SUDPLAN Services Available after FP7 and their Possible Future Use

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Abstract. This paper gives an overview on the software results of the SUDPLAN project. The results can serve as a technical basis for the integration of climate change effects in urban planning, including access to adequate climate change information. End-users provide local data to improve the downscaling of climatic and environmental variables, based on regional climate model output to deliver projections of environmental conditions in the right scale for the local planning process. Downscaling is performed by a set of Common Services that deliver data describing rainfall intensity, frequency and duration; hydrological conditions; soil moisture and surface water resources; and air quality. The urban scale projections provided may be used to assess urban storm water flooding and sewer system capacities, river flooding, and citizen health. The client side functionalities necessary to integrate, visualise and support local climate change aware analyses are provided by the Scenario Management System. The general approach, the downscaling result quality, and the soundness of the technical developments are demonstrated by four representative case studies in Stockholm, Wuppertal, Linz and Prague. A large part of the results is available as Open Source software.

Keywords: climate change, mitigation, precipitation, IDF, SUDPLAN, Delta Change

1 INTRODUCTION

The SUDPLAN (Sustainable Urban Development Planner for Climate Change Adaptation) project answered to the ICT-2009.6.4 call *ICT for environmental services and climate change adaptation*. SUDPLAN targets the first outcome a) *ICT for a better adaptation to climate change*, addressing the need for an "Easy-to-use, web-based systems for better preparedness, decision support and mitigation of climate change impact on population, utilities and infrastructures" and "… scenario-based prediction, damage assessment, planning and training, 3D/4D modelling, simulation and visualisation, as well as sensor networks". The SUDPLAN project started in January 2012 and ended in December 2012. This paper will outline the potential use of SUDPLAN services.

2 SUDPLAN System

SUDPLAN provides the means to downscale future rainfall, hydrological and air quality data for a specific city, taking climate change into consideration. With end-user's local model integrated downscaled data can be seamlessly used as input for local model simulations. Moreover, the integration, visualisation and information management of local planning scenarios are supported. Through this SUDPLAN integrates the effects of climate change into urban planning processes on all levels from the Master Plan to the individual permit. SUDPLAN software comprises two principal software components, the Scenario Management System (SMS) and the Common Services (CS), see **Fig. 1**.

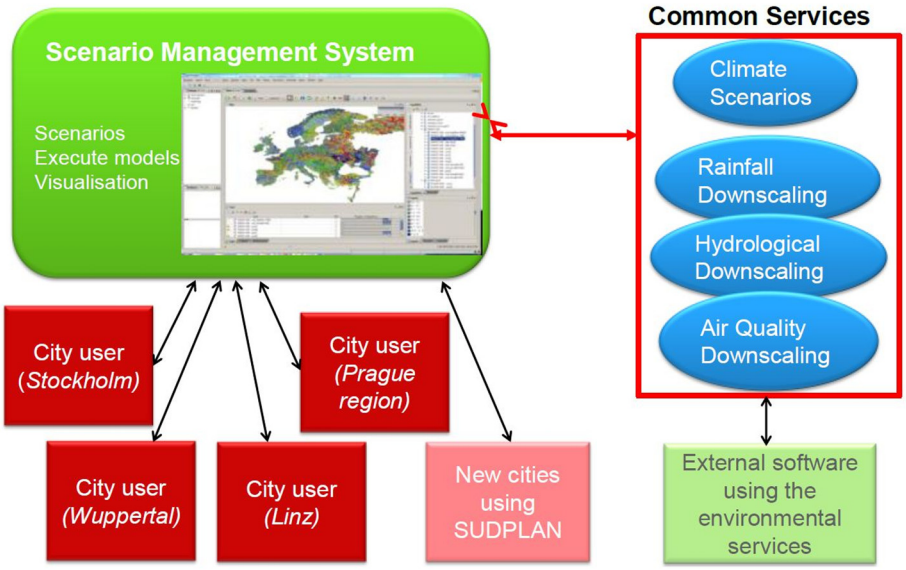

Fig. 1. Overview of SUDPLAN main components

The SMS provides the graphical user interface to access CS and consists of the SMS Framework, Model as a Service Integration and Advanced Visualisation. It serves as a generic integration platform to facilitate climate change induced urban development planning. It contains tools to visualise time series and spatial data, including advanced 3D/4D presentations. CS facilitate the access and visualisation of climate, hydrological and air quality information on the Pan-European scale. Through OGC service interfaces (SOS, SPS, WMS and WFS) CS expose regionally downscaled climate scenarios forced by different global climate model results. Further, Pan-European information allows urban downscaling of intense rainfall, hydrological conditions and air quality. Depending on the specific CS to be used the required input is high resolution time series of precipitation, time series of river discharge or gridded emissions.

