Prepared enabling change

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CAN WE ADAPT TO CLIMATE CHANGE?

Visions of the Future and their Role in PREPARED

By Professors Simon Tait and Richard Ashley (Bradford University)

Urban Water Systems are dominated by large assets, many of which have design lives of several decades. It is anticipated that many of the impacts of climate change will only become apparent after many years. Therefore, any project which considers how such infrastructure systems are affected by the anticipated impacts of climate change must be able to consider the future in a logical and structured way. There are a number of ways in which researchers, technologists and managers can identify and address issues that may have a significant impact far into the future.

The concept of the PREPARED project developed from a 'roadmapping' approach that was used in the Water Supply and Sanitation Technology Platform (www.wsstp.eu). Roadmapping involves identifying a pathway to a desired future state, together with ideas as to which technologies are needed to change the water and sanitation systems to achieve this desired future. Much of the work in PREPARED relates to inventing, developing and utilising improved and innovatory technologies and other measures. Unfortunately, the levels of uncertainty about the future, especially in terms of climatic and socio-economic conditions, can challenge the potential effectiveness and value of such innovative technologies as their effectiveness will depend on what the future actually will become. We therefore need to assess how effective PREPARED's new, and innovative technologies will be when future conditions change and especially if the future conditions are not what are expected at the time of the invention of the innovation.

By using a roadmapping approach in its project conception, PREPARED was predicated on a concept of identifying the 'best' technologies in the water and wastewater sector to achieve a desired future state. This approach can be problematic; firstly you need to identify a future desired state, an almost impossible task given the level of uncertainty in our predictions of the future, especially in terms of social and economic criteria. As the future is uncertain, we therefore cannot know what technologies will necessarily be ideally applicable in the future or even if today's clever technologies will actually be appropriate in a future world. The presumption of 'invent it and they will use it' is naïve. The water sector is but one of many sectors essential for human life and is usually a 'follower' in technology advance, not a leader. Therefore, many of the advances in this sector are reactive to other sectoral innovations. An alternative more exploratory approach thus needs to be taken in PREPARED alongside the roadmapping approach implicitly embedded in the WSSTP research agenda. This is sensible because if the roadmap pathway does not ensue, i.e. the future will not be what we think it will, then PREPARED will still deliver valuable outputs to water utilities and others.

An alternative approach to considering the future is to first define the boundaries within which changes, due to external drivers to a system such as climate change, may be expected to occur. Then the pressures and impacts these are likely to exert on the future state of a system can be estimated and, from this process, the robustness of any possible responses to the anticipated impacts can be assessed. For urban water systems these boundaries should include estimates of the possible ranges of future climate and socio-economic conditions. Visions of the future may be termed 'scenarios' and can be used to represent how things *might* look at some time in the future, not *how we expect them to look*. There are many versions of scenarios in use to envisage how the future might look. These are not meant to be predictions of the future but simply logically, consistent and plausible visions to test innovations. Various scenarios are available in each country, in different forms for various sectors of services and infrastructure. Hence there is no single scenario or even set of scenarios that can be used exclusively for scenario planning even within a particular sector, country or region. This is a major challenge for PREPARED as many countries and scales of case studies are being looked at.

Is it possible to adapt and respond to climate change?

CAN WE ADAPT TO CLIMATE CHANGE?

As part of the boundary setting, consideration of the socio-economic aspects of future scenarios is required to determine the drivers, impacts and consequential economic, social and environmental effects of climate and other changes. The socio-economic factors within the scenarios define much of the need, capacity and willingness of the stakeholders in the future to respond to the climate change stresses as technological capacity, innovation and cultures are embedded in any assumed scenario. PREPARED needs to define a logical and consistent approach to scenarios in order to better plan and evaluate the effectiveness of the responses needed to adapt to climate change and to see if these are credible and robust across the range of scenarios used. An ideal response measure is one that appears robust under any assumed future scenario. However, experience suggests that there are rarely any single measures that exhibit such robustness across the range of all potential futures.

There are two types of scenarios relevant in PREPARED:

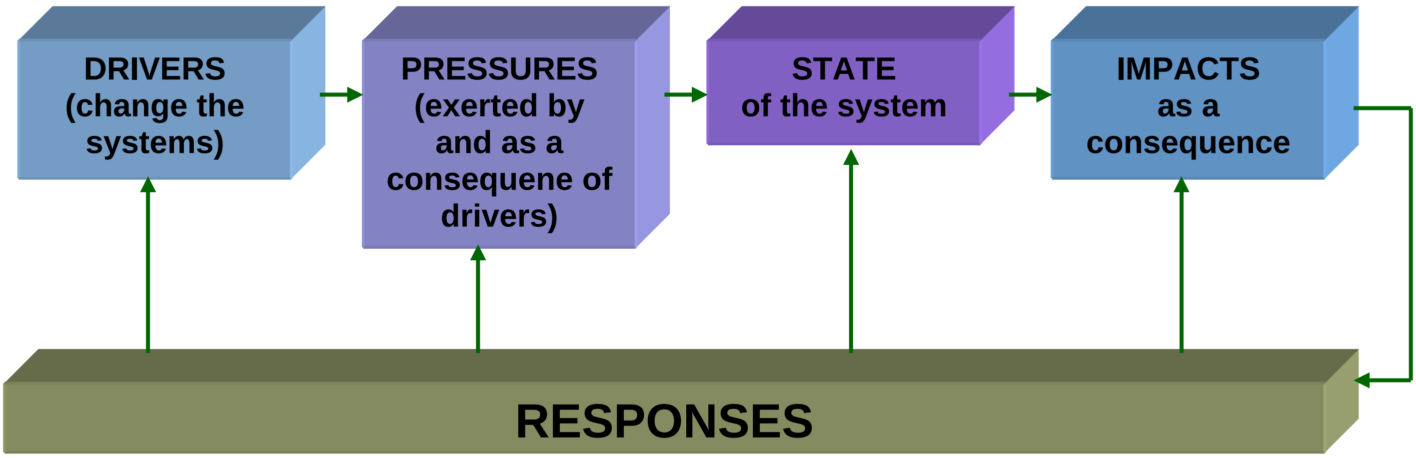
The ***driver*** scenarios are those that are potentially impacting on the state of water supply and sanitation systems and their effects can be envisaged using a Driver-Pressure-State-Impact-Response framework as shown in the figure below. The most obvious of these are scenarios used to estimate the various possible climate change trajectories and hence changes to key meteorological and hydrological parameters. However, there are many other drivers that continue to exert pressure on the state of water supply and sanitation systems, some of which are more or less amenable to human control. For example, in Europe, environmental regulations are a major group of drivers that continue to alter the state of these systems and may be to some extent, controlled.

Driver Pressure State Impact Response Framework

The ***socio-economic*** (S-E) scenarios influence the driver scenarios in that societal behaviour also affects how the climate changes (e.g. due to more or less greenhouse gas emissions) and also how systems are regulated. Socio-economic scenarios also define the capacity, capability and attitudes as to how climate change and other driver pressures and impacts are, or can be, responded to. The economic strength of a society will differ under various scenarios and as adaptive capacity is strongly related to wealth this will also affect the ability to adapt. Characteristics of the socio-economic scenarios should include the willingness, capability and approach within that scenario's societal system to develop, access and utilise innovative technologies, practices or behaviours.

Societal futures are strongly influenced by value systems. Such value systems influence how decision makers and others handle the uncertainties in the drivers and also the effectiveness of the responses as behaviour is generally within a 'bounded rationality' that constrains willingness to change.

In PREPARED it is proposed to develop scenarios that can estimate a limited range of 'futures' based on a consideration of a range of future climates and economic conditions. These different visions of the future 'scenarios' will identify the range of impacts that water and sanitation systems may experience. This will then allow those in PREPARED who are developing new and innovative technologies and approaches to estimate the impacts on urban water systems and then assess how their innovations will respond to these impacts under a range of potential 'futures' rather than a single expected future predicted under a 'roadmapping' approach. The use of scenarios should mean that PREPARED innovations are more flexible in that they should be designed to be effective under a range of potential futures.



