Sustainable Urban Development Planner for Climate Change Adaptation (SUDPLAN)

by Gidhagen, L., Denzer, R., Schlobinski, S., Michel, F., Kutschera, P. and **Havlik, D**.

SMHI

AIT AUSTRIAN INSTITUTE OF TECHNOLOGY

cismet
cismet GmbH | www.cismet.de | info@cismet.de | Fon-Fax 0700 cismet de

cenia

APERTUM

DFKI Deutsches Forschungszentrum für Künstliche Intelligenz GmbH

LF STOCKHOLMS OCH UPPSALA LÄNS LUFTVÅRDSFÖRBUND

Wuppertal

TU Graz

Geoscience   IT   End-users (urban planners)

Partners

1. **Swedish Meteorological and Hydrological Institute**

2. **Austrian Institute of Technology**

3. **cismet GmbH**

4. **Czech Environmental Information Agency**

5. **Apertum IT AB**

6. **Deutsches Forschungszentrum für Künstliche Intelligenz**

7. **Stockholm Uppsala Air Quality Management Association**

8. **City of Wuppertal**
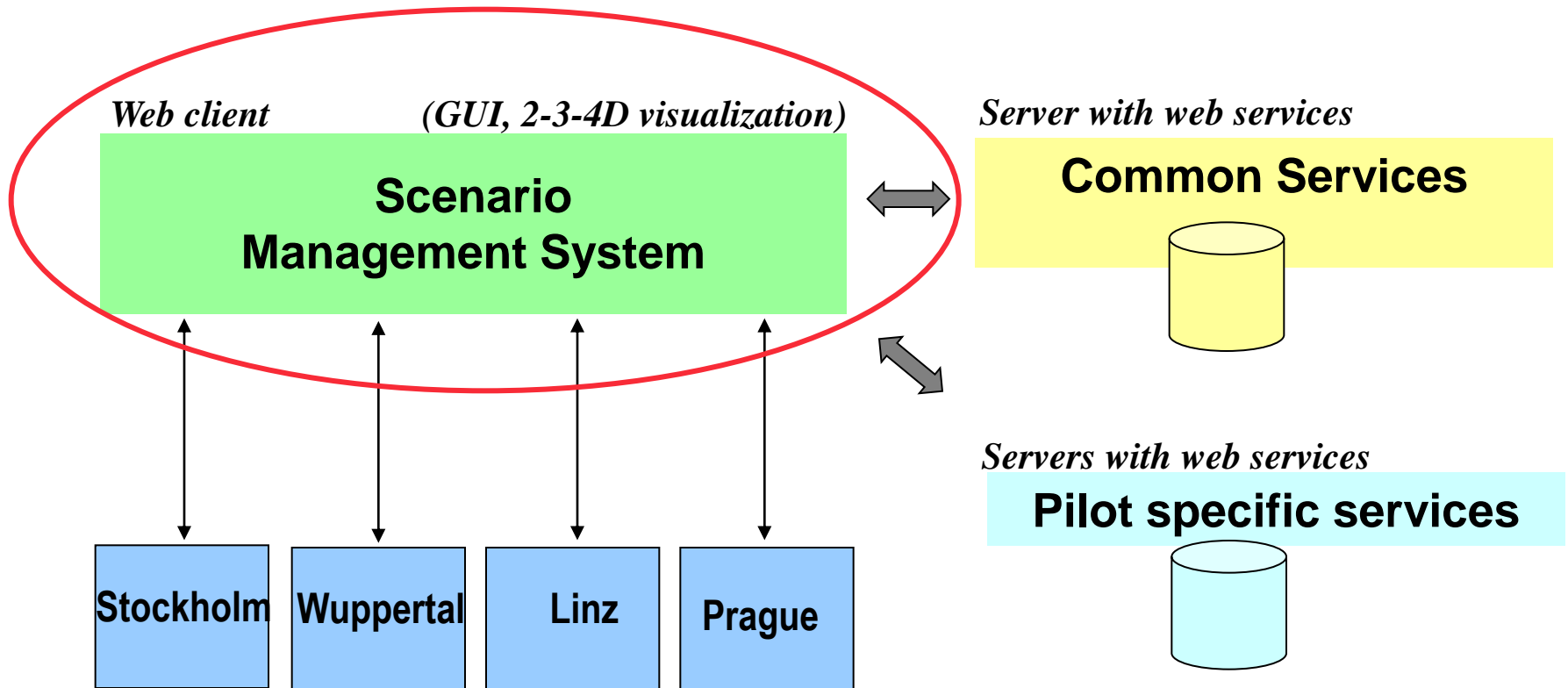
9. **Technische Universität Graz**

