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WFD River Basin Management Planning in the Context of Climate Change Adaptation - Policy and Research Trends

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Abstract: Discussions are on-going at EU level on how Member States should incorporate climate change considerations into the implementation of EU water policy. This issue is all the more a highlight with the development of the first river basin management planning under the Water Framework Directive (WFD), which operationally started in 2010. The integration of knowledge about possible climate change impacts on water policy implementation concerns various aspects such as risk characterisation, monitoring, design and implementation of action programmes and evaluation of the "good status" objective's achievements (in 2015). These questions have been and are currently discussed with a wide range of experts and stakeholders of the WFD Common Implementation Strategy (CIS) and the first part of this presentation will summarise key recommendations expressed in this framework. The second part describes research trends supporting policy developments, discussing in particular how scientific findings and recommendations on e.g. adaptation measures could be best taken on board by policy-makers and water managers within the forthcoming years. Examples of research projects funded by the European Commission will be used to illustrate this purpose, and perspectives for strengthening links among the scientific and policy-making communities in this area will be highlighted.

Keywords: Water Framework Directive, river basin management planning, climate change adaptation, policy, research

1. INTRODUCTION

The Water Framework Directive (European Commission, 2000) is based on integrated water resources management principles, including in particular a stepwise approach regarding risk characterisation, monitoring, programmes of measures embedded into river basin management planning (Chave, 2001; Quevauviller *et al*., 2008). Besides “classical” risks of water quality deterioration and overexploitation (which have to be considered in the light of “good status” achievements by 2015), discussions are on-going at EU level about climate change-related risks and their implications on water management. This issue is all the more a highlight with the development of the first river basin management planning under the Water Framework Directive (WFD), which operationally started in 2010. The integration of knowledge about possible climate change impacts on water policy implementation concerns various above mentioned technical aspects (risk characterisation, monitoring, action programmes) as well as the evaluation of the "good status" objective's achievements (in 2015). These questions have been and are currently discussed with a wide range of experts and stakeholders in the framework of working groups operated under the so-called WFD Common Implementation Strategy (CIS). The first part of this paper summarises key issues which were discussed within this framework. The second part describes research trends supporting policy developments, discussing in particular how scientific findings and recommendations could be best taken on board by policy-makers and water managers within the forthcoming years. Examples of research projects funded by the European Commission are used to illustrate this purpose and perspectives for strengthening links among the scientific and policy-making communities in this area are discussed. Considerations expressed in this paper have been adapted from recent publications (Quevauviller *et al*., 2011; Quevauviller, 2011).

2. WFD AND CLIMATE CHANGE

Through its stepwise approach, the WFD makes IWRM principles operational with the aim to achieve good water status by 2015 (chemical status for all waters, ecological status for surface waters, and quantitative status for ground waters). The different milestones are summarised below:

- Delineation and characterisation of water bodies (reporting units) within well-defined River Basin Districts, which directly relies on water system understanding (and a proper analysis of pressures and impacts). This classification had to be carried out by Member States between 2004 and 2005 and reported the results to the European Commission. A report giving a synthesis of Member States' reports was prepared by the European Commission and published in March 2007[1].
- Establishment of registers of protected areas within each River Basin Districts, which have been designated as requiring specific protection of their surface and ground waters or for the conservation of habitats and species directly dependent on water. These include water used for the extraction of drinking water and all protected areas covered under the following directives: the Bathing Water Directive[2], the vulnerable zones under the Nitrates Directive[3], the sensitive areas under the Urban Wastewater Directive[4], and the areas designated for the protection of habitats and species including relevant Natura 2000 sites designated under the habitats[5] and wild birds[6] directives.
- Establishment of monitoring networks based on the results of characterisation and risk assessment (performed in 2004-2005) to provide a comprehensive overview of water status. Monitoring programmes had to be designed by Member States and made operational by the end of 2006. This step is an essential part of the overall management cycle as monitoring data will constitute the backbone of status assessment.
- Development of a River Basin Management Plan (RBMP) for each river basin district in the European Union (including transboundary river basins), including a summary of pressures and impacts of human activity on water status, a presentation in map form of monitoring results, a summary of the economic analysis of water use, a summary of protection programmes, and control and remediation measures. The first RBPM was published by the end of 2009 further to a public consultation which took place in 2008. A review is planned by the end of 2015 (prior to the launching of the second river basin management plan, which will also be subject to public consultation) and every six years thereafter.
- Consideration of the principle of recovery of costs for water services, including environmental and resource costs in accordance with the polluter pays principle.
- Design of a programme of measures for achieving WFD environmental objectives that should be operational by the end of 2012. Basic measures include, e.g. controls of groundwater abstraction, controls of point source discharges and diffuse sources liable to cause pollution etc. Supplementary measures include e.g. taxation, research etc. (a full list of measures is available in Annex VI of the WFD). The programme of measures has to be reviewed and if necessary updated by 2015 and every six years thereafter.

