Theme	**1. Global Change & Risk Management**
Topic	**1.1 Adapting to climate change: understanding the impact of climate change, vulnerability assessments and adaptation measures**
Main Question	How can water resources managers and water service managers adapt to climate change?
Related sub-questions	*Question 1:* How vulnerable are water resources and water services to climate change? *Question 2:* What type of climate related information do water managers and water services managers need to successfully adapt to climate change? *Question 3:* How should climate be mainstreamed in Integrated Water Resources Management (IWRM)? *Question 4:* What measures are available to water resources and water services managers to cope with climate change? *Question 5:* What type of capacity building programs are needed to prepare water (services) managers for the consequences of climate change?
<u>General introduction</u>	Water is a unique and vital resource for which there is no substitute. It ignores political boundaries, fluctuates in both space and time, and has multiple and conflicting demands on its use. Climate change will affect the hydrological cycle, and thus water availability, as well as water services. Evidence of changes in the hydrological cycle is available and with progressing climate change the changes in the cycle (temperature, precipitation and run off) will increase over the coming decades. Adaptation is therefore inevitable. However, without first assessing how vulnerable water management and water services are to climate change, new challenges to deal with climate change cannot be identified. In general, the concept of "vulnerability" as related to water resources relates to the ability of biophysical systems to adapt to change. One facet that would tend towards vulnerability include the natural climatic variability and (rapid) climate change, which influence both uses and the resource itself. *Resulting Question 1: How vulnerable are water resources and water services to climate change?* --- The quantity of water on Earth is fixed, while the distribution of precipitation and the levels of evapotranspiration have varied in the regions throughout history, following natural cycles. Next to climate variability and climate change, direct and indirect impacts of demographic processes can affect the availability, quality and trends in water use patterns. The good news is that climate information for the seasonal up to decadal timescales is improving quickly. Today, much of the climate scenarios and models provide information on temperature and precipitation changes at the global down to regional level. Hydrological models and datasets are at regional, basin and national level. And, for water development planning and operations information and data are required for the very local level. *Resulting Question 2: Is the water sector sufficiently benefiting from the improving climate information on the seasonal and decadal time scale? Should it be improved through a dialogue with climate science on the specific requirements for water*

	management? --- Integrated Water Resources Management (IWRM) is a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. The time horizon for IWRM is up to 30 – 100 years for investments, a time horizon relevant to take the impacts of climate change into account. With climate changes and increases climate variability, the need for managing water resources becomes even more urgent. Water flows will become less predictable and more subject to extreme events. While working on mitigating climate change, it is essential to address the consequences of climate changes. It is vital that expected effects of climate changes are incorporated in the water development plans and management plans. IWRM plans have to address the consequences of climate changes and include adaptation measures. *Resulting Question 3: Should climate be mainstreamed in Integrated Water Resources Management (IWRM)?* --- Water resources changes are one of principal consequences of climate change. In order to deal with the changes and the uncertainty in the predictions of change , water institutions and professionals need – in addition to conventional management approaches, new tools and financial resources to cope. These tools include vulnerability assessments and "climate proofing" water development plans and operations. Also water managers should start planning "beyond the box", in combinations of innovative structural and non-structural measures including new economic evaluation protocols and decision criteria for long term investment plans. *Resulting Question 4: What measures and innovations are / ought to be available to water resources and water services managers to cope with climate change?* --- Capacity building for climate change refers to the development or strengthening of personal skills and that of relevant institutions and organizations to reduce vulnerability to climate-related impacts. Vulnerability assessments and "climate proofing" are new topics for water professionals and institutions. *Resulting Question 5: Is there a need for capacity building programmes on coping with climate change? What type of capacity building programs are needed to prepare water (services) managers for the consequences of climate change?*
(Types of) Organizations to be involved in topic consultations	*International Agencies*: WWC, IWA, IUCN, Green Cross International, CPWC, WMO, UNESCO, GWP, UN-Habitat, UNEP, FAO, GWP, IRC, USACE, WWAP, IGRAC, IHP-UNESCO, INBO *National Governments:* Ministries of Water and/or Environment *Research Institutions*: IWMI, Max Planck, UNESCO-IHE, WUR, Kassel University, KNMI, IRI, ISET, SOPAC, Duke University *Multilateral and bilateral donors*: World Bank, AfDB, ADB, DGIS, BMU, BMZ, DANIDA, SIWI, JWF, *Environmental agencies / NGOs*: IUCN, Green Cross International *Related national organisations, NGOs and Local civil society*: KNMI, NWP, Wageningen University