Main Objective

- to develop an **easy-to-use web-based planning, prediction, decision support and training tool**, for the use in an urban context, based on a **what-if scenario execution environment**, which will help to assure population's health, comfort, safety and life quality as well as sustainability of investments in utilities and infrastructures within a **changing climate**
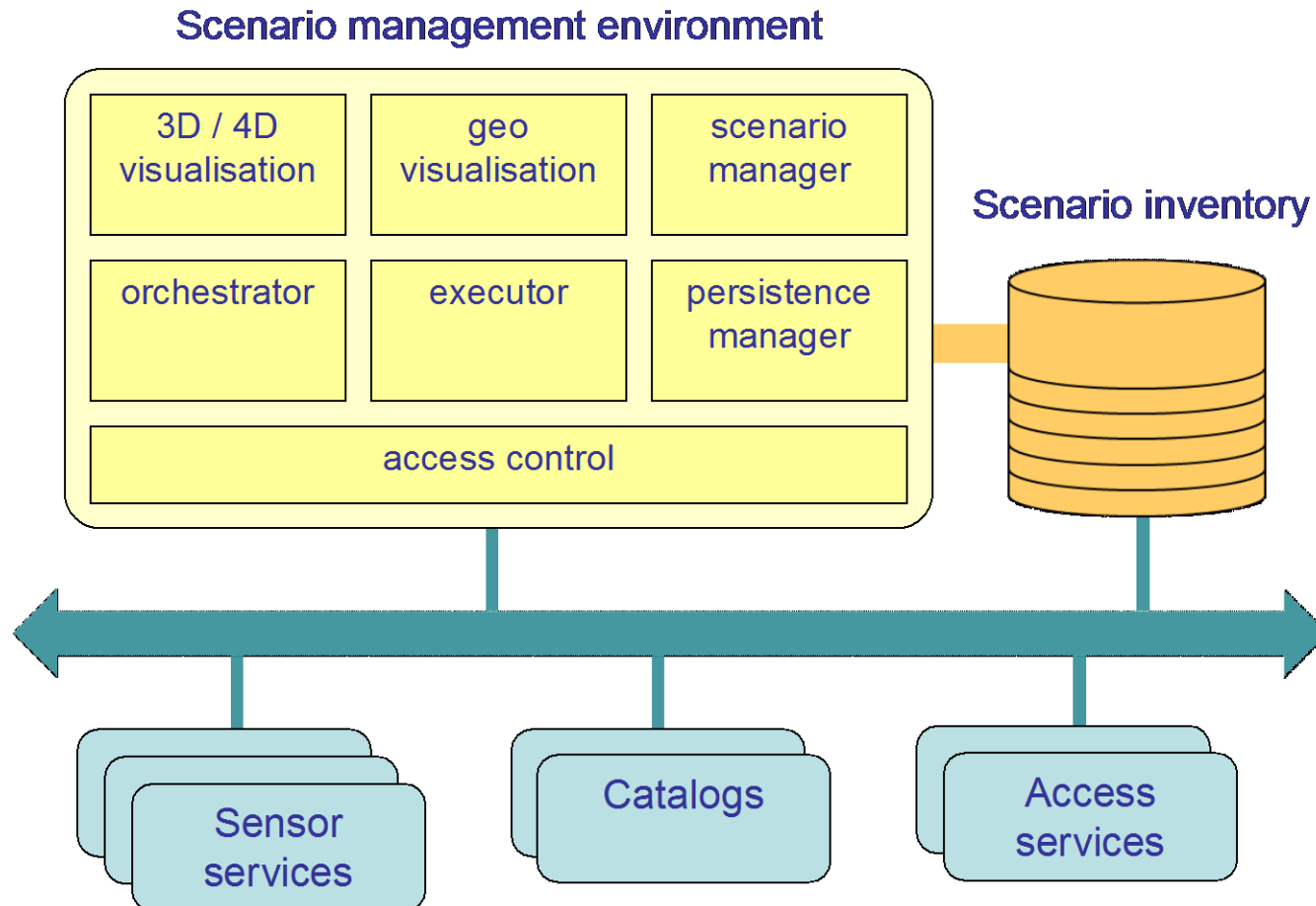
Targeted end-users

- City planners
- Scientific users, modellers

Developers/Application providers will support the two groups of users

SUDPLAN overview

Web client   *(GUI, 2-3-4D visualization)*

Scenario Management System

Server with web services

Common Services

Servers with web services

Pilot specific services

Stockholm   **Wuppertal**   **Linz**   **Prague**

Scenario Manager: overview

3D/4D visualization (mockup)

