

SAEOS STRATEGY

The South African Earth Observation System Strategy



science
& technology

Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

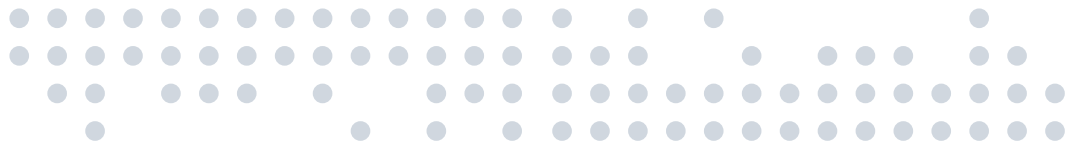
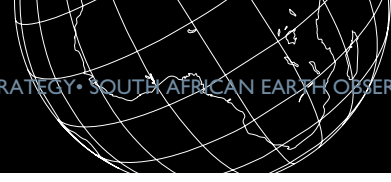




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EXECUTIVE SUMMARY

The Department of Science and Technology (DST) was mandated by Cabinet to engage with the international community in promoting an integrated global earth observation system. 'Earth observations' include measurements that assist with sustainable development, the wise use of natural resources and the environment, and the mitigation of disasters. This strategy is the result of a consultation process, led by the DST and with participation from a wide range of stakeholders, which culminated in the recommendation that a South African Earth Observation System (SAEOS) be developed.

The SAEOS will coordinate the collection, assimilation and dissemination of earth observations so that they can be fully utilised to support policy, decision-making, economic growth and sustainable development in South Africa. This will add value to the earth observations and related activities currently funded in South Africa by making the information available to a broad spectrum of users in an integrated, timely and easily accessible form.

The SAEOS Strategy outlines the benefits and functions of the SAEOS, addressing the roles and responsibilities of all players. It defines the data policy and principles under which SAEOS will operate and identifies a large number of existing data sources, all of which are completely or predominantly publicly-funded, which could contribute to SAEOS. It defines the mechanisms for dealing with institutional and human capacity constraints. The techniques, systems and participants referred to in this document are not considered definitive and may change over time.



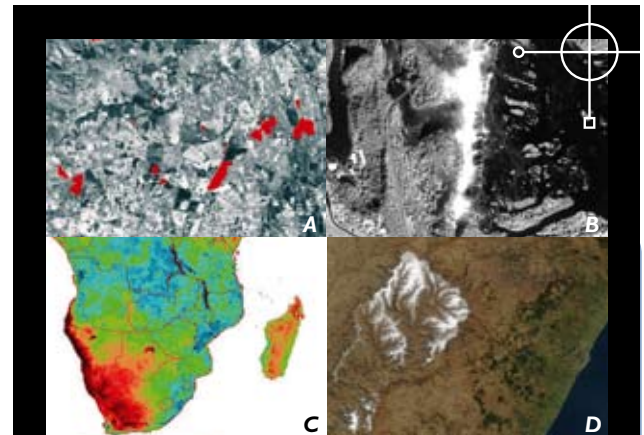
I. INTRODUCTION

This document sets out the aims and activities of the proposed SAEOS. It is the result of a consultation process led by the DST, involving the following stakeholders:

The Departments of Agriculture (DoA), Communication (DoC), Defence (DoD), Environmental Affairs and Tourism (DEAT), Foreign Affairs, Health (DoH), Land Affairs (DLA), Minerals and Energy (DME), Provincial and Local Government (DPLG), Trade and Industry (DTI), and Water Affairs and Forestry (DWAF).

Parastatals and other organisations with relevant datasets of earth observations, including the Agricultural Research Council (ARC), the Satellite Application Centre (SAC) of the Council for Scientific and Industrial Research (CSIR), Hermanus Magnetic Observatory, the Institute of Software and Satellite Applications, the South African Biodiversity Information Facility, the South African Environmental Observation Network (SAEON), the South African Weather Service (SAWS), the State Information Technology Agency and the Council for Geoscience.

Key users of earth observation data, include the science community, policymakers at all three levels of government, industry and civil society.



DIRECT SATELLITE RECEPTION IN SOUTH AFRICA

(A) Spot 20-10m res, (B) Eros 1.8m resolution,
(C) NOAA 1km resolution, (D) Modis 250m resolution



BASIC NODE COMPONENTS

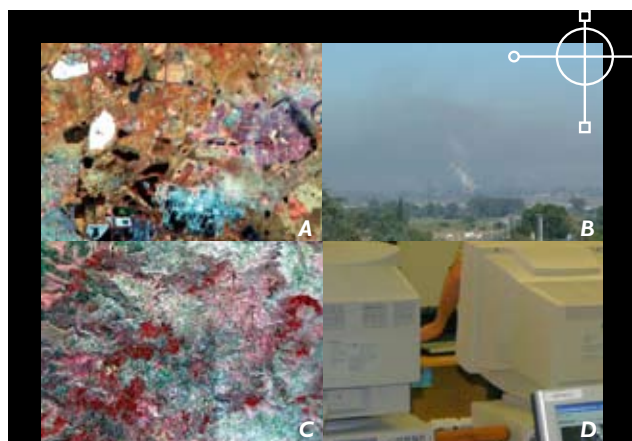
Office and site infrastructure, Node manager, Database/GIS
Education outreach officer, Research technician/admin



