Early warning and disaster risk reduction in Southern Africa: Integrating space-based and in situ data including Local knowledge

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Southern African Research and Documentation Centre

MERCSA
I Musokotwane Environment Resource Centre for Southern Africa

Outline of presentation

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About SARDC

Vision: To enhance the effectiveness of key development processes in southern Africa through the collection, production and dissemination of information, and enabling the capacity to generate and use knowledge

IMERCSA
I Musokotwane Environment Resource Centre for Southern Africa

IMERCSA: empower all to take positive actions towards integrated and sustainable natural resource development and management

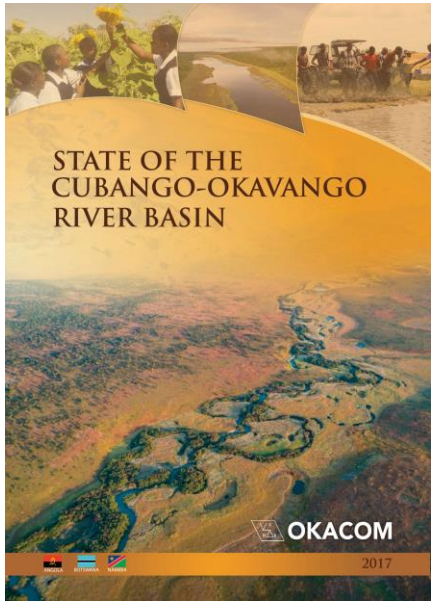
Focus areas: climate resilience, land, water and other natural resources management, food security, natural disasters

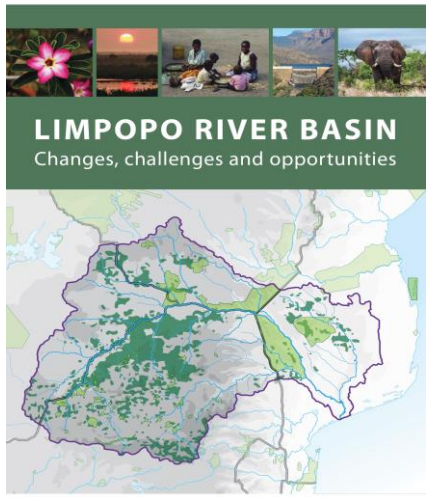
Partnerships: MOUs with SADC, UNEP, SADC GMI, ZAMCOM, IUCN

IMERCSA use of space technology

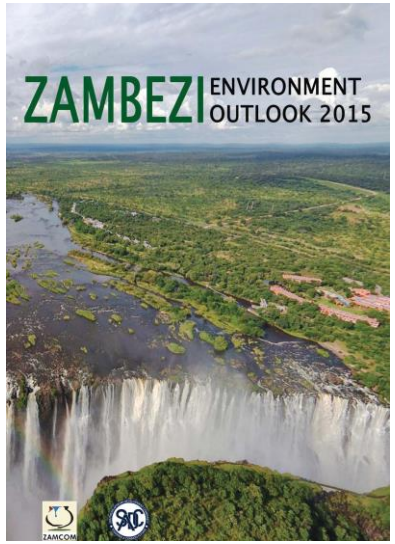
- Environment Outlooks IMERCSA flagship
- Environmental Atlases
- Bridge the gap between technocrats and the general public
- Unpack data and information to make it accessible and useful to different target audience
- Facilitate integration of satellite data with indigenous knowledge systems
- Mapping of vulnerability and climate risks in southern Africa using both remote senses data and indigenous knowledge systems
- Interpret the remote sensed maps to simple language understood by the farmer
- Little reporting before and during the disasters, due to lack of information and limited access to information.