SUDPLAN overview

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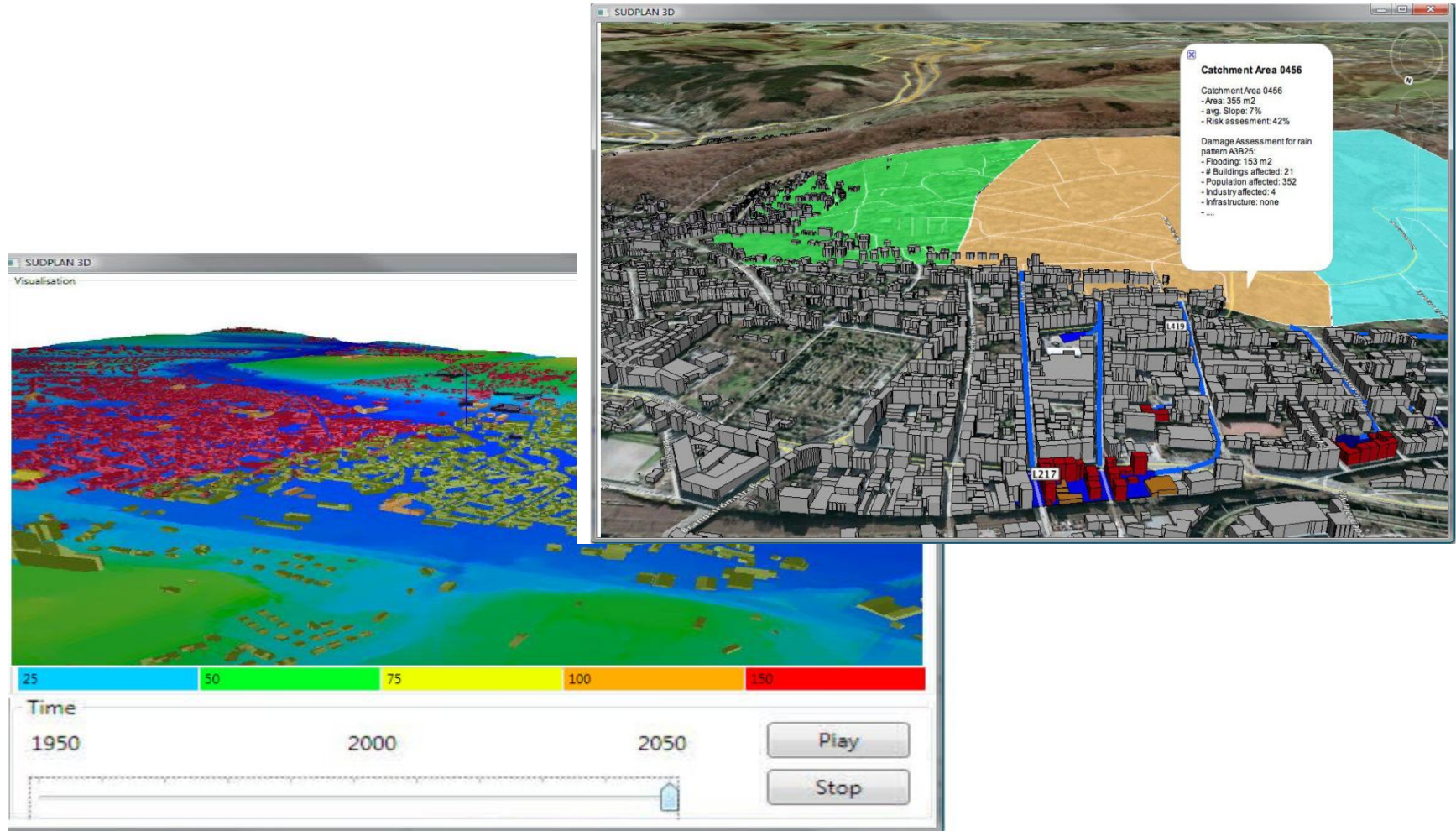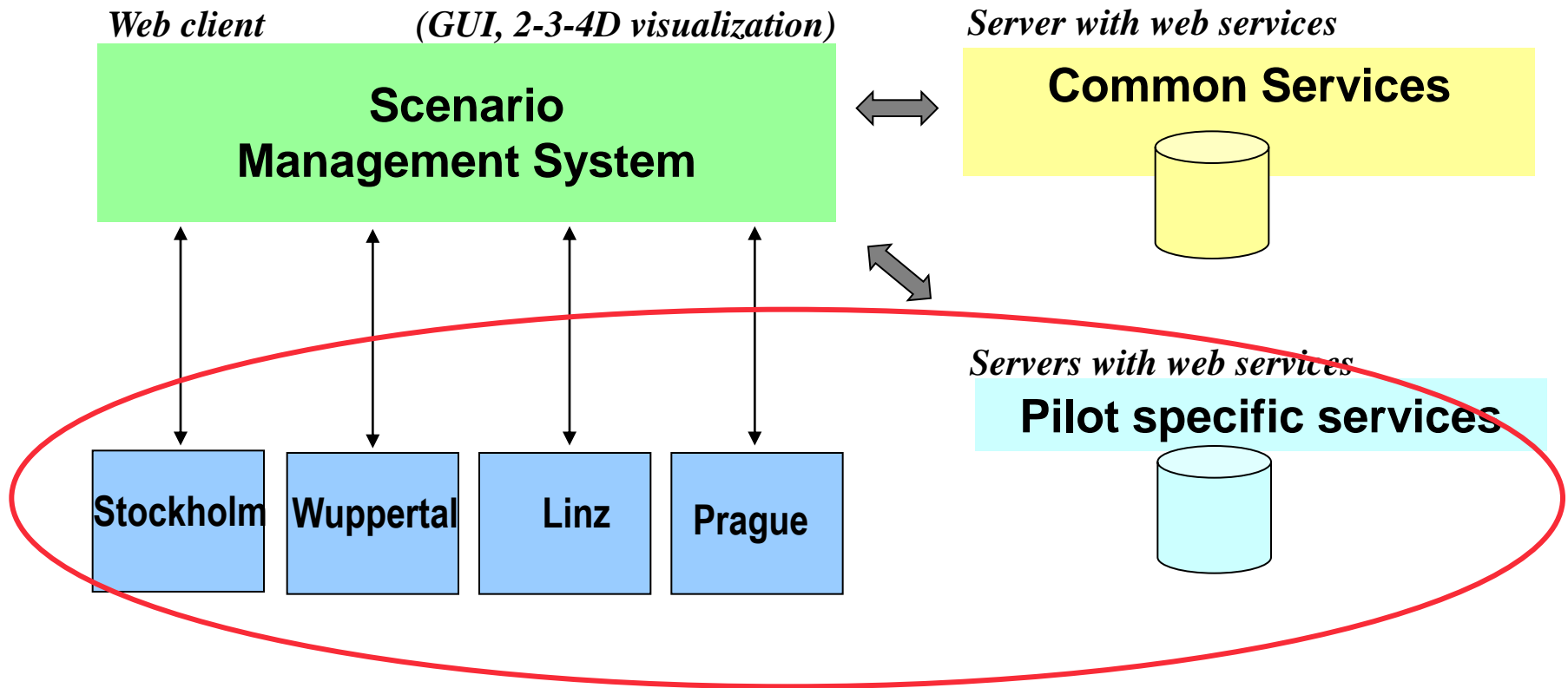
SUDPLAN modelling

