

Mitigation of Climate Change Impacts on Urban Drainage Systems

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Abstract

It is in the interest of society to provide protection for the population and to protect the valuable infrastructure against urban flooding in a timely and cost efficient way. Climate changes may change the precipitation pattern significantly. It is foreseen that in some places around The World, the extreme rainfall events will increase both in number and in intensity. DHI is part of a series of investigations aiming at modeling, understanding and mitigation of the impact of climate changes on flooding from urban drainage systems. The goal of these investigations is to provide guidelines to local authorities on how to carry out timely and cost efficient management of potential future climate changes.

This paper describes a modeling procedure for problem identification and quantification in relation to urban flooding, by use of MIKE FLOOD.

Keywords

Climate change, flooding, MIKE FLOOD, MIKE URBAN, rainfall, sewers, urban drainage.

Predicted climate changes

Many governments around The Word have decided to work with three climate change scenarios and consider that the probability is the same for each of them. The scenarios are:

A2 describing a heterogeneous world with strong local development, which results in a continuous growth of the world population. The development of the economy mostly takes place at a regional level. The economical growth and technological changes are fragmented and take place at a slower pace than the other two scenarios.

B2 describing a world where the main focus is on local solutions, which are sustainable with respect to economics, social issues and the environment. There is a continuing increase in the worldwide population, but it is taking place at a slower pace than in Scenario A2. Scenario B2 has an average economical development and has a slower and more diverse technological development than the other two scenarios.

EU2C describing a world where international society and individual countries collaborate in finding technological solutions and changing behavior before human actions have an impact, which will increase the global temperature by more then 2 °C compared to the pre- industrialized level. This scenario corresponds to the ambitions of the EU, as expressed by "The European Council" in 2005.

The three scenarios are shown in Figure 1. Note that the three scenarios do not differ very much for the first 30-50 years. The differences between the scenarios start to develop and become visible after that time.

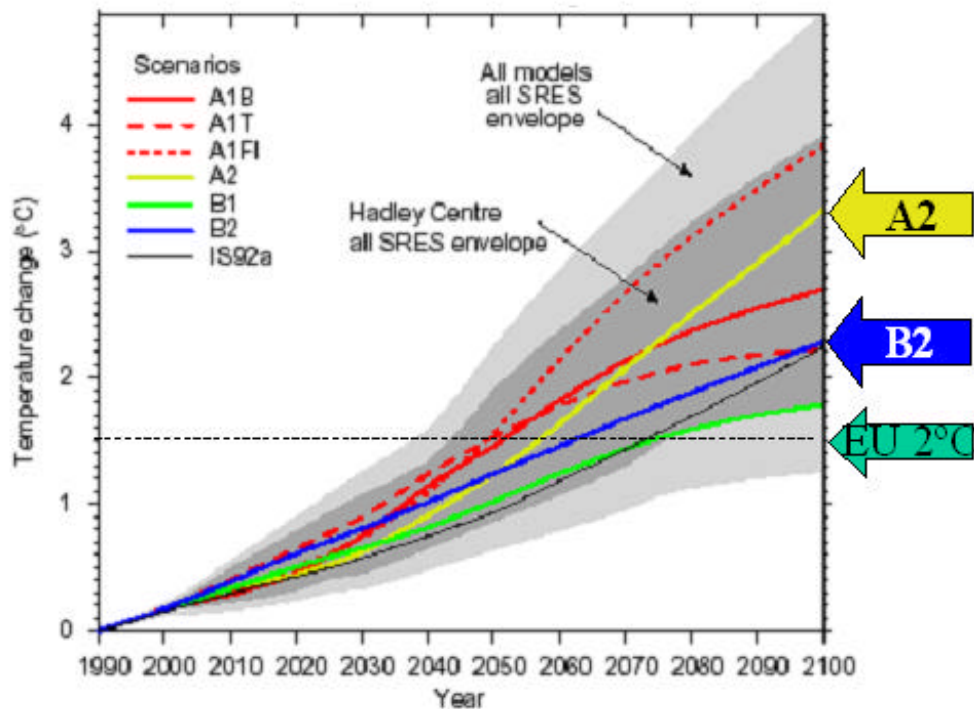


Figure 1. The development of the three climate scenarios, i.e. A2, B2 and EU2°C.

Data availability

Most of the climate change data available for the analyses of the changed precipitation patterns covers the development of scenario A2 during the period 2071-2100. Such data typically consist of 1 hour rainfall data on an area, e.g. of 25x25 km. Hence, at present there is no or limited information available about how the rainfall will change up to the year 2071.

