

# Climate change 2.0 and water management – some simple thoughts on a complex issue!

*“Climate is what we expect, weather is what we get”. Mark Twain.*

Climate Change<sup>1</sup> 2.0 is now upon us and the 21st century climate challenges will require 21st century perspectives from water professionals. If we are to believe the current media hysteria – nothing in our lives will ever be the same. Is it really so? Do the climate change predictions of, for instance, the IPCC (2007) really mean so much new for water resources planning? As water professionals we plan based on reality rather than predictions. What are we to do now then?

## **The new climate x-change: bank on it!**

Put simply, rain – freely falling or stored, possible inflow from groundwater and human water diversion -- is the credit side of the water resources balance ledger in a basin; evapotranspiration, runoff and water demand are the debits. Changes to any of these will impact, more or less, directly on water resources availability. Climate variability and change influences our water resources planning as loan interest rates influence your private economy. It adds uncertainty. Raise the interest rate (less precipitation, more evapotranspiration and/or higher consumptive human use) and your budget is strained and less flexible; decrease the interest (more precipitation, decreased evapotranspiration, and/or less consumptive human use) and you've got more room to manoeuvre.

But, we are not helpless, since we can “supplement” our capacity to cope with changes, just as if we increase our income by taking a second job (improved water management, infrastructure development) or live more frugally and improve our ability to cope with negative change (water demand management, increased water efficiency, less water consumptive activities). It is only when money burns a hole in our pocket (high ratio of our income, i.e. high water use relative to renewable average availability) that we become seriously vulnerable and, perhaps, risk even bankrupting ourselves.

A critical question for water professionals, therefore, is if climate change will really force us to have a paradigm shift in our thinking and planning for water resources management and use (as an economist in red-hot economic times would plan for survival in a stalled economy)? Climate change, combined with bursting urban populations, growing per capita water use, overbuilt coastal areas and other land use changes, may imply large or even disastrous water resources changes. This is the generally agreed perception today, but as we see, climate is but one among several different change factors.

## **Revolutionising our revolutionary changes**

To be sure, revolutionary changes occurred already during the 20<sup>th</sup> century. Over that century, human water use has increased at least 6-fold (with human population increasing “only” 3-fold) (Cosgrove and Rijsberman, 2000; Gleick, 2003). This increase in human water use has also been accompanied by increased pollution loads and deterioration of aquatic ecosystems (e.g. Turner and Rabalais, 1994; Nixon, 1995; Koplín et al., 2002; Kavanaugh et al., 2003; ERMITE, 2005; Baresel and Destouni, 2006; Lindgren et al., 2007).

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<sup>1</sup> Climate change is used as synonymous with human induced global warming. Climate variability is used when referring to natural climate (change).

That's the direct water factors! In addition deforestation and agricultural expansion reshaped the planetary surface. Added to that, in 2007 humans became for the first time a more urban than rural people (see Figure 1) (United Nations, 2005). Urbanisation adds complexity by impacting water consumption and management. And vulnerability increases. One in 10 humans lives in costal areas at less than ten metres above sea level (McGranahan *et al.*, 2007). Lest we forget, these people are not now suddenly living at risk. They've always been at risk in these areas; climate change simply changes the dynamic.