ZAMBEZI RIVER BASIN


STATE OF THE
CUBANGO-OKAVANGO
RIVER BASIN
OKACOM
2017


LIMPOPO RIVER BASIN
Changes, challenges and opportunities


ORANGE-SENQU
River Commission
ORASECOM
15
2000 - 2015


ZAMBEZI ENVIRONMENT
OUTLOOK 2015

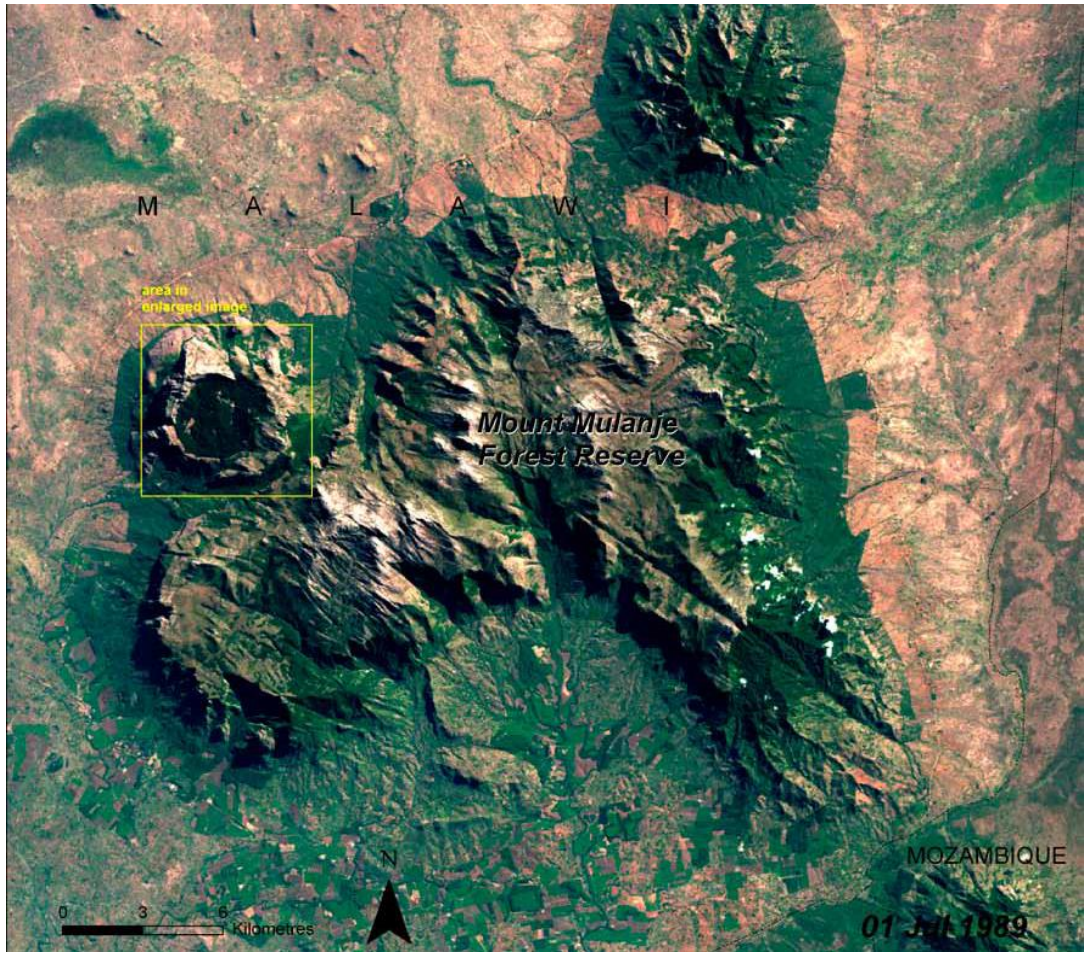

M O Z A M B I Q U E
09 Oct - 21 Nov 1972

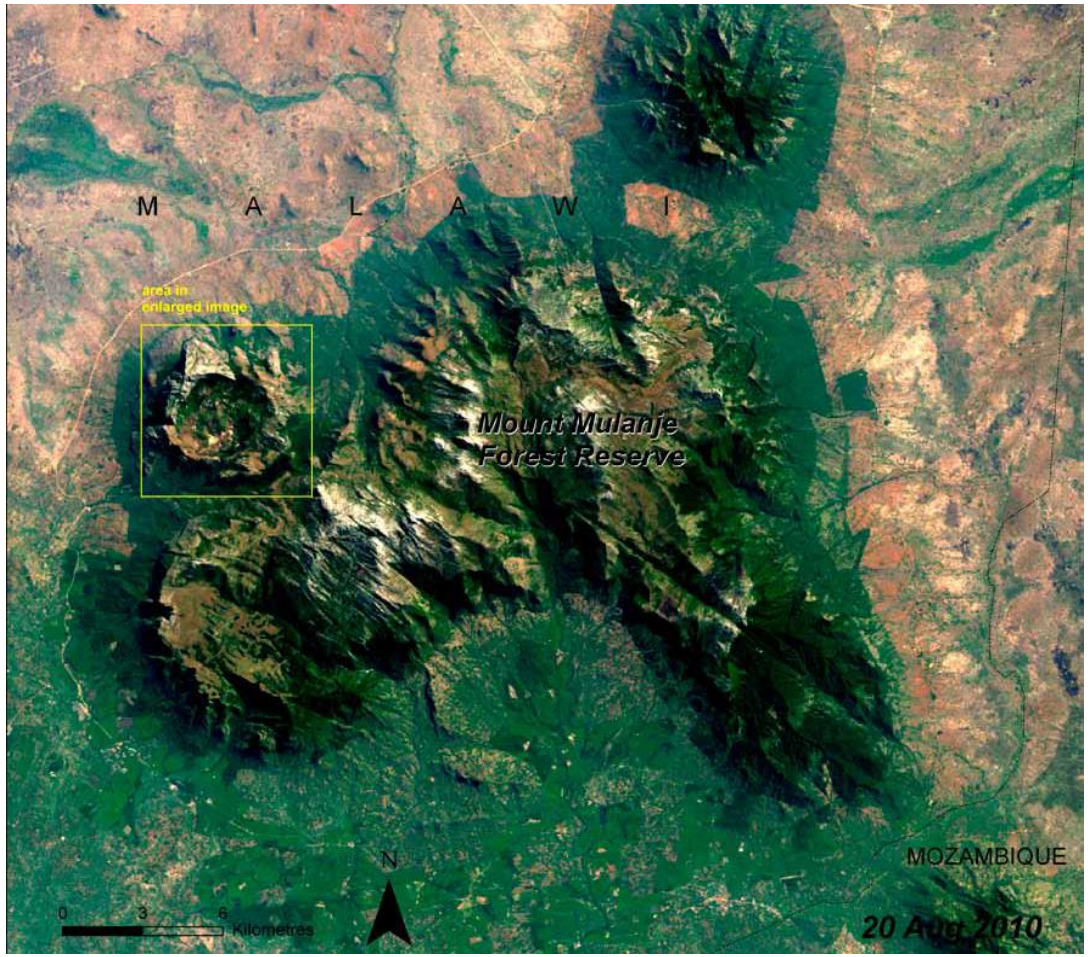
1972


M O Z A M B I Q U E
Lake Cahora Bassa
26 Oct 2006 - 02 Nov 2006

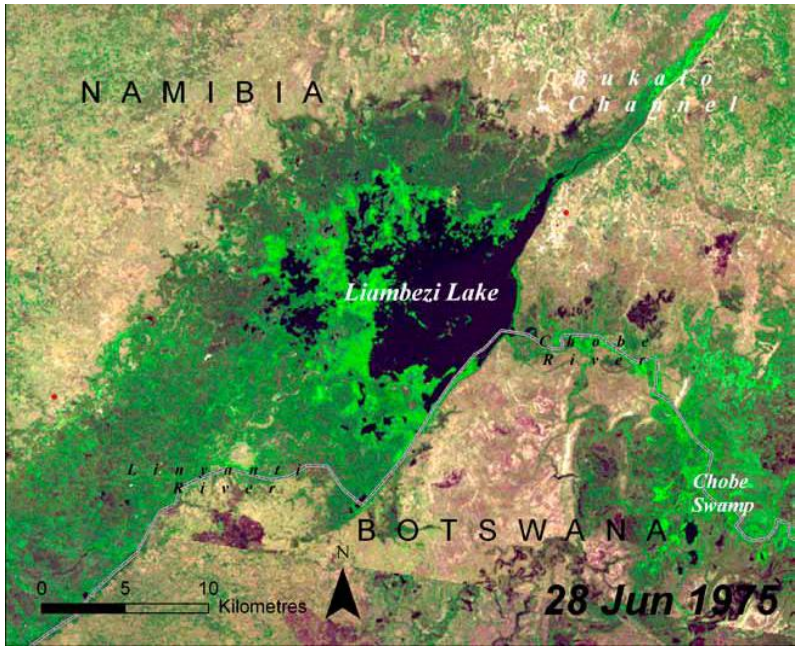
2008

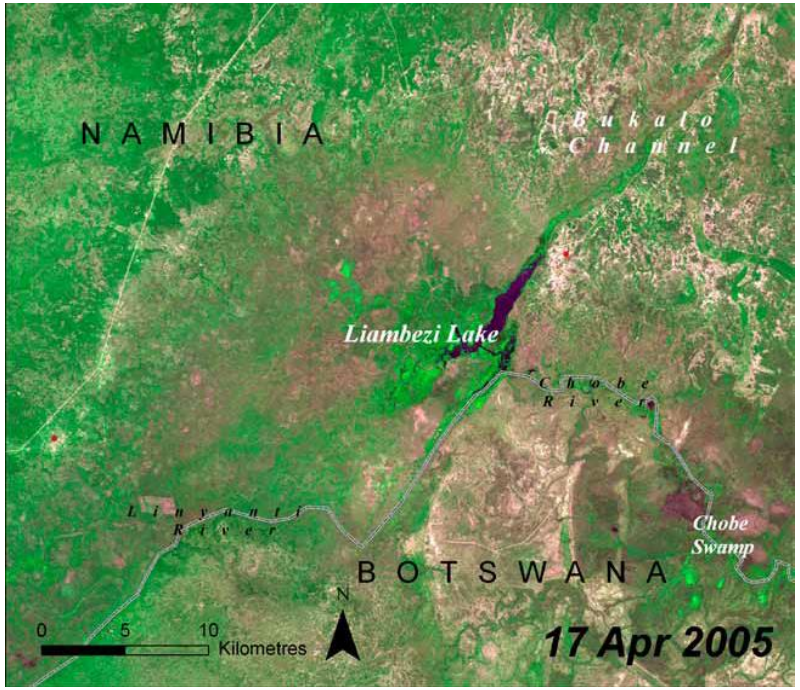
Mount Mulanje 1989 and 2010





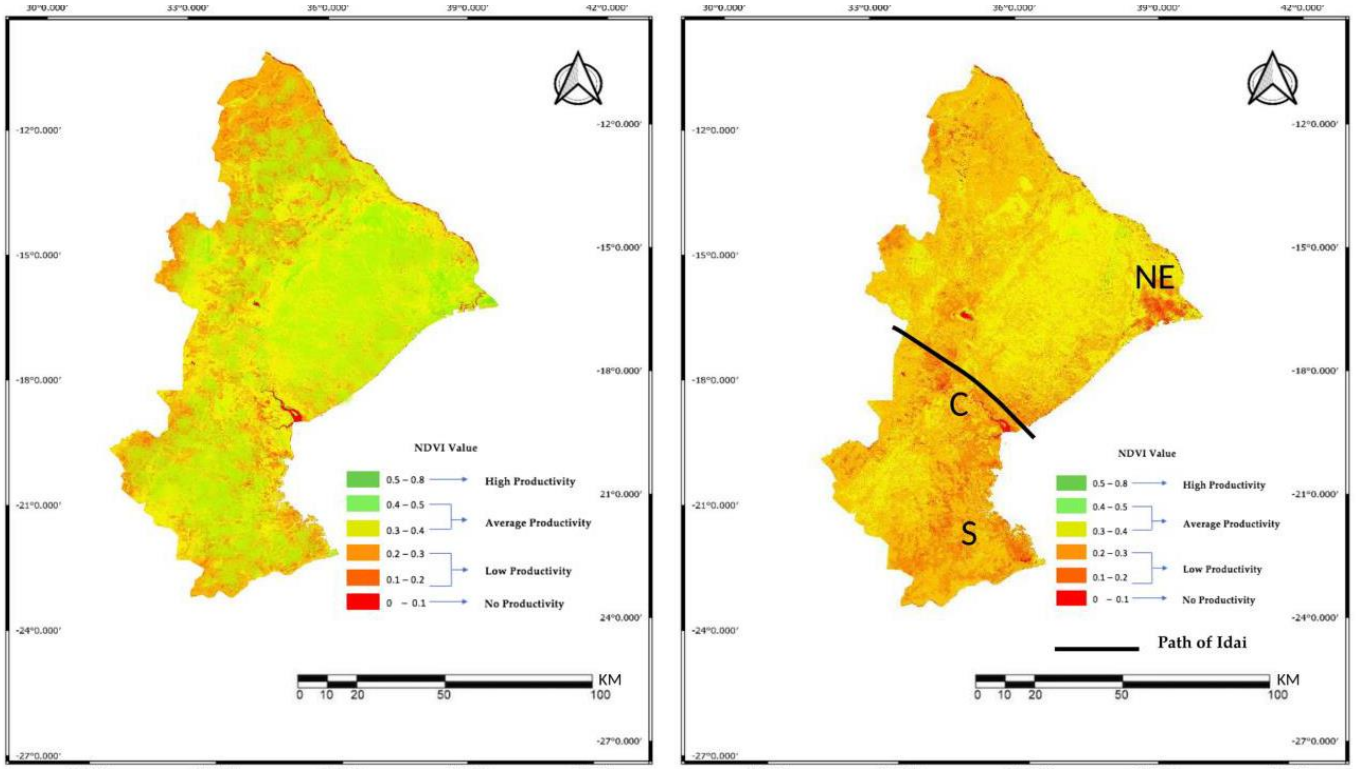
Liambezi lake





Assessing NDVI before and after cyclone Idai

