# Research in meteorology and atmospheric science in South Africa, 2003 - 2006

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South African Weather Service

## Size of Local Community

The local atmospheric community comprises of over 200 members. Most of these members are also members of the South African Society for Atmospheric Sciences (SASAS). The SASAS membership is mainly comprised of South African Weather Service personnel but also includes lecturers, and students from various SA universities, researchers from various science institutes such as: CSIR, AGROMET, Marine and Coastal Management (Dept. of Environmental Affairs and Tourism), ESKOM, Water Research Commission etc.

## SASAS Activities during the period 2003-2006:

2003:

1. The 2003 SASAS conference was held as a joint conference with AMDAR (Aircraft Meteorological Data Relay). This joint meeting took place at the Farm Inn conference venue near Pretoria. The theme of the conference was *Maintaining the Balance Between Fundamental and Problem Solving Research*.
2. The Stanley Jackson Award was initiated in 2003. The purpose of the award is to reward scientists in the atmospheric or oceanic sciences who have made a significant contribution to their fields through their research which has been published in a recognized scientific journal in the year preceding the award. Each year 5 independent referees are nominated by the SASAS Council to evaluate the submissions for the award. The referees are required to rank the submissions in order of excellence and the winner is determined from these ranked scores. The award takes the form of certificates for all the authors and a cash prize of R2000 which is divided equally between the authors of the best paper.
3. At the SASAS/AMDAR 2003 Conference, Prof. Peter Tyson was welcomed by SASAS as a new Honorary Member of the Society.

2004:

1. The annual SASAS conference was the 20$^{th}$ and held as a joint conference with the 9$^{th}$ International Meeting on Statistical Climatology (IMSC). The venue was the Waterfront in Cape Town. The theme of the joint conference was *Consolidating Understanding*.

2005:

1. The annual SASAS conference was held in Richards Bay. The theme of the conference was *The Energy Cascade, from High to Low, Fast to Slow, Small to Large*.
2. During May 2005 the new website domain was registered: www.sasas.org.za. The new SASAS web page has ever since received a large number of hits. The website serves as a general point of contact for members and the public, as well as for publicizing society news and other news items.
3. Two new Honorary Members were proposed and accepted by Council: Profs Johann Lutjeharms and Johan van Heerden.

2006:

1. The annual SASAS conference was held in Bloemfontein. The theme of the conference was *Life in an Austral Climate*.

**South African Weather Service's (SAWS) Research activities**
**-Long-range forecasting**

2003:

1. MSc dissertation (University of Pretoria): Pattern Analysis and Recalibration of a Perfectly Forced Atmospheric General Circulation Model, by A. G. Bartman.
2. Received the Stanley Jackson Award in 2003 for the best published paper by a member of the South African Society for Atmospheric Sciences, that contributed to atmospheric and oceanic research in South Africa. Willem Landman and Lisa Goddard (International Research Institute for Climate and Society).
3. Establishment of the Global Forecasting Centre for Southern Africa (www.gfcsa.net for more detail).
4. Two papers sent to peer reviewed journals (International Journal of Climatology, Meteorological Applications), One paper contribution to the COLA Experimental Long-Lead Forecast Bulletin (ELLFB), One paper presented at international conference and two papers at national conferences.
5. Canonical correlation analysis (CCA) was used operationally to predict near-global SST anomalies. The SST forecast fields were then forcing an ensemble of 10 members of the COLA T30 GCM run at the SAWS. Ensemble mean rainfall and temperature anomaly fields were subsequently produced each month. GCM forecasts are now produced monthly from forcing the model with persisted SST anomalies.
6. The RegCM3 regional climate model was implemented at the SAWS.

2004:

1. WA Landman was appointed as Professor Extraordinary at the University of Pretoria from 1 January 2005 to supervise postgraduate students.

2. WA Landman became member of the Climate Variability and Predictability (CLIVAR) Project's *Working Group on Seasonal to Interannual Prediction* (WGSIP).
3. One paper presented at international conference, One paper to non-peer reviewed journal, and 2 papers published in popular literature.

2005:

1. Started the development of a sophisticated multi-model forecasting system for South African seasonal rainfall and temperature. This system incorporated general circulation model (GCM) forecasts from models run at the SAWS, the Universities of Cape Town and Pretoria and international centres such as the International Research Institute for Climate and Society (IRI). This system was planned to be fully operational in 2007. Developed a new statistical downscaling technique for seasonal rainfall over South Africa, which optimizes the attributes of perfect prognosis and MOS.
2. WA Landman was a resource person during three weeks of a six week training course presented at the University of Oklahoma, USA. The course title was "Fifth Workshop on Regional Climate Prediction and Applications" for nations surrounding the Indian Ocean. L Ntsangwane attended the six week course.
3. WA Landman appointed by WMO in 2005 as Leader of the Expert Team on *Long-Range Forecasting (Infrastructure)*.
4. Three papers to peer reviewed journals (2 to Geophysical Research Letters, 1 to Journal of Climate), and 1 paper to non peer reviewed journal.
5. The ECHAM4.5 was installed at the SAWS. The first climatological ECHAM4.5 runs were initiated towards the end of 2005.
6. A Standard Verification System was implemented at the SAWS and was used to calculate verification statistics of the operational probabilistic consensus seasonal forecasts the SAWS issues every month. Verification was performed for the period 1998 to 2003.
7. The ECPC Regional Spectral Model (RSM) was implemented at the SAWS

