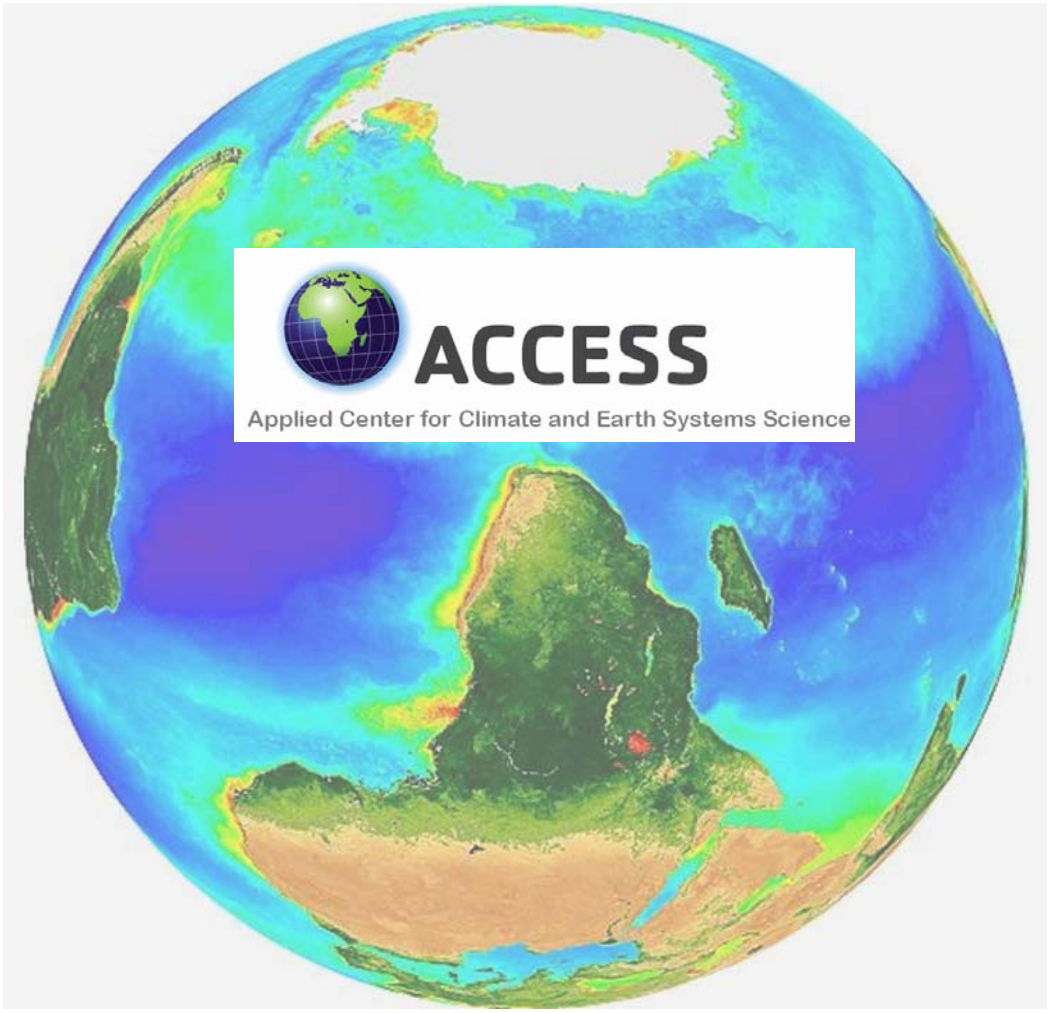
Applied Centre for Climate & Earth System Studies

Profile
May 2009



1. Introduction

Sub-Saharan Africa, with its surrounding oceans, is endowed with a distinctive array of natural features and earth system processes that make it a unique natural laboratory for the study of Earth's climate, its past, present and future. Southern Africa has also had unique successes in dealing with its tumultuous colonial and apartheid past, and continues to seek innovative means of dealing with its pressing social and political challenges. These are achievements that have earned the region international recognition and re-integration into the world community. Now that the era of globalization has taken root in the world's economy, and that the challenges of global warming and climate change are conspiring with the multitude of previously recognized environmental problems, southern Africa is well positioned to play a leading role internationally in demonstrating how to approach these global challenges on a sound and appropriate social and scientific basis.