Process of paper and session development:	1. Draft 1 of topic scoping paper to be sent to key institutions for comments 2. Improved draft to be placed on website 3. Improved draft with comments received to be discussed at the February coordinators meeting to: a. Agree on key questions b. Agree on the topic document so that it can be placed on the Forum web-site c. Agree on key stakeholders to take part in the development of the topic d. Agree on consultation process: relevant meetings with key stakeholders e. Agree on the process and actors to develop the forum session.

Question 4	What measures are available to water resources and water services managers to cope with climate change?
	Clarification of the issue related to groundwater/surface water storage A unique attribute of water storage is its flexibility. While major uncertainty still surrounds the detailed effects of climate change on the water cycle, groundwater resources are likely to be relatively robust in the face of climate change compared with surface water, due to the buffering effect of groundwater storage. Groundwater, therefore, may have an important role to play in ameliorating the worst effects of climate change on the water environment, if managed appropriately. While groundwater storage is a critical strategy, aquifers are limited by how quickly they can be filled or discharged. Surface storage in particular has the ability to deliver and store water quickly. *Statement of facts and trends* Increasing water storage can serve both drought and flood protection. Ideally, surface and groundwater storage can be implemented together to use the advantages of each. This type of integrated implementation will significantly improve the reliability and flexibility of water management systems to meet future needs and cope with future uncertainty and variability. *Expectations for the future* Storage of water can be increased. Groundwater reservoirs (aquifers) which store water, when available, can be more advantageous than surface water storage, despite the pumping costs, because of the reduction in evaporation losses. However, this classical drought management policy is becoming increasingly difficult to implement because of its consequences on the environment. *Main prospects and concerns (to be expressed in statements for session debates)* Increased storage is a logical option to cope with changing hydrological parameters (rainfall and runoff). New dams and reservoirs are not always a popular solution though. They raise controversies over environmental and resettlement issues and have been blamed for spreading vector-borne diseases like schistosomiasis and malaria.
Statement 1	*Groundwater (storage) one of the most important resilience / adaptation options. Decentralized storage mechanisms should be encouraged as a coping measure to deal with climate change.*
Statement 2	*Groundwater storage potential is much underused. Better insight in groundwater potentials for storage and as a coping mechanism should be explored.*
Statement 3	*Storage is very limited in developing countries compared to developed countries, yet rainfall variability is greater in particular in Africa. Humanity and decision makers will need tools to deal with this variability. This means we will need storage (of all kind) infrastructure, inland water transport, new ways to xxxx [measure water flow?].*
Statement 4	*A portfolio of actions related to water adaptation measures to cope with climate changes is needed.*
Statement 5	*In order to deal with increased uncertainty of climate change, water management needs new tools and financial resources to cope – in addition to conventional management approaches.*
(Types of) Organizations	International Agencies:

to be involved in session consultations	National Governments (min of finance/agriculture/economic affairs) Trade organizations: Association(s) of agricultural producers: Professional Associations: Research Institutions: Multilateral donors: Environmental agencies / NGOs: Related national organisations, NGOs and Local civil society.
Process of session development:	1. Draft 1 of session description to be sent to key institutions for comments 2. Improved draft to be placed on website/included in announcements 3. Call for session participation (March 2008) and selection of candidates 4. Collaborative work to develop sessions, with or without resource base assistance