The impact on the precipitation due to climate change

According to the climate change prognoses, it is expected that the distribution of rain throughout the year and the maximum rainfall intensities will change significantly this century. It is expected that in many places the extreme rainfall events will increase in volume and intensity during the summer period. In scenario A2 (covering the period 2071-2100) the yearly precipitation will increase slightly and the heavy rains during the summer will increase both in number and intensity.

Modelling of the impact of climate changes

Modelling of the impact on the impact of climate changes may be carried out in a two-step procedure, where the first step is problem identification and the second step is problem quantification. The problem identification may be carried out by use of a traditional 1D hydrodynamic model, like MOUSE or MIKE URBAN. The model is then run with the new input (rainfall and downstream water levels) estimated for the climate scenario and location with flooding are identified. During the second step of the procedure a digital terrain model is prepared around the flooded areas and a MIKE FLOOD model is set up and run to get exact computation of the flood depth, extent and duration. An example of such a flood map can be seen in Figure 2.

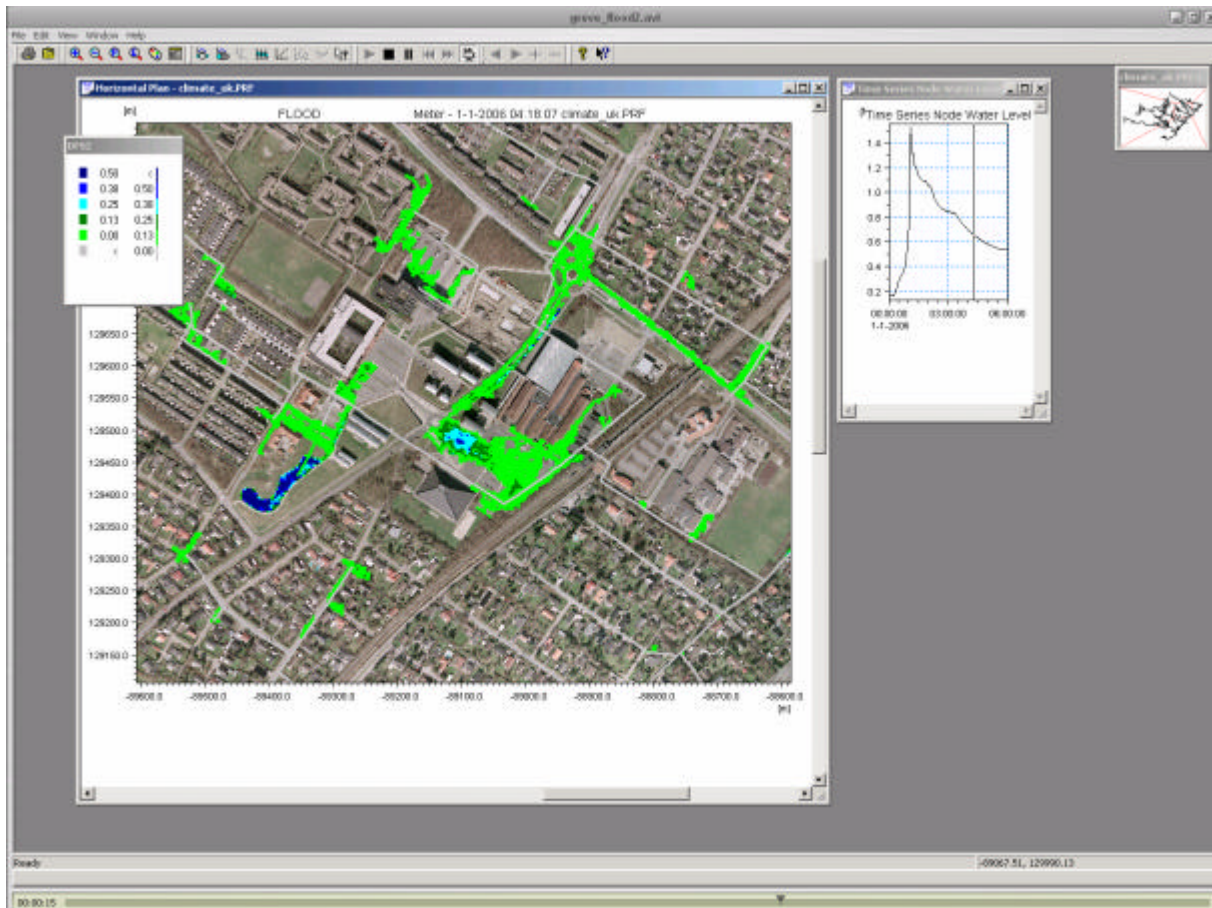


Figure 2. A flood map computed by MIKE FLOOD.

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