Besides the management framework established by the WFD, climate-related disasters (in particular floods and droughts) are considered in the Flood Directive (2007/60/EC) and the Water Scarcity and Drought Communication highlighting current policy developments in this area. It should be noted that climate change is not classified as an anthropogenic pressure in a narrow sense in the terminology of the WFD, even if there is a general consensus among scientists that climate

[1] Commission Water Framework Directive report, March 2007
[2] Directive 76/160/EEC, OJ L31 of 5.02.1976
[3] Directive 91/676/EEC, OJ L375 of 31.12.1991
[4] Directive 91/271/EEC, OJ L135 of 30.05.1991
[5] Directive 92/43/EEC, OJ L206 of 22.07.1992
[6] Directive 79/409/EEC, OJ L103 of 25.04.1979

change is at least to a certain extent caused by human activities. Indeed, climate change impacts cannot be mitigated by current WFD programmes of measures (linked to the implementation of various EU directives), which are essentially directed towards anthropogenic pressures (mainly pollution but also overexploitation of water resources).

It is increasingly suspected that climate change might influence different steps of WFD implementation, and thus possibly the status objectives (Wilby *et al*., 2006; Ludwig *et al*., 2009; Quevauviller *et al*., 2011). Discussions at policy level are also reflected in a guidance document published by the European Commission, which examines river basin management in a changing climate (European Commission, 2009a). In this respect, possible hydrometeorological risks affecting water management (mainly related to floods and droughts) are not specifically addressed in the WFD, which however provide a framework to include climate change impacts into the planning process. In particular, the requirement to identify and characterise 'significant pressures' affecting waters could be considered as including climate change (Wilby *et al*., 2006). Climate change might indeed potentially exacerbate existing or future anthropogenic pressures and should hence be considered within the policy framework. Impacts might for instance occur on river flow patterns, precipitations, water level fluctuations etc. (Wilby *et al*., 2006; Ludwig *et al*., 2009), while extreme flood and drought events may lead to increased sediment loads and mobilisation of contaminated sediments. Potential climate change impacts on WFD milestones are discussed in the above referred guidance document (European Commission, 2009a) which has been built upon principles of the European Commission's White Paper on 'Adapting to climate change (European Commission, 2009b). One feature of this document is the identification of adaptation strategies to increase the resilience to climate change of a wide range of sectors, including by improving the management of water resources and ecosystems.

Besides the above framework, and complementing the actual water quality and quantity management aspects, extreme events such as floods and droughts are also considered at EU policy level. Firstly, the Floods Directive requires EU Member States to assess and manage flood risks, with the aim to reduce adverse consequences for human health, the environment, cultural heritage and economic activity associated with floods in Europe (European Commission, 2007a). This directive has to be coordinated with the implementation of the WFD from the second river basin management plan onward. It therefore provides a comprehensive mechanism for assessing and monitoring increased risks of flooding, including those due to climate change, and for developing appropriate adaptation approaches. Secondly, water scarcity and droughts are also considered in the policy context (European Commission, 2007b). In particular, an annual European assessment of water scarcity and droughts is conducted by the European Commission to monitor changes across Europe and to identify where further action is needed in response to climate change. In addition, a review of the strategy for water scarcity and droughts is planned for 2012.

It may, therefore, be considered that the successive steps of the WFD River Basin Management Planning (RBMP) process provide a convenient structure for incorporating adaptation to climate-related water risks (including extreme events leading to possible disasters) through risk assessment, monitoring, environmental objective setting, economic analysis and action programmes to achieve well defined environmental objectives (European Commission, 2009a).

