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Water and climate change in Africa – from causes to consequences

By Terje Oestigaard

There is a need to extend the climate change discourse. This should not be by paying less attention to the causes, which are now well known, but by stressing more the consequences, which have been largely neglected in political discourses, especially changes in water systems. This is also an issue of how global society should react to the uncertainties climate change represent for Africa and its development. Globally, the current political agenda focuses mainly on mitigation of carbon emissions, a consideration that also structures international aid policies, and less on adaptation and how to develop countries and societies when hydrology and environment changes. Thus, a water perspective may add important insights and future policy guidelines of particular relevance to Africa's development.

Causes

It has been suggested that the planet has entered a new geological 'era', the *Anthropocene*, in succession to the Holocene (Crutzen and Stoermer 2000; Crutzen 2002). The reason is the explosive impact humans have had on the planet over the last three centuries. From a world population of about 750 million people in 1750, the population is expected to reach about 9 billion in 2050. Thus, the earth's resources have never been under greater stress as a result human uses and exploitation. Agriculture and the burning of fossil fuel have dramatically increased greenhouse gases, which have reached their highest level in the last 400 millennia. As a result, the Intergovernmental Panel on Climate Change (IPPC) estimates that the earth will become warmer by 1.4-5.8 degrees during this century (Crutzen 2002:23). Consequently, humans are a major environmental force in changing the planet and the atmosphere, hence the suggested 'Anthropocene' era.

Given the predicted global warming, much of the agenda has focused on the consequences of melting glaciers, in particular the ice-caps in the Antarctic and Greenland, with subsequent rises in sea level. The IPCC has identified the Polar regions, small island states, mega-deltas and Africa as places that will be hardest hit by climate change.

Consequences

Higher global temperatures result in intense melting of glaciers and snow. Rising sea levels are a major challenge, but the main effects of climate change are the other changes in water systems, in particular increased evaporation and thus changes in precipitation patterns. Moreover, water availability will change with regard to amount, frequency and distribution. It is expected the weather will be more extreme in the years to come. This may result in heavier rainfall or more floods, or in failing rains and diminishing water levels in rivers, lakes and aquifers. Importantly, the amount of water in the hydrological cycle is constant and therefore the question is: where will there be more water and where less? And when will the rivers flood and the rain come? Too much water at the wrong time is as devastating for agriculture as too little when it is really needed for cultivation.

Water has generally been omitted from development theories (Tvedt and Oestigaard 2010), but is one of the key elements in adaptation. Changes in the hydrological cycle have an immediate impact on sustainability, food security and development. The current drought in the Horn of Africa is a consequence of failing rain and is the worst in 60 years. Changes in water systems are the consequence of climate change as they are manifested in ecosystems affecting people.

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Carbon mitigation as development aid

Reducing carbon emissions is without question important. Norway, for instance, together with several other countries, to a certain extent combine development aid and reducing emissions through forest conservation and reforestation in Africa and elsewhere. This may in many cases be an important way of securing livelihoods and thus a means of adaptation.

On the other hand, there are also several problems with this approach. First, local and national problems of poverty and development are not seen as challenges in their own right in the here and now, but in a future, global perspective. Thus, this is a pre-emptive strategy to reduce impending catastrophes due to climate change, which will affect developing countries hard. The global good is seen as more important than local problems. Second, preservation of (rain)forests often takes place in areas with a high population density where there is an increasing need for agricultural land for food production. By 2050, it is expected that food demand will increase by 70-90 per cent (Fraiture et al. 2009:124). Areas of potential agricultural production may be used to save the global climate, which developing countries will also ultimately benefit from. However, where agricultural land is not used, the future agricultural potential in highly populated areas is limited. Third, the green saving of carbon is not a solution but a postponement of the problem. Carbon does not disappear in trees – it is stored. When the trees die, the carbon is released. In order to avoid a further increase in carbon emissions, forests have to be continuously planted in the future. Thus, those areas in developing countries used for storing carbon cannot be used for food production in the future without releasing carbon emissions.

Carbon mitigation as part of development aid may therefore prove detrimental to developing countries in the future. With the predicted population increase, there will be a more stress on and a greater need for food production. But these elements are also part of the climate change discourse, and this discourse has many voices.

Political processes in Africa and scientific uncertainties

Although the political discourse on climate change has been dominated by the rich West, both in terms of defining the problems and the solutions, on the ground the situation is more complex. There are many actors and players with different agendas and means, and there is no consensus on how to tackle the climate challenges of the future, since it is a highly sensitive issue.

Of particular interest is the fact that before the COP15 summit in Copenhagen in 2009, all Africa's environment ministers put forward a joint political position before the meeting. From their perspective, the focus should strongly be on adaptation, whereas mitigation was a second priority. The adaptation challenges with regard to climate change mainly relate to the uncertainties in future water systems. But what is climate change?