Global change, which encompasses global warming and the associated global climate changes, are widely viewed as menacing threats, but they also present splendid opportunities for drawing together the range of disciplines needed to address many of the challenges faced in the developing world in an integrated way. The dismantling of barriers that existed in the past, has facilitated the opportunity for broad-based collaboration between institutions, agencies and disciplines; collaboration that can place southern Africa in a globally recognised position, and that can attract, train and deploy a new generation of professionals. By this means, a combined and large scale effort can provide the opportunity for education, and sustainable development and contribute to the alleviation of poverty, which remains the highest priority in Africa.

The Applied Centre for Climate and Earth System Studies (ACCESS) sits at the nexus of these challenges and opportunities (Figure 1), and this document scopes out the context, the goals and the activities planned over the next five years under the auspices of ACCESS, that has been mandated as a new Centre of Excellence (CoE) in the South African Department of Science and Technology (DST).

1.1 Background

Discussions around the establishment of ACCESS preceded the announcement of the DST Innovation Plan [1] and thus ACCESS was originally envisaged as an independent initiative among related research groups, agencies and institutions. Initial discussions, led by Professor George Philander, (Professor of Geophysics at Princeton University and South African Research Chair Initiative [SARCHI] professorship at the University of Cape Town) were held between several parties in South Africa. A meeting held in July 2006 chaired by the Director General (DG) of the DST, established a process which led to several workshops, culminating in the decision to establish ACCESS as a formal CoE in the framework of the DST Global Change Grand Challenge (GCGC). Thus, the planning of the GCGC and its Science Plan[2], pertains to

[1] DST Innovation Plan: http://www.dst.gov.za/publications-policies/strategies-reports (The Ten-Year Plan for Science and Technology.pdf)

[2] http://globalchange.grandchallengeonline.org/documents/drafts-for-comment.

the role that ACCESS will play in this initiative. While the scope and reach of ACCESS depends on the evolving implementation strategy of the GCGC and its associate governance model, this document attempts to define its envisaged role, its structure and function and its intended outcomes in the next five years.

