



## Integrated management and modelling in urban drainage systems: the potentialities in a developing megacity

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WWW-YES- 2009, 8th World Wide Workshop for Young Environmental Scientists, 2-5 June 2009, Paris



## Overview

- Introduction
  - Background/Context
  - General Aims & Objectives
  - Brief background to the case studies
- Analysis to be performed – Knowledge gaps
- Model developments & Initial results
- Future work

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## Background/Context

- Accelerated urbanization in developing countries
- Conflicting water services: water supply, drainage, sewage collection and treatment, and receiving water uses
- Pressures on urban water systems (water balance & water quality)
- Effective management of UDS = scientific understanding of their impacts



## Background/Context

- UWWS: sewer system – WWTP – river
- UWWS have been designed, operated and improved as separate entities
- Potential benefits of a holistic management (*Developing countries*) - Key role of simulation models
- ↓ pollutants discharged into the receiving system
- Sewer solids provide a transport matrix for different pollutants

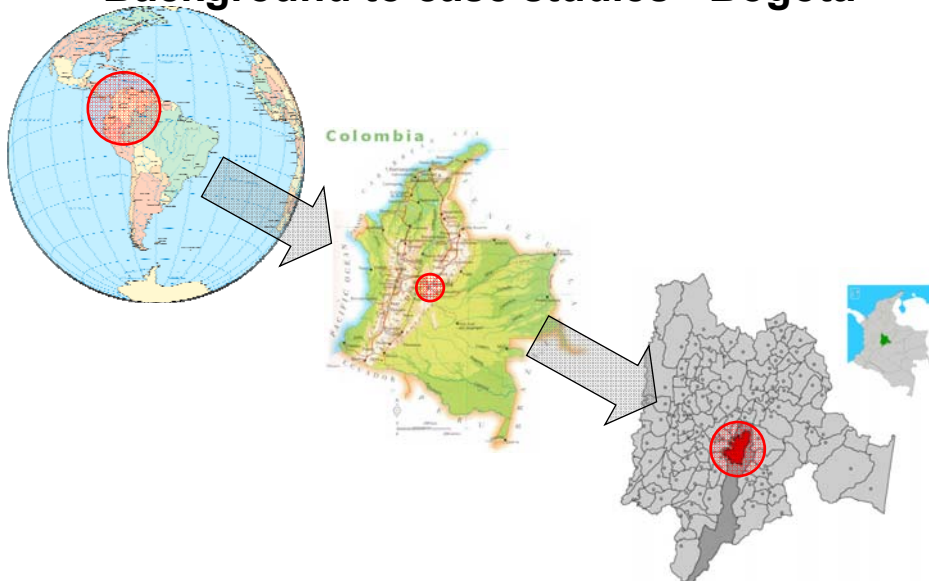


## General Aims & Objectives

- Bogotá (Colombia) is a prime example of a mega-city demanding an integrated management of water resources
- Development and application of appropriate modelling tools at different levels of detail
- Integrated UDS modelling framework (Bogotá, ...)
- City Drain toolbox + Case study from Europe (Linz, Austria)
- Two different scales: sub-catchment and macro-modelling scales

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## Background to case studies - Bogotá



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## Background to case studies Bogotá

- 7 million inhabitants, around 330 km<sup>2</sup> of urban area
- Storm and WW systems with a large number of wrong connections
- Wastewater and CSO discharges into the rivers
- DWF 17 m<sup>3</sup> s<sup>-1</sup> vs. WWT system capacity 4 m<sup>3</sup> s<sup>-1</sup>
- The Bogotá River with a mean flow of 10 m<sup>3</sup> s<sup>-1</sup> has a 60 km anaerobic stretch

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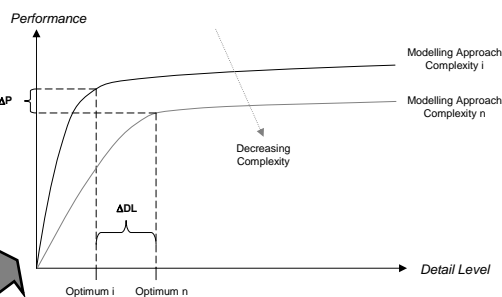
## Analysis to be Performed