Driver-pressure-state-impact-response Framework

Visions of the Future and their Role in PREPARED

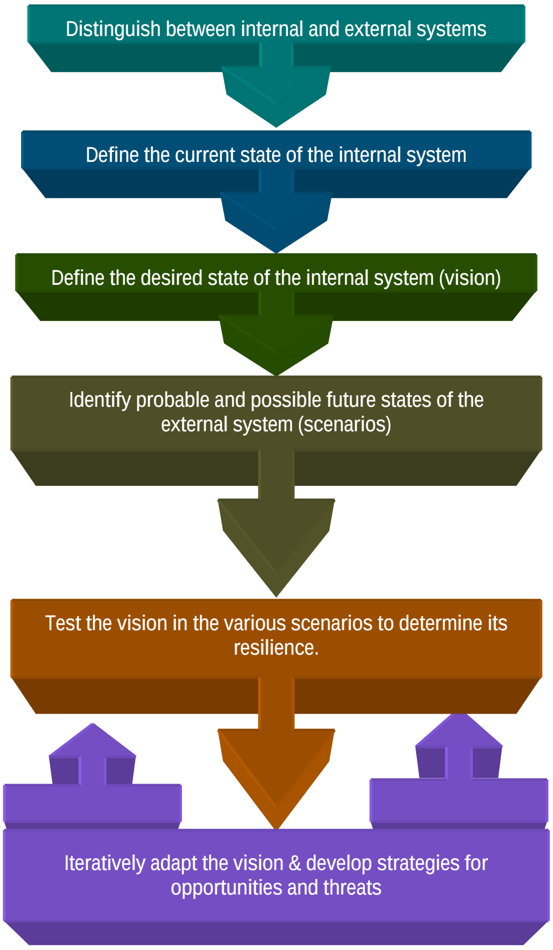
By Andrew Segrave (KWR)

The PREPARED project was designed to assess and improve the degree to which water supply and sanitation systems in European cities have the capacity to deal with climate change. The focus is on technological, adaptive capacity. But the project also considers managerial and policy measures for tailoring interventions to suit different environmental, social and economic contexts.

Cities are seen as the optimum scale for managing the trade-offs between systems caused through human activity and natural systems as regards 'universal' dilemmas. PREPARED focuses on dilemmas that are common to cities throughout Europe and aims to develop technologies, knowledge, and tools that can be generalised across geographic locations and cultures. Besides tackling this spatial variance, the aims of PREPARED imply taming the future. It is this challenge that is currently of concern.

The future cannot be calculated

The dilemmas referred to in PREPARED are future dilemmas. Building or altering water supply and sanitation infrastructure typically involves an investment of several decades. And similarly, the climate change process is also expected to span decades. When dealing with the future it is important to explicitly define the degree to which the future



Process outline

exists and can be known. Scientific research in the PREPARED project rests on these basic principles, which are far from trivial. For now let us assume that the future is 'open' but not 'empty'. In other words, we can design some aspects of the future with will, free from destiny. Furthermore, the future cannot be known because it does not exist, bar the visions of the future in the minds of people. What do exist in the present are visions and expectations of the future. It is these images that can be studied, along with data from the present and the past.

Statistical projections and models can provide information about probable future states but the future itself cannot be calculated. The risk of such extrapolations is that they do not account for emergence in complex systems and may give decision makers a false sense of certainty. Water supply and sanitation are essential to a society's wellbeing so it would be irresponsible to rely on such extrapolations alone as the basis for decisions.

Can we manufacture the future?

With the help of physical scientist and engineering disciplines, contemporary industrial societies have developed the ability to manufacture futures. Conversely, our knowledge of these futures is seriously limited and the unintended consequences of human activities are countless.

A good example is accelerated climate change:

During the industrial revolution people wanted technological advancement, not amplification of extreme weather conditions. We are now living in the future of those decision makers, benefitting from the technologies. But who is responsible for the unintended consequences? When knowledge is lacking, responsibility tends to be postponed. PREPARED engages with this issue by proposing to design roadmaps from the present situation to a desired future state. This may be characterised by complexity, uncertainty and ambiguity.

Traditional responses to these issues depend on models and statistics to make predictions. Theorists have acknowledged that inter-connectedness, interdependence and seemingly acausal connections place this eminent and hugely successful system under pressure.

To tackle planning problems intelligently systems thinking is required. The first step is to distinguish between the internal and the external systems. This boundary is usually determined by the 'sphere of influence' of those doing the planning.

For PREPARED the water supply and sanitation system of a particular city could be taken as the internal system. Next, the current state of this internal system is evaluated to create a reference point. Once this has been done the following step is to determine a vision that represents the desired state of the internal system. This vision is associated with a given time horizon, for example 2030 or 2050.

Selection of a suitable time horizon for PREPARED is critical since it should extend over the investment period of typical water supply and sanitation infrastructure while allowing for the relatively slow process of climate change. Conversely, when designing a strategy or roadmap towards achieving the vision then the time horizon needs to be translated back to a human scale of years rather than decades. People tend to discount temporally distant events, so the vision may otherwise be ignored in everyday decisions and actions. For this reason it is important to design short- and long-term strategies.

Context scenarios

It is in the final stage of the analysis that the vision for the internal system is confronted with various probable and possible future states of the external system. These future states are known as context scenarios. Context scenarios can be used to determine the resilience of a vision. When it comes to climate change, models are often employed to explore the uncertainty concerning future climate patterns. 'What if' scenarios simply represent different future conditions as imagined by those involved. One important issue that needs to be considered when testing a vision against climate scenarios is the richness and realness of the scenario.

Climate change is just one dimension of the future state of any external system. Other social, economic, political, technological, ecological, and demographic aspects of any particular future state of the external system will also determine the impact that climate change has on a given water supply and sanitation system. False dilemmas can also appear when we concentrate on the short-term goals of a specific sector. This type of thinking often results in two-dimensional trade-offs, like financial gain versus biodiversity, etc. We run the risk of over-simplifying the real complexity of interrelated systems. For this reason it is preferable to use internally consistent context scenarios such as the Global Environment Outlook (GEO) scenarios, produced by the UN Environment Programme. In PREPARED, visions could be tested against these context scenarios as well as other 'what if' scenarios.

Once the context scenarios have been selected, then the resilience of a vision can be tested by analysing its effectiveness in each scenario. The process of testing a vision against context scenarios should be repeated.

Driver-Pressure-State-Impact-Response framework

One useful means of categorising information about the internal and external systems and presenting decision makers with alternatives, rather than a predetermined solution, is the Driver-Pressure-State-Impact-Response framework.

To understand the relationships between these categories, scientific models are generally developed. Research projects often focus on improving the quality of these models and increasing certainty about outcomes. One risk associated with this focus is that the spectrum of scenarios is reduced to that which can be justified by the models based on past data. Similarly, decision makers can be lulled into a false sense of security if they assume that the model outcomes represent all possible future states. And if the model outcomes are misused to defend decisions, rather than employing the model to better understand the relationships between the systems, then the learning aspect of the process is neglected and claims of resilience are for the most part symbolic.

The resilience of man-made systems may be increased by investing in time, flexibility, robustness, and/or knowledge. When an adaptive approach is feasible, strategies are likely to focus on improving flexibility and knowledge. But if frequent adaptation is costly, as with investments in urban water supply and sanitation infrastructure, robust solutions are needed. A robust solution implies that it is likely to remain effective within a wide range of context scenarios concerning the internal and external pressures the solution may face in the future.

The PREPARED project could help decision makers by demonstrating when investing in robust water supply and sanitation infrastructure is necessary and when flexible strategies are more promising. In the process of testing the resilience of a vision against context scenarios, opportunities and threats become apparent. These may be represented using indicators for which early warning systems can be designed. Decision makers can then choose to invest in robustness and/or flexibility in their strategy when anticipating problems and exploiting emerging opportunities.

Defining a shared vision

Perhaps the most critical and complicated stage in the process described above is the definition of a clear vision. The various stakeholders in a water supply and sanitation system generally have diverse interests, perceptions, and understandings of the issues at hand.

Defining a shared vision is a process for which social learning is required. The original vision, before it is tested against context scenarios and adapted, should focus on that which is desired and not on what is perceived as necessary or possible.

The motives for decisions regarding the desired future state do not depend on certainty but on hopes, values, responsibilities, interests and ethics. Leadership and morality cannot be substituted by certainty and foreseen necessity. The burden of climate change seems to have resulted in managers and policy makers transferring the responsibility for decisions to scientists in the search for certainty. But accepting this task would be foolish since science cannot determine what is right or wrong or generate knowledge about the unknowable.

References: This article makes reference to other research work, not noted in this publication. The most prominent reference can be found on http://www.polity.co.uk/book.asp?ref=9780745627779

How do utilities Waternet (Amsterdam) and Berliner Wasserbetriebe (Berlin) plan for the anticipated impacts of climate change?