The need for policy responses to tackle climate change impacts on water is recognised worldwide as illustrated by the IPCC Technical Paper on Water (Bates *et al*., 2008), which is addressed primarily to policy-makers engaged in all areas related to freshwater resource management, climate change, strategic studies, spatial planning and socio-economic development. Some recommended policy principles include the need to anticipate changes to water systems that are climate sensitive, to understand the extent and causes of variability and change at reference sites (in particular, the most vulnerable ones), to assess direct and indirect influences on pressures due to climate change, and to identify and closely monitor climate change "hot spots". Guiding principles for adaptation favour options that are robust to the uncertainties in climate projections and integrate cross-sectoral delivery of adaptation measures (in line with the river basin management planning).

The above considerations clearly highlight that the climate change dimension will increasingly have to be integrated into WFD river basin management planning (European Commission, 2009a). As said before, climate change impacts indeed interact with and potentially aggravate other anthropogenic pressures, e.g. changes in precipitation and hotter/drier summer periods alter both the availability of water and the demand for water for uses such as agriculture, lower water levels may lead to an increase in the concentration of pollutants (less dilution), etc. The integration of climate change considerations into WFD river basin management planning is discussed in details in the above mentioned guidance document (European Commission, 2009a) and in recent publications (Wright *et al*., 2011; Quevauviller, 2011).

3. THE KNOWLEDGE BASE OF EU WATER POLICIES

The WFD provides a well established policy platform enabling to build up communication and best practice exchanges among all actors involved in water management at EU level (policy implementers, technology providers, scientific community, industrial stakeholders, NGOs etc.) in the context of the Common Implementation Strategy (Quevauviller *et al*., 2011). Research activities strive to support the WFD implementation and related water policies, actually following trends that have started in the early days of the Framework Programmes (FP) for Research and Technological Development (RTD) (Schmitz *et al.*, 1994) and which are pursued within the Seventh Framework Programme (2007-2013).

On-going FP7 EU-funded research areas relevant to water policies address pressures on environment and climate, impacts and feedback, environment and health, conservation and sustainable management of natural resources (including groundwater), evolution of marine environments, environmental technologies, understanding and prevention of natural hazards, forecasting methods and assessment tools, and earth observation (Quevauviller *et al*., 2011).

In the area of climate policy, research related to climate change and water is needed to improve understanding and modelling of climate changes related to the hydrological cycles at scales that are relevant to decision-making (possibly linked to policy). At present, scientific information about water-related impacts of climate change is not sufficient, especially with respect to water quality, aquatic ecosystems and groundwater, including their socio-economic dimensions. Research into climate-change impacts on the water cycle and related extreme events (in particular floods and droughts) will help improving the understanding and assessment of key drivers and their interactions in order to better manage and mitigate risks and uncertainties. Series of on-going climate-related research projects are funded by the 6th and 7th Framework programmes, examples of which are described in the literature (Quevauviller, 2011) and in the following paragraph.

4. CURRENT RESEARCH

4.1 Introduction

As mentioned above, a range of research projects are directly or indirectly supporting water and climate policies, in particular the scientific challenges posed by the WFD, the Flood Directives and other policies based on operational features. Only a few of them are used as examples in this paragraph (as presented at the EWRA Symposium in Catania on 30 June 2011). For a more exhaustive list of projects, the reader is invited to consult available project catalogues produced by the European Commission and related papers (European Commission, 2009c; Quevauviller, 2010; Quevauviller *et al*., 2011; European Commission, 2011).

4.2 Climate change impacts on the water cycle and ecosystems

One of the key research projects in this are is the WATCH project (Global Change and Water – www.eu-watch.org) which studies climate change impacts on the global water cycle with the aim to clarify the overall vulnerability of global water resources to climate change. Regional studies are also undertaken, e.g. in the Mediterranean area through the CIRCE project (Climate change and impact research: the Mediterranean environment – http://www.circeproject.eu). Focused research considers specific impacts, e.g. investigations on the consequences of climate change in mountain regions where snow and ice is currently an important part of the hydrological cycle by the ACQWA Project (Assessing Climate change impacts on the Quantity and quality of Water – www.acqwa.ch). Climate change impacts are also studied on specific environments, e.g. vulnerable groundwater and dependent ecosystems through the GENESIS project (Groundwater and Dependent Ecosystems – www.thegenesisproject.eu) while the MIRAGE project (Mediterranean intermittent river management – http://www.mirage-project.eu/index.php) studies climate change impacts on intermittent river management.