2. SAEOS MOTIVATION, SCOPE AND BENEFITS

Reliable information on a wide range of topics, such as weather and climate, water resources, land cover and the status of marine resources, is essential for sound planning in the management of natural resources and agriculture, and the protection of human life, health and property, as well as for optimal economic development and infrastructure performance. This information, referred to as “earth observations”, is obtained by measuring and recording signals taken on, above and below the earth’s surface, in the oceans and atmosphere, and from space, and ranges from primary observations to derived, value-added products that convert raw data into useful information. The “earth observations”, in the context of Global Earth Observation System of Systems (GEOSS), will yield a broad range of benefits to society referred to as societal benefit areas (SBAs) that includes:

- Reducing loss of life and property from natural and human-induced disasters.
- Understanding environmental factors affecting human health and wellbeing.
- Improving management of energy resources.
- Understanding, assessing, predicting, mitigating, and adapting to climate variability and change.
- Improving water resource management through better understanding of the water cycle.
- Improving weather information, forecasting and warning.
- Improving the management and protection of terrestrial, coastal and marine ecosystems.
- Supporting sustainable agriculture and combating desertification.
- Understanding, monitoring and conserving biodiversity.



POLLUTION AND EROSION

(A & B) Air Quality Monitoring (Landsat image showing plume from Mittal steel)

(C & D) High Erosion

Earth observations are collected and stored by a wide range of institutions at international, national and local level. Most earth observation activities are in, or receive most of their funding from, the public sector. SAEOS is a South African response to the GEOSS - which will provide comprehensive, coordinated earth observations from national, regional, and international as vital information for society - and is intended to maximise the benefits that society gets from current investment, principally through adding value to the observations by making them widely accessible and usable. This may have the secondary effect of improving efficiency in the collection and use of observations.



The objective of the SAEOS is to coordinate the collection, assimilation and dissemination of earth observations, so that their full potential to support policy, decision-making, economic growth and sustainable development in South Africa can be realised.

This will be achieved through -

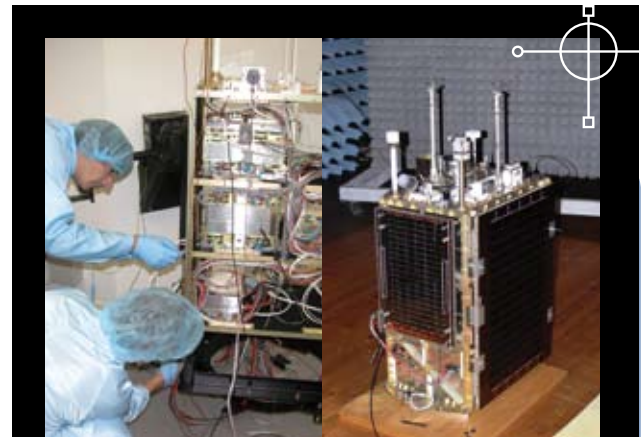
- identifying and correcting shortcomings in the sampling, data processing, systems modelling and information dissemination processes;
- ensuring that the information needs of users are met, in the form that they require, when they need it, and at an affordable cost;
- exploiting the opportunities for synergy and cost-saving between previously separate systems by, among other things, promoting the development of open, interoperable information and communications technologies for earth observation;
- developing or promoting standards for earth observation information interchange;
- ensuring that crucial datasets are securely archived;
- creating value-enhanced datasets by linking together previously stand-alone, incompatible and mutually inaccessible observations, and by linking observations with models; and



- accessing relevant data from observation systems in neighbouring countries and from global observation systems, and in return supplying data needed for the solution of regional or global problems.

To achieve these objectives, SAEOS will create a framework for coordinating and integrating South Africa's existing earth observation capacities, and linking them to complementary capabilities in neighbouring countries and to the GEOSS. SAEOS will also assist in meeting the earth observation obligations of a range of international treaties, agreements and initiatives to which South Africa is a party¹.

The overwhelming majority of primary data mobilised by SAEOS will come from existing observation systems. Where necessary, SAEOS will advocate or support the development of new observation and information-sharing capabilities, and the relevant technologies and human resource capacities to service them.



SATELLITE ENGINEERING

¹ For example, the World Summit on Sustainable Development Plan of Implementation, and the United Nations Framework Convention on Climate Change, Convention on Biological Diversity and Convention to Combat Desertification.

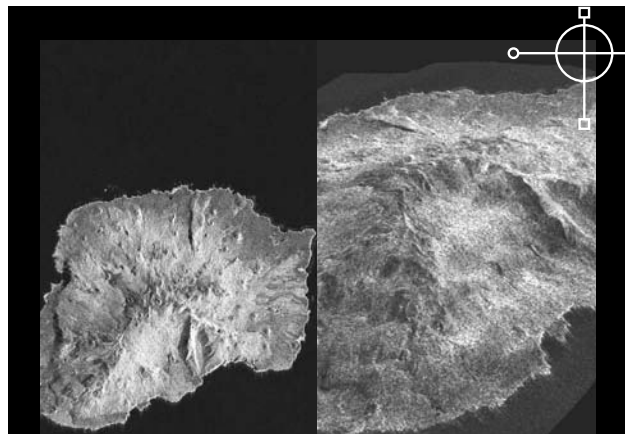


SUPPLY CHAIN UP TO DATA PROCESSING

SAEOS will be a “system of systems”, rather than a centralisation of existing activities in the earth observation domain, which is exceptionally broad and diverse. SAEOS adds a minimalist layer of coordination and cooperation in order to make the whole greater than the sum of the parts. The key to this enterprise is data quality, standards and interoperability, i.e. making the reliable data in different observation systems mutually accessible and easily and seamlessly available to users.