### 1. Sub-catchment scale

*How the complexity of the storm water quality model and the level of spatial detail of the sewer system affect the overall predictability and robustness?*

### Methodology

Comparative modelling between study cases  
- "El Virrey" experimental sub-catchment  
- Linz



**Uncertainty and sensitivity analysis**

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## Analysis to be Performed

### 2. Macro-modelling scale

- Combined or separated systems? How wrong connections affect the system performance

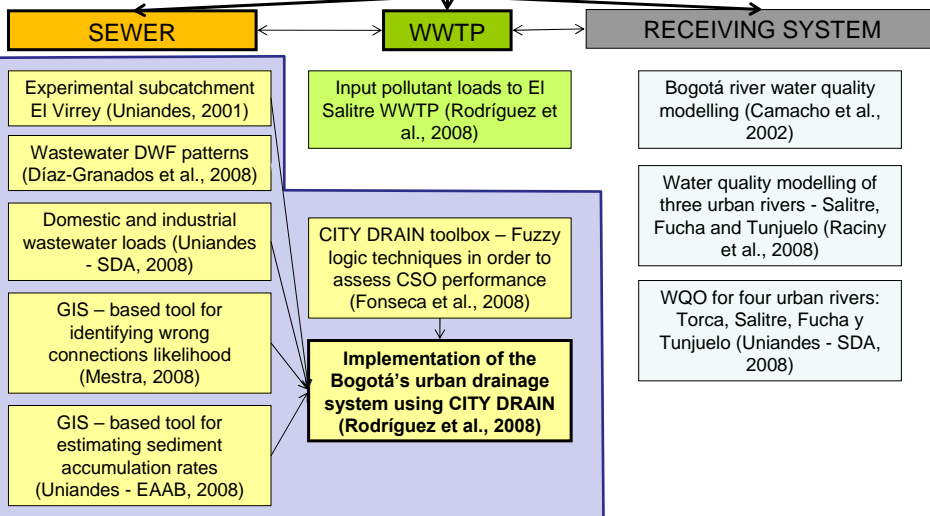


### Methodology

- Bogotá Case



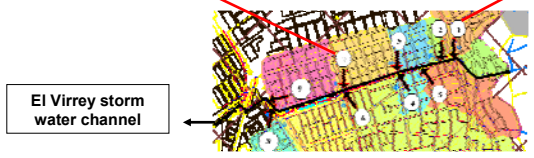
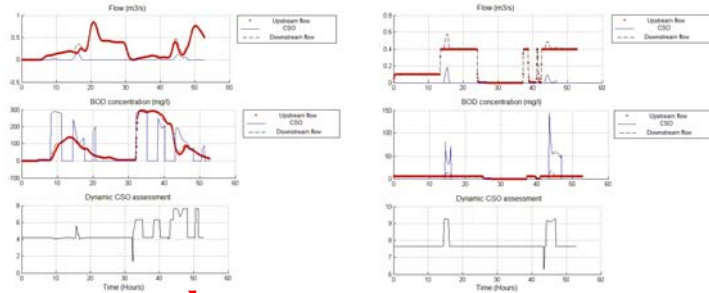
### SUPPORTING DATA AND TOOLS FOR INTEGRATED MODELLING – THE BOGOTÁ CASE







## Supporting data and tools



**CITY DRAIN toolbox – Fuzzy logic techniques in order to assess CSO performance (Fonseca et al., 2008)**

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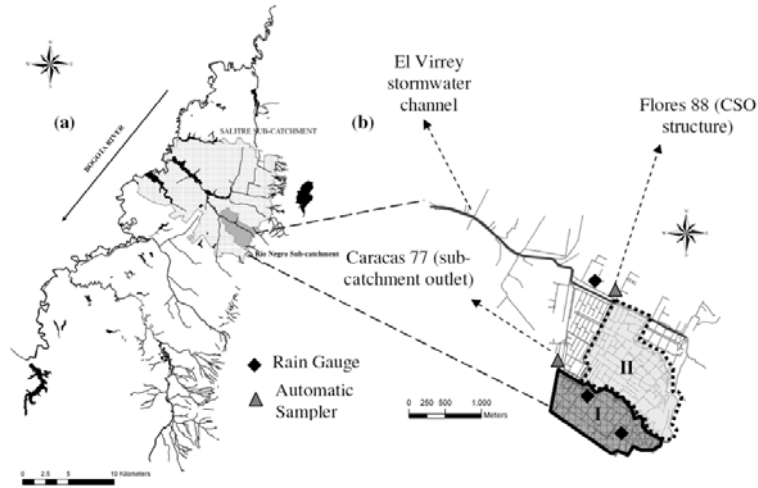
## Supporting data and tools



