Climatic changes of extreme precipitation in Denmark from 1872 to 2100

Arnbjerg-Nielsen, Karsten; Gregersen, Ida Bülow; Sunyer Pinya, Maria Antonia; Rosbjerg, Dan; Madsen, Henrik

Publication date:
2013

Document Version
Publisher's PDF, also known as Version of record

Abstract for ICWRER conference, Koblenz 2013.

Climatic changes of extreme precipitation in Denmark from 1872 to 2100.

Karsten Arnbjerg-Nielsen, Ida Bülow Gregersen, Maria Sunyer, Dan Rosbjerg
Dept. of Environmental Engineering, Technical University of Denmark

Henrik Madsen
DHI

During the past 30 years rather dramatic changes in extreme precipitation has been observed in Denmark. The changes have mainly been observed in the frequency of extreme events, but also a tendency towards more severe events is occurring. The increase in precipitation extremes have led to inundations in most of the larger cities during the last 10 years; the flood in Copenhagen in 2011 implied the second highest damage costs measured in Denmark during the last 100 years. Hence much effort is directed at explaining the observed increase and to predict future occurrence rates and sizes of precipitation extremes. The objective is to establish cities that are resilient to pluvial floods by means of a gradual upgrading of the drainage capacity in combination with a structured risk management approach.

Using the regional climate model (RCM) data repositories from PRUDENCE and ENSEMBLES, estimates of climate change impacts from anthropogenic effects can be established based on projections of daily precipitation. These estimates have then been further downscaled to enable urban pluvial inundation calculations using different statistical downscaling and extreme value analysis techniques. . From the results it is clear that the impact from anthropogenic activity is very likely to be a significant increase in extreme precipitation amount and occurrence. The increase will be larger for higher return periods and shorter durations. However, the uncertainty of the increase is very high, and the RCM outputs are to some extent correlated which leads to over-confidence in the results obtained by using these repositories.

Studies of data from a high-resolution network show that some of the observed changes during the recent decades can be partly explained by changes in atmospheric teleconnections. These results are important for the extrapolation to future events. Currently efforts are dedicated to constructing similar models based on outputs from climate models, but the models are complicated due to the fact that the correlation structure of high-resolution precipitation in the climate models deviates from the structure we observe in historical networks of rain gauges. The results from the analysis will be combined with an analysis of non-stationary behavior in a network of gauges measuring daily precipitation from 1872 to present.