Spatial distribution of pre-cyclone (left) and post-cyclone (right) NDVI. The comparison by optical remote sensing shows the loss of green leaves on the post cyclone imagery.



IMERCSA Plans using space technology

Community Focused Flood Early Warning System.

- To reduce the vulnerability of communities in the Busi-Pungwe-Save (BuPuSa) Transboundary Basins to floods, by providing an effective flood risk assessment, monitoring and early warning system, increased capacity and knowledge base, and inclusive communication strategy and action plans.

a) Flood risks and vulnerabilities of local communities assessed and documented to inform early warning and response measures. Specific outputs: 1. Flood risk assessement maps; 2. A comprehensive status report on flood risks and vulnerability assessment in BuPuSa Basins;

b) A flood Monitoring and Early Warning System (MEWS) that combines observations from hydro-meteorological stations as well as remote sensing information and data

IMERCSA Plans using space technology and local knowledge

Integrating Indigenous local knowledge in early warning and disaster management

- Various studies indicate that increased impact of disasters in southern Africa is to a greater extent attributed to the abandonment of Indigenous Knowledge Systems (IKS).
- Intergrating local indcators in early warnings
  - Telestial bodies, moon, stars, sun, wind
  - Animals
  - Birds
  - Trees
- The local communities are privy to this knowledge as it has been handed down from generation to generation within their context, hence something that is interlinked with their way of life

Atmospheric Phenomena as Indicators of weather and climate

Moon

- The direction of the moon does not only indicate the amount of rainfall to be expected, but also show the change of a season. A bigger encirclement *dziva* indicates that there will be sufficient rains and a meager figure is believed to be a sign of starvation and little rainfall in a particular season
- The presence of *amayezi amnyama* (dark clouds) is symbolic of heavy rains to come with high risk of flooding.