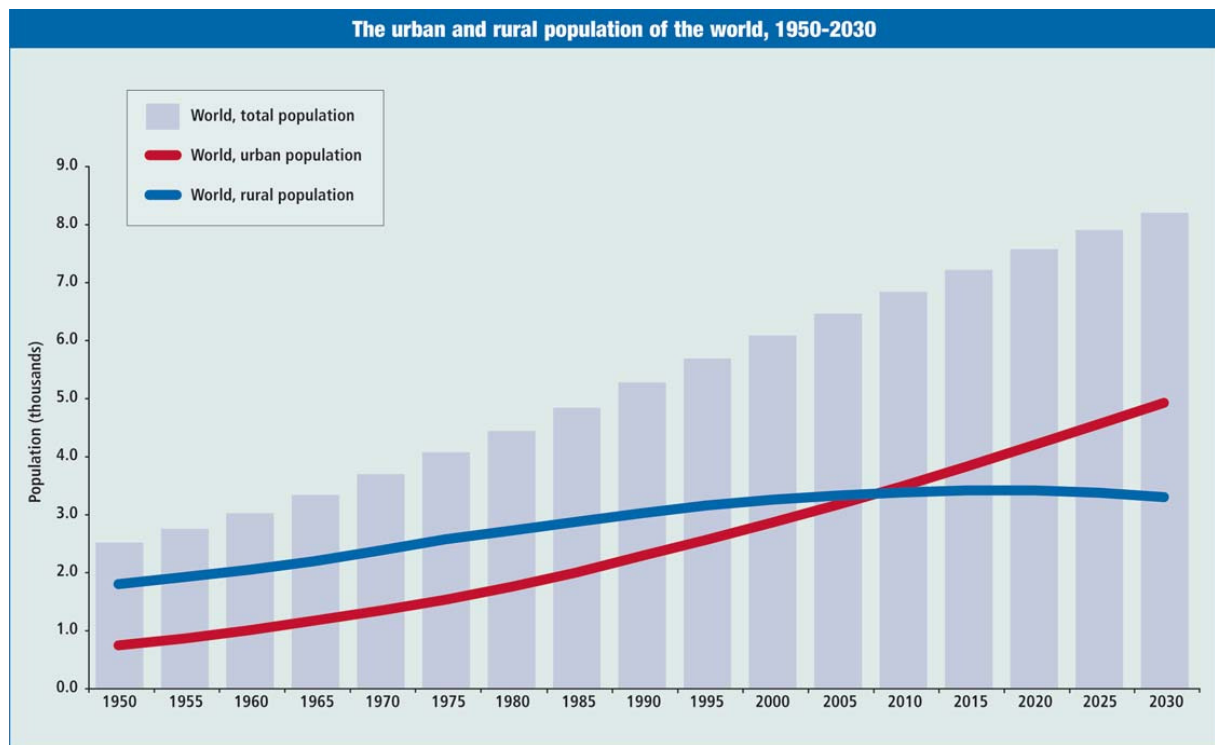


Figure 1. World Urbanization Prospects. Reproduced from the United Nations (2005)

These realities thus necessitate that adaptation and mitigation measures include a multitude of aspects, as adapting to a single factor or implementing one measure otherwise may counteract another. At the centre stage of such efforts is the understanding of the total effects on water resources from a range of impacting factors.

As water professionals, we need to accept that climate change has reshuffled the deck. We must redefine what we do and how we do it; we need participate actively in the ongoing debates on environment, development and policy in perpetuity. (How long climate change remains the media flavour of the day remains to be seen.) Water professionals must make sure the debate is widened, made realistic and not watered down, pardon the pun, with simplicity but addressing the multiple causes behind changes. We must, in essence, become educators. Here's some food for thought:

**Change, not stability, should always be the starting point for all (water) planning.** The saying says that perception is reality. Unfortunately, far too many planners and decision makers outside of the water sector perceive climate change as something completely new. That perception goes something like this: for centuries, the relative tranquillity and calm seen

by civilised societies over the last two millennia is the natural, stable state of things, while the climate changes that are being emphasised now and which are predicted to increase in the future is far more dramatic, disastrous and deadly. The reality is somewhat different.

The natural climate has always been changing. It is, at least partly, our inability to observe, acknowledge and account for this fundamental truth (in particular over the last few decades) that has caused many of the problems that we see today in the water sector. The “stable-climate thinking” has weakened the sector’s coping capabilities for current problems and future challenges. If we would have planned for the ever ongoing natural variability, we would today be better equipped to cope also with human induced changes.

A recent example, glaciers are receding dramatically in most regions of the world, with tremendous impact on water resources (more water now – less in the future, lost storage capacity, etc). Is this situation unique? Maybe on average global level, but have a look on Figure 2 exemplifying highly variable regional glacier conditions in the Alps. The late 20<sup>th</sup> century global warming is evident, but so is also an extended period before 1970 with a regionally similar situation, followed, interestingly, by a trend with more general glacier advance. In fact, media in the 1970s and 80s quite often focused on a “new ice-age”. As water professionals, we must provide better explanations, through graphs such as these, why changes in recent decade(s) have other driving forces (such as human induced climate change) than earlier (and similar) trends. This is absolutely not to argue against human-induced global warming, but assessments have to be more transparent and explanatory on the complexity of the climate-water link and that natural variability is high, has always been so, and must be factored in and understood. And even more important, we should also, after the long period of earlier recession, have been better prepared for such a variable situation in this region. It is, evidently, not unique even under natural conditions. Flexibility and adaptation are key words.