SAEOS will provide a mechanism for the high-level coordination and integration of earth observation activities, so that the observing systems can work together more effectively. It will do so by-

- setting data interface and communication standards;
- acting as a “broker” in identifying user needs and connecting them with data suppliers;
- convening expert groups to identify gaps and emerging issues, and then develop plans to address them;
- directing long-term sustained research and development in earth observation to bridge the gap between science and societal benefit, and acting as an advocate for, and publicist of, earth observation systems.



MARION ISLAND RADAR AND DEM



3. LEGISLATIVE CONTEXT

It is not foreseen that new legislation will be required to support SAEOS activities. SAEOS will be operating within an existing framework of statutes, which are largely supportive of SAEOS activities, and include the following key legislation:

Act	Implications
General legislation with a bearing on data and information	
Promotion of Access to Information Act, 2003 (Act No. 2 of 2000)	This Act defines the rights of public access to information collected by state and private bodies.
Legislation that affects some categories of earth observation data	
Land Survey Act, 1997 (Act No. 8 of 1997)	The Chief Director of Surveys and Mapping (DLA) is responsible for implementing section 3(1) of the Act which, among other things, involves geodetic and topographic surveys and geospatial information services in the Republic; acquiring remotely sensed imagery; and preparing, compiling and amending representations of geospatial information.
Spatial Data Infrastructure Act, 2003 (Act No. 54 of 2003)	This Act establishes the SA Spatial Data Infrastructure as the national technical, institutional and policy framework to facilitate the capture, management, maintenance, integration, distribution and use of spatial information; and establishes a Committee for Spatial Information as an advisory body to the Minister (for Agriculture and Land Affairs) and others. The Minister may prescribe standards and measures on the sharing and integration of spatial information. Data custodians have certain obligations in terms of this Act.
Legislation establishing the mandates of bodies responsible for earth observations	
The Scientific Research Council Act, 1988 (Act No. 82 of 1988), the South African Weather Services Act, 2001 (Act No. 8 of 2001), and Chapter 14 of the National Water Act, 1998 (Act No. 32 of 1998)	These Acts define the statutory obligations of the bodies. In some cases specific reference is made to their obligations to collect, disseminate or store earth observations on a variety of specific topics.

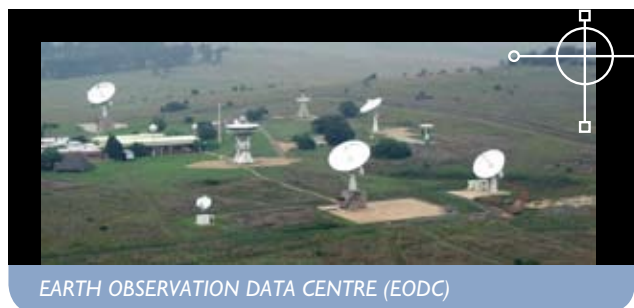


4. FUNCTIONS OF SAEOS

SAEOS will establish an overarching national framework for earth observations in South Africa, covering -

- oversight, coordination and integration of existing observation systems;
- the control and finance of new elements for the integrated observation system, where such elements are agreed to be necessary, but do not fall logically or efficiently under any existing institution.

It will not be responsible for the operations of existing systems, or the funding of their core functions.

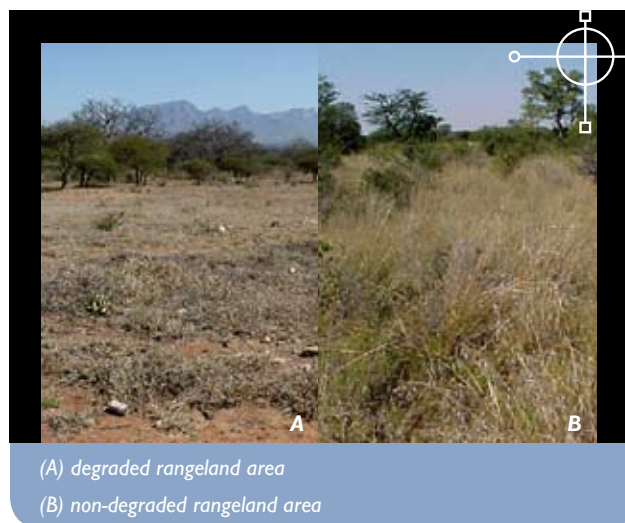


4.1 The SAEOS Portal

The SAEOS Portal will be a user-oriented entry point to SAEOS. It will be a web-accessible software entity, hosted on a server system with the necessary bandwidth and reliability, and will -

- provide metadata to potential users;
- collect SAEOS usage statistics and information;
- inform users of their obligation to acknowledge the source of data; and
- translate user enquiries into instructions to access data from the contributing databases, and return such data promptly enough to meet user requirements, and in a format and language that the user can understand.

This could be done using international best practices, such as those used for the NASA EOS Portal and, in South Africa, by the Innovation Fund's South African Integrated Spatial Information System project and the CSIR SAC Wide Area Monitoring Information System (WAMIS), with its underpinning "sensor web" technology.



Some users may be unable to access the data via the web portal. A limited degree of other support (paper products, CD-ROMS etc.) will be provided on request by the SAEOS operating institution, and at the expense of the requester. A "user" may be a person or a system, which means that the Portal must have a standards-based application programming interface as well as a graphical user interface. The Portal will be developed using open-source software and will itself be an open-source project.