Adriana Hulsmann (Coordinator for PREPARED) interviewed them to find out

Urban utilities need to be prepared for the anticipated impacts that climate change will have on the water and wastewater services they provide. These impacts will be both direct and indirect. For the utilities, being prepared for the anticipated impacts of climate change implies serious consideration of future planning and developments and anticipating what extended capacity or new infrastructure might be needed to cope with the expected challenges. This is the key question that utility managers grapple with in the light of the high uncertainty imbedded in the current climate change predictions. Exactly what impact climate change will have on planning, investments and operations of utilities is pivotal to their service provision.

The reality of planning for the future is mainly driven by what financial investments would be needed; utilities are expected to balance risk and investment in a time of extreme uncertainty. Where financial resources are scarce and competing demands are being made on urban areas, utilities have to find the right balance. The conundrum is to find a balance between the level of risk in times of uncertainty and to predict how and what would be acceptable to the citizens as end-users that ultimately have to foot the bill. Common belief is that high levels of investment will significantly reduce risk. However, the question remains whether these high investments are necessary, considering the planning and investment uncertainty that utilities have to deal with.

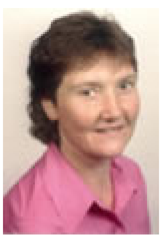
With these questions in mind two utility managers, Jan-Peter van der Hoek and Regina Gnirrs, respectively from Waternet in Amsterdan and Berliner Wasserbetriebe in Berlin were interviewed. Questions we put to them on their views of the anticipated impacts of climate change with the associated uncertainty and investment policies of their utilities. The responses of both interviewees showed a similar pattern regarding their climate change strategy.

Both utilities produced a strategic vision document that covers the period till 2040-2050 and both companies agreed that a flexible approach is needed because the urban population is changing, water demands are changing and spatial requirements are changing.

Waternet uses the STEP method which considers demographic, social, technological, ecological and political trend analysis. Demographic predictions can be anticipated with relative ease, and also the changes in domestic water consumption. More difficult, however, is the assessment of the impacts of water saving initiatives and industrial developments during a time of economic uncertainty. This is complicated by the differing timelines of economic developments which are normally short-term while concurrently it influences the planning and infrastructure decisions that utilities have to make in the long term.

A very important aspect in facing the future is being on the cutting edge of innovation and technology. Technological development and research needs to be 10 to 20 years ahead of new investment needs. These developments and research also have to consider the flexibility of the system as a whole. The current systems are not flexible enough for the utilities to cope with changing demands and both Waternet and Berliner Wasserbetriebe strive for more flexible solutions. To be aware of any new predictions both companies closely follow the Intergovernmental Panel on Climate Change (IPCC) as well as the foresight studies, including horizon scanning and scenario thinking within their own companies and research institutes. Multiple scenarios for the necessary investments are developed that are both flexible and that give a good understanding of the future. And where possible investments are postponed till more (certain) information is available.

Jan Peter van der Hoek, Waternet



Regina Gnirrs, Berliner Wasserbetriebe

PREPARED DEMONSTRATION CITIES

Utilities alliances – Test and demonstration of PREPARED climate-proof solutions portfolio

By Gesche Grützmacher (KWB)

Current climate change models project that changes in temperature, precipitation patterns, water resource availability and quality will progress over the coming decades, increasing de facto the financial, sanitary and social impacts. It is commonly accepted that mitigation measures alone will not be sufficient, and society has to prepare for the consequences of climate change impacts.

Water and waste water utilities in Europe and beyond are preparing to cope and adapt to the expected impacts of climate change. They are looking for new ways of planning, designing, and operating water supply and sanitation to cope with the expected changes and their inherent uncertainties. The PREPARED project aims to support European cities in their preparation for climate change.

The project was designed on the basis of the needs of the cities. The participating cities/utilities will demonstrate and validate the programmes being implemented during the project's life cycle. This is seen as the lynchpin to ensure getting the most value out of the financial and research input by providing tested, applied and relevant climate-proof solutions to drinking water and sanitation systems. The ultimate objective is to gain, at the end of the four-year project, a proven, visible, European portfolio of adaptive solutions for the water sector and support the EU commitment and leadership in the field of climate change.

Climate change adaptation measures will be demonstrated through three alliances where the outcomes of the research activity will be verified and confirmed for real-scale evaluation purposes with the financial support of the cities, pertaining to equipment, data acquisition, supplies, etc. To ensure efficiency, the demonstrations will be conducted by the usual research partner of the utilities (see the PREPARED website for a full list of consortium partners). Each demonstration alliance will address one of the major challenges that utilities have initially identified.

The demonstration component of the project will include four focus areas, namely:

- The establishment of a PREPARED Alliances Forum where knowledge and experiences will be shared;
- A demonstration alliance on 'Adaptation to water resource scarcity and quality changes';
- A demonstration alliance on 'Adaptation to extreme rainfall events';
- A demonstration alliance on 'Integrated approaches to enable climate change adaptation'

PREPARED cities/utilities will demonstrate the following aspects:

Barcelona: Decision support system for planning complex urban water systems for regions under water stress

Conceptual scheme of catchment and conservation of water from high flow events

Methodologies for urban runoff risk assessment

New methodologies for sediments monitoring in sewer networks

Berlin: Substance flow model and decision support tool for managing drinking water supply from varying sources under climate change conditions in partially closed water cycles

Planning instrument for an integrated and recipient/impact based CSO control under conditions of climate change

Istanbul: Conceptual scheme for rainwater harvesting and grey water management as alternative resource for regions under water stress

Genoa: Decision support system for the competing uses of source water incl. protection of water intakes

Aarhus: Integrated real time control of sanitation systems incl. early warning for Water quality in receiving waters

Real time integrated monitoring system supporting improved rainfall monitoring

Eindhoven: System for early warning of deteriorating water quality in distribution networks

Water Cycle Safety Plan protocol

preliminary Water Cycle Hazard Database

Database of risk reduction options

GIS applications

Gliwice: Enhanced real-time measuring and forecasting technologies for combined sewer system

Lisbon: System for distributed real time disinfection control

Demonstration system for early warning of health risks from faecal contamination in recreational waters

Water Cycle Safety Plan protocol

preliminary Water Cycle Hazard Database

Database of risk reduction options

GIS applications

Oslo: Remedial actions to prevent adverse effects of regrowth in networks at higher temperatures

Integrated real time control of sanitation systems incl. early warning for Water quality in receiving waters

Models and knowledge for operation and maintenance of wastewater networks exposed to rapid changes in flow

Water Cycle Safety Plan protocol

preliminary Water Cycle Hazard Database

Database of risk reduction options

GIS applications

Real time integrated monitoring system supporting improved rainfall monitoring

Seattle: Real time integrated monitoring system supporting improved rainfall monitoring

Simferopol: Water Cycle Safety Plan protocol

preliminary Water Cycle Hazard Database

Database of risk reduction options

GIS applications

Lyon: Prototype software tool on the sensors calibration and verification and the evaluation of uncertainties

New reports available on the PREPARED website— http://www.prepared-fp7.eu/prepared-publications

Flood proof wells: guidelines for the design and operation of water abstraction wells in areas at risk of flooding

River floods are the most common natural disaster in Europe, and flood damage is expected to increase in the next decades. Among the assets at risks are water wells, which are used to abstract groundwater for the drinking water supply. Flooding of well fields can obstruct the supply of safe and sufficient drinking water, amongst others due to microbial and chemical contamination of the abstracted raw water.

This document provides practical guidelines on how to make water well fields 'flood proof'. This includes adaptation of the well design, but also management procedures before, during and after flood events. The document builds upon the knowhow and practical experiences of water suppliers in the Netherlands and Germany, and is intended to be used by water suppliers in Europe and elsewhere.

A common protocol to be used for sensor testing

This document contains a common protocol to be used for sensor testing or be used as a reference to be adapted in cases it cannot be fully applied.

The objectives of a proposed test shall be specific to the requirements of end users and the desired results of the evaluation. In the PREPARED project, tests will be carried out mainly for new sensors or for existing sensors used for new purposes or with new data processing methods. The sensor tests will include (but not be limited to) evaluation of repeatability, reproducibility, availability of standards, maintenance problems and requirements, uncertainties, and drifts under various conditions, especially those conditions corresponding to demonstration sites in Work Area 1 of the PREPARED project.