According to the IPCC, climate change:

> … refers to any change in climate over time, whether due to natural variability or as a result of human activity. This usage differs from that in the Framework Convention on Climate Change, where climate change refers to a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods. (IPCC Summary for Policymakers)

In scientific analyses regarding climate change, periods of 30 years are normally used in studying weather variability in time and space, and there may be significant variations within these periods.

Moreover, there are uncertainties in the models, which represent predictions, not absolute truths. This is unproblematic, because this is the way scientific models work: depending on the parameters, premises and data used in different models, different results are achieved. In fact, David Hulme (2009) argues that more research today on climate change does not necessarily lead to better knowledge, since more and more the discourse takes place within political and cultural frames. Consequently, one needs to place greater emphasis on understanding the latter aspects.

Because of all the uncertainties regarding future climate, policy-planners consider two opposite scenarios: there will be both more droughts and more floods and with greater frequency and intensity, but where and when these will occur is uncertain. And the rains may come at the wrong time of year for cultivation.

Will there be more or less water in the Nile?

The River Nile may serve as an example of the importance of understanding the role of water in society and in development processes and the uncertainty of climate models for the future. The Nile is the world's longest river and the catchment area is shared by 11 countries. Today about 370 million people live in the Nile Basin countries, of which about 200 million live in the catchment area. By 2030, these numbers are expected to rise to 600 million people and 400 million respectively. Thus, it is of the utmost importance to know whether there will be more or less water in the Nile, especially as parts of the Nile Basin already experience high water stress and scarcity.

The White Nile contributes approximately 15 per cent and the Blue Nile approximately 85 per cent of the total volume of the Nile as measured at Aswan in Egypt, where the annual average of water is 84 billion cubic metres. Today, Egypt and Ethiopia each have a population of more than 80 million. This numbers is expected to increase rapidly in both countries in the future, so that there will be more pressure on this vital but already limited resource. Hence, the question of whether there will be more or less water in the Nile due to climate change is a crucial one.

An interdisciplinary research group analysed the outputs of 17 general circulation models (Elshamy et al. 2008).[1] Global Circulation Models (GCMs) are generally

1. The Nile Basin Research Programme's Climate in the Nile Basin Area research group, autumn 2007 at the University of Bergen.

seen as the best for analysing future climate scenarios. The research group was able to propose a water scenario for the period 2081-98. How much water there is in the Nile depends on three factors: 1) annual precipitation, 2) runoff and 3) evapotranspiration, which is temperature sensitive. The Upper Blue Nile basin covers an area of approximately 185,000 km2. The mean average annual precipitation is between 1200-1300 mm, but the rain pattern is highly seasonal and 70 per cent of the rain falls between June and September. The study of the Upper Blue Nile was undertaken at Diem, since about 60 per cent of the annual flow at Dongola comes from there.

Based on the GCMs, there was no consensus regarding future precipitation, which ranged from a 15 per cent decrease in rainfall to a 14 per cent increase. However, more models suggested decreased rather than increased precipitation. Taken together, the models showed almost no changes in rainfall patterns and only a slight reduction of 2.4 per cent in the wet season. However, with the predicted increase in temperature of between 2 and 5 degrees in the same period, there will be more evaporation and less runoff, and consequently less water in the Nile. When all the models regarding runoff were put together, they indicated that runoff would be reduced by about 3.5 per cent, which could result in about a 15 per cent reduction in the flow at Diem compared to today. However, the overall flow of water in the Nile is highly sensitive to rainfall patterns in the different sub-basins, and some sub-basins may receive more rain than others. The models for predicting future precipitation are not sensitive enough to present precise and secure analyses for the future. Consequently, there are many uncertainties regarding climate change's effect on the water systems in the Nile Basin and the Nile's flow.

This case study illuminates some of the problems with climate change analyses. There are many uncertainties regarding the different scenarios: in this case, the models suggested precipitation patterns ranging between minus 15 per cent to plus 14 per cent. The average indicated there will be almost no changes. The main problem is that in 2098 only one of these scenarios will be the correct one, and the average of models is nothing more than that: the reality in 2098 regarding precipitation may be anything between minus 15 per cent and plus 14 per cent, or something else. These are statistical analyses and models. Moreover, proper data for climate analyses in Africa are often incomplete or lacking, which in itself creates uncertainty in addition to the uncertainties of future climate changes at local, regional and global scales.

Mitigation and adaptation – causes and consequences

The IPPC's Fourth Assessment Report says: "Adaptation and mitigation can be complementary, substitutable or independent of each other … Although adaptation and mitigation may be substitutable up to a certain point, they are never perfect substitutes for each other since mitigation will always be required to avoid 'dangerous' and irreversible changes to the climate" (p. 101). Mitigation has first priority. From a global perspective, this seems somehow natural, but where does it leave Africa?