Sun

- When the rain season is about to commence, the sun does not heat directly on the people's heads. Red sky in the west towards sunset indicates dry conditions and if this persist then it is an indication of drought
- If the sun is coated by *gore* (small mist or fog) rainfall is expected within few hours.
- If the *gore* is large then the rainfall would be plentiful.
- During the rainy season if the sun is extremely hot people expect heavy rains that day or the following day.
- When it becomes cold during the rainy season it means there will be little or no rain, which then may lead to dry spells or drought.
- Prolonged dry spells are expected when persistent winter coldness extends into spring.

Snow and wind

- Falling of snow indication of good rains
- When wind blows from the northern direction good rains is expected. A lot of *chamupupuri* (whirlwind) *is* a sign of above normal rains which then may lead to floods in the low-lying areas.
- If there is little whirlwind, then rainfall would be erratic.

Behaviour of animals as Indicators of weather and climate

Animals

- Pigs grunting during the day, the swarming of larks and swallows, cows frolicking, and the singing of the 'hammerhead'. When sheep start to shed some of their wool and become smooth and when donkeys and cows start mating, it is regarded time to get ready for sorghum cultivation.
- Cows lie down when rain is eminent
- when *mbira* rock rabbit squeaks in ways that is unusual, it heralds the coming of rainfall in the area.
- When game animals such as *nhoro* (kudu), or *mhembwe* (wild buck) give birth in large numbers, it signifies a normal to-above-normal rainfall season.
- When *tsindi (*Squirrell) develop a lot of fare it signifies that there will be drought. Scientifically the animal will be preparing itself for the cold weather towards the rainy season which is normally associated with little rainfall.

Amphibians

- When the *dzetse* (bull frogs) begin to hiss continuously, it signifies that the rain season is around the corner. If this type of frog appears in numbers in a water pond known as *gandwa,* it is an indicator of high rainfall. Farmers in low-lying areas would start relocating to higher ground.

Reptiles

- If *mbeva* (mice), are abundant, it signifies an approaching drought. As part of the preparation for an imminent drought period mice get as much food as possible to cushion during dry season.

Birds and insects as indicators of weather and climate

Birds

- Continuous crying and unsettledness of *inkanku* (a rain-making bird-hammerhead'.) are symbolic of heavy rains with high risk of flooding
- Swarming of Swallows mean that there is a plentiful supply of flying ants near the surface (upon which the birds feed). These insects like to fly when the air becomes humid.
- Height at which weaver birds build their nests indicate likelihood of floods if high

Insects

- When *zviteza* (certain type of ants) begin to surface and continuously move around collecting grass for storage, it means the rain season is imminent. Communities could even predict when rains would come and that it would be a long-wet spell by observing the amount of grass being carried for storage by these ants in large numbers. This was also a reminder to the villagers that they should collect as much food as possible as there could be floods which may cut links between the villages. Usually, *zviteza* emerge for two or so days and continuously collect food. Parents would then make sure that their children do not play in rivers and fire wood would be collected to dry places for use during the wet spell.
  - When insects such as *mandere* (day-flying chafers) make incessant singing, it signals the imminence of rainfall, while the singing of *nyenze* (cicadas) signifies the commencement of rains two or three weeks to come.
  - *ishwa* (flying termites) and the *mikonikoni* (dragon fly) are considered indicators of good rainfall
  - *makonye* (worms) or many flies signify drought.
  - Ant antennae detect slight changes in temperature, which might allow them to sense and react to the drop in temperature that usually accompanies a rain storm.
  - If spider webs are widely spread and denser it signifies lots of rain. The villagers would prepare accordingly.

Trees as Indicators of weather and climate

Non-fruit trees

- When the leaves of *mupfuti* (brachystegia boehmii) tree begin to wither, but not peeling off, plenty of rainfall is expected in a matter of days. In contrast, when leaves wither and peel off, it means that a dry spell is imminent.