Climate input →	CS database →	CS models →	Local models
Regionally downscaled climate scenarios over Europe	Precalculated European data of - intense rainfall - hydrological data - air quality	Urban downscaling of - intense rainfall - hydrological data - air quality	Pilot defined modelling
SMHI's RCA model (at least in first phase)	CS models over Europe executed by SMHI	CS models over cities executed by end-users	City-specific models executed by end-users
Input from GCMs (global models)	RCA model output used as input	Precalculated CS Europe results used as input	CS downscaling results used as input
External projects	*Common Services (CS)*		*SUDPLAN pilot applications*

Overview of the SUDPLAN modelling of environmental factors, going from the European scale (left) to the urban and eventually finer scale (right). SUDPLAN involves the Common Services modelling as well as the specific modelling required by different pilot cities

Pilots specific objectives in response to a changing climate

- **Stockholm**: **Urban air quality and local scenario emissions**, scaled down to individual streets and evaluated against EU directives (**health impact**)

- **Wuppertal**: **Heavy, short rainfall events** and their impact on the infrastructure, using **high-resolution 3D/4D modelling** of >800 creek sections and 650 km of **drainage channels**.

- **Linz**: **Stormwater flooding events** and its **impact on waste water treatment plants** and their combined sewer overflows, to avoid polluted drainage water to spill over into the river, using sensor system and runoff models

- **Prague**: **Quantifying environmental pressure** on Prague and its surroundings (air pollution, heat waves, drying up of soils as well as local floodings due to intense rainfall), **modelling population dynamics** as a response to environmental conditions

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**Scenario
Management System**

