







EO, Land Motion and Climate Adaptation in Mediterranean Cities

10-11 June 2014, Athens

Context UN Report: Water and Cities Facts and Figures





- Due to rapid urbanization, cities face a growing demand for water and sanitation services. To meet this demand, cities are going deeper and further, which leads to over-exploitation of water resources.
- Every second, the urban population grows by 2 people.
- 95% of the urban expansion in the next decades will take place in the developing world.
- In Africa and Asia, the urban population is expected to **double** between 2000 and 2030.
- Between 1998 and 2008, 1052 million urban dwellers gained access to improved drinking water and 813 million to improved sanitation. However, the urban population in that period grew by 1089 million people and thus undermined the progress.
- One out of four city residents worldwide, 789 million in total, lives without access to improved sanitation facilities.
- 497 million people in cities rely on shared sanitation. In 1990, this number was 249 million.
- 27% of the urban dwellers in the developing world do not have access to piped water at home.

UN-Water Decade Programme on Advocacy and Communication (UNW-DPAC)

minimum facilities, into the open drinking water sources of the poor.

- Contaminated drinking water results in **cholera** epidemics, faecal-oral diseases such as **diarrhoea**, and outbreaks of malaria.
- While malaria was often considered a rural disease, it is now among the main causes of illness and death in many urban areas.

Leakage

- Leakage -loss- rates of 50% are not uncommon in urban distribution systems.
- Some 250 to 500 million m³ of drinking water gets lost in many mega cities each year.
- Saving this amount could provide an additional 10 to 20 million people with drinking water in each mega city.
- 2 UN-Water Decade Programme on Advocacy and Communication (UNW-DPAC)

Context **UN Report: Water and Cities Facts and Figures**



Slums or informal settlements

- Today, 828 million people live in slum conditions, lacking basic services. This number grows by 6 million each year.
- · Many slum dwellers die each year as a result of inadequate drinking water and sanitation services.
- · Many slums are built in flood-prone areas and thus vulnerable.
- 43% of the urban population of south-central Asia lives in slums.
- The urban population in Asia will increase by 60% before 2025.

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Mega cities

- Mega cities are cities with 10 or more million inhabitants. They host 9% of the world's urban population.
- Nearly all mega cities around the world were facing increasing Water scarcity in 2010.

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Nations World Water Development Report: Water, a Shared Responsibility'. Chapter 3. www.unesco.org/water/wwap/wwdr/wwdr2/table contents.shtml

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Websites

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- United Nations Educational, Scientific and Cultural Organization (UNESCO). Website of the International Year of Freshwater 2003. www.wateryear2003.org/
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- www.un.org/waterforlifedecade
- World Health Organization (WHO). Regional Office for Europe website, section on 'Urban Health' www.euro.who.int/en/what-we-do/health-topics/environmental-health/urban-health
- World Water Assessment Programme website, WWAP Challenges Water and Cities.
 www.unesco.org/water/wwap/targets/index.shtml#cities

Context

Urban growth, flood-prone areas, water scarcity, over-exploitation of resources



Water and urban growth by numbers

- Every second, the urban population grows by 2 people.
- 95% of the urban expansion in the next decades will take place in the developing world.

Over-exploitation

 Due to rapid urbanization, cities face a growing demand for water and sanitation services. To meet this demand, cities are going deeper and further, which leads to over-exploitation of water resources.

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InSAR - Technique

Ground motion measurement What is SAR interferometry





Introduction to ALTAMIRA INFORMATION and to InSAR technology Main application sectors

SNCF

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xstrata

géostock

Santos



Institutional



- Natural Hazards mitigation
- Safety improvement
- Hazard information services (floods, climate changes...)













TERRAFIRMA

LAndslide Modelling and tools for vulnerability assessment Preparedness

and REcovery management

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Increase of flood event in Jakarta

- Flood events have been increasing in Jakarta during the past decades 35 % of the city inundated in 2007.
- Floods in Jakarta are caused by the insufficient capacity of the urban drainage system
 - Inadequate maintenance ⇒ significant sediment and solid waste in the channels, some canal are operating to less than 1/3 of their initial capacity.
 - Important urbanization ⇒ reduction of retention area of the natural storm water and increase rainwater runoff
- Problem of land subsidence mainly due to groundwater extraction (fast urban development) and ground compaction (load of constructions)
 - Some North Jakarta areas subside in the range of 15 25 cm/year ⇒ sinking to 4-5 m below sea-level by 2025
 - Increase risk of inland sea water intrusion and tidal flooding

Case study: Jakarta Background of the study







Objectives of the Project

- To analyze past ground deformation in order to understand ground behavior over the years
- To mitigate flood risk over the city
- Two parallel InSAR studies from different satellites has been performed

Historical study

ALOS: June 2007 to December 2010 CSK: October 2010 to January 2011

- More than 3 million measurements points achieved with ALOS PALSAR and 5 million with CSK.
- Areas of significant motion are detected: subsidence up to 80mm per year.
- During the last year of the study, global stabilization of the subsidence areas is detected.









Objectives of the Project

- To analyze past ground deformation in order to understand ground behavior over time
- To mitigate flood risk over the city

Historical study

Historical analysis of a large period: 2003-2009 (performed with 43 images Envisat)



The area of interest is the agglomeration of Alexandria in Egypt



Case study: Alexandria Historical study over Alexandria, Egypt



cm/year +3

- 90.152 points have been selected.
- The urban area of Alexandria is affected by terrain deformation such as subsidence and uplift.
- The InSAR study enables critical areas to be detected and it is a valuable tool to mitigate natural hazards

Case study: Georgetown Case of the Georgetown (Guyana) seawall





Case study: Georgetown Case of the Georgetown (Guyana) seawall





 High number of measurement point detected along the seawall.

- Instability at the Ogle Kocker used to control the flow of water in the drainage canals (trenches) in the city.
- Higher subsidence reaches 2 cm in 8 months.





- Today, expanding cities are facing challenges such as over-exploitation of water resources
- When they are located in coastal areas or near rivers, they are often affected by floods
- To estimate correctly flood risk, two evolutions have to be added: Sea level rise together with subsidence of the cities themselves
- ALTAMIRA INFORMATION measures ground motion (subsidence and uplift) with millimetric precision using radar satellite images
- The case studies for Jakarta, Alexandria and Georgetown have shown that InSAR technology is a valuable tool to contribute to risk assessment of cities in flood areas
- Detailed information about the flood risk is a first step for risk mitigation





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Thank you for your attention

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