Fruit trees

- fruit trees such as the *tsvanzva, shumha, maonde matamba, matondo, masawo, muchakata (parinari curatellifolia), mushuku (uapaca kirkiana)* and mango. These are observed to predict the eminence of the rain season and the quantities of rainfall in any given agricultural season. If fruits are plenty there is likely to be drought in the next season and the opposite is predicted true.
- When the fruits ripen earlier than usual, it means that the season will experience a good rainfall pattern. People would then start preparing large fields and different types of crops which require plenty of rainfall.
- Peach trees blossom same time –indication for good rain

Crops

- Sprouting of grains left at the fields indicated that spring had come and communities could get ready to start cultivation of sorghum.

IMERCSA Plans using space technology

BUPUSA Tri Basin Atlas of the changing Environment

- Atlas to present visual representation of the changes taking place in the tri-basin as well as the projected changes using remote sensing, infographics, pictorials and short narratives.
- The Atlas is timely as it will present areas which need urgent action in the strategic plan of the tri basins.
- Will contribute to decision making for the ongoing BUPUSA processes

Challenges of use of space technology

Despite several efforts, harnessing the potential of space technology and GIS applications for (DRR/M) continues to be hindered in many southern African countries

- Space technology and GIS applications continue to be underutilized primarily because of the lack of capacity in terms of human, scientific, technological, organizational and institutional resources;
- lack of access to high resolution data, low expertise for the operational applications of these technical tools,
- lack of sharing of such data and lack of appropriate policies
- limitations of a comprehensive real time flood monitoring system and early warning system,

Affordability and lack of technical capacity

- Though several space-based products are now available free of costs, space agencies face challenges in providing a large amounts of data free of charge
- The availability of high-resolution data and radar satellite data remains a challenge due to their relatively prohibitive cost.
- Even if the data are made available, many countries lack the technical capacity to analyze and use the data effectively
- Low level of internet penetration due to the digital divide in many southern African countries exacerbates the problem even further.

Policy Issues

- While most of the countries in southern Africa have built capacities for satellite data application in disaster reduction and management, a lot of these activities remain at pilot or experimental stages and without sustainability. One major reason is the lack of policy and subsequent institutional arrangement at national level.
- Due to lack of appropriate policies despite the increase in availability of data and information, knowledge and expertise related to DRR/M, such information do not effectively reach the relevant decision makers.
- Lack of clear policies leads to duplication and delay in coordination mechanisms. Considerable base line data and maps are available within line ministries and different departments. But lack of a data sharing policy limits the exchange of data and information.

SADC Frameworks for Disaster Management

SADC DISASTER PREPAREDNESS AND RESPONSE STRATEGY AND FUND

- Risk modelling, mapping and monitoring;
- To strengthen forecasting, early warning and early action capabilities through improved data collation, analysis, monitoring and dissemination of risk information
- The following will be the areas of focus: i) Risk knowledge of hazards and of vulnerable people and society to these hazards; ii) National monitoring and warning service supported by a technical capacity to monitor hazard precursors, to forecast the hazard and vulnerability evolution and to issue warnings;
- Capacity for SADC Secretariat and relevant stakeholders developed in early warning and early action systems
- Facilitate the establishment of a regional multi-hazard, early warning and early action systems, which integrate indigenous and scientific knowledge systems,
- Promote and support partnerships with existing early warning institutions that may be more advanced and on which SADC can build the regional disaster management information system;

SADC Frameworks for Disaster Management

Overall objective To strengthen forecasting, early warning and early action capabilities through improved data collation, analysis, monitoring and dissemination of risk information.

Area of focus: i) Risk knowledge of hazards and of vulnerable people and society to these hazards; ii) National monitoring and warning service supported by a technical capacity to monitor hazard precursors, to forecast the hazard and vulnerability evolution and to issue warnings

Recommendations

- Need for a regional policy that support data and information sharing within and between countries
- National Spatial Data Infrastructure (NSDI) needs to be promoted to enable the data sharing more effectively
- Continuous monitoring of the changing of the environment
- Need for technical capacity building in this area
- Need to build appropriate infrastructure for remote sensing
- Integrate with indigenous local knowledge

Thank you