4.2 The Earth Observation Data Centre

The South African Earth Observation Data Centre (EODC) will have the mandate to ensure the secure archiving and curatorship of earth observation data, and the provision of data deemed to be in the public domain to users free of charge. In some cases the organisations supplying the data will be able to archive it, and the EODC's function will then be to promote the application of the appropriate standards. The EODC will be mandated to



acquire earth observation data from any source identified by the SAEOS operating structures for placement in the archive. This applies particularly to the regular acquisition of remotely-sensed satellite images. The EODC also deals with other spatially and temporally-referenced data that are within the SAEOS domain.

Both the Portal and the EODC will need to comply with a range of standards, including those required by the Spatial Data Infrastructure Act and Standards South Africa, as well as those required by international bodies such as the Open Geospatial Consortium and the International Organisation for Standardisation (ISO). NASA's EODC will be used as an example of good practice.

The SAEOS Strategy will be implemented by the National Space Agency, the overall purpose of which is to manage, coordinate and integrate all space activities in South Africa for the benefit of all citizens.

4.3 Responsibilities of existing structures

The existing bodies engaged in earth observation activities in South Africa will retain their current responsibilities until agreed otherwise. As a clearer picture of gaps and operational efficiencies emerge through the activities of SAEOS, those responsibilities may be added to, reduced or passed on to better-suited entities (including entities which may currently not exist) after a process of negotiation between all parties affected, and with due consideration of implications regarding statutory obligations, cost efficiency, institutional capacity, sustainability and personnel.

In particular, two bodies exist with mandates that may be seen to overlap to some degree with SAEOS. Their functions may be explained as follows:

(a) The South African Spatial Data Infrastructure

The South African Spatial Data Infrastructure, established in terms of the Spatial Data Infrastructure Act, falls under the DLA. Its purpose is to ensure compliance with standards, the coordination,

collection and dissemination of spatial data. Its functions overlap partially with the SAEOS, but a large amount of spatial data has little to do with earth observations, and much earth observation data is not really spatial data. The SAEOS will therefore have to comply with the provisions of the Act, as implemented by National Spatial Information Framework, but will have a differentiated and more operational role with respect to earth observations.



Monitoring urban growth in Winterveld North of PTA between 1989 and 1995

(b) The South African Environmental Observation Network

The SAEON falls under the National Research Foundation. Its vision is a sustained, coordinated, responsive and comprehensive network that delivers long-term reliable data for scientific research and informs decision-making for a knowledge society and improved quality of life. This has clear resonances with the SAEOS mission. The SAEON evolved to meet the need for long-term ecological research, and therefore has a strong emphasis on the natural environment (rather than the broader societal benefit areas (SBAs) of GEOSS and SAEOS) and less of a focus on interoperability. In this rapidly-evolving domain, it is clear that the mandates and objectives of SAEOS and SAEON are convergent, and the work of SAEON will be a core component of the broader SAEOS.

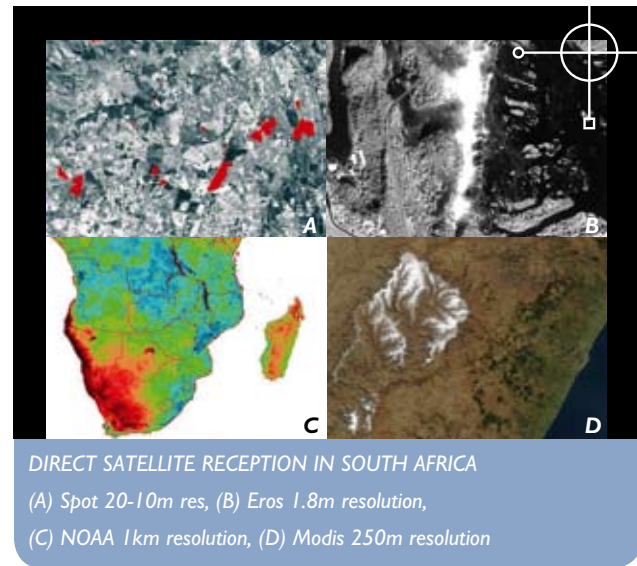


(c) Satellite Applications Centre (SAC)

The CSIR Satellite Applications Centre is a national research facility that seeks to maximise the benefit of information, communications and space technology in South Africa, regionally and globally. SAC has competence areas that develop a wide range of applications that have direct benefits to societies (i.e. disaster management, food security, water resource management etc), namely:

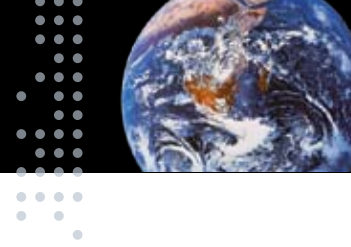
- Space Engineering – this unit focuses primarily on providing logistics management and security (tracking and navigation) applications based on satellite platforms to respond to the South African, regional and global ICT market needs.
- Ground Segment Services – provides world-class spacecraft mission support, engineering, project management, and infrastructure development to the satellite industry and SAT-COMS users.
- Earth Observation – SAC provides key areas in satellite earth observation imagery:
 - Earth Observation Data Centre (EODC) - provides standard products from a wide range of Satellite Image systems to the region in support of a range of national

and commercial objectives. The recently developed Wide Area Monitoring Information System (WAMIS) will provide a range of automated information services, including vegetation status, fire warning and climatological indicators for national and regional use.