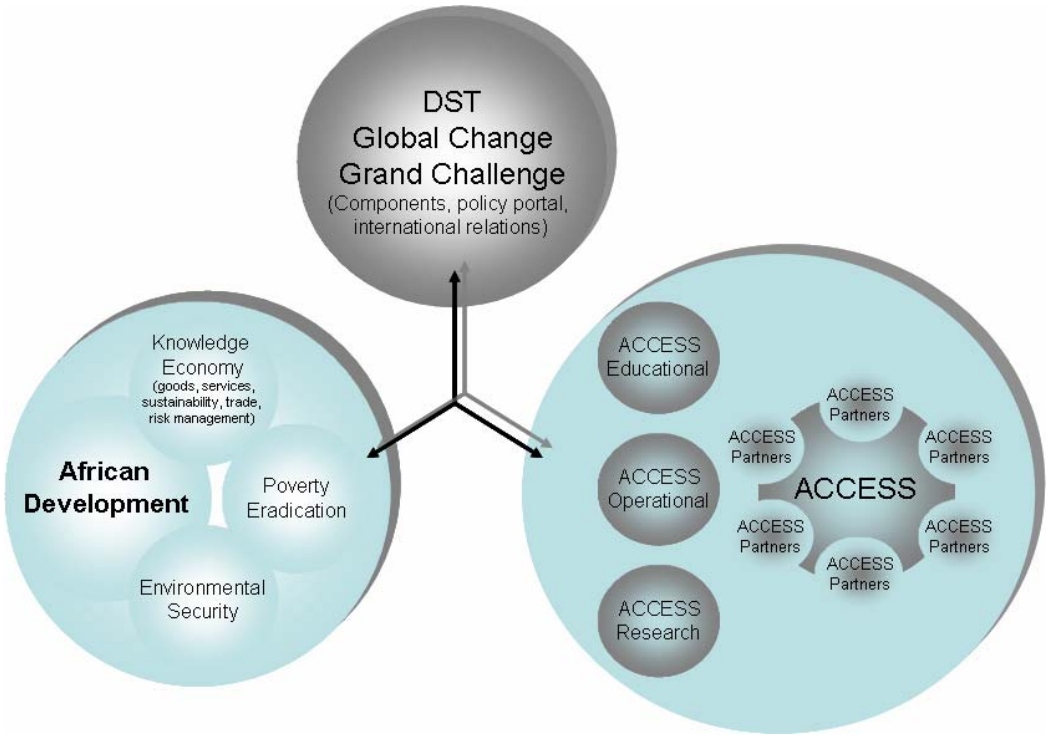


Figure 1: ACCESS is a "development through science" programme, addressing regional needs, by developing capacity to engage regional and global challenges, and maximising the advantage of our unique social and natural assets.

An interim Steering Committee has been formed comprising representatives of the range of research groups, institutions, agencies, science councils and government departments that have regarded themselves as stakeholders in the programme. A Steering Committee decision was made in August 2008 that the Council for Scientific and Industrial Research (CSIR), would host the programme and that a contract would be entered into between the CSIR and the National Research Foundation (NRF) which would govern both the operation of ACCESS as well as determine the expected deliverables, outputs and outcomes. The duties of CSIR, as hosts, are defined by the terms of the Agreement and the CSIR will enter into subsidiary agreements with participating institutions, agencies and other groups as appropriate.

1.2 Context

Humans, in a very short time, have become geological agents capable of interfering with the processes that make ours, a habitable planet. Global warming, and the associated climate changes, is now a pressing environmental security issue rooted in the energy consumption that maintains our traditional economic development and wealth creation. The debate on responding to environmental challenges (in the developing world context) is highly politicized and therefore demands that a sound and objective scientific basis for decision making is provided. The major social

challenges facing southern Africa are rooted in its modern history, with the result that despite recent political successes and the establishment of robust and institutionalised democracy in the region, the vast majority of citizens across southern Africa continue to endure abject poverty. This raises a series of ethical considerations about the response to global warming / climate change and natural resource exploitation and therefore the appropriate development of global, regional and local policy. It is particularly complex in the developing world such as in the southern African region (which is replete with fossil fuel resources) given the need to balance the sometimes competing demands of development, economic growth (and the associated urgent requirement of increased power generation), poverty alleviation, sustainable utilization of non-renewable and renewable resources, maintaining environmental security, conserving our special natural heritage, the responsibility of global citizenship and maintaining our proud scientific legacy along with the demonstrated ability provide leadership in global negotiations.

Of scientists we expect accurate estimates of the risks that global warming and other environmental challenges present. Of social scientists and economists we expect recommendations concerning our appropriate response. These pressing circumstances provide the ideal opportunity for an effort that should not only be directed at the requisite science and technology, and policy development and implementation, but also to implement a programme of technical training and education which will eventually contribute to the recognition of the southern African region, its experts and citizens, as key players on the global stage.

Scientifically, the reduction of the uncertainties in the available information concerning future climate projections in the short and longer term global warming time frames, is a high priority. Studies based in southern Africa can contribute significantly to this goal because the region has enormous climatic, geological, oceanographic and biological diversity, which provides an ideal test case for earth systems scientists. Southern Africa is in effect a huge peninsula that juts into three remarkably different oceans which strongly influence the regional and global climatic conditions. Furthermore, the evolution of modern humans is rooted in southern Africa. This alone confers on us a special responsibility as custodians of the seat of modern humankind and it thus appropriate that a unique and globally recognised earth system initiative should take root in this region. Thus, the earth system context provides an ideal opportunity to investigate both natural southern African earth system dynamics, the interaction with human systems and to engage its youth and citizens in appreciating its uniqueness.

It is in this context, that the South African Government (through the DST) has developed a series of S&T based programmes to deal with “Grand Challenges” for development and innovation in the country and the region. Of these, the GCGC is a key strategy which recognises that global change (incorporating human mediated climate change, its impacts and associated mitigation and adaptation strategies) is a fundamental driver of social and environmental change and its concomitant challenges. The ever increasing demand for resources, transformation of landscapes and ecosystems, waste and emissions impacts and many other consequences of development, and their feedbacks to earth systems, means that these have to be considered as an integrated whole, as opposed to what were traditionally treated as separate earth system (natural sciences) and human systems (social sciences)

domains. Environmental security, which incorporates the need to address local, regional and global environmental challenges demands that an appropriate balance be found between the demands of development (in a socially responsive way) and the maintenance of a sustainable and supportive natural environment.

