How does climate change affect groundwater in South Africa?

R MASERUMULE, C COLVIN AND S WOODBORNE
CSIR Natural Resources and the Environment, PO Box 395, Pretoria, 0001
Email: rmaserumule@csir.co.za – www.csir.co.za

INTRODUCTION

Groundwater is a relatively small component of South Africa's water resources accounting for approximately 15 % percent of South Africa's water consumption (DWAF 2002). Unfortunately, this statistic is overshadowed by the fact that close to 65% of the population and more than 300 towns are entirely dependent upon this resource for their domestic water supply. The use of freshwater resources like groundwater is expected to increase in South Africa and other developing countries due to population and economic growth, changes in lifestyle and expanded water supply systems. Investigating the impact that climate change has on groundwater resources is an important step in determining management plans for the sustainable use of groundwater resources.

CLIMATE CHANGE AND GROUNDWATER RESOURCES

When developing management plans to effectively address the future challenges that one expects to face as a result of climate change, the following questions should be posed:

- What are the projected changes in climate in South Africa?
- What are the estimated impacts of these changes on groundwater in South Africa?
- What are the appropriate adaptation and mitigation response for dealing with the changes to the groundwater in South Africa?

Climate change is expected to significantly affect global freshwater resources (Arnell, 1999). Increased precipitation intensity and variability are projected to increase the risk of extreme events such as flooding and droughts in many areas of South Africa. Global sea levels, which are expected to rise, can affect coastal regions in South Africa.

Groundwater is an important drinking water supply source to many, especially rural, communities in South Africa.

Droughts and heavy precipitation are expected to have both short and long-term impacts on groundwater quantity and quality. The risk to the groundwater resource can be categorised in the following way:

- Decrease in water quality due to salt water intrusion
- Increase in run-off due to elevated water table
- Increase in the occurrence of international water conflicts
- Decrease in water quality due to nutrients/contaminants being more concentrated
- Decrease in water quantity and quality due to run-off and erosion
- Decrease in agricultural development and profits due to drought.

Historically, migration has been the adaptation option used to deal with the consequences of droughts and floods. There is an increased interest in incorporating traditional knowledge related to the use of water harvesting into public policy (IPCC, 2008). Unfortunately, little is known about the cost of the impacts of climate change on groundwater resources in South Africa.

MODELLING THE EFFECTS OF CLIMATE CHANGE ON GROUNDWATER

The changes that are being observed in precipitation and other important components of the water balance suggest that a dynamic framework is necessary to conceptualise and investigate the projected changes in groundwater. Hydrological models are valuable tools for confirming past phenomena through the use of historical data while enabling projections from suggested scenarios. Models should be chosen to reflect the problem objectives, data constraints, and spatial and temporal scales of the application (Leavesley, 1994).

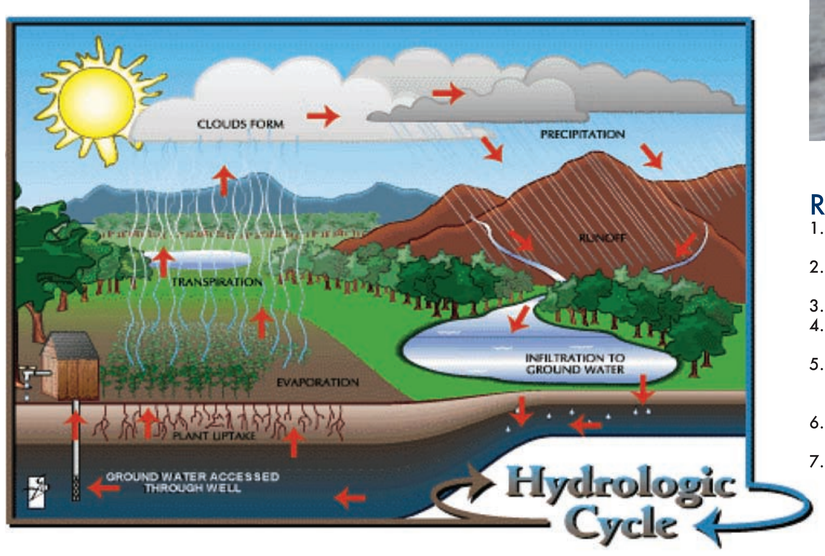
IMPORTANCE OF EFFECTIVELY LINKING SCIENCE TO POLICY

In the early 1600s the importance of the link between public policy and scientific output was articulated by Francis Bacon when he expressed the need for scientists to play a major role in government. (Bacon, 1625). As a society, our dependence on science will increase as we work to find strategies to combat the problems related to climate change. While the amount and detail of scientific information available has increased over the past few years, our response has in some ways been hindered by our inability to properly process the information in a meaningful way. In some cases the gap that exists between scientific output and public-policy decisions can be attributed to communication problems. In the past the dissemination of scientific information to lay persons has always been a challenge. Today we are faced with rapid environmental, social and economic changes that can be attributed to climate change, which make it important to effectively deal with the communication problems that exist (Abel et al., 1998).

South Africa is classified as a developing country, so issues surrounding poverty alleviation and economic development are still in the forefront of the public policy agenda. The integrated approach to determining the future impact of climate, societal values and economy on groundwater resources should assist policy makers in their efforts to balance the demands of protecting the environment without stifling the economic growth necessary to transition from a developing nation into a first-world country.

CONCLUSION

There is no longer a question as to whether or not mitigation and adaptation strategies should be put into place to protect our groundwater resources. The question is which mitigation and adaption strategies would be successful in creating a win-win situation for all stakeholders involved while effectively protecting the environment. Finding ways to effectively engage stakeholders in the process should increase the likelihood that proposed adaption and mitigation strategies are effectively incorporated into management decisions focusing on water resources.



With South Africa's use of water set to increase with population and economic growth, it is important for researchers to study the impact of climate change on groundwater resources, so they can help map the way forward.

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