2006:

1. WA Landman was appointed Honorary Associate Professor at the University of the Witwatersrand to supervise postgraduate projects and present a small number of lectures.
2. Developed a model output statistics (MOS) operational forecasting system (using ECHAM4.5 GCM output) for monthly rainfall and its extremes over South Africa.
3. MSc dissertation (University of Pretoria): An Assessment of the Performance of Recalibration Systems of GCM Forecasts over Southern Africa, by Mxolisi Shongwe (Swaziland national).
4. MSc dissertation (University of Pretoria): The Internal Variability of the Regional Climate Model RegCM3 over Southern Africa, by Mary-Jane Kgatuke.
5. Four papers to peer reviewed journals (Climatic Change, Bulletin of the American Meteorological Society, South African Journal of Science, International Journal

of Climatology), 2 contributions to the ELLFB, I paper at national conference, 1 technical report.
6. 25-year, 6 ensemble member ECHAM4.5 GCM climate run completed.
7. 20-year 5 ensemble RegCM3 run completed for the DJF season.
8. First ever operational regional model (RegCM3) forecast for the region.

**Major projects, including those funded by the Water Research Commission**

1. Skill Comparison of Dynamical and Empirical Downscaling Methods for Southern Africa from a Seasonal Climate Modelling Perspective. Duration: 2002-2006. Origin of funds: Water Research Commission (ZAR450 000).
2. Model Output Statistics Applied to Multi-Model Ensemble Long-Range Forecasts over South Africa. Duration: 2004-2008. Origin of funds: Water Research Commission (ZAR436 000).
3. Seasonal Hydrological Probabilistic Forecasts. Duration: 2005-2007. Origin of funds: National Research Foundation (ZAR96 000).
4. Operational forecast verification. Duration: 2004-2007.
5. Ocean and Climate Variability in the South West Indian Ocean: Impact on rainfall and fisheries. Swedish/South African Agreement, National Research Foundation, Pretoria, January 2003 - December 2005
6. Measurements and regional model studies of ocean-atmosphere interaction in the Southern Ocean in order to improve our understanding of the ocean boundary layer's contribution to subtropical climate and weather systems
   South African National Antarctic Programme, Pretoria
   April 2003 - March 2004
7. Water Research Commission, South Africa (2004-2007: with M Rouault and J. Lutjeharms): Hydroclimatic variation over southern Africa at intra-annual and inter-annual time scales, with special reference to the role of the oceans
8. Benguela Current Large Marine Ecosystem (2004-2007): Large scale climate modes in the South Atlantic and their impact on the BCLME
9. Benguela Current Large Marine Ecosystem (2005-2007): A modelling platform for application to the BCLME region.
10. NRF (2002-2004 and 2005-2009): Modelling the impacts of climate variability.
11. Australian Research Council (2001-2003: with M. England): Midlatitude variability in the Southern Ocean and its role in Australian climate.
12. Malaysian government, Malaysia (2003-2005 with F. Tangang): Oceanic influences on variability of the monsoon over Malaysia.

**Capacity Building**

A number of capacity building exercises have been undertaken by the various institutions. These have been in the form of training opportunities, participation and

exposure to international conferences/ workshops. A number of young black scientists from SAWS participated in the following conferences:

1. "Theory and use of Regional Climate Models" workshop at Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste, Italy in 2003.
2. Training course on short-term climate prediction in Beijing, China in 2003.
   6th International Regional Spectral Model Workshop in New York, USA in 2005
3. Workshop on climate variability over Africa in Alexandria, Egypt in 2005.
4. Training course in long term forecasting, Oklahoma, USA
5. 7th International Regional Spectral Model Workshop in Israel in 2006
6. Pre-SARCOF climate experts meeting in Zimbabwe in 2006
7. SARCOF meeting in Gaborone, Botswana in 2006
6. 3 MSc degrees awarded to Black and female staff, 1 BSc Honours 2006

**Summary**

This period has been characterized by a growth in the size of ocean and atmosphere sciences in South Africa. The research work and activities of the communities have been mostly focussed on the following six broad areas viz. Climate Change, Climate variability, aerosols and atmospheric pollution, long-term forecasting, numerical modelling (both ocean and atmosphere) and physical oceanography of both the Agulhas and Benguela Current Systems. These areas are indeed a logical step in improving the understanding of the physical processes which modulate South Africa's weather, climate and other related environmental conditions. In recognition of the global nature of the large physical processes that are involved, the research focus has also extended to regions beyond the South African borders creating a relatively good coverage of the Southern Hemisphere. Despite the growth and huge success in the work of this community, research funding and capacity-building remain challenges which will need to be urgently addressed in the next term. The local institutions are playing an important role in terms of integrating meteorology with other science disciplines and developing applications to realize the socio-economic benefits. The further enhancement of the latter benefits requires a thorough address of the stated challenges.

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