In all, southern Africa is endowed with an envious platform on which to base an integrated innovation and training programme that can go a long way to address the Science and Technology (S&T) and development needs of our society.

1.3 The goals of ACCESS

The Applied Centre for Climate and Earth System Studies is a "development through science" programme which seeks to inspire optimism with the promise of a better future. The main outcome that ACCESS seeks is to provide educational opportunities, since education is the key to upliftment and innovation. To that end ACCESS intends to be a centre of excellence that warrants international recognition, and that draws the African youth to studies of our planet and its management, and indeed, produces the decision makers of the future.

The programme, that has been conceived with the goal of providing a novel platform on which global and regional environmental challenges can be investigated and whose outputs are integrated into a useful products for our decision makers. It seeks to integrate a hitherto disparate set of earth and human system science disciplines (and a relatively fragmented research effort), and to broaden the S&T horizon into a whole greater than the sum of its parts. As a key element of the DST's GCGC, ACCESS seeks to ensure that the coupled nature of the region's unique terrestrial, oceanic and atmospheric earth system components is recognised as an asset that should form the basis of a proud programme that produces a new class of expertise, a series of societally relevant and applicable outputs and a world-class research programme that contributes to improved regional and global knowledge. ACCESS will co-operate with the other components of the GCGC, which in turn, add further depth and integration. In particular, the interaction with the mooted CoE on Global Change and Sustainability and the Risk & Vulnerability Atlas project will be critical so that the two efforts develop in concert and can be mutually inclusive of their respective goals and outcomes.

A range of S&T agencies, academic research and teaching intuitions and service provision agencies of government have joined forces in developing a programme of activities that will achieve these goals. Contributions from the natural science fields of geology, hydrology, oceanography, atmospheric sciences, biogeochemistry and biology will be integrated with contributions from the geographical and social science fields that deal with the impact of earth systems on society and the impact of society on earth systems. The programme will be structured into three basic areas, Education and Training, Operational Outcomes and Research. ACCESS seeks to add value to existing efforts and to utilize these for the creation of novel approaches and novel outcomes. Thus, the range of partners in the programme will contribute the respective specialist element in the context of the overall earth system approach.

1.3.1 *Education and training*: This is regarded as the highest priority of ACCESS and aims to set in place an internationally recognized and vital educational programme which attracts a significant cohort of

African and international students, and which will have an impact at all levels of education – from primary school through to post-doctoral programmes to in-service training for professionals. At the core of the programme will be an inter-institutional Masters Degree programme in Earth System Science. In addition outreach activities at school level and at professional level are envisaged. These will include school programmes, technical meetings and workshops and leadership encounters with decision makers and scientists.

1.3.2 *Operational Outcomes*: Several agencies that provide services are already in existence (such as the South African Weather Service (SAWS)), and while these work well and are effective, there is tremendous value in inter-agency and trans-disciplinary collaboration in order to improve outputs (e.g. reduce uncertainty) and to develop novel products where there are gaps. A range of tractable indices that measure the pulse of the earth system (including society) corpus is envisaged. These fall into three main groups: (a) routine forecasts of oceanic conditions in the coastal zone, (b) improved seasonal and long-term weather forecasts, (c) and projections of future climate changes.

1.3.3 *Research*: The research programme of ACCESS seeks to assemble an integrated understanding of southern African earth systems (including human systems). It is designed to approach the coupled ocean-atmosphere-terrestrial system in the context of the entire regional segment of the earths surface, regarding the Southern Ocean, the Agulhas and Benguela Currents, the tropical regions of influence and the intrusion of the southern African land mass as a whole. In addressing the question of what has driven (in paleo-climate terms) and drives the climate cycle, what influences its variability and trajectory, it seeks to both better understand the influence of global scale processes on the regional system and the feedbacks that the region imposes on the global earth systems. An additional research component, which aims to investigate the role of society in these earth systems will be implemented and will address both the environmental security implications of the work, as well as seeking the best means of achieving uptake and interaction of the outcomes.

