SUDPLAN

Facilitating Urban Hydrological Climate Change Impact Assessment in Europe

Jonas Olsson[1,2], Lars Gidhagen[1], Akira Kawamura[2]

[1]Swedish Meteorological and Hydrological Institute, SE-601 76 Norrköping, Sweden

[2]Tokyo Metropolitan University, Tokyo 〒 192-0397, Japan

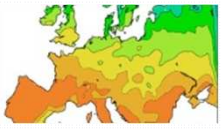
Introduction

The EU-project SUDPLAN (Sustainable Urban Development Planner for Climate Change Adaptation) aims at developing a web-based planning, prediction and training tool to support decisions in long term urban planning. This 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. With its open nature and architectural design, SUDPLAN will contribute to a shared information space in Europe.

The Common Services

The functionality of the SUDPLAN tool is centred around three so-called "common services" related to:

- short-term rainfall for urban hydrology
- rural hydrology
- air quality



In the tool, results from Regional Climate Model (RCM) scenarios will be made available with possibilities of further processing and downscaling to allow for local climate change impact assessment.

Urban downscaling of short-term rainfall

The commonly available results from RCMs are generally on a 50×50 or 25×25 km grid and a daily time scale. These resolutions are however too low for urban hydrological applications, which generally require short-term precipitation intensities (5-10 min) at a very local scale (single km², essentially a point value). To assess future precipitation changes at these small scales, and generate data for effect studies, downscaling is required. In SUDPLAN, this is achieved by the Delta Change (DC) method (e.g. Hay et al., 2000). In which historical observations are modified in line with the expected consequences of the climate change.

Two versions of event-based downscaling

The basis of event-based downscaling in SUDPLAN is extreme value analysis of annual rainfall maxima of different durations in RCM output, using the Generalized Extreme Value (GEV) distribution. In the main, first version, downscaling is performed in terms of IDF-curves and traditional design storms.

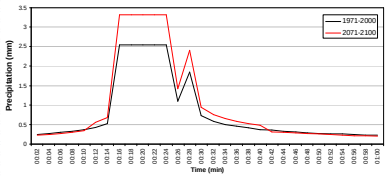


Figure 1 Examples of original (black) and re-scaled (red) design storms.

For each selected climate change scenario, this analysis is applied to one reference and one future, user-specified 30-year time-series of 30-min values from the five RCM grid points surrounding the desired location. The relative difference between extreme intensities for short durations may in turn be used to re-scale the user's existing local design storm (Fig.1).

In the second version, the design storm concept is developed to include storm direction and movement . This is done by a "storm generator" that transfers the central design to surrounding locations, taking climate change impact on peak intensity into account (Fig. 2).

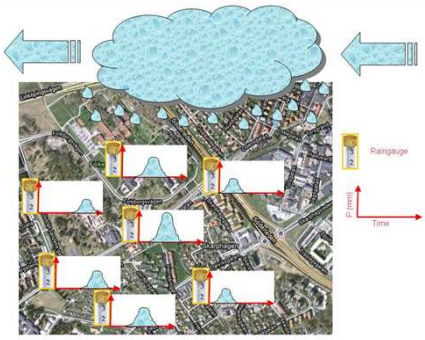


Figure 2. Schematic of the storm generator, simulating the passage of a storm over a catchment and generating consistent time series (design storms) in selected locations.

Downscaling of continuous time series

Downscaling of continuous series is performed by applying Delta Change to historical short-term observations (e.g. tipping bucket) , uploaded by the user, as described in Olsson et al. (2009). This DC approach considers the entire frequency distribution of precipitation intensities, which makes it possible to transfer opposing trends to historical observations, such as higher maximum intensities but lower seasonal volume (Fig. 3).

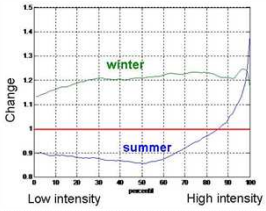


Figure 3 Example of future changes in the frequency distribution of rainfall intensities for Swedish conditions. The red horizontal line indicates no change.

Pilot applications

The short-term rainfall common services will be applied and evaluated in two pilot applications, one on CSO management in Linz, Austria, and one on storm water flooding in Wuppertal, Germany.

The steep narrow valley makes the city of Wuppertal very vulnerable to flooding.

References

Hay, L.E., Wilby, R.L., and Leavesley, G.H., 2000. A comparison of delta change and downscaled GCM scenarios for three mountainous basins in the United States. *Journal of the American Water Resources Association* 36, 397-397.

Olsson, J., Berggren, K., Olofsson, M., and Viklander, M., 2009. Applying climate model precipitation scenarios for urban hydrological assessment: a case study in Kalmar City, Sweden. *Atmospheric Research* 92, 364-375.

Acknowledgement

SUDPLAN is a project co-funded by the European Framework Program 7, under challenge ICT-2009-6.4 ICT for Environmental Services and Climate Change Adaptation of the Information and Communication Technologies program, project number 247708.

Contact: Jonas.Olsson@smhi.se **web:** http://www.sudplan.eu