Impacts of Climate Change on Stormwater Systems in Reykjavík

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Due to climate change, precipitation is projected to increase in Northern Europe (Bates et. al., 2008). Such changes can influence the design and management of stormwater systems. Most of the current climate change studies have not analyzed short duration precipitation which is needed for stormwater system design. The objectives of this project are first to investigate whether changes in short duration extreme precipitation have occurred in Reykjavík in the past decades. Then this information is used to assess increased flood risk in the stormwater system in downtown Reykjavík using Mike Urban program. The only precipitation record with sufficient length and resolution in Reykjavík is from the Icelandic Meteorological Office. From 1951 to 1999, the data was recorded on paper, but a digital gauge was then installed. Three methods have been used to detect changes: The Mann-Whitney test, the Kolmogorov-Smirnov test and the Mann-Kendall test. The trend magnitude is estimated with the Theil-Sen slope.

No significant trends were found on an annual basis. A positive significant trend of 0.12mm/decade, was found in August (10 minutes duration) and a negative trend of -0.08 mm/decade was found in November. The times series analysis also reveals the presence of decadal to multi-decadal variations related to natural climate variability, which may have counteracting effects on long-term trend detection, as the variations could be larger in magnitude than potential trends. The 1M5 Method is the primary method used in Iceland to find design precipitation intensity, based on the 1 day event with a 5 year return period (Elíasson, 1999). By updating the method with new data (1985-2008), 10 minutes design intensity increased by 16%. An increase in short term extreme precipitation may increase the risks of flooding in stormwater systems. The inconveniences are expected to be greatest in the older parts of towns with combined sewer and rainwater collections systems. These increased risks will be investigated in downtown Reykjavík. Modeling of possible future scenarios may identify the weakest links within the system, and help define and prioritize mitigation efforts to minimize floodings.

References

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