Thus, as a whole, these three elements will address the variability, dynamics and trends of the coupled system (from physicals to biology) will become a focus that seeks to attract the best minds in the country and the world to join in this effort.

2. Participating Institutions, Agencies & Councils

2.1 The nature of collaboration

The success of ACCESS will ultimately be attributable to the contribution made by the participating institutions, agencies and councils (IACs) as ACCESS structures, and activities will comprise those of existing IACs, in addition to those specifically

initiated and directed by ACCESS structures and resources. ACCESS will thus serve as an integrating platform (or umbrella) that can add value to IACs by providing a critical mass and cross-disciplinary scope, facilitate novelty and innovation and co-operation among the respective participating IACs.

This section of the document gives a brief scope of the range of IACs that have indicated their intension to participate in ACCESS structures and activities, but ultimately the degree of integration that will be achieved by ACCESS will depend on a number of items including the legal constitution and mandate of participating IACs. A formal mechanism of engaging IACs will be employed. It is also envisaged that the participating IACs will comprise South African IACs, as well as regional, continental and international IACs as the programme becomes established and grows.

The current version of this section thus represents a starting point for the programme, and it intended that the participation will grow rapidly and broadly.

2.2 The Council for Scientific and Industrial Research (CSIR)

The CSIR (www.csir.co.za) is a South African parastatal research council comprising a range of research divisions and specialised units. The CSIR is the administrative host institution of ACCESS and several of the divisions have a key role in the ACCESS programme. The CSIR is funded partially by direct parliamentary grant (30%) and partially by cost-recovery contract research conducted for all spheres of government and the private sector.

2.2.1 Among these are the Meraka Institute which houses the Center for High Performance Computing (CHPC).

2.2.2 The satellite Application Center (SAC) is a specialised facility providing a range of satellite data and information.

2.2.3 The division of Natural Resources and Environment comprises a number of structured research foci including its Ecosystem and Coast & Oceans Competence Areas. These house research groups working in terrestrial, coastal and oceanic global change research on a range of scales from local to global. NRE is also implementing a strategic initiative in Climate Change and Atmospheric Modelling which will work closely with ACCESS.

2.3 The South African Government: Department of Water & Environmental Affairs.

The DWEA has recently been created from a re-arrangement of government ministries in South Africa (April 2009). The erstwhile Department of Water Affairs and Forestry (DWAF), Department of Environmental Affairs and Tourism (DEAT) have been respectively split and reconstituted into a new dispensation. The fate of their agencies (below) has not yet been announced at the time of writing. They are treated here without allocation to any one of the new departments.

2.3.1 Marine & Coastal Management (M&CM)

M&CM is a Deputy Directorate which is mandated to implement coastal management and marine living resource management and the research that pertains to both of these two functions. M&CM is also the agency which nominally regulates and implements the Living Marine Resources Act (fisheries and marine ecosystems) and the Integrated Coastal

Management Act (integrated coastal management) and is responsible for associated monitoring, compliance and surveillance. The agency also has a responsibility for maintaining and operating the polar and Antarctic research stations belonging to South Africa. Research conducted by M&CM is in the marine domain by definition, and is both operational as well as fundamental research focussed on the structure, function and dynamics of coastal and oceanic ecosystems (physical and biological). M&CM also owns a fleet of vessels that are deployed in the Exclusive Economic Zone of the region and also services the Antarctic island division. M&CM staff is public service employees and research and operations are funded largely by the Living Marine Resources Fund (obtained from fish quota levies and penalties).

2.3.2 South African Weather Service (SAWS)

SAWS (http://dev2.weathersa.co.za/) is a semi-independent agency that is legislatively constituted to provide two distinct services, namely public good services (e.g. forecasting) which are funded by government, and commercial services, where the user-pays principle applies. SAWS is an authoritative voice for weather and climate forecasting in southern and South Africa, and as a member of the World Meteorological Organization (WMO), it complies with international meteorological standards. As an Aviation Meteorological Authority, SAWS is designated by the state to provide weather services to the aviation industry and to fulfil the international obligations of the government under the Convention of the International Civil Aviation Organization (ICAO). The organisation also provides maritime weather forecasting services for the vast oceans around southern Africa extending towards Antarctica. In addition to the operational capacity of SAWS, it also conducts a range of research activities pertaining to the development of novel operational forecasting techniques for short, medium, and long term weather and climate.