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Servers with web services

Pilot specific services
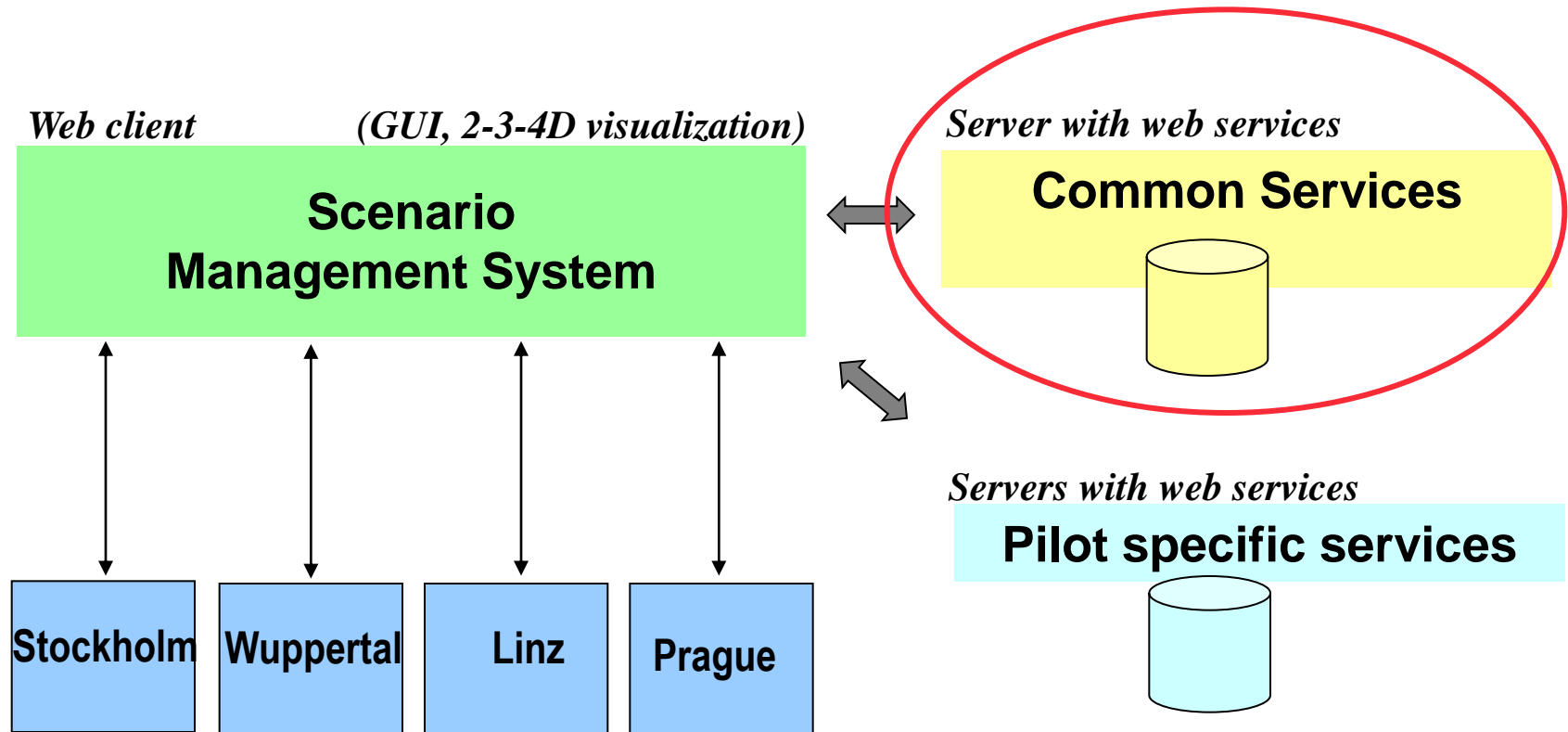
Common Services: key objective

Downscaling of Regional Climate Model results on the European scale to cover the **urban scale (typically 2x2 km spatial resolution) for use in any European city**

Two modes of operation:

- Based on the downscaled information, quantify, report and visualise the future risks for flooding, extreme rain intensities and high air pollution events

- Collaborate with existing, established infrastructures and models, e.g. **integration of Common Services into other applications or services**.

  - model execution/planning with SPS;

  - data access through SOS, WCS;

  - WFS & WMS also supported)

Common Services: functionality

1. **Climate scenarios on the European scale**

   ▪ Precipitation (including extreme rainfalls), Air quality, ambient temperature, hydrology

2.1 Intense rainfall: urban downscaling

2.2 Intense rainfall on the urban scale: storm water generator

3.1 Hydrology: urban downscaling (HYPE with improved local input)

   ▪ water flows, and flow and turnover of nitrogen and phosphorus

3.2 Hydrology: input to local hydrological models

4. **Air Quality: urban downscaling (**MATCH, an Eulerian off-line chemistry-transport model from SMHI)