- Earth Observation Value Addition - provides an ever-increasing range of derived information products. The wide range of established activities include contributions to national land cover assessment, environmental impact and warning services to government and industry; demographic monitoring and prediction for local and regional government; water, electric power and telecommunications assessment and prediction support and wildlife conservation monitoring.

SAC supports, receives and distributes satellite imagery from a number of satellites ranging from low to very high resolution data.



5. DATA POLICY FOR EARTH OBSERVATIONS

All participating data custodians are to make a portion of their data visible to users accessing information via SAEOS. The size of this portion (which may include the entire dataset) and nature of the data provided is a matter of prior and ongoing agreement between the original data custodians and users, who will be represented by SAEOS.

All data subject to the above agreements ("SAEOS-accessible data") are regarded as being in the public domain, and may be used free of charge if the data is accessed via the SAEOS electronic portal (any other mechanism of access may be subject to a user charge). This does not prevent the SAEOS Portal from directing users to data sources they may find useful, but that are not free of charge.

Users must undertake to acknowledge the original source of the data, which will be reflected in any data products supplied through SAEOS.

The responsibility for appropriate use of the data, and for any derived products created from the data, rests exclusively with the user. Users are encouraged to provide feedback to SAEOS regarding problems they have encountered in the datasets, and derived products that they have developed.

Neither SAEOS, nor the original data custodians, will take any responsibility for interpretations and manipulations of the data undertaken by users.

The ownership of and responsibility for the quality and integrity of the data made available via SAEOS, and intellectual property rights pertaining to it, remain at all times with the original custodians of the data. They are free to amend or withdraw data at any time in order to satisfy these responsibilities, provided that they notify SAEOS of such changes in order that metadata can be updated.

Datasets created using public funds are expected to be in the public domain, except if -

- revealing the data without prior screening of the user might compromise national security;
- revealing the data in disaggregated form might infringe on the right to individual privacy;
- release of the data might compromise the economic development of South Africa, for instance by revealing commercially valuable information to international competitors, or making intellectual property public before it has been registered for protection;
- revealing the data would threaten the environment or biodiversity, such as revealing the location of a rare species.

The corollary to the above is that public funding should generally not be provided for the collection and databasing of earth observations unless such data are to be placed in the public domain within a reasonable period of time, taking into account that -

- the quality of the data has to be ensured;
- its use may be time sensitive;
- it may be intended for special reserved purposes, such as the publication of theses or papers or the short-term recovery of commercial value;
- in many cases significant value has been added to these datasets by their custodians.

Where publicly funded data are not to be placed in the public domain, the onus is on the custodians of such data to provide reasonable grounds for not making the data publicly available.

Metadata should in most cases be freely available, even if the data themselves are not, and should include information on data access conditions.



6. THE ARCHITECTURE OF A SOUTH AFRICAN EARTH OBSERVATION SYSTEM

In this context, “architecture” refers to systems and components that contribute to SAEOS, and how the contributing systems fit together and interact with one another and the user environment.

The architecture (depicted in Fig. 1) takes into account -

- international trends in information and communication technology, especially in relation to open standards and distributed data systems;
- the realities of existing systems and communication capacities;
- the implications of the data policy.

In the model shown in Figure 1, only a subset of the total data holdings of each contributing subsystem is visible to SAEOS and its users. The holdings remain in their native data format and location within the owner’s dataset, but are tagged with a field noting their visibility to SAEOS. Standards-based interface pro-

ocols resident in the host environment, and standards-based translators resident in the SAEOS portal, make the selected data and metadata accessible to queries from the user. The user can also access data, if authorised to do so, directly from data holders via the normal channels. The actual architecture created by SAEOS will be based on the recommendations of the implementing agency.

A SAEOS reference model architecture will define the interfaces and protocols through which all SAEOS participants connect and communicate. This reference model will be in the public domain.

Bandwidth, and the cost of bandwidth, will be key constraints in the implementation of this, and virtually any other architecture that satisfies user needs.

There are a large number of earth observation databases in South Africa. These are held by public institutions, including parastatals and higher education institutions, which are potential contributors to SAEOS. The list of datasets in Appendix I is not exhaustive, but gives a good indication of the scope of earth observations in South Africa.