**Bogotá's urban drainage system esquentization to be implemented using the CITY DRAIN toolbox (Uniandes, 2009)**

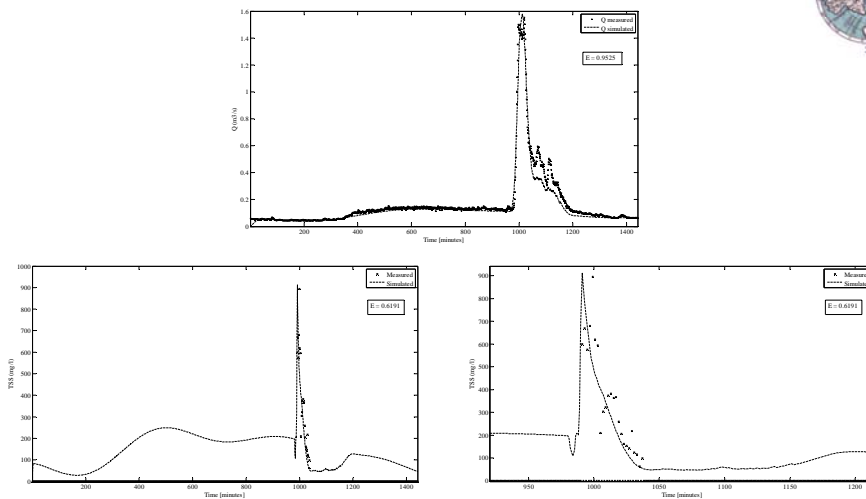
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## Initial results Subcatchment scale



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## Initial Results



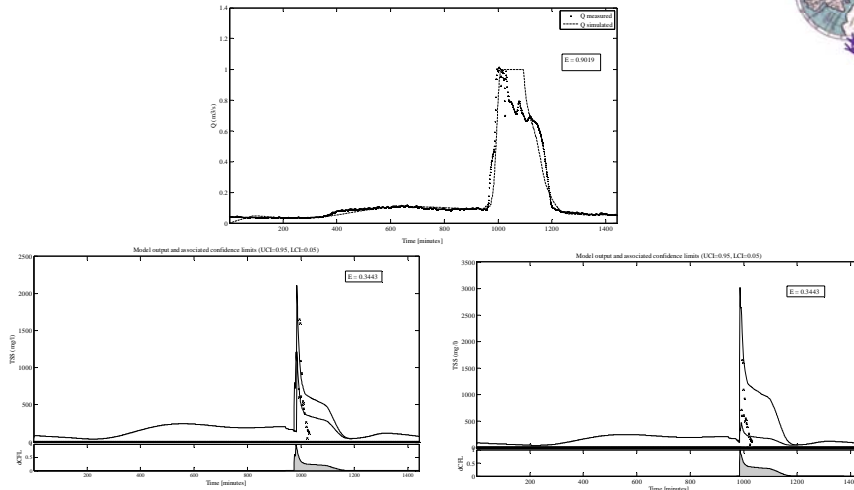
### Rainfall runoff and TSS modelling at Caracas 77 – 8 May 2001 Best predictions

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## Initial Results



**Rainfall runoff and TSS modelling at Flores 88 – 8 May 2001  
Uncertainty bands for TSS**

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## Future Work

### Sub-catchment scale:

- Fully analyze all available events at the experimental sub-catchment El Virrey (*event based modelling*)
- Analyze available data from experimental subcatchment at Linz (*continuous modelling*)

### Macromodelling scale:

- Fully implement and test the City Drain toolbox application to the Bogotá's urban drainage system

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**THANK YOU FOR YOUR ATTENTION!**

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