This common test protocol is intended to provide sufficient information to the testing organisation to carry out the test and make a determination about the performance of sensors tested at specific sites, and can lead to the issuance of a test report. It is also intended that the test protocol can be used as an administrative document that governs all important aspects of the testing and can serve as a test plan template.

Climate change effects which may impact the urban water cycle

The Overview of GIS applications, risk assessment and risk management of climate change hazards report provides descriptions of GIS (Geographic Information System) software and applications which may be used for risk assessment and management of the urban water system. The described software can help to evaluate climate change impacts on drinking water supply and sewerage systems, to predict possible changes and to prepare for the consequences.

The descriptions were collected through the questionnaire among PREPARED project partners (both research and utilities), and from available digital information (Web) and a literature review. The overview is intended primarily for Water/Wastewater professionals, who are responsible for integrated GIS, hydraulic modeling packages and decision support systems (DSS). This report gives a general indication of the state of the art GIS applications development in a specific direction. It is a starting point to find GIS solutions that can support RA/RM of climate change hazards to the urban water system, although it will not automatically guide you to the best one. The study also helped to find what GIS capabilities are still missing from the viewpoint of the end users.

Macro-scale sensor placement

This document provides a summary of existing techniques in the field of macro-scale sensor placement, for instance the optimal placement of a limited number of sensors within an urban water network. Macro-scale sensor placement techniques are normally intended for calibration and/or monitoring purposes, as a necessary step in the application of intelligent and cost-effective monitoring for water distribution and sewer collection systems.

The best location for a set of measurements is dependent on the usage of the data subsequent to sampling and current techniques address numerous distinct objectives, including model calibration, contaminant detection, burst detection and source tracing.

The report focuses on the calibration agenda in accordance to the targets for the PREPARED project. A wide range of techniques applicable to water/wastewater networks of varying sizes and levels of complexity are evaluated, with methods generally divided into sensitivity-based ranking methods, Greedy sequential algorithms and global optimisation-based methods. This document is a useful resource for researchers involved in sensor network design, including those involved in the development of relevant tools in the PREPARED project.

Defining risk and uncertainty, and methods related to risk assessment, uncertainty analysis and propagation

This report focuses on defining risk and uncertainty, and details methods related to risk assessment, uncertainty analysis and propagation.

Risk is introduced and defined, followed by an introduction to risk assessment, with literature review details of several relevant methodologies, all of which could be used in the risk analysis of urban water systems. A summary of the most used methods is provided.

Deterministic quantitative risk assessment (QRA) is introduced, followed by the recognition that there is always some inherent uncertainty when dealing with the key facets of determining risk, leading to a discussion on stochastic QRA, which aims to account for the uncertainty using the methods described.

Finally, some preliminary risk categories for water systems are outlined and these are subsequently broken down to examine some potential social, environmental and economic risks posed by the various hazards that may impact the water systems in the face of a changing climate.

REVISION OF THE DRINKING WATER DIRECTIVE (DWD) 98/83/EC

Where do we stand now?

Reported by Adranna Hulsmann (KWR)

In 2003 the European Commission started an investigation into the need to revise the DWD. The process started with a large-scale stakeholder consultation during the Drinking Water Seminar [WHEN AND WHERE WAS THIS]. A number of potential issues for inclusion in a revised DWD were identified and agreed to by stakeholders and experts.

Issues on the revision agenda included the parameters in the DWD and the parametric values or standards, more attention for small-scale water supplies (where most of the water quality problems are found), materials in contact with drinking water and a risk-based approach for drinking water also called water safety plans.

In the years since the drinking water seminar many studies have been carried out and various working groups addressed the issues identified. Much effort was put in the preparation process both by the European Commission, the Member States, individual experts and consultants. Also the informal network of European drinking water regulators (ENDWARE) played an important role in the revision process.

ENDWARE consist of representatives of the EU Member States and meets twice per year to discuss matters related to the Drinking Water Directive. ENDWARE has no legal status and was set up many years ago during the process leading up to the current DWD in force. Over the years of existence, ENDWARE has grown into an important platform for informal and confidential knowledge exchange between Member States and between Member States and the European Commission.

In February 2011 the EC announced its conclusions that at this stage no legislative revision of the Directive under the ordinary legislative procedure is required. Also a full revision process would take many years to complete and transpose. However, the EC continued to mention that increased implementation and enforcement efforts are required to ensure safe drinking water in particular in smaller supplies and finally that technical adaptations e.g. of Annex II (monitoring) and Annex III (analysis) are possible through a much quicker process (delegated acts or implementing acts).

With respect to the revision of the quality standards in the DWD it was decided that they reflect best available current scientific knowledge. With respect to the coherence with other water legislation adopted since 1998, in particular the WFD it was stressed that the Member States should focus on proper implementation of the WFD. On the materials in contact with drinking water the Commission repeated its position that the DWD is not the appropriate instrument to address this issue. The Commission is also looking into a risk-based approach for small water supplies. There is no legal basis in the DWD for a risk assessment/risk management based approach but it will remain a voluntary and recommended exercise.

It is obvious that the current developments about the revision process are high on the agenda of the 2011 ENDWARE meetings. Because of the confidential nature of the meetings no further details are available.

Footnote: The PREPARED project has close ties with ENDWARE through its PAC (Project Advisory Committee member, Birgit Mendel (Germany)

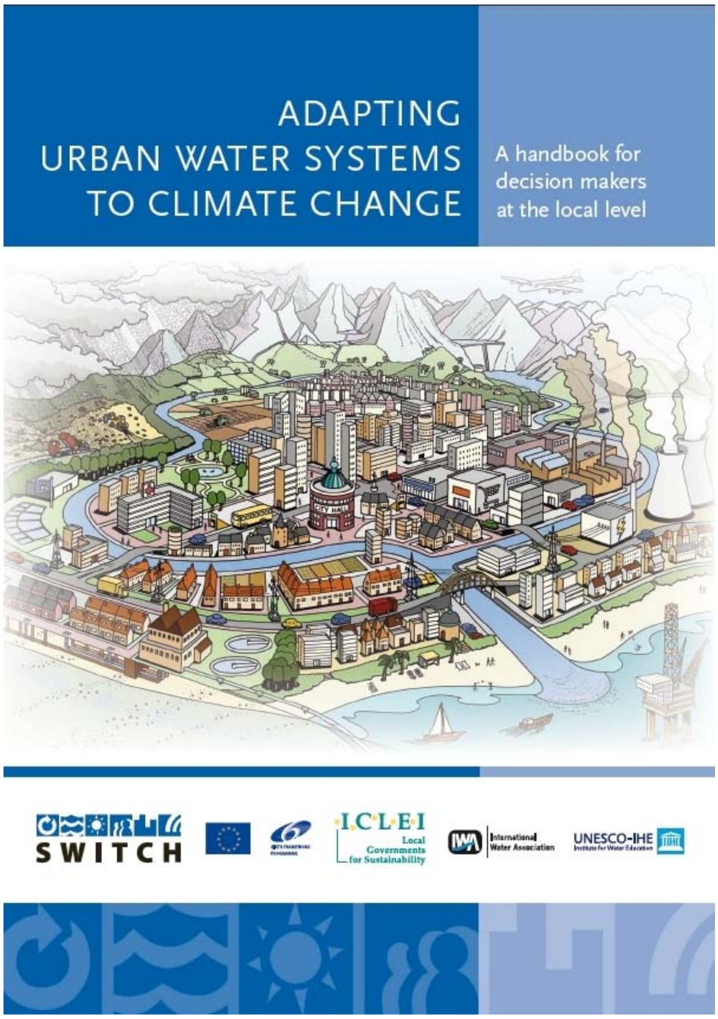
Adapting Urban Water Systems to Climate Change

PREPARED participated in a new handbook on the implications of climate change for water in cities and possible local level responses has been published as part of the 'SWITCH – Managing Water for the City of the Future' project.

The handbook examines some of the key areas of vulnerability to climate change within urban water systems and proposes flexible and future-oriented urban water planning as a means to address climate change and implement adaptation actions. It also presents case studies of cities throughout the world that have already planned for adaptation or implemented specific actions aiming at increasing their resilience to climate change.

The handbook is published by ICLEI, UNESCO-IHE and IWA. The handbook can be downloaded from the IWA website:

http://www.iwahq.org/j6/themes/water-climate-and-energy/climate-change-adaptation.html



Climate Change News Snippets

Increased Water Scarcity and Drought in EU

While Europe is by large considered as having adequate water resources, water scarcity and drought is an increasingly frequent and widespread phenomenon in the European Union. The long term imbalance resulting from water demand exceeding available water resources is no longer uncommon.