2.3.3 South African National Biodiversity Institute (SANBI)

SANBI (www.sanbi.org.za) was established on 2004 through the signing into force of the National Environmental Management: Biodiversity Act which expanded the mandate of SANBI's forerunner, the National Botanical Institute to include responsibilities relating to the full diversity of South Africa's fauna and flora, and built on the internationally respected programmes in conservation, research, education and visitor services developed over the past century by the National Botanical Institute. SANBI's mission is stated as: "To promote the sustainable use, conservation, appreciation and enjoyment of the exceptionally rich biodiversity of South Africa, for the benefit of all people". SANBI operates a number of national parks and gardens, curates biological collections and executes a wide range of educational, conservation, science and research programmes. One of these is the Climate Change and BioAdaptation programme whose Director, Dr Guy Midgley, is also a member of the UNFCCC and is a IPCC Lead Author.

2.4 The South African Government: Department of Science & Technology (DST).

ACCESS has emanated from the DST (http://www.dst.gov.za/) and as indicated in the sections above, is embedded in the DST 10-year plan for Science and Technology (http://www.dst.gov.za/publications-policies/strategies-reports/strategies-reports) which comprises the Grand Challenges (including the Global Change and the Space Science and Technology Grand Challenges). The DST research agency, the NRF (www.nrf.ac.za), is a key role—player in ACCESS, both in terms of the management of the CoE (in its own right) and via its own programmes:

2.4.1 Southern African Environmental Observation Network (SAEON)

SAEON is a research facility established by the NRF of South Africa (http://www.saeon.ac.za/) as is a key component of the GCGC of the Department of Science and Technology. SAEON has established and maintains nodes (environmental observatories, field stations or sites) linked by an information management network to serve as research and education platforms for long-term studies of ecosystems that will provide for incremental advances in our understanding of ecosystems and our ability to detect, predict and react to environmental change. The core research programme will strive to distinguish between anthropogenic and natural change as well as to unravel the relations between social change and ecosystem change. ACCESS is currently co-operating with two of these nodes, the Elwandle Node (Coastal-inshore node based in Grahamstown (SAIB)) and the Egagasini Node (Marine Offshore Systems based at M&CM) and expects that this will grow to incorporate more of the SAEON nodes in the future.

2.4.2 South African Polar Entity

At the time of drafting this document the South African National Antarctic Programme (SANAP) which has hitherto been a programme of the now restructured DEAT, is set to transform into an autonomous agency under the auspices of the NRF. The exact mandate and function of this entity are yet to be promulgated, but its role as a national facility and platform in support of ACCESS activities is expected to be a key aspect thereof.

2.5 University of Cape Town (UCT)

UCT houses several SARCHI professorships and several academic departments and research units / groups that have a key stake in ACCESS. These include (but are not limited to) the Departments of Oceanography, Environment and Geographic Sciences (ENGEO), Geology, Zoology and Criminology. Three of these are:

2.5.1 Mare Institute:

The Mare Institute (http://www.science.uct.ac.za/research/groups/mare/) is directed by Professor John Field, housed in the Department of Oceanography (http://www.sea.uct.ac.za/links.php), unit is a portal to a range of marine related research on at UCT and is also responsible for implementing the Applied Marine Science Masters programme where the ACCESS Education programme has its roots. The Department of

Oceanography also currently houses the Marine Remote Sensing Unit and hosts the SARCHI Chair of Professor George Philander.

2.5.2 Climate Systems Analysis Group (CSAG)

CSAG (http://www.csag.uct.ac.za/) is a unit at the ENGEO department which hosts the SARCHI Chair of Professor Bruce Hewitson, an IPPC Lead Author. CSAG is a dynamic group of multi-disciplinary scientists with research projects linked to all aspects of the climate system, from the Physics and modelling of Climate Systems through to impact and adaptation of climate change.