Common Services 1: Scenario data on the European scale
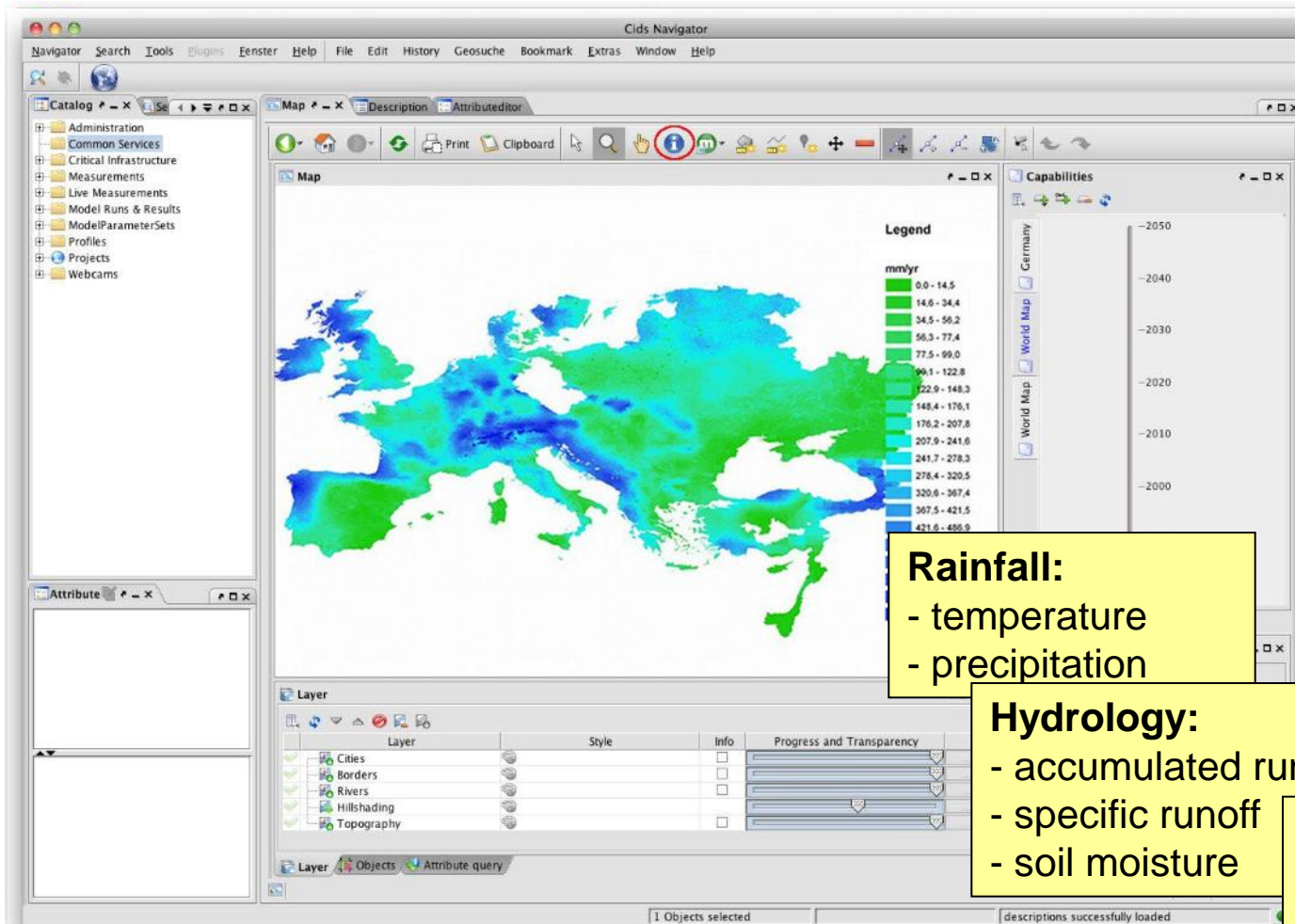
10-year averaged grids (mockup)