It was estimated that by 2007, at least 11 % of Europe's population and 17 % of its territory had been affected by water scarcity, putting the cost of droughts in Europe over the past thirty years at EUR 100 billion. The Commission expects further deterioration of the water situation in Europe if temperatures keep rising as a result of climate change. Water is no longer the problem of a few regions, but now concerns all 500 million Europeans.

Reducing farm animals' wind by adding garlic to feed could substantially reduce greenhouse emissions, according to research by West Wales' scientists featured by Euronews.

Combating climate change is a top EC priority for the EU

The European Commission has approved funding for 183 new projects under the LIFE+ programme, the EU's environment fund. The Commission will contribute more than €16 million to 14 projects directly tackling climate change, with a total budget of €40 million. In addition, 12 projects focussing on other issues will also have an indirect impact on greenhouse gas emissions.

The 183 projects, approved on 19 July 2011, involve all EU Member States and cover actions in the fields of climate change, but also nature conservation, clean technology, environmental policy and information and communication on environmental issues. Overall, they represent a total investment of some €530 million, of which the EU will provide €244 million.

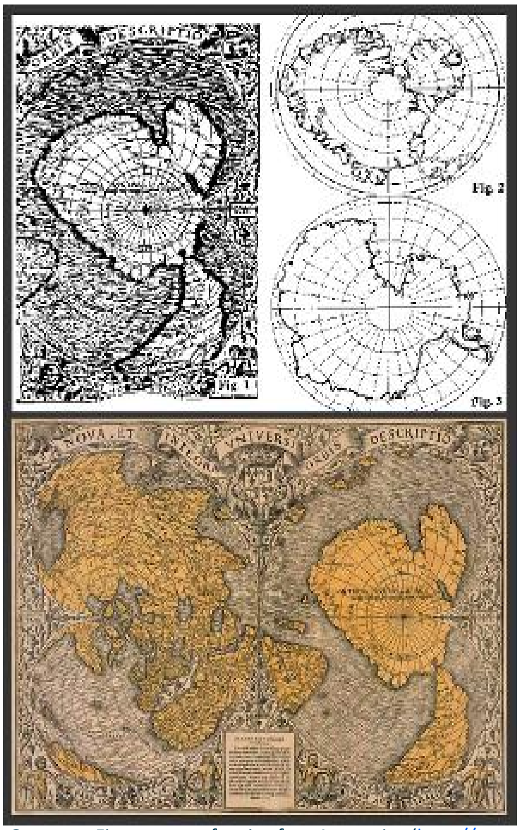
Combating climate change is a top priority for the EU. Europe is working hard to cut its greenhouse gas emissions substantially while encouraging other nations and regions to do likewise. At the same time, the EU is developing a strategy for adapting to the impacts of climate change that can no longer be prevented. Reining in climate change carries a cost, but doing nothing will be far more expensive in the long run. Moreover, investing in the green technologies that cut emissions will also create jobs and boost the economy.

The EU is showing the way forward through its strategy to fight climate change and the policies that it already implements or has proposed to the member states and the European Parliament.

When Antarctica was a Tropical Paradise

Geological drilling under Antarctica suggests the polar region has seen global warming before. Antarctica today is covered by an ice sheet up to 5 kilometers thick.

But it was not always so cold and remote. Geologist Molly Miller of Vanderbilt University discovered, in the Beardmore Glacier area of Antarctica, the remains of three ancient deciduous forests complete with fossils of fallen leafs scattered around the petrified tree stumps These trees are alive today but only grow in warm moist areas such as Queensland. Antarctic also harbors bones of extinct marsupials and Dinosaurs with massive coal beds full of once flourishing flora and fauna.



Oronteus Fineus map of an ice free Antarctica (http://www.ancientdestructions.com.au/site/destructions/oronteus-fineus-map.php)

Today, Antarctica is the coldest, most desolate place on earth, a land of barren mountains buried beneath a thick ice cap.

Classic geology states that this ice sheet has been in existence for millions of years. However, two ancient maps—the Piri Reis and the Oronteus Finaeus maps—show Antarctica ice free. These maps are reckoned to have their source in the two thousand year old libraries of ancient Alexandria. The maps were submitted to the U.S. air force cartography section for evaluation and they found them to be accurate.

Why and when Antarctica iced over is still a research topic. The geological school of thought pins this on increased levels of carbon dioxide (1,000 parts per million (ppm)) in the atmosphere 55 million years ago, that heated the world enough to melt all its ice caps and raise sea levels. At present, there are 390ppm of CO_2 in the atmosphere, a rise – caused by emissions from power plants, factories and lorries—from pre-industrial levels of around 280ppm. This has already raised global temperatures by almost 1ºC. By the time earth gets to 500ppm there will be major melting of the ice caps. Over geological time, carbon dioxide levels and atmospheric temperatures are interlinked: when the former rises, the latter goes up in its wake and these changes take place over millions of years.

A second line of evidence exists for a recent ice free Antarctica: in Greenland and Antarctica are laboratories that bore through the ice to collect data on the layers of ice. In Antarctica researchers hit rock bottom where in the case of Greenland they hit plant remains. Each layer contains volcanic dust and certain isotopes such as Carbon14 and Oxygen18 that reveal data on the nature of the climate in distant eras. If each layer represents a year, then Antarctica's 140,000 layers are not millions of years old as conventional geology claims and it could have been laid down rapidly within a short number of years. This could of happened as recently as six thousand years ago. The rapidity of the event is supported by the fossilisation of the ancient tree forests that Molly Miller discovered. Fossilisation is a process that usually only occurs in catastrophic circumstances such as comet discharge, extreme mass coronal ejections or disturbed planetary motions resulting in magnetic field reversal.

Sources: http://www.guardian.co.uk/world/2011/jul/17/antarctica-tropical-climate-co2-research, http://www.ancientdestructions.com.au/site/destructions/antarctica-tropical-paradise.php

EUROPEAN ADAPTIVE INITIATIVES OF THE WATER SECTOR TO FACE CLIMATE CHANGE IMPACTS

By Matthias Staub (KWB), Yann Moreau-Le Golvan (KWB)

Introduction

While the water sector is one of the sectors where climate change will be most pronounced, it is also one of the sectors where there is the highest adaptation potential. For regions already known for unfavourable climatic conditions, the increased frequency or duration of extreme weather events over recent years has already lead to unprecedented actions to adapt water supply and sanitation. Within the EU project PREPARED, a catalogue of adaptation initiatives was developed in order to support utilities in their development and implementation of solutions.

Adaptation practices refer to adjustments which might ultimately enhance resilience or reduce vulnerability to observed or expected changes in climate. With climate change, adaptation cannot rely on short-term strategies, but rather on long-term, permanent but flexible strategies.

Venice flooded in 2006

In an urban world with an increasing number of megacities, supplying the population with potable water will be a major challenge for the 21st century. In Europe, on average, 18 percent of total water abstraction is used for urban use, mostly for domestic purposes. Even without climate change and increased urbanisation, cities already suffer a number of threats pertaining to the water cycle, including pollution and alterations of natural ecosystem functions. The global changes will accelerate and accentuate these threats. Most studies underline the vulnerability of the major sectors of our economies. Therefore, the question is not 'do we need to adapt?', but rather 'adapt to what?', 'what to adapt? ' and 'how to adapt?'.

1. Adapt to what?

The purpose of adaptation is to be able to face and mitigate the adverse effects of climate stressors for the water sector, which are complex and multiple. Climate change may alter the reliability of water sources and of the supply infrastructure, the ability to treat raw water to potable standards, and may finally also influence the demand for water. However, the different water sources will be challenged unequally: while surface waters and shallow aquifers will be highly impacted on, deeper aquifers will be less impacted on both concerning water quantity and quality.

Water scarcity

The number of areas and people affected by droughts went up by almost 20 percent between 1976 and 2006 in Europe. Average summer flows in the rivers of Southern England may decrease by 30 percent by 2020, a similar reduction is forecasted for South Africa, while average stream flow reduction in Ontario, Canada, could reach up to 40 percent. This may also have an influence on water quality during low flows.

