Cross-comparison of Adaptation Strategies Across Large River Basins
(I adapted the content)

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The global picture. Wetter / Dryer, consistency over the models, river discharge (2100)

-12 - -10
-10 - -8
-8 - -6
-6 - -4
-4 - -2
-2 - -0.1
0
0.1 - 2
2 - 4
4 - 6
6 - 8
8 - 10
10 - 12

Sperna Weiland et al, 2010, (HESS)
Immerzeel et al June 2010 (science)
Sperna Weiland et al, in press (climate change)

The global picture groundwater depletion

The groundwater in the arabic world

International Groundwater Resources Assessment Center

- linked with UNESCO, WMO and GEF
- transboundary aquifer management (isarm.net)
- Global groundwater salinity inventory
- Decentralized aquifer recharge
- Development of meta-information system for all groundwater-related data and information in Yemen (2010)

www.igrac.net and www.isarm.net
Ground water modelling in Syria

All Irrigated Areas
(Russian Maps + LANDSAT)

Irrigated Problem Areas
(Balance factors < 1)

Recharge/Abstraction:
(Recharge+inflow-outflow)/Abstraction:

Nile basin

Is there a potential from upstream developments To compensate climate change

- Water saving projects
- Lower water losses through Reducing evaporation
General conclusions

- In international river basins it will be difficult to compensate even small climate changes by water savings.
- When dealing with climate change in river basins both ground and surface water resources should be taken into account (e.g., large scale infiltration).
- In river basins, adaptation to climate change should be treated in concert with other developments, these might be much more important.
- Changes are beyond the mandate of the water sector for adaptation. Adaptation to climate change cannot be treated as a single sector issue (i.e., water sector should solve it).

Some best practice to do

Concentrate on measures that are also beneficial now:
- Design such that you are prepared to more variability.
- Keep the data collection up to date.
- Invest in better flood/drought warning systems.
- Do not base design on time series analysis of long records only but make use of future projections.
- Consider not only technical measures but treat water also as an economic good (i.e., incentive not to spill it).

For coastal development, sea level rise is nothing new, it only goes faster:
- Look for easy wins (small additional investments increase lifetime of investments).
- Demand for new investments (also from the private sector) that these are prepared for a sea level rise more than xx cm.
- Consider first protection measures that make use of natural processes (often cheap and sustainable) (NL-Building with Nature).

But it is also a blessing:

Climate change as platform for co-operation in large river basins (Confidence building) because:
- It will affect everybody.
- It has potentially huge effects.
- Not trivial to solve.
- Nobody is guilty.

⇒ forms a basis for discussion between experts without political agenda ⇒ high potential for raising confidence between experts as well as capacity building.

Dealing with climate change and sea level rise in the Netherlands

Policymakers approach
The Netherlands: situation

- 10 million people in flood-prone areas
- Deepest location: Zuidplaspolder around Nieuwerkerk aan den IJssel: NAP – 6.76 m.

Safety standards rather high

De facto a varying safety:
- NH and ZH: 1/10,000 per year
- North and South: 1/4,000 per year
- Yellow: 1/2,000 per year
- Green: 1/1,250 per year

Now look who is talking....

Al Gore, inconvenient truth

Now we had a problem:

The risk of climate change / sea level rise is not the flood hazard itself

but

The image that the Netherlands might not be safe anymore for investments

Now that is a major risk!!
Finding:
Scientists do not agree on magnitude of Climate change and sea level rise

Asked basically three questions
1. What is the maximum plausible SLR between now and 2100 (130cm)
2. Are we able to defend the Netherlands to that rise (YES)
3. What will it cost (1 B-EURO/yr)
4. Can we pay this (YES)

OK, than that is what we will do, discussion closed

So the difficulty in communication between hydrologists and decision makers (part I)

“ You have a problem, the climate is changing ! “

Hydrologist

Decision maker

So the difficulty in communication between hydrologists and decision makers (part I)

“ How much….? “

Hydrologist

Decision maker
Population and economical growth  energy demand  land use

- Energy-economy models
- Greenhouse gas emissions
- Carbon cycle models
- Greenhouse gas concentration in the atmosphere
- Global + regional climate models
- Global/regional climate projections
- Hydrologic + hydraulic models
- Hydrologic effects
- Measures
- Water management

Top-down approach to arrive at water management scenarios

Costs of the measures 5,000,000,000 EURO (NL)

But after 5 years...... a new IPCC report, progressing science

- Meaning that the investments were:
  - Too much
  - Too Little
  - OK?

How: An approach in the UK + NL : Ask a different question

Key philosophy
Adaptation to climate change has no value in itself. We do this because we want to live, work etc. in the Rhine-Meuse delta.

We must not ask how much the climate will change but...

- We ask the question, how much should the climate change before we are in trouble (climate change = change in natural boundary conditions)

Once we know this we know how vulnerable we are
For investments we need to know

For decisions time is important: try to express the uncertainty in terms of time instead of magnitude of change

=> carry out a sensitivity analysis for the water management system: try to answer, how much change can I handle before I run into trouble (= adaptation tipping point).

=> once determined, use different scenario's to assess the min/max available time to react (start alternative strategies/initiate measures etc)

Typical conclusions from the approach in the Netherlands (years based on most extreme scenario's)

- **Fresh water supply** will be severely hindered through salt water intrusion through the rivers (becomes an issue not before 2040)
- **Storm surge barrier** (Maeslantkering) designed for SLR up to 50cm (becomes an issue not before 2060)
- **Accessibility Rotterdam Harbour** hindered (Storm surge barrier needs to close more than once a year at SLR 75cm (becomes an issue not before 2080)
- **Coastal flood defence** through sand supply (becomes an issue not before 2100 / or if sand cannot anymore be collected from the North Sea)

Recommendations

There is a lot of very good, valuable scientific work, however:
The current state of the research provides the decision maker too little ammunition to start actions:

Prepare the following program

- Identify the magnitude of SLR where the current management strategies for all relevant countries will fail and assess the earliest date that this may happen => priority
- Propose a few solutions to delay the date or to solve the threat
- Co-operate on preparing a white book on climate change and sea level rise in the Arabic world with these results and provide that to the governments.
- Involve only those institutes that will freely share and distribute their results.