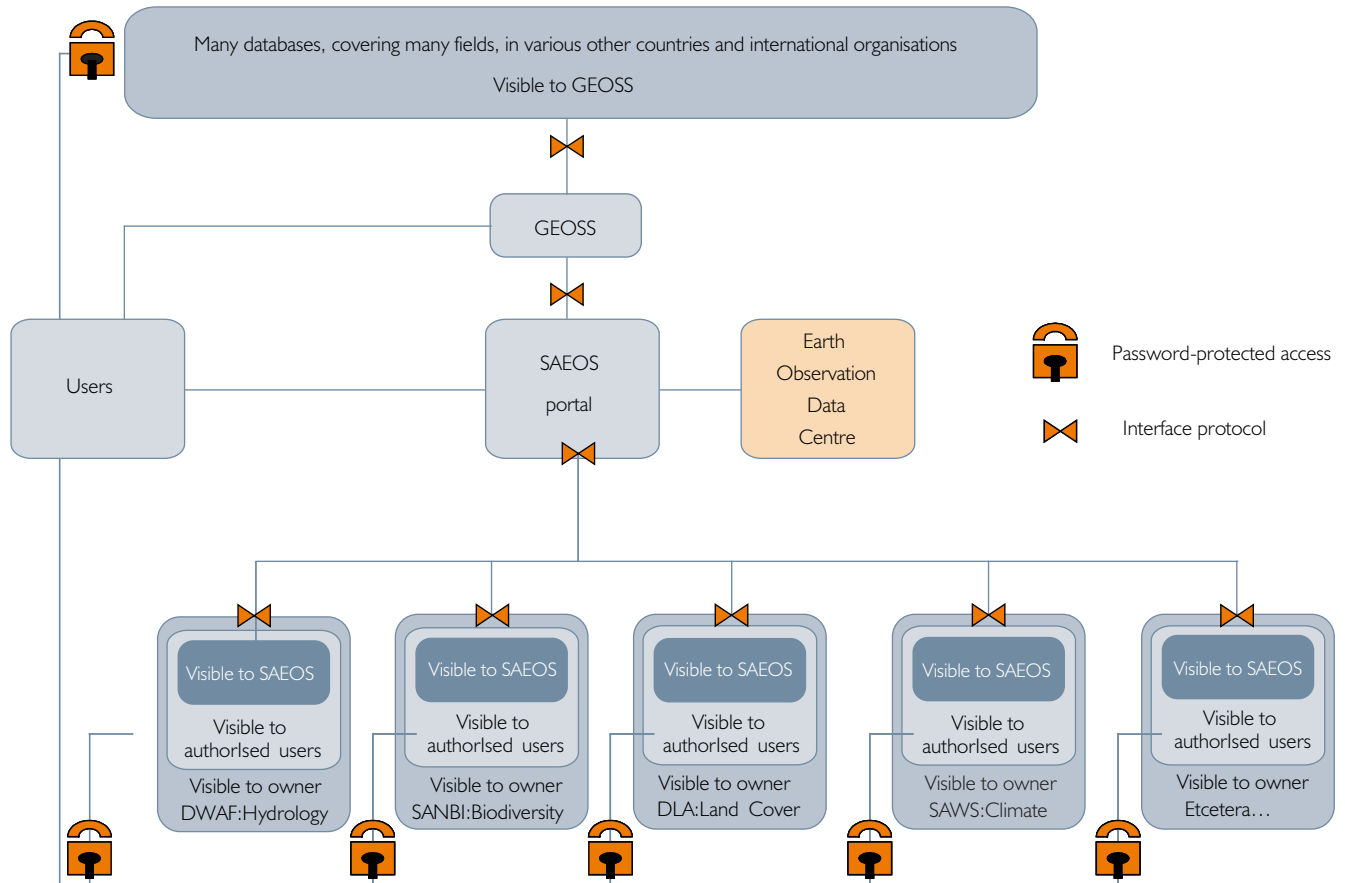


Figure 1. The broad proposed conceptual architecture of SAEOS.

Note: The data holders shown have been used as examples, and have not necessarily made any commitment to SAEOS.



7. BUILDING HUMAN AND INSTITUTIONAL CAPACITY

The SAEOS will establish mechanisms to identify gaps and constraints in South Africa's national earth observation capacities, from an infrastructure, institutional and human capital perspective. South Africa needs to grow the number of people in diverse positions who are educated in using and interpreting earth observation data, so that society can benefit fully from the vast amounts of data becoming available through the GEOSS and SAEOS initiatives.

The instruments to address capacity shortfalls will include the following:



SAEON and Capacity Development: Education and Outreach

7.1 Human capacity

- Endorsement, by the SAEOS implementing agency (the National Space Agency), of proposals by contributing earth observation systems for increased capacity, where the resulting improved service is considered to further the objectives of SAEOS in a cost-effective way.

- Advocacy by the National Space Agency to higher education institutions and the South African Qualifications Authority for the delivery of accredited specialised training in earth observation topics.
- Arranging training courses or materials, including over the Internet, to meet SAEOS needs where higher education institutions are unable to do so.
- Awarding by the National Space Agency of a number of postgraduate bursaries annually for the acquisition of advanced skills in domains deemed of critical importance to SAEOS.
- Identifying, creating, communicating and facilitating opportunities for earth observation skills development using international bilateral or multilateral arrangements, especially where these are based on long-term partnerships and relationships.

7.2 Infrastructural capacity

To ensure the availability of adequate bandwidth, software, servers and archival capacity will be required to satisfy the additional needs of SAEOS, if necessary through the purchase of new assets.

7.3 Institutional capacity

SAEOS itself is an institutional capacity intervention. The physical capacity for observation, data handling and communication must keep abreast with technological developments, and must be maintained in a state that satisfies user needs. In some instances this may require coordination at a level higher than the individual observation systems themselves, in order to minimise costs and risks, and maximise benefits.



8. NOTES ON RELEVANT BODIES AND SYSTEMS

The **Agricultural Research Council** is the home of the Institute for Soil Climate and Water.

The **Council for Geoscience** is responsible for the National Seismic Network and geological survey.

The **Council for Scientific and Industrial Research** is the parent institution of the Satellite Application Centre and other operating units with earth observation capabilities, such as the Natural Resources and the Environment unit, and the Meraka Institute.

The **Department of Agriculture** is home of the Division of Agricultural Statistics, which keeps records of cultivated areas, live-stock numbers, yields and prices for agricultural commodities.