2.5.3 The African Security and Justice Programme

The African Security and Justice Programme (http://www.asjp.co.za/) Directed by Professor Clifford Chearing (SARCHI Chair) is the core focus of the Centre of Criminology. It runs an African focused and globally engaged theoretically oriented teaching and research programme. One of the sub-programme of the unit is focussed in Environmental Security research explores emerging institutions of polycentric governance for mitigation of and adaptation to climate change. Supporting and Sustaining New Economies is a programme funded by the Embassy of Finland. The programme considers ways in which the knowledge and capacities of poor constituencies can be mobilized in responding to climate change.

2.6 University of Pretoria

The University of Pretoria hosts a number of departments and units that have a stake in the ACCESS programme and other ACCESS Stakeholders. Among these are:

2.6.1 The Department of Geography, Geoinformatics & Meteorology (GGM):

The Department of GGM (http://www.up.ac.za/ggm) whose Head of Department, Professor Hannes Rautenbach is a leading climate system and modelling expert with a long term research programme focussed on short, medium and long term climate and meteorological weather forecasting.

2.6.2 Centre for Environmental Economics and Policy in Africa (CEEPA):

CEEPA is located within the Department of Agricultural economics, Extension and Rural Development at the University of Pretoria (http://www.ceepa.co.za/. The mission of CEEPA is to enhance the capacity of African researchers to conduct environmental economics and policy inquiry of relevance to African problems and increase the awareness of environmental and economic managers and policy makers of the role of environmental economics in sustainable development and is headed by its Director Professor Rashid Hassan.

2.7 University of KwaZulu Natal:

The University of KwaZulu Natal Pretoria hosts a number of departments and units that have a role in ACCESS, but in particular the School of Bioresources Engineering and Environmental Hydrology

(http://www.beeh.unp.ac.za/index.html) is recognized nationally and internationally for its successful and dynamic research programmes. It hosts the Emeritus Professor Roland Schulze who is an expert on Hydrology and Climate Change impacts, and is also an IPPC lead author.

2.8 University of the Witwatersrand (WITS):

The School of Geography, Archaeology and Environmental Studies has an excellent reputation both locally and internationally as one of the leaders in African scholarship on issues such as sustainability, climate change, urban social and environmental justice, tourism and development. We are also one of the leading experts in rock art studies, the Stone Age, paleoarchaeology, ancient livestock herding and ceramics. We offer undergraduate programmes in the disciplines of Geography and Archaeology and postgraduate degrees in Physical Geography, Human Geography, Environmental Studies, Tourism, Archaeology, Rock Art and Palaeoarchaeology. Professor Coleen Vogel has developed a key research focus on vulnerability to global environmental change (incorporating climate variability and disaster risk reduction), adaptation and mitigation (compromising the institutional arrangements that may be required for effective adaptation, mitigation and disaster risk reduction) and the implications for coupling such research more directly to planning and practice (including development and disaster risk reduction).

2.9 Stellenbosch University

The Department of Geology, Geography and Environmental Studies as several programmes and staff members which focus of Earth Systems research. In particular, P Prof Alakendra N Roychoudhury is collaborating on Southern Ocean biogeochemistry and has interests in other marine and terrestrial biogeochemical areas. It is anticipated that other researchers, departments and entities will participate in ACCESS activities on both the educational and research aspects.

2.10 Rhodes University

The Department of Zoology and Entomology at Rhodes University http://www.ru.ac.za/zoologyandentomology/) houses two Staff members Professor Christoher McQuaid (SARCHI Chair) and Dr William Froneman who have a research programme focussed on the Southern Ocean and have an interest in several ACCESS activities

2.11 The Benguela Current Commission (BCC)

The Benguela Current Commission is a statutory inter-governmental organization whose broad objectives of BCC are to facilitate the protection and conservation of the BCLME while restoring and maintaining ecological integrity and ensuring optimal and sustainable use of the resources through the implementation of ecosystem-based management. The Commission engages with all sectors of marine interests and services in the EEZs of the three countries. It has a mandate from the three countries to promote integrated development, sustainable management and protection of the environment using an

ecosystem approach to ocean governance. The BCC engages with the ACCESS consortium on a number of activities.

2.12 The SADC Drought Monitoring Center (DMC)

The SADC MDC (http://www.sadc.int/dmc/index.htm) hosts he season weather forecasting system entitled Southern African Regional Outlook Forum (SARCOF) and has engaged with ACCESS on participation in some of the operational activities proposed.