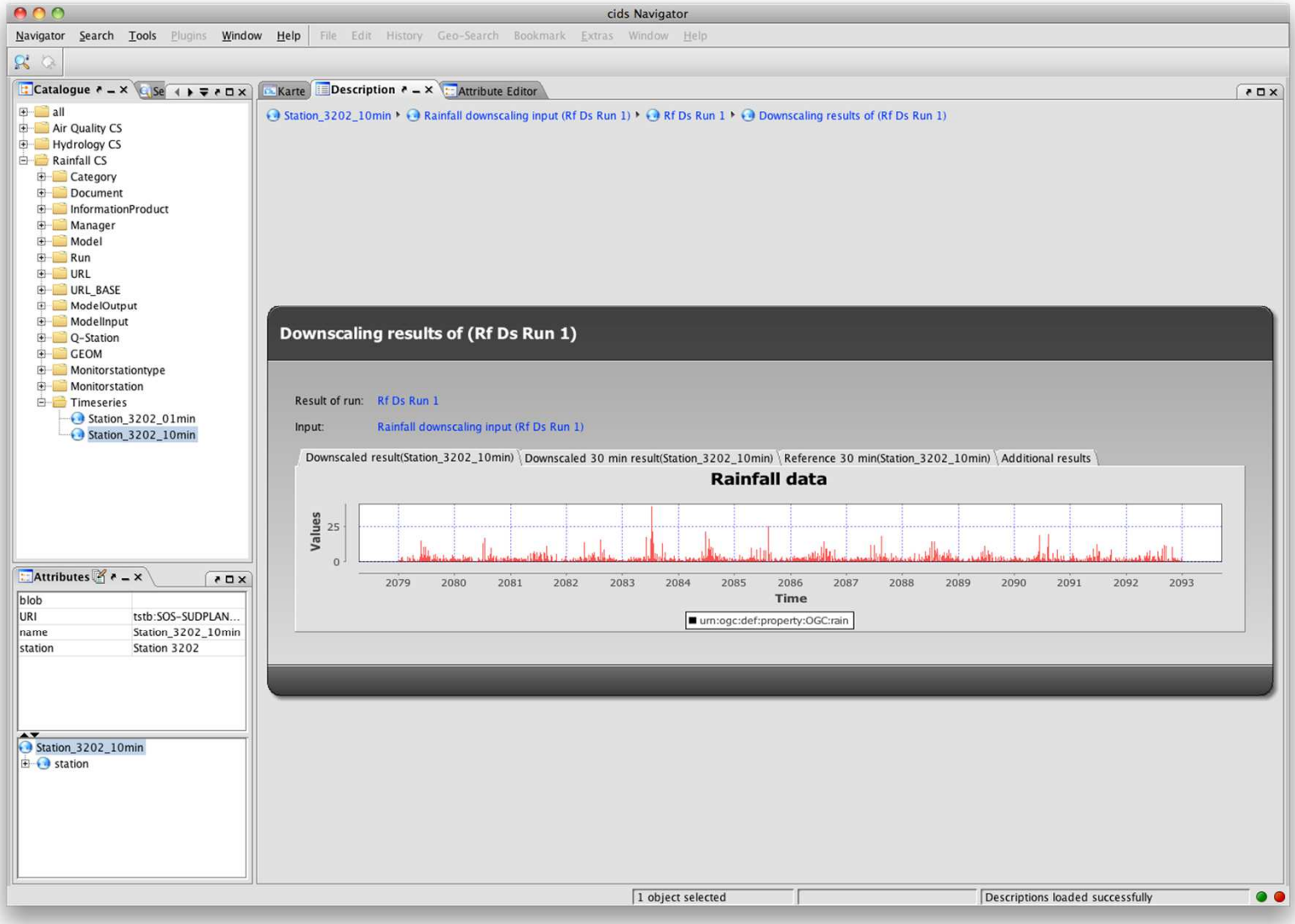
CS Urban Downscaling: 4. Choose target year



CS Urban Downscaling: 4. Add metadata (description)



CS Urban Downscaling: 5. View downscaling results



Thank you for your attention!

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