DOWNSCALING PROBABILISTIC CLIMATE CHANGE SCENARIOS RESULTS

RIVER BASIN MANAGEMENT ISSUE

Water Quality						Water Quantity		Alterations		Others
1	2	3	4	5	6	7	8	9	10	
						T	T	(T)		

(1) Diffuse pollution by agriculture
(2) Salinisation
(3) Contaminated sediment and floodplain soils
(4) Large scale pollution due to past mining / industries activities
(5) Pollution by organic matter
(6) Emerging compounds
(7) Water scarcity
(8) Floods and low flow
(9) Hydromorphological alterations
(10) Soil erosion

C = System Characterisation
M = System Monitoring
T = System Trend
R = System Remediation, Mitigation

RIVER BASIN

Danube	Ebro	Meuse	Elbe	Brévilles	Others
	✓ - Spec.	✓ - Spec		✓ - Spec	Brenta, Eden, EU

Spec. : Results specific to selected River Basin

KEY FINDING TYPE

Understanding Processes (lab-scale)	Characterisation (field scale)	Modelling
		✓

BENEFITS TO END-USERS

Technical		Management	Policy	
WFD Implementation	Research	River Basin	Compliance	Policy making
✓	✓	✓		

INTRODUCTION

HYDRO 1 aims to take climate information from large scale model and to downscale the information in order for them to be relevant scenarios at the local and catchment scale. HYDRO 1 research consists of (i) collecting observed climate data for diverse study areas; (ii) evaluating climate models with respect to reproducing current climate data (such as rainfall and temperature data), their respective variability and extremes; (iii) studying droughts and extreme rainfall variation over Europe (up to 2070); and (iv) developing a weather generator including a rainfall model for the Dommel, Gallego, Brenta and Brévilles catchments.

KEY ISSUES

HYDRO 1 has studied future change in droughts and extreme rainfall over Europe and in the Brenta, Dommel and Gallego catchments. Therefore the results of HYDRO 1 address directly *Water quantity issues* such as *Water scarcity* and *Extreme rainfall events*.

Results and data obtained in HYDRO 1 aim to gain knowledge on prediction of climate change in the long-term (20 to 100 coming years).

- ***System trend***: The results are discussed with respect to both Water scarcity and Extreme rainfall events.
    - *Water scarcity*: The prediction for 2070 showed that (i) there would be more long summer droughts (>6 months) in southern Europe associated with >30% decrease in rainfall amount and (ii) there would be more frequent short term (3-6 month) drought in Northern Europe. In Northern Europe, winter rainfall

would increase inhibiting winter droughts. However, in Northern Europe summer rainfall will decrease increasing the short term summer droughts. For the Dommel, there were, at this stage of the research, too many uncertainties to accurately predict future change in drought. For the Gallego, the climate model predictions showed that the droughts will be more frequent and longer. Key parameters used to predict droughts are a region specific drought index (which depends on the resource of water available and the vulnerability of the area) and rainfall. Temperature also has an impact on drought through increased evapotransipration but has not been taken into account in the prediction. Therefore the predictions are likely to give optimistic/conservative estimates of change.

- *Extreme rainfall events*: HYDRO 1 studied change in short duration and long duration extreme rainfall events (using the largest rainfall in each year) which occur in the study area. Two durations of rain were considered: 1 day rainfall and 5 to 10 days rainfall. The prediction showed an increase of extreme events. Short extreme events will increase in amount and frequency all across Europe. Longer extreme events will increase and there will be larger increases in the biggest events than more moderate events, particularly in Northern Europe. There are uncertainties regarding the prediction of short extreme rainfall events in Spain. Key parameters which affect extreme rainfall events include temperature. The increase of temperature increases the humidity content of the atmosphere and creates more extreme rainfall events. This effect is included in these results.

RECOMMENDATIONS

HYDRO 1 results enabled to draw the following recommendations on how the climate system may behave under climate change:

- *Methodology*: Any one model simulation of future climate may represent only one of many possible future climate states. One of the means by which such issues may be addressed is by undertaking a large number of climate model simulations to assess the uncertainty and estimate the most likely future climate. It is therefore recommended that predictions of climate change should *use multiple different models* which may be compared in their ability to model historical climate and so their possible skill in predicting future climate.
- The results generated by the weather generator (rainfall data) are very useful input data for hydrological and hydro-geological models which will in their turn enable the prediction of the consequences of heavy rainfall on processes such as floods and contaminant transport.
- *Mitigation - Droughts*: In order to implement river basin management measures to minimise the effects of the increase of droughts expected in the future, it is necessary to take into account how much extra unused water resource is presently present in the hydrological system (amount of water with respect to population water demand). Solutions are likely to be found at the regional scale.
- *Mitigations - Extreme events*: Increases in extreme rainfall events have to be taken into account by river basin managers. The management measure shall be location specific. Moreover, extreme rainfall events must be managed by also taking into account droughts. For example the construction of water reservoirs may enable the channelling of rainfall from extreme rainfall events and simultaneously allow the creation of water resources in case of droughts.

These recommendations will be useful for the following **end-users:**

- **Climate change modellers** who are in charge of modelling and predicting climate change.
- **River basin managers** who are in charge of managing water quantity issues.