Opening page:
- map over Europe

Select 1:
- rainfall
- hydrology
- air quality

Select 2:
- climate scenario(s)
- variable to show

Rainfall:
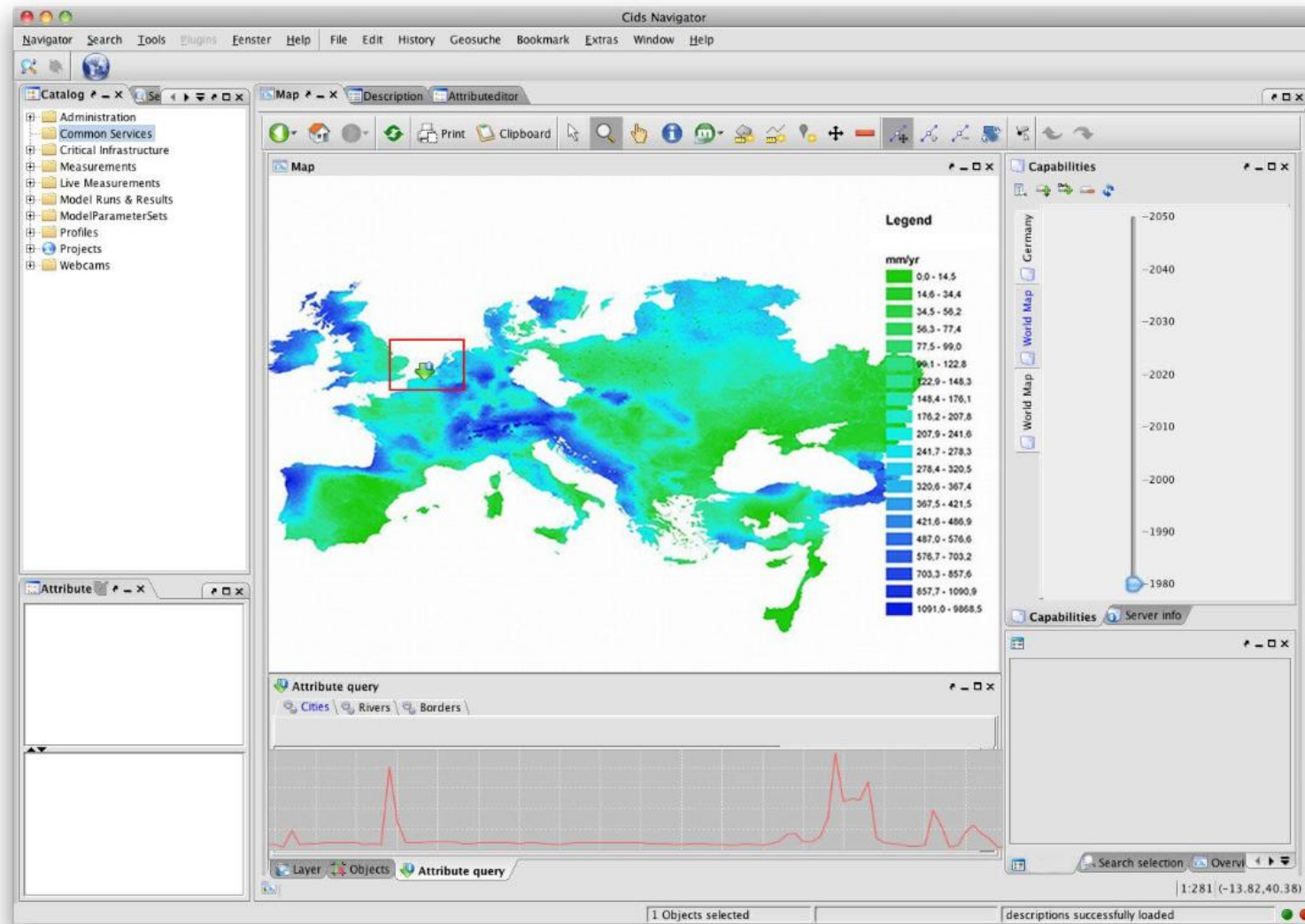- temperature
- precipitation

Hydrology:
- accumulated runoff
- specific runoff
- soil moisture

Air Quality:
O3, PM10, PM2.5,
NO2, NOx, SO2, CO

Common Services 1: Scenario data on the European scale

Time evolution at a specific location (mockup)

**Time series
 access:**
- whatever location

- Different variables

- Different time
 resolutions
 (yearly, monthly,
 daily)

Common Services 2.1: Downscaling intense rainfall

User uploads precipitation time series (mockup)

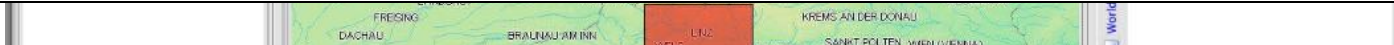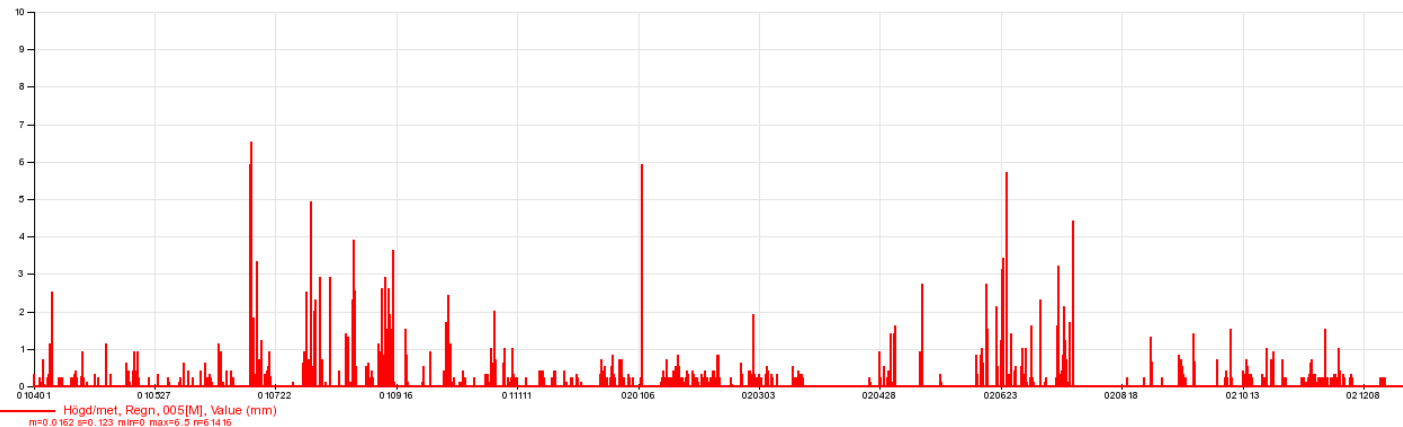**Opening page:**
- map over Europe