Sea Level Rise

In 2007, around ten percent of the world's population lived in coastal areas of low elevation (10m), with two-thirds of the world's largest cities (> 5 million) at least partially located in these low areas. The causes of sea level rise are the loss of land-based ice on Greenland and Antarctica and on mountains and the thermal expansion of oceans due to warming. The IPCC's 2007 report presented model results suggesting a global sea level rise of 18-59cm for 2090-99 compared to 1980-99. Recent studies suggest that IPCC projections of sea level rise by 2090–2099 are underestimated by roughly a factor of 3. Sea-level rise may have an effect on salinisation of coastal aquifers and lakes, as well as on coastal settlements due the increased risk of sea-induced flooding.

The number of areas and people affected by droughts went up by almost 20 percent between 1976 and 2006 in Europe.

Temperature changes

For Europe, climatic scenarios give temperature increase estimates ranging from 1 to 5.5° Celsius by 2100. This will impact the biological and chemical processes driving water quality. Records of Dissolved Organic Carbon (DOC) concentrations in 22 UK upland waters have shown increases of an average of 91 percent during the last 15 years. Increases have also occurred elsewhere in the UK, northern Europe and North America. Changes in water temperature may also impact water quality in reservoirs and removal efficiency in wastewater treatment plants. Temperature rise may also have a direct impact on the availability of surface water resources due to increased evaporation, while groundwater recharge will be poorer, threatening vulnerable aquifers. In parallel, the water demand of green areas and ecosystems will increase due to higher evapotranspiration, resulting in an additional demand.

2. What to adapt?

The 'targets' for adaptation are both the technical equipment related to urban water supply and sanitation as well as the thinking and handling behaviour of the concerned stakeholders. Hence, adaptation strategies may focus on:

- water utilities infrastructure, such as pipes and production sites (adaptation to new water quality, alternative sources, altered groundwater recharge etc.),
- the management of water demand and supply (quantity, quality),
- the differentiation between the destinations of water (irrigation, household use, etc.), as well as their evolution (e.g. due to heat waves and concomitant urban demand), the management of pollution risks, due to changes in water quality or due to changes in frequency and severity of rainfall events (sewer overflows), the enhancement of the natural assimilative capacity of receiving water bodies.

3. How to adapt?

Ideally, adaptations strategies should be:

Different types of adaptation strategies include the following:

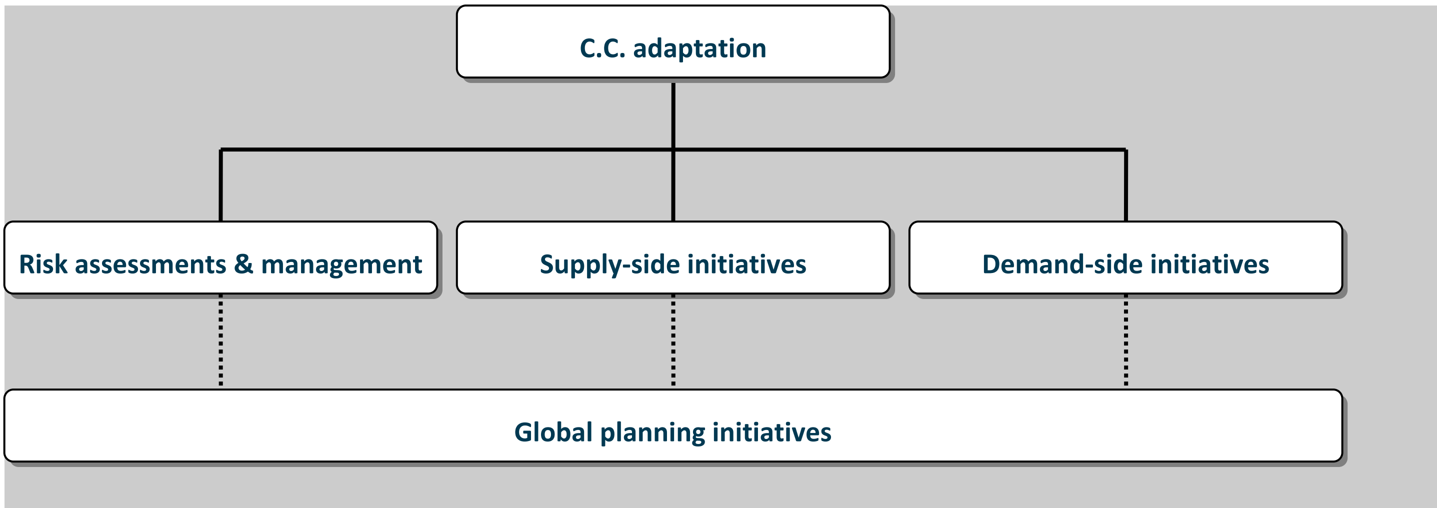
- 'no-regret' solutions – i.e. yielding benefits whatever the scenario,
- effective,
- feasible,
- reversible,
- minimising environmental impact,
- cost-effective,
- equitable,
- reducing the vulnerability (or at least, not increasing it).

'Soft' versus 'hard' strategies

One generally distinguishes between 'soft' (institutional and capacity) and 'hard' (infrastructure and engineering) solutions. These two concepts may also be classified as 'structural' and 'non-structural' measures. Soft adaptation strategies are often better able to manage uncertainty than hard adaptation strategies, the latter being often related to long-term investments.

'Demand-side' versus 'supply-side' strategies

Another distinction can be made between 'demand-side' and 'supply-side' water adaptation measures. Supply-side options generally involve increases in storage capacity or abstraction from water courses, whereas demand-side options aim at controlling or even decreasing demand, and achieving a balance between supply and demand. While demand-side options may lack practical effectiveness because they rely on the cumulative actions of individuals, some supply-side options may also be environmentally unsustainable such as additional abstractions from the environment.



Different adaptation initiatives as organised in the catalogue

Coping with uncertainties

Adaptation strategies will all need to address the inherent uncertainties of climate change. Infrastructure should be designed acknowledging (1) that it will need to cope with a larger range of climate conditions than before; and (2) that this range is and will remain highly uncertain. Unfortunately, uncertainties tend to increase with decreasing scale. Climate models may well be unable to provide the information current decision-making frameworks need until it is too late to avoid large-scale retrofitting of infrastructure. However, since uncertainties need to be addressed, it is possible for instance to base decisions on scenario analysis and to choose the most robust solution, i.e. the one that is the most insensitive to future climate conditions, instead of looking for the best choice under one scenario.

4. Scope and organisation of the catalogue of initiatives

Considered climate change adaptation initiatives

An initiative is 'an act or strategy intended to resolve a difficulty or improve a situation; a fresh approach to something'. While addressing a wide range of initiatives, the scope is constrained to adaptation in the urban water sector, with special focus on the European continent. However, due to the global nature of climate adaptation, examples from other regions which could be relevant for adaptation in Europe are also considered. The inventory of initiatives is complicated by the fact that many adaptation measures are not perceived as 'adaptation to climate change', but as simple long-term evolutions of a given practice, or as adaptation in response to a catastrophe that is not directly perceived as a manifestation of climate change.

Adopted classification

A distinction is made between

- risk assessment and management initiatives,
- supply-side adaptation initiatives,
- demand-side adaptation initiatives, and
- global planning initiatives.

The links between these adaptation measures shall be understood as shown in the following diagramme on two levels: the measure implementation level and the global planning level. Measures can be implemented according to an overall adaptation strategy using global planning tools, or not.

Closing remarks

This catalogue of initiatives aims at providing examples on how utilities could go ahead into preparing their water supply and sanitation systems to climate change. Initiatives include various measures ranging from the promotion of active learning to the prevention of sewer flooding and water conservation measures. A considerable review of the literature, of recent publications and news yielded more than 200 different examples of adaptation initiatives that may be relevant for the adaptation of the urban water sector.

The catalogue of initiatives is built as a 'living document', since new initiatives for climate change adaptation can be initiated and taken anytime. It is, per se, evolving and will be continuously improved and appended until the end of the project in 2014.

Within PREPARED, this living catalogue is supporting the development of solutions. In addition to the report, this work is also accessible to a broader audience thanks to the "WaterWiki" of the International Water Association (IWA).

Quality Assurance: Richard Ashley (Univ. of Sheffield), Gesche Grützmacher (KWB), Minnie Hildebrand (IWA)
References: This article makes reference to other research work, not noted in this publication. All References can be found in the full article on http://www.prepared-fp7.eu/prepared-publications

Young PREPARED participant profile

Profiling a young PREPARED participant, Siao Sun who works as part of the urban water research team in INSA (Institut national des sciences appliquées), Lyon, France.

Siao Sun

Siao is a post-doctoral student and joined INSA to continue her research in the water sector. At INSA, she works on the PREPARED project with Prof. Jean-Luc Bertrand-Krajewski.

