Urban Water Management: How to prevent drowning … in data

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The 21st century presents humankind with perhaps its greatest challenges ever. A big part of meeting that challenge lies in how the urbanization of three billion additional people will be accomplished between now and mid-century. The United Nations expects some 6.3 billion people – 68 per cent of the world's population – to be living in urban environments by 2050. China alone will urbanise 300 million people between now and 2030 – that is equal to the entire population of the US, the World's third most populous country, and just 20 years! Over next few decades, billions more people are expected to join the global middle class. The vast majority will come from emerging markets, which are projected to double their share of global consumption (from one third to two thirds) by 2050. Growth in consumption and incomes will add further pressure on the finite space and strained natural resources and environment – particularly within cities.

Urbanization associated with economic migration into cities outpaces the rate at which infrastructure and housing density can adapt to meet the challenges associated with the rise of cities. This situation particularly creates the need for trade-offs in allocating space for transport infrastructure, drainage infrastructure, industrial estates and commercial property within local communities. Traditional approaches to planning and urban growth are becoming unsustainable in the allocation of space for a single function (e.g. increased drainage infrastructure or parkland and public spaces).

Simultaneously we are going through an explosion in urban informatics. Data are collected all the time, everywhere. In addition to fixed *in situ* sensors that record light, temperature, pollution and other environmental factors, proliferation of personal sensors like Fitbit and Up wristbands record the location, activity, and physiology of individuals. Mobile phones and citizen scientist networks could provide crowd-sourced sensing of the environment and infrastructure. Widespread use of video cameras and RFID (radio frequency identification) technology are already monitoring the movement of pedestrians and vehicles. However, very little of that surveillance data are analyzed for purposes other than forensics or revenue generation.

Smart cities are often linked to the idea of 'big data'. For instance, open sensor data provide the foundation for making cities smarter by enabling new services and acting as a feedback for improving existing services. However, data itself does not constitute value. Value needs to be derived through high-level processing of raw data and fusing of the physical, biological, and informational sensing of the city. In this context, intelligent data analysis based on diverse data sources remains one of pillars of my research interests.

Flooding is an increasing hazard to rapidly urbanizing society. Good governance implies careful water management in terms of both design and planning such that the effect of rainstorms and extreme water levels is taken into account with relevant precision.
In this talk we describe number of innovative approaches to harnessing big city data for benefit of detailed simulation of flooding events. Together, these applications form a new versatile water management modelling instrument which not only supports operational water management, but decision making processes and dissemination of information to public during disasters.