Select 1:
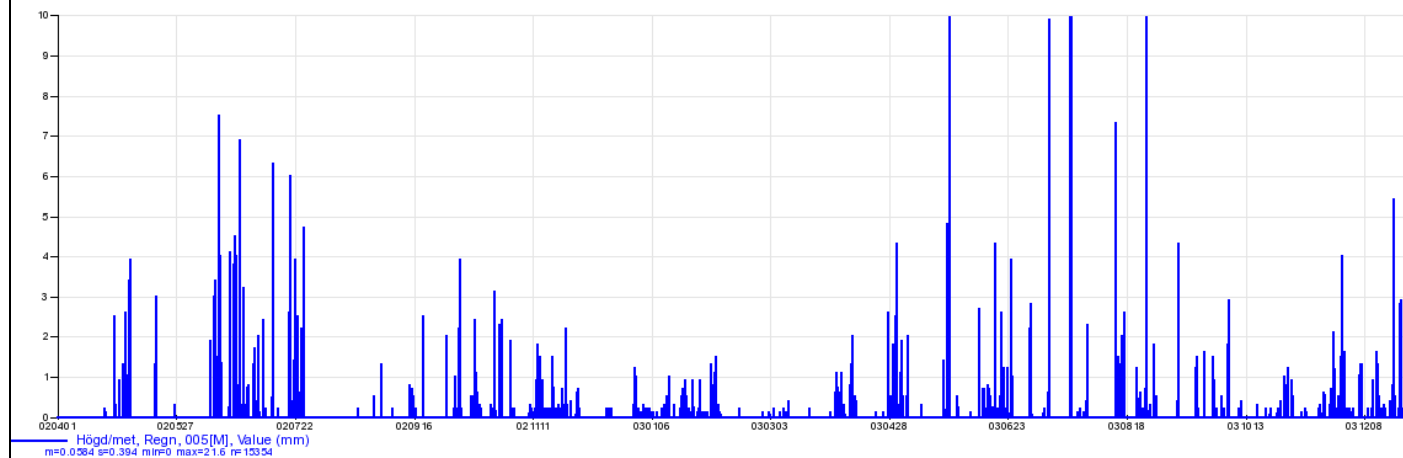- urban domain
  & rain gauge location

Select 2:
- climate scenario

Upload own data:
- high resolution
  precipitation
  (present conditions)

Output:
- high resolution
  precipitation
  (future conditions)

Common Services 4: Downscaling Air Quality

User-specific urban emissions (mockup)

Opening page:
- map over Europe

Select 1:
- urban domain

Select 2:
- climate scenario

Upload:
- emission grids

Run model:

Display result:
- select variable
- select time

Conclusions

- SUDPLAN Common Services provide:
  - climate scenarios from global climate models => regional (Europe) => urban scale.
  - "best possible" estimates of future precipitation, temperature, hydrological and air quality.
  - OGC-compliant communication and service infrastructure
- Web-based Scenario Management Environment
  - supporting the planning and decision making process
  - to be compliant with emerging SISE (Single Information Space in Europe for the Environment) infrastructure.
- The end-users:
  - city planners & scientific users providing the functionality for city planners (IT, environmental modellers, statisticians etc.)
  - will be able to evaluate risk hazards of storm water local runoff, river flooding and elevated air pollution levels for planned or existing urban areas subject to a changing climate.

SUDPLAN

The research leading to this presentation has been founded by the European Commmunity:

Contribution to FP7 Call Objective

- Call objective ICT-2009-6.4: "ICT for environmental services and climate change adaptation"
- Target Outcome A: "ICT for a better adaptation to climate change"
- FP7 Contract 247708

Indicative Budget & Resources

- Total budet 3.3 Million Euros
- **EC funding of 2.5 Million Euros**
- Duration 36 months starting January 2010,
- overall resources 254 MM