After obtaining her undergraduate and master degrees in Hydraulic and Hydropower Engineering in Tsinghua University, China, Siao explored water as a subject in more detail and sat for her PhD at the University of Exeter, UK under the supervision of Prof. Slobodan Djordjevic and Prof. Soon-Thiam Khu.

The three years in Exeter was full of opportunities and Siao was awarded a PhD with the thesis Decision-making under uncertainty: optimal storm sewer network design considering flood risk. In her dissertation she looked at uncertainty analysis in sewer stormwater behaviour modeling, decision making under risk and optimisation of storm sewer network with artificial intelligent techniques.

Siao's participation in the PREPARED project

INSA is involved in developing a toolbox for real-time monitoring and modeling. This toolbox aims to contribute to the increasing technological capacity and performance of traditional water sectors by better use of sensors and models.

Siao will be working on data validation methods and improved rainfall measurements. Both topics are exciting and have a lot to explore. For instance, for rainfall measurement, an X-band radar system will be installed in Lyon. As this is a relatively new technology in rainfall measurement, the device will need to be tested and aspects such as the calibration, validation and comparison with traditional rain gauges will need to be evaluated. This will Siao the opportunity to broaden her research area.

PREPARED is Siao's first encounter with an encompassing project involving many institutions around the world. Her involvement and existing knowledge will be beneficial to the project and for her, it poses an ideal opportunity to expand her research horizon and learn from experienced professionals from varied backgrounds. PREPARED is a comprehensive project that focuses on sharing knowledge and information. To be a part of this will stand Siao in good stead as she will be in the thick of cutting-edge research and knowledge sharing ambits.

How PREPARED will relate to France's problems associated with climate change

Climate change is of global concern and France is obviously not exempt from it. The country will benefit from the outcomes of the project on various levels, one being the concept of shifting from water safety plans to water cycle safety plans. This will assist French cities to identify risks in their existing water systems and better plan to improve resilience. Another benefit will be felt in the advancement of rainfall measurement which will improve modeling to estimate floods and CSO (combined sewer overflow) discharges and thus lead to better operation and control.

The main water issues faced in France

While the water quality in France is of a high standard, demographic pressures and the effects of climate change on the water sector is of concern. On the one hand potential climate change effects such as water scarcity and drought and on the other the threat of flooding is of great concern.

Cooperation in European Union projects

Siao finds the way in which a large project such as PREPARED works fascinating and she finds the internaction and cooperation between so many different organisations, cities and people from different countries very interesting. Siao hopes to become part of the PREPARED network of researchers and professionals.

The 1847 lecture that predicted human-induced climate change

http://www.guardian.co.uk/environment/blog/2011/jun/20/george-perkins-marsh-climate-speech

A near-forgotten speech made by a US congressman warned of global warming and the mismanagement of natural resources. But a far less remembered American can claim to be the person who first publicised the now largely unchallenged idea that humans can negatively influence the environment that supports them.

On 30 September 1847, George Perkins Marsh (1801-1882) , who was a congressman for the Whig Party (a forerunner of the Republican party), gave a lecture to the Agricultural Society of Rutland County, Vermont. (The speech was published a year later.) It proved to be the intellectual spark that led him to go on and publish in 1864 his best-known work, Man and Nature: Physical Geography as Modified by Human Action.

George Perkins Marsh, 1801-1882, an American diplomat, is considered by some to be America's first environmentalist. Photograph: Library of Congress

More than 160 years on, it pays to re-read his speech as it shows that he was decades ahead of most other thinkers on this subject. He delivered his lecture a decade or more before John Tyndall began to explore the thesis that slight changes in the atmosphere's composition could cause climatic variations. And it was a full half a century before Svante Arrhenius proposed that carbon dioxide emitted by the ‘enormous combustion of coal by our industrial establishments’ might warm the world (something he thought would be beneficial).

‘Man cannot at his pleasure command the rain and the sunshine, the wind and frost and snow, yet it is certain that climate itself has in many instances been gradually changed and ameliorated or deteriorated by human action. The draining of swamps and the clearing of forests perceptibly effect the evaporation from the earth, and of course the mean quantity of moisture suspended in the air. The same causes modify the electrical condition of the atmosphere and the power of the surface to reflect, absorb and radiate the rays of the sun, and consequently influence the distribution of light and heat, and the force and direction of the winds. Within narrow limits too, domestic fires and artificial structures create and diffuse increased warmth, to an extent that may effect vegetation. The mean temperature of London is a degree or two higher than that of the surrounding country, and Pallas believed, that the climate of even so thinly a peopled country as Russia was sensibly modified by similar causes’.

In the speech he also called for a more thoughtful approach to consuming natural resources, despite the apparent near-limitless abundance on offer across the vast expanses of northern America. He believed that all consumption must be reasoned and considered, with the impact on future generations always kept in mind: he was making the case for what we now call ‘sustainable development’. In particular, he argued that his constituents should re-evaluate the worth of trees:

‘The increasing value of timber and fuel ought to teach us that trees are no longer what they were in our fathers' time, an incumbrance. We have undoubtedly already a larger proportion of cleared land in Vermont than would be required, with proper culture, for the support of a much greater population than we now possess, and every additional acre both lessens our means for thorough husbandry, by disproportionately extending its area, and deprives succeeding generations of what, though comparatively worthless to us, would be of great value to them.’

Marsh added that the conducting powers of trees render them useful in restoring the disturbed equilibrium of the electric fluid and they are of great value as reservoirs and equalisers of humidity. ‘In wet seasons, the decayed leaves and spongy soil of woodlands retain a large proportion of the falling rains, and give back the moisture in time of drought, by evaporation or through the medium of springs. They thus both check the sudden flow of water from the surface into the streams and low grounds, and prevent the droughts of summer from parching our pastures and drying up the rivulets which water them.’

He warned against droughts and water scarcity if too large a proportion of earth’s surface is stripped of woodlands and he urged his constituents to care for the forests as in their absence ‘the vernal and autumnal rains, and the melting snows of winter, no longer intercepted and absorbed by the leaves or the open soil of the woods, but falling everywhere upon a comparatively hard and even surface, flow swiftly over the smooth ground, washing away the vegetable mould as they seek their natural outlets, fill every ravine with a torrent, and convert every river into an ocean.’ Marsh warned that the suddenness and violence of rivers and streams will increase as the soil is cleared; ‘bridges (will be) washed away, meadows swept of their crops and fences, and covered with barren sand, or themselves abraded by the fury of the current, and there is reason to fear that the valleys of many of our streams will soon be converted from smiling meadows into broad wastes of shingle and gravel and pebbles, deserts in summer, and seas in autumn and spring.’

CALCULATING MEASUREMENT UNCERTAINTIES IN SEWER SYSTEM FLOWS

By Prof Jean-Luc Bertrand-Krajewski, Lyon, France

Measurement of flow in sewer systems is a complex task considering the dynamic behaviour of what is to be measured and the effects resulting from non-ideal conditions of operation. Flow is a quantity measured indirectly, usually obtained by the measurement of other quantities and applying mathematical models.

When flow measurements are regularly used for managing sewer systems, performance of the measurement system and the quality of measurement results becomes critical both to daily operation and to decision making processes within the utility.

Different solutions can be adopted in order to measure flow in free surface flow conditions in sewers. One of the most common methods is the velocity-area, usually using multi-sensing flow meters comprising a combination of sensors for level and velocity measurement. These are often mounted in stainless steel rings or bands, fitted in the inner surface of sewer pipes. The flow can be calculated from measurement of different quantities, namely, level and velocity, by applying the continuity equation. The slope-area methods are also sometimes used in conjunction with the velocity-area method to ensure redundancy. In both cases, calculation of the flow involves the use of non-linear mathematical models in a multi-stage system. In addition, these methods generally assume uniform flow conditions often difficult to ensure in actual measurement sites.

A simple usual lateral CSO structure in Ecully sewer system, Greater Lyon, France, but a complex location for measurement (complex free surface shape, with various possible flow regimes depending on hydraulic conditions) Photograph: Jean-Luc Bertrand-Krajewski

In most of the measurement locations, mounting the instrumentation is made under adverse conditions, usually in places where flow performance can be strongly affected by the geometry of pipes and by irregularities in joints. Dragged objects and debris can also damage the instrumentation and sediment grease and oil accumulation can obstruct the sensors. These unpredictable events eventually identified during maintenance operations or data processing, can lead to significant measurement errors. However, incorporation of these effects as contributions to measurement uncertainty proves to be difficult. Thus, it is expected that the error sources are strongly dependent of local conditions at each measurement location.