The **Department of Environment Affairs and Tourism** is the point of contact for the Climate Change Convention and the Convention on Biological Diversity.

The **Department of Land Affairs** maintains databases on land ownership, the National Spatial Referencing System (including GPS), national mapping, national aerial photography and the National Spatial Information Framework. (See **South African Spatial Data Infrastructure**.)

The **Department of Provincial and Local Government** is home of the National Disaster Management Centre (NDMC).

The **Department of Science and Technology** is the lead department for GEOSS.

The **Department of Water Affairs and Forestry** has several sections that collect and record relevant data. The Hydrology section maintains a large database of river flows and reservoir volumes. The Groundwater section keeps records of boreholes, the water table and water quality in aquifers. (See Institute for Water Quality.) The Forestry section collects data on both natural and plantation forests.

Global Atmosphere Watch (GAW) is a worldwide system for monitoring atmospheric concentration, particularly of greenhouse gases and ozone-depleting substances. It has a long-standing station at Cape Point, which is operated by SAWS.

The **Global Earth Observation System of Systems** will be built by South Africa and many other countries and participating organisations as agreed at the Third Earth Observing Summit in Brussels, February 2005, to coordinate earth observations around the world in order to improve the information available to support decisions in nine defined societal benefit areas.

Hermanus Magnetic Observatory is a national facility reporting to the National Research Foundation. It collects magnetosphere and ionosphere observations.

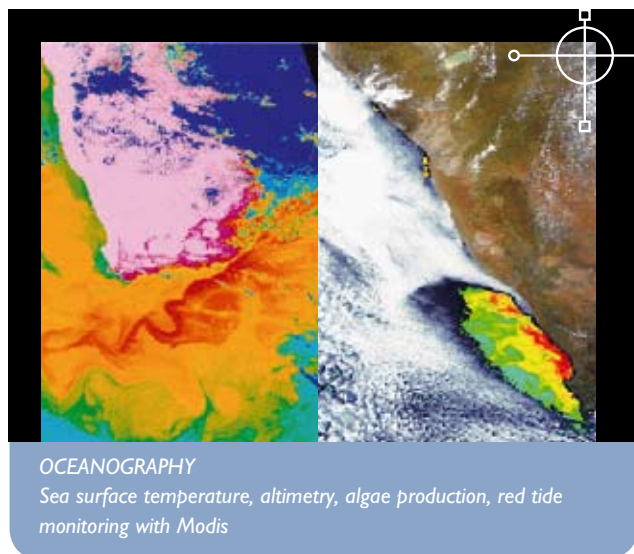
The **Institute of Water Quality** is part of DWAF, located at Roodeplaat, and performs routine water analyses from hundreds of locations nationally, and databases the results. It is also the owner of the Working for Water programme, which works on the eradication of alien plants.

The **Institute of Soil, Climate and Water (ISCW)** is a part of the ARC. It has the long-term National Oceanic and Atmospheric Administration's Advanced Very High Resolution Radiometer data record for southern Africa, and is the principle repository of soils data.

The **Institute of Satellite and Software Applications**, located at the Overberg Testing Range, is part of the Department of Communications and has satellite data downloading capabilities.

The Plant Protection Research Institute (PPRI) is part of the ARC, maintains databases on pests and diseases of crop plants, and alien species.

The Resource Quality Service (RQS) Directorate is part of DWAF.



The Resource Protection and Waste (RP&W) Directorate is part of DWAF.

The Satellite Application Centre (SAC) is part of the CSIR, and is responsible for downloading, archiving and developing products of space-based earth observation.

The South African Environmental Observation Network is a DST initiative to create a platform for long-term observations of the South African environment.

The South African Biodiversity Information Facility is the national node for the Global Biodiversity Information Facility, of which South Africa is a member. It is managed by South African National Biodiversity Institute.

The South African Integrated Spatial Information System is an environmental information system developed by a consortium of science councils and higher education institutions under an Innovation Fund proposal.

The South African National Biodiversity Institute (SANBI), was recently formed, but inherited the observation assets of the National Botanical Institute, including a large plant species distribution database.

The South African National Parks (SANParks) Board is responsible for the administration of national parks. It has long-term species population records and various other relevant datasets, e.g. on fire occurrence.

The South African Spatial Data Infrastructure is administered by the National Spatial Information Framework, part of the DLA. It does not store earth observation data, but its main objectives include operating a meta-database of spatial data, facilitating spatial data sharing and minimising duplication of data collection.

The South African Weather Service operates an extensive network of weather stations, many automated, as well as upper air soundings, weather radars, etc. It is a major climate archive, and a point of contact with the World Meteorological Organisation (WMO). It operates a GAW station at Cape Point.

Statistics South Africa is the official statistical agency of the South African Government, responsible for, among other things, the national census carried out approximately every five years.

The Wide Area Monitoring and Information System (WAMIS) is a disaster warning system developed by CSIR SAC on behalf of the DPLG's Disaster Management Centre.



9. REFERENCES

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Scholes, R.J. 200. Regional Implementation Plan for Southern Africa. GTOS 2. Global Terrestrial Observing System, Food and Agriculture Organisation, Rome.