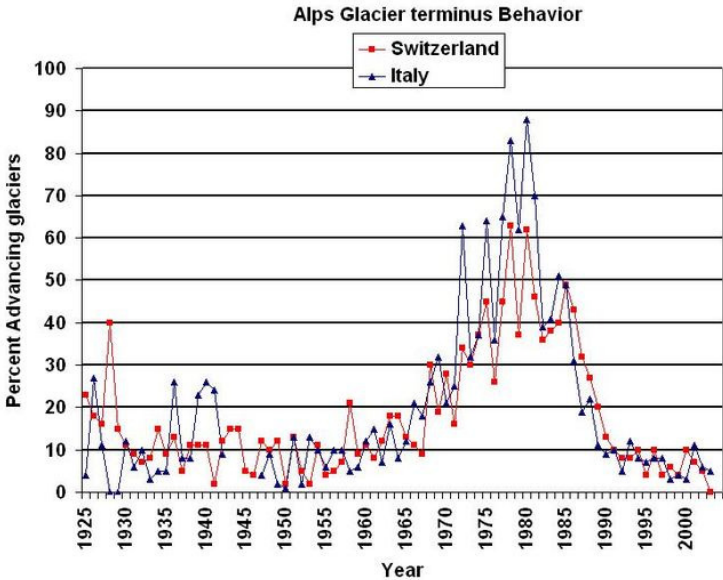


Figure 2. Glacier terminus behavior in the Alps, indicating the percentage of advancing glaciers. The terminus data is from the Swiss and Italian Glacier Commissions. (Pelto: [www.nichols.edu/departments/glacier/](http://www.nichols.edu/departments/glacier/)) and the graph is reproduced from [Wikimedia Commons](#)

The problem in naturally water scarce countries (or countries with great variability) is that water resource planning strategies resemble the way fish catch quotas are determined. First, scientists determine what the sustainable fish catch should be. Then, a political process begins (a process considering a range of social and economic factors, often short term) that almost always ends up with a much higher quota. The result is declining stocks and increased vulnerability to natural changes. As for water, many countries in dry regions or regions with high variability use far beyond what could be considered sustainable in the long term and under such conditions. Considering your bank loan again – if you use 90% of your income to pay your interest rates, a small increase of such rates may be devastating. So may a small decrease in precipitation. Such use ratios are what many countries suffer from today and if/when they run into problems, the blame should not only be put on climate change!

**Complexity is part of the natural system.** Water management has been complex in the past, and will certainly be so also in the future, with or without human induced climate change. Too often, over-simplistic speculations such as “it will get dryer where it is already dry and it will get wetter where it is already wet” are too easily dragged out in the media (often, unfortunately, also by some water professionals) as a basis for making fast water resources planning decisions. Such over over-simplifications should not be accepted as a basis for planning. As water professionals, we need to investigate the significant reality and complexity on the appropriate spatial-temporal scales for water resources management, rather than for global climate modelling.

**Non-climatic factors are significant parts of the water resource equation.** Factors beyond climate, including availability, temporal and spatial distribution, etc., influence water resources and need to be an integral part of water resource planning and management as well as in the discussions on global change (which include much more than just climate change) effects on water. Land use changes, large-scale water diversions, changes in consumption patterns, changes in production (agriculture, industry), changes in population and population patterns, etc., may influence both water resources and local-regional climate in various complex ways even more than the local-regional manifestation of the global climate change (Darracq et al. 2005; Shibuo, 2007). Feedback systems in reality become an intrinsic web of relationships and outcomes. Understanding such links forms the foundation for any understanding of the water-climate interface. As water professionals, we have a responsibility to be far more engaged and drive discussions on local-global change effects on water resources than what is currently the case.

Let us take one concrete example. The dramatic shrinking of Lake Chad is often referred to as evidence of what dramatic climate change may lead to. A study by Coe and Foley (2001), however, clearly pointed out that the observed changes in the regional climate since the 1960s have had only minor impacts on the dramatic changes of the lake compared to other factors (many of which are also human induced). Similar findings are also reported for the dramatic Aral Sea shrinkage over the same time period (Shibuo, 2007). Also for the considerably less dramatic, yet also important expected future development of nutrient loading within and from the major Swedish Norrström drainage basin (including also the capital Stockholm) to the Baltic Sea, other change and development factors have been found to be more important than climate change (Darracq et al., 2005). Are these examples arguments for that climate change is not important? Absolutely not! What they show is that climate change should not always be considered as the major factor, since also other, non-climate development and change factors can significantly or even dramatically affect water resources! Thus, if we focus only on climate, on the expense of other factors, we will be in trouble. To add complexity, other

scientists may argue that climate change is indeed the main driver in for instance Lake Chad (Evans, 1996). Nothing is simple in the world of water!

### **Concluding remarks**

We have discussed here some perspectives that need to be better understood and incorporated in the climate change research and debate to better reflect the water dimensions. Climate change should, and will, influence the way we conduct our business as water professionals but if we could get planners, policy makers and decision makers to also better recognise and understand the natural variability and full range of other factors that impact on water, our societies would clearly be in a much better state to cope with unexpected and severe future changes. Improved understanding of the climate-water links is an integral and fundamental prerequisite for all development. It is therefore a critical factor if we are to meet the Millennium Development Goals (MDGs) and secure food production, industrial development and ecosystem services. It all depends on water, and water is the critical link between the climate and human society. We hope that this short intervention will spur some healthy debate!

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