The measurement process is the act of assigning a value to some physical variable, by operating the sensors and instruments in conjunction with data acquisition and reduction procedures. In an ideal measurement, the value assigned by the measurement would be the actual value of the physical variable intended to be measured. However, measurement process and environmental errors bring in uncertainty in the correctness of the value resulting from the measurement. To give some measure of confidence to the measured value, measurement errors must be identified, and their probable effect on the result estimated. Uncertainty is simply an interval estimate of possible set of values for the error in the reported results of a measurement. The process of systematically quantifying error estimates is known as uncertainty analysis (UA).

Monitoring of urban water processes should be governed by the ability of the measurements to achieve the specific objectives within the allowable uncertainties. Thus, measurement uncertainty assessment should be a key part of the entire monitoring programme: description of the measurements, determination of error sources, estimates of uncertainties and the documentation of the results. Uncertainty considerations need to be integrated in all phases of the monitoring process, including planning, design, the decision whether to measure or not with specific instruments and the carrying out of the measurements. In essence, this means that uncertainty must be considered even at the definition-of-objectives stage; the objectives should include a specification of the allowable uncertainty defined in relation to the planned use of measurement results.

Uncertainty analysis is a rigorous methodology for estimating uncertainties in measurements and in the results calculated from them. It combines statistical and engineering concepts. The analysis must be done in a manner that can be systematically applied to each step in the data uncertainty assessment determination.

Biases are usually very difficult to detect and remove. Sensor calibration with links to primary or secondary standards is a way to evaluate and remove (by correction) biases. However, sensor calibration qualifies the sensor itself and not necessarily its use in a given location under given conditions which may themselves be the source of additional bias. This aspect should be accounted for as much as possible, as even relatively small biases may have dramatic effects on the final results from monitoring programmes. If biases can be detected and assessed, they can be accounted for in the uncertainty assessment. In other cases, correct information on systematic errors is non-existent or very weak, and estimations are not possible. An alternative method in this case may be to simulate scenarios, i.e. to simulate the effects of possible systematic errors on the final results, in order to answer questions like “what if…” (e.g. how would the discharge and its uncertainty change if the water level sensor had a bias of + 2 cm?). In all cases, investigation to identify and remove possible biases, even if it is difficult, is an important task to be carried out with the highest degree of rigor and intellectual honesty.

Frequently, instrumentation errors are the only ones dealt with in estimating uncertainties. This is unfortunate, because in many situations errors such as those induced by flow-sensor interaction, flow characteristics, and measurement operation are frequently larger than the instrument errors. This is why, as much as possible, the location and conditions of use of sensors should be accounted for to evaluate the total resulting uncertainty. For example, a water level sensor may have an instrument uncertainty (evaluated by means of an adequate calibration with certified standards) of ± 1 mm. If this sensor is used in a sewer system where the water is not still and perfectly horizontal, but moves downstream and generates small waves at the surface with possible secondary currents, leading to a non-horizontal free surface, the final uncertainty may reach ± 1 cm or more.

Conceptual biases (i.e. errors that might stand between concept and measurement) are generated during the test design and data analysis through idealisations (assumptions) in the data interpretation equations, use of equations which are incomplete and do not acknowledge all the significant factors, or by not measuring the correct variable. Despite the potential importance of conceptual biases, and the challenging in assigning significance to what has been measured, this category of uncertainty is beyond the scope of this deliverable and will not be further discussed.

The full research article will be published shortly and will be available on the PREPARED website as well as on the www.IWAWaterWiki.org.

Quality assurance: Maria do Ceu Almeida, Alvaro Silva Ribeiro, Siao Sun, Joep van den Broeke

References: The full research paper contains all references

PREPARED AS PARTNER IN THE IWA WORLD CONGRESS ON WATER CLIMATE AND ENERGY

—13-18 May 2012—

For the PREPARED project, like the rest of the world, water and energy, are critical for our survival and will be of increasing importance in the future. Climate change is forcing us to reassess the way we have always worked. PREPARED will share its climate change adaptation experience for cities and utilities to Dublin in 2012 as a congress partner. The demonstration and practical nature of PREPARED will afford delegates the opportunity to hear first-hand what innovative solutions work and how they work.

Following on from conferences on Climate Change Adaptation and Water and Energy, the International Water Association will host its inaugural World Congress on Water, Climate and Energy in Dublin in 2012.

The congress will explore the topics of resilient and sustainable cities with a focus on climate change adaptation and mitigation. Climate change adaptation challenges and incorporating uncertainty into the city vision and infrastructure will be discussed together with the impacts and responses of climate change on water resources.

Solutions to these challenges, including the role of technologies and smart networks will also be a central theme. Recognising that technology is only part of the solution the conference will address the economic, political and regulatory aspects of water, climate and energy.

Submissions for oral and poster presentation are invited on the topics listed on the congress website.

While the PREPARED project will be a full participant in the larger congress and workshop sessions, specific plenary and workshop sessions will be held as a congress within a congress. These sessions will look at the specifics of the outcomes of the PREPARED project, for instance the important issue of planning city infrastructure for the future by using scenario planning methodologies, Water Cycle Safety Planning and the impact on cities and utilities, adaptation strategies, etc.

PREPARED consortium partners, will share their research findings and congress delegates will have opportunities to debate and participate in this cutting-edge technology project. All the PREPARED sessions will be open to all congress delegates.

Visit the Congress website for more details of the Mainstream Congress or contact the PREPARED Project Management Team for PREPARED—specific information.

The Dublin Convention Centre is the location for the IWA World Congress on Water, Climate and Energy 2012. It is located in Spencer Dock area on the banks of the River Liffey.

The PREPARED Congress Programme Focus

A number of workshops and plenary sessions will focus on the PREPARED project aims and outputs:

- Two Plenary Sessions focusing on PREPARED and the case studies from the demonstration cities.

Workshop Sessions on

- Scenarios in the water and sanitation sectors
- Water Cycle Risk
- Planning for Adaptation Workshops (adaptation i.t.o. short, medium-and long-term and how to bridge the gap between them)

MESSAGE FROM THE PREPARED PROJECT COORDINATOR

Adriana Hullsman, Coordinator for the PREPARED project

The impact from climate change will have serious consequences for urban areas, such as the increased occurrence of extreme rainfall events, more than the current sewer and storm water systems can cope with. While this increased burden on the sewer and storm water systems will result in flooding of urban areas and contamination of receiving surface waters, the flipside of the same coin is longer periods of high temperatures with little or no rainfall, resulting in drought and water scarcity. Concomitantly, the absence of winter periods in the Mediterranean region results in considerably less precipitation while water demand increases.

These are just a few examples of the challenges that urban managers have to cope with.

The impact of climate change is real, and in most instances dramatic. What makes it more difficult for planners and managers to cope with these impacts, is the uncertainty to predict these events. The question is: how to prepare for the uncertainties of future events.

While climate change impacts on global level, solutions need to be found at local level. One of the first steps is to identify the challenges for your city and to assess the adaptation options available for the short and the long terms.

Thus, becoming a PREPARED city is possible and vital. The PREPARED consortium is working on solutions that will be shared with cities across the world to help them prepare for climate change.

Adriana Hullsman

PREPARED PROJECT PARTNERS

1. KWR Water b.v. - The Netherlands
2. DHI - Denmark
3. SINTEF - Norway
4. Kompetenzzentrum Wasser Berlin gGmbH - Germany
5. Institut National des Sciences Appliquées - France
6. International Water Association (IWA)
7. University of Exeter - United Kingdom
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19. Krüger - Denmark
20. Aquateam Norwegian Water Technology Centre - Norway
21. IWW Rheinisch-Westfaelisches Institut - Germany
22. Clavequeram de Barcelona - Spain
23. Berliner Wasserbetriebe - Germany
24. Municipality of Eindhoven - The Netherlands
25. Mediterranea delle Acque S.p.a. a Iride ACQUA Gas - Italy
26. Istanbul Water and Sewerage Administration - Turkey
27. Utility of city of Gliwice - Poland
28. Empresa Portuguesa das Aquas Livers, SA - Portugal
29. Water Department of Greater Lyon - France
30. Municipality of Oslo Water and Sewerage works - Norway
31. Simferopol Drinking Water Supply & sewerage Company - Ukraine
32. Aarhus Water and Wastewater - Denmark
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34. Seattle Public Utilities - United States
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