4.3 Climate change impacts on droughts

A recently launched cluster on 'Climate change impacts on water and security' builds up cooperation among EU countries and neighbouring Mediterranean countries (Ludwig et al., 2011), including research on climate change impacts on droughts. Research specifically addressing water scarcity and droughts has been discussed by the XEROCHORE Support Action (An Exercise to Assess Research Needs and Policy Choices in Areas of Drought – http://www.feem-project.net/xerochore/) which has established the state of the art of drought-related policies and identified research gaps on various drought aspects (climate, hydrology, impacts, management, policy) and steps to take in order to fill them (Kampragou et al., 2011). Recent research project on drought focus on improving early warning systems, e.g. the DEWFORA project (Improved Drought Early Warning and FORecasting to strengthen preparedness and adaptation to droughts in Africa) started in 2010 and the DROUGHT-R&SPI project (Fostering European Drought Research and Science-Policy Interfacing) started in 2011. Other examples (which were not presented by the author at the EWRA Symposium in Catania) are projects to EWRA activities such as MEDROPLAN (Mediterranean Drought Preparedness and Mitigation Planning), PRODIM (Proactive Management of Water Systems to face Drought and Water Scarcity) etc.

4.4 Research on extreme floods

Following up an large-scale research project in support of the EU Flood Directive (the FLOODsite Project – Integrated Flood Risk Analysis and Management Methodologies – www.floodsite.net) which terminated in 2009, research on improving preparedness and risk management for flash floods and debris flow events is now developed in the framework of the IMPRINTS project (Improving Preparedness and Risk Management for Flash Floods and Debris Flow Events – http://www.imprints-fp7.eu/, Cabello et al., 2011). Parallel international cooperation between the European Union and Asia focuses on flood resilience in urban areas through the CORFU project (Collaborative research on flood resilience in urban areas), which looks at advanced strategies for improved flood management in cities (Djordjevic et al., 2011).

5. NEEDS FOR SCIENCE-POLICY INTERFACING

Within the last five years, science-policy interactions in the water sector have highlighted the need for a different paradigm regarding the communication of research outputs in an easily usable form by policy-makers (Quevauviller *et al*., 2005, 2010b). It is increasingly recognised that

improving the dialogue and communication between scientific and policy-making communities would be possible through the development of an operational "science-policy interface". Such an interface would aim to boost exchanges and improving the uptake of research information by policy-makers and research needs (expressed by the latter) by the scientists. However, the development of an operational interface will only be possible through interactions and guidance of a dedicated group mixing policy people, scientists and stakeholders (Quevauviller, 2011).

The development of an interfacing mechanism is being contemplated within the so-called WFD Common Implementation Strategy (CIS) which serves as an exchange platform among Member States and Stakeholder's organisations representatives. The aim is to help Member States to get a timely access to scientific information supporting IWRM implementation in general (and in particular the Water Framework Directive and its daughter directives, as well as other relevant directives such as e.g. the Floods Directive) and to identify short, medium and long term research needs. It is hoped that an operational SPI (science-policy interface) will be established in a sustainable way, which is one of the challenges ahead for the years to come.

6. CONCLUSIONS

Needs to consider climate change adaption measures at river basin scale are currently discussed in Europe through the Water Framework Directive. This challenge, however, requires a strong knowledge base and supporting research is deemed essential in this respect. It is indeed recognised that effective actions will be closely linked to our capacity to integrate scientific knowledge in the EU water and climate policy cycle, and this calls for the development of science-policy interfacing mechanisms (Quevauviller, 2010b, 2011). This ambitious goal involves many different actors, hence its complexity as it considers not only the "human side" with different mentalities but also many different disciplines/sectors with their specific practices and jargons (Quevauviller, 2010a). At present, this framework remains to be practically developed and implemented in Europe, and this is a task to be tackled for the forthcoming decade.

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