Climate Change and Water Management

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Much concern has been expressed in recent years in the sense that the world is running out of water, especially when it is considered that the world population will increase to around 9 billion people by 2050, and the world's economic activities and food requirements will increase as well. This is linear thinking, scientifically inaccurate, technically invalid, and there is no question that it will prove to be wrong.

The water scarcity problems that the world is facing are due to the past and the current processes and practices that are being used in various countries, which are, for the most part, highly inefficient. While there are signs of improvement in certain countries, the efficiency of overall water management in the world as a whole leaves much to be desired. Some signs of improvement can be seen in many parts of the world, but much more remains to be done.

Let us consider the United States. The latest water use figures released by the U.S. Geological Survey in September 2009 are for the year 2005. These figures show that the United States in 2005 used much less water than in 1975, even though its population did increase very significantly compared to 1975, and its industrial and agricultural activities also increased. On a per capita basis, an average American used 30% less water in 2005, compared to 30 years ago. If the per capita use in 2005 was the same as in 1975, it would have needed 12 more Colorado Rivers! Another example is the production of still. In 2005, one ton of this metal was produced with 90% less water than in 1975, a dramatic reduction. In spite of these improvements, however, water use in the United States could be more efficient. For example, urban water management and use in mayor cities like New York, Los Angeles or Chicago are still significantly worse compared to cities like Phnom Penh, Singapore, Tokyo or Zaragoza. With further efficient policy measures, water use requirements can be reduced by another 30% in less than five years, with current management practices and available technology.

Such changes in all countries will require a new mindset from the water professionals and the political leaders. Changing habits and existing mindsets will not be easy: it will require a determined concerned effort from everyone concerned!

The threat of climate change will introduce another set of uncertainties in water management, especially as, at present, the available information is of not much use for the water profession. For example, current predictions of global increase in temperature, and increase/decrease in average rainfall is of very limited use for water management. Unfortunately, at our present state of knowledge, we cannot even predict how the annual average rainfall in countries like India, China or Morocco will change with any degree of reliability. In other words, we are not at all confident about the reliability of the current predictions, the magnitude of the scale, geographical coverage and consequences of climate change in water management terms.

However, even if this basic information was available, this would still be inadequate since proper water management can only be done with reliable data and information on manageable scale river basins. For example, average rainfall forecasts over major river basins like Ganges-Brahamaputra, Nile or Huang He are not very useful or relevant. These have to be scaled down to a much lower geographical scale which can be handled in terms of planning and management at smaller-scale sub-basin levels. This elementary information will be a good beginning, but will not be enough.

For good water management, we need information on how extreme rainfall events, like floods and droughts will be affected by climate change. Historically, at present and in the foreseeable future, water infrastructures were designed and will continue to be designed, on the basis of estimates of future extreme events that depend on the past knowledge and historical information. For example, over the past several decades, estimates of probable maximum floods have continued to improve and have been fine tuned steadily. Thus, historically, the concept of standard design flood gave way to the estimate of probably maximum flood for important water infrastructures. The concept of freeboard further accounted to reduce uncertainties.

Because of these design improvements, in most countries the extreme rainfall events, either floods or droughts, witnessed in recent years are still within the norms of climatic fluctuations witnessed in the past. At our present state of knowledge, and the best guesses of knowledge advances for the next 10 years, I do not foresee sufficient progress which will enable us to make major changes in design of water infrastructure, this mainly because climatic uncertainties are still unknown. Thus, it is still not possible to forecast extreme events due to climate change on the basis of the latest climate models available, models which are likely to be available only during the next decade. This basically reduces such forecasts to an academic exercise which would be of very little help to the real world water planners and decision-makers.

Climate change seriously undermines the earlier concept of a stationary climate. It presupposes that the future climate will be very different to what we have witnessed in the past. Unfortunately, at our current state of knowledge, we cannot transform the precipitation forecasts from the latest GCM models to any reliable estimates of flood frequency. Nor are these GCM models capable of replicating the historical climate, which further reduces our trust in the use of such models for water management.

In addition to the uncertainties of climate change, the water profession has to address many other uncertainties that we are likely to face in the future. Among these are the rate and the structure of the future population growth in different parts of the world, economic growth rates of the future, food and energy requirements and how to manage them, developments of numerous feedback loops due to economic, social, and political reasons, which likely to very significantly alter the current forecasts, technological advances as well as their social acceptance and adoption rates, etc. All these uncertainties, including climate change, will make water management in the future an increasingly complex and difficult task.

During the transitional period of the next one to three decades, it will be essential to improve hydrological and meteorological networks so that reliable and more extensive information in the future water availability can be collected, analyzed and promptly used. Unfortunately, however, in many developing countries, the quality of hydro-meteorological networks has deteriorated, rather than improved. Unless this trend is reversed, there is a real danger that many developing countries may be stampeded into using many theoretical, untested and questionable methods, developed by the academics of the developed world, which are likely to be of very limited relevance or use for the conditions of the developing world because of the very different social, economic, climatic and institutional conditions.

For a country like Morocco, what in my view will be essential is that the country should not make decisions which may prove to be unnecessarily expensive, and even detrimental, to its nation´s interest and which may even prove to be counterproductive to improve the quality of life of the average Moroccan.