

Technical University of Denmark



Influence of urban land cover changes and climate change for the exposure of European cities to flooding during extreme precipitation

Kaspersen, Per Skougaard; Høegh Ravn, N. ; Arnbjerg-Nielsen, Karsten; Madsen, H.; Drews, Martin

Publication date:
2015

Document Version
Peer reviewed version

[Link back to DTU Orbit](#)

Citation (APA):

Kaspersen, P. S., Høegh Ravn, N., Arnbjerg-Nielsen, K., Madsen, H., & Drews, M. (2015). Influence of urban land cover changes and climate change for the exposure of European cities to flooding during extreme precipitation. Abstract from European Climate Change Adaptation Conference 2015, Copenhagen, Denmark.

DTU Library Technical Information Center of Denmark

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Influence of urban land cover changes and climate change for the exposure of European cities to flooding during extreme precipitation.

Per Skougaard Kaspersen ^{a*}, Nanna Høegh Ravn ^b, Karsten Arnbjerg-Nielsen ^c, Henrik Madsen ^d, Martin Drews ^a

^a Climate Change and Sustainable Development group, Department of Management Engineering, Technical University of Denmark, Frederiksborgvej 399, building 110, DK - 4000 Roskilde, Denmark

^b LNH Water, Skelbækgade 30 3th, 1717 Copenhagen V, Denmark

^c Department of Environmental Engineering, Technical University of Denmark, Miljovej, Building 114, 2800 Kgs. Lyngby, Denmark

^d DHI, Agern Allé 5, 2970 Hoersholm, Denmark

* Corresponding author. Tel.: +45 2012 5884; E-mail address: pskk@dtu.dk

Keywords: *Urban flooding, extreme rainfall, land cover change, climate change, remote sensing, Landsat, hydrological modelling, risk assessment*

Abstract

The extent and location of impervious surfaces within urban areas due to past and present city development strongly affects the amount and velocity of run-off during high-intensity precipitation and consequently influences the exposure of cities towards flooding. The frequency and intensity of extreme precipitation are expected to increase in many places due to climate change and thus further exacerbate the risk of pluvial flooding. Improved knowledge of the individual and combined impacts of urban land cover changes and climate change towards the risk of flooding is critically needed for city administrations and local governments when planning for climate proof cities. This paper presents a methodology for examining the influence of recent observed changes in urban land cover for European cities for the exposure to flooding under present and future climatic conditions. A combined hydrological-hydrodynamic modelling and remote sensing approach is used to simulate the occurrence of (and related flooding during) a range of extreme rainfall events under current and expected future climatic conditions, and for different levels of urbanisation, which corresponds to historical (1984) and current (2014) urban land cover conditions. The approach is applied for eight European cities, representing different climatic conditions and historical urbanisation trends within Europe. Remotely sensed Landsat moderate resolution (30m) satellite imagery are analysed using a regression modelling approach to quantify historical changes in impervious surfaces. The outputs of the remote sensing analyses are combined with regionally downscaled estimates of current and expected future rainfall extremes to enable 2D overland flow simulations and flood hazard assessments, and to compare the relative influence of land cover changes with that of expected climate change. Preliminary results show that the influence of recent land cover changes for flood

exposure in European cities are in the same order of magnitude as what can be expected as a result of 2 degrees global warming (RCP4.5), and thus that urban planning play a central role for the vulnerability to flooding within urban areas.