While the rich West has politically emphasised mitigation as the answer to climate change, African countries do not see that as their responsibility and focus on adaptation to the consequences of climate change, first and foremost how to develop their societies when they face a predicted increase in extreme rainfall variability resulting in more droughts and devastating floods.

During the Stockholm World Water Week in 2011 there was a high level ministerial panel comprising water ministers from Africa, who discussing how to develop their respective countries in the face of climate change.[2] There was general agreement that an overall aim of African countries is carbon mitigation, minimising climate change and developing a green economy. However, African countries produce less than 4 per cent of greenhouse gases and do not see it as their responsibility to solve the problems caused by developed countries. In fact, African countries, if they are to develop, will be dependent on utilising their energy potential beyond renewable energy and will thus contribute to increased carbon emissions. But, as was also stressed, it is possible to use the climate change agenda to meet two of the overall aims of development, hydropower (energy) and food security. This can be done by investing in building dams and reservoirs, which also secure water in dry seasons, and by stimulating a green economy. Consequently, the question was raised whether Western donors are willing to use development aid to secure water and food resources in the widest sense. In sum, aid as carbon mitigation and protection of forests is not what Africa most needs in dealing with the consequences of climate change.

Water in development: combining mitigation and adaptation

The awareness of extreme droughts and floods directs the political discourse in a new direction. But there is another area where water straddles mitigation, adaptation and the Millennium Development Goals. Improving the water and sanitation sector is fundamental to reaching the MDGs. In addition, this sector consumes significant energy and contributes 3-4 per cent of worldwide carbon emissions. The urban water-energy nexus includes energy consumption throughout the whole water cycle from pumping water, treatment of water, distribution of water, use and consumption (heating for cooking, showers etc., with subsequent losses), pumping sewage and finally treatment of sewage. The carbon emissions in this process are equal

2. The ministers and dignitaries were: Kebede Gerba, State Minster, Ministry of Water and Energy, Ethiopia; Mohammed Abdel Motaleb, Head of Planning Sector, Ministry of Water Resources and Irrigation, Egypt; Ogunlade R. Davidson, Minister of Energy and Water Resources, Sierra Leone; Sarah Reng Ochekpe, Minister of Water Resources, Nigeria; S.S. Nkomo, Minister for Water Resources and Development, Zimbabwe; Rejoice Mabudafhasi, Minister of Water and Environmental Affairs, Nigeria; Kamal Ali Mohammed, Minister of Irrigation and Water, Sudan; Issoufou Issaka, Minister of Water Resources and Environment, Niger, and Betty Bigombe, State Minister for Water Resources, Uganda.

to the emissions from the global aviation industry. With the growing urban population, improvements in the water and sanitation sector may reduce these emissions by 10-30 per cent and at the same time improve the living conditions of millions, thus combining mitigation, adaptation and achieving the MDGs (see Olsson 2011).[3]

Conclusions and policy recommendations

Changes in water systems may, and most likely will, result in more extreme droughts and floods with subsequent famines, climate refugees and, ultimately, deaths. With increased population and urbanisation, the water issue will be even more important in the future for the development of African countries, since water is a scarce and vital resource central to achieving many of the MDGs.

By stressing the role of water in climate change and development processes, a broader spectrum of research needs to be incorporated into the discourse. Emphasising the consequences of climate change for water by no means lessens the importance of carbon mitigation, but expands the discourse, which includes the social mechanisms involved in adaptation to changing environments, development processes and poverty reduction.

Politically, the high level panel of water ministers at the Stockholm World Water Week highlighted some of the difficulties by stressing water issues in relation to food production and security, poverty reduction and climate change. Politicians in parliaments and governments, even environment ministers, are in general scarcely aware of the role water plays in society and climate conditions. Hence, the water ministries are often marginalised with small budgets and there is little cooperation with other ministries, including water ministers elsewhere on the African continent.

Thus, although there is a scientific, policy-oriented and policy-driven discourse among African politicians regarding adaptation to climate change, this would be strengthened by advocating a stronger focus on water. This is because one important future challenge will be how to develop countries and hydro-structures that have to be increasingly resilient in the face of changing hydrological regimes and ecosystems, since there could be both droughts and floods of greater intensity and frequency. A central element in practical political planning and implementation will be how to deal with this uncertainty. Not only will water become more important in the future, in many places it will also be a scarcer resource as a result of climate change. Consequently, understanding changing water systems will be of the utmost importance to Africa's future.

3. These questions were addressed by the panel on Water and Climate in Focus: Transitions in Utilities in Urban Areas at the Stockholm World Water Week, 21 August 2011.

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