APPENDIX I: IDENTIFIED EARTH OBSERVATION DATASETS IN SOUTH AFRICA

Topic	GEOSS societal benefit area	Existing systems in South Africa	Users
Disaster advance warning, management and assessment			
Fires	Disasters	WAMIS SANParks	DWAF, fire protection associations, NDMC, DPLG
Floods	See also Water	DWAF, WAMIS	NDMC, DWAF; DPLG
Earthquakes, tremors, subsidence, tsunamis	Disasters	Geosciences	NDMC, mining industry, port authorities; DPLG
Extreme weather and climate events			
Wind storms	Weather	SAWS	NDMC, the Civil Aviation Authority
Droughts	Agriculture, climate	SAWS	DoA, organised agriculture, the food industry
Snow, frost, extreme cold	Weather	SAWS	Farmers, rescue agencies
Short-to medium-term weather forecasts			
Rainfall, temperature, winds, pressure	Weather	SAWS	Aviation and shipping, farmers, public, energy sector
Upper air soundings	Weather	SAWS	WMO, SAWS, general circulation models
Food security			
Fish stocks and harvest	Agriculture	Sea Fisheries Research Institute	DEAT, fishing industry
Staple crops	Agriculture	DoA's Agricultural Statistics Division	DoA (the National Food Security Committees)
Livestock	Agriculture		DoA, meat industry, veterinary services, climate change focal point
Food consumption			Food security committees, agricultural planners
Nutrition		DoH	DoH
Fresh water supply and quality			
Groundwater aquifers	Water	DWAF hydrology	DWAF, local authorities, farmers, RP&W



Topic	GEOSS societal benefit area	Existing systems in South Africa	Users
Fresh water supply and quality (continued)			
Reservoir levels	Water	DWAF	RP&W, NDMC, local authorities
River flow	Water	DWAF Hydrology	RP&W, engineering consultants, NDMC
Water quality	Water	DWAF RQS	Water boards, industries, local authorities, irrigation farmers, conservation authorities, RP&W
Water consumption	Water	DWAF	Water boards, catchment authorities, planners, RP&W
River health	Biodiversity	DWAF/CSIR	Conservation authorities
Ecosystem degradation			
Erosion, sedimentation	Agriculture	RQS, ISCW	DoA, DLA, DWAF
Desertification	Agriculture	SAC, ISCW	DoA, Convention to Combat Desertification
Bush encroachment			DoA
Alien plant invasion	Ecosystems, biodiversity	ARC-PPRI, SANBI	DWAF working for water, DEAT, conservation authorities
Eutrophication of water bodies	Ecosystems, water	RQS	RP&W, local authorities, DoH, conservation authorities, tourism
Salinisation	Agriculture	ARC-ISCW	DoA, mining industry, farmers, RP&W
Land cover, land cover change and land use			
Land use patterns – mining, industrial, municipal, agriculture, etc.	All	None	RP&W
Underground fires, subsistence, contaminated land	Water, ecosystems, biodiversity, health	Landsat/Infrared	RP&W, DME
Urban areas and settlements			RP&W, local authorities, Department of Housing



Topic	GEOSS societal benefit area	Existing systems in South Africa	Users
Land cover, land cover change and land use (continued)			
Cultivated land	Agriculture, ecosystems, biodiversity	National Land Cover Project (ARC/CSIR)	DoA land planners, conservation planners, Eskom, DoD, RP&W
Plantation forests	Agriculture	National Land Cover Database DWAF Afforestation Permit System, Forestry companies	DWAF, forestry companies, fire protection associations, conservation authorities, climate change focal point
Protected areas	Biodiversity	SANParks, provincial conservation authorities	Conservation planners, NGOs
Diffuse pollution, agricultural activities	Agriculture	DWAF	RP&W
Biodiversity conservation			
Species distributions	Biodiversity	SANBI, Bird Atlas, Frog Atlas, SA-ISIS	Academics, conservation planners, DEAT
Species populations	Biodiversity	SAEON, SANParks, provincial conservation authorities, World Wildlife Fund SA, fishery authorities	DEAT, Conservation agencies, conservation NGOs
Extent and location of wetlands	Ecosystems	DEAT	RP&W, DEAT, farmers, developers,
Extent and location of forests	Ecosystems	DWAF	Food and Agricultural Organisation's Forest Resource Assessment
Vegetation/biome maps	Biodiversity, ecosystems	SANBI	Conservation planners, climate change focal point, NGOs, academics



Topic	GEOSS societal benefit area	Existing systems in South Africa	Users
Air quality			
Emissions of listed substances, including greenhouse gases, particulates and pollutants	Health	DEAT, local authorities	DEAT, industry, DoH, local authorities, public, climate change focal point
Ambient air composition	Health	GAW, local authorities, Eskom, CSIR	DEAT, industry, DoH, local authorities, public
Acid deposition	Ecosystems	Eskom	RP&W
Environmentally-related health and infectious diseases			
Pathogens in water	Health	RQS	Water boards, local authorities, public, RP&W, catchment authorities
Incidence of notifiable diseases (e.g. malaria, cholera)	Health	DoH	RP&W
Climate and climate change			
Long-term trends in rainfall and temperature	Climate	SAWS, DWAf, ARC	Farmers, water planners, health authorities, climate change focal point
Socio-economic data needed for application and interpretation of earth observations			
Population distribution, age and gender composition	Recognised, but not in a specific SBA	Statistics SA	All of the above users
Economic activity		Statistics SA	
Geospatial data necessary for organising, displaying and interpreting earth observations			
Base maps	Recognised, but not in a specific SBA	SA Spatial Data Infrastructure	All of the above users
Topography and drainage			
Infrastructure			

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