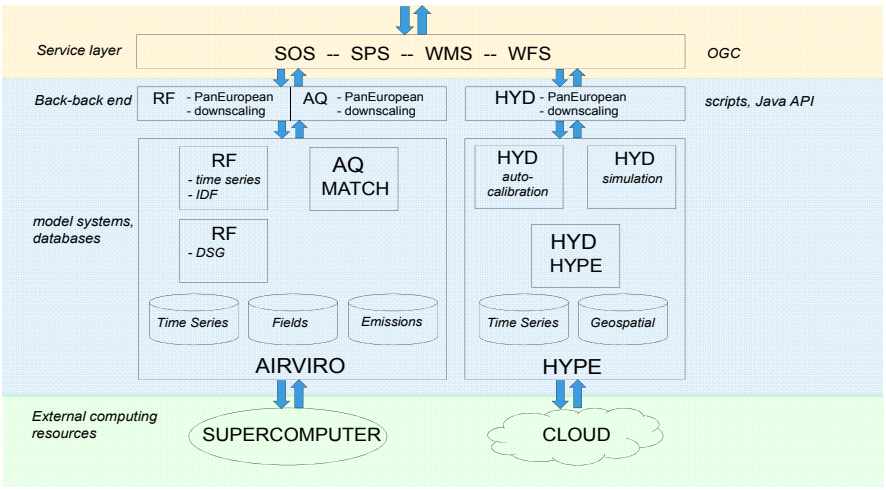

Fig. 2. Common Services layered architecture

3 Potential use of SUDPLAN Services

SUDPLAN supports planners to include future rainfall, hydrological and air quality data on the urban or regional scale in their planning process. With SUDPLAN planners can improve the quality of projections (future future environmental conditions) by uploading local data [1]. This process is called "downscaling" (**Fig. 3**).

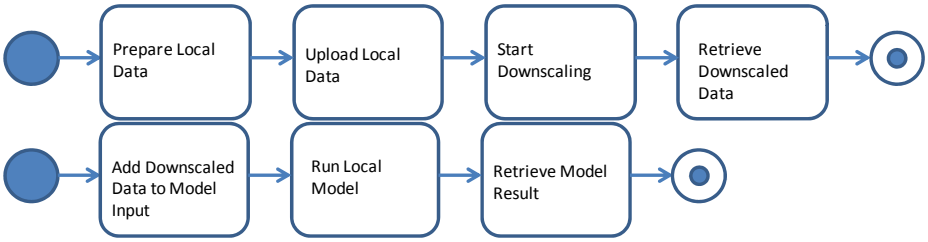

Fig. 3. The downscaling process in SUDPLAN

Considering projections of environmental data is especially relevant for long term planning because large scale infrastructure projects involve an assessment of environmental conditions (Environmental Impact Assessments - EIA), either because they determine the project design (e.g. dimensions of rainwater runoff pipes) or because the project itself may impact the environment (spill of polluted water, exposure to air pollution. EIA are often regulated by legislation, e.g. in Sweden the transport sector follows a manual for how to and when assess the impact of planned road and rail projects. EIAs are often required during the project construction and might continue after the project, to confirm sound planning.

4 Available Demonstrations

SUDPLAN project results have been validated in four pilot applications with significantly different urban planning issues including different CC adaptation measures like the dimensioning of waste water pipes, the inclusion of alternative drainage options (higher road curbs) or waste water storage capacities, demonstrating the transferability of the approach. The two time/scale/planning phase lines in **Fig. 4** illustrate the use of SUDPLAN results in the context of an EIA.

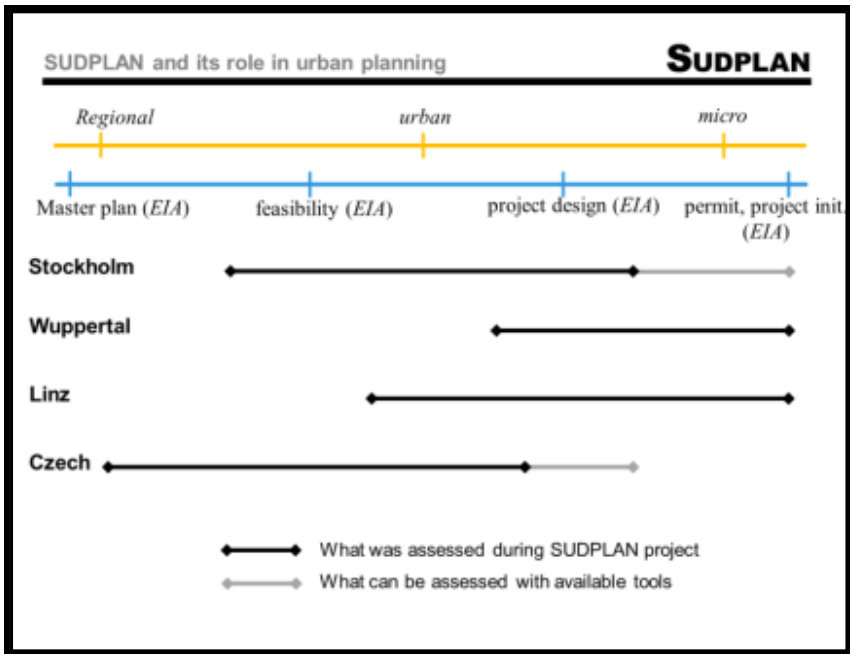

Fig. 4. SUDPLAN in the planning process

Stockholm, Sweden: Air quality in Stockholm today is not fulfilling the standards given by EU and Swedish legislation. Two advantages are expected from the use of the SUDPLAN Common Services. It is possible to assess projections of long-range air pollution transport where both climate change and expected changes in European emissions can be taken into account. By combining this information with results of local models, it is possible to assess various relevant temporal and spatial scales. SUDPLAN's advanced 3D visualisation of air quality modelling results help them to communicate to the politicians and the public where and why air quality problems occur [2].

Wuppertal, Germany: With climate change the city of Wuppertal (Germany) anticipates extremely localized runoff events from increased heavy, short-term rainfall. The potential damage of public infrastructure and of private property is a major concern. The Wuppertal case study is based upon two guiding ideas: The first is the de-

velopment of a tool that enables planners to define and run simulations of 1D-2D sewer and surface runoff in the course of heavy storm water events and to visualise the results of these model runs. The second is to consider the effect of climate change on future rainfall patterns by using downscaled rainfall data that are provided as input to the simulations [3].

Linz, Austria: The focus of the Linz pilot is to estimate the impact of climate change on the pollutant loads spilled from urban drainage systems into the natural environment as a result of the overflow of sewer systems. Since more frequent and heavier rainfall is expected as a result of climate change, significant impacts to the natural ecosystem are to be expected. Therefore, long-term simulations with rainfall runoff transport models are required in the long-term planning process, where rainfall is the major system input. [4].

Prague, Czech Republic: The overall goal of the Prague case study is to use the SUDPLAN services in describing and assessing the state, trends and future development of air pollution and hydrological conditions in Prague in the context of climate change including air quality projections for different activity scenarios (energy, transport, industry and agriculture sectors) with special focus on particulate matter and ground level ozone. SUDPLAN have been applied in urban and spatial planning as well as in environmental impact assessment of large infrastructural and construction projects and agriculture, since crop yield is heavily influenced by changes in average temperature and rainfall [5].

5 Conclusion

The SUDPLAN has produced software that can serve as a technical basis to use climate change model results in a local context. The Scenario Management System as a large part of the software is available as Open Source Software [6]. Common Services are maintained at Swedish Meteorological and Hydrological Institute after the project lifetime. Post-project development has included a simplified web application for only rainfall downscaling, the RainPortal [7]. The application has a clear commercial potential and is tested as a consultancy tool at Swedish Meteorological and Hydrological Institute. The tool allows an easy and rapid way to deliver information of the risk for future extreme rainfall events, supporting the design of water drainage and surface runoff systems for whatever location in Europe.

6 References

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