United Nations/Austria/European Space Agency Symposium
SPACE SYSTEMS – PROTECTING AND RESTORING WATER RESOURCES
13-16 September 2005
Austrian Academy of Sciences, Institute for Space Research Graz, Austria

Space Capabilities to support

Prediction and Management

of Humanitarian Consequences of Water-related Disasters

Peter Zeil

ZGIS research Centre for GeoInformatics Salzburg

Overview

- Vulnerability & Human Security
- Prediction: the case of hurricane Katrina
- Management: the case of the Tamis River floods, Rumania/Serbia
- Management: case study Buzi, Mozambique
- Information flow and communication
- Institutional requirements
- Conclusion

The Concept of Vulnerability

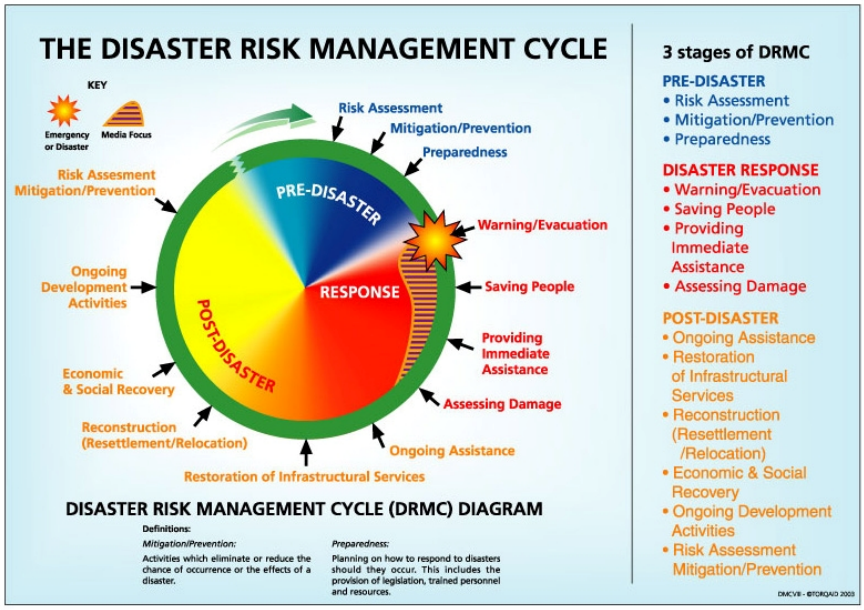
- **Vulnerability** (one possible definition):

"*Degree to which a **unit** and **its attendant human-environment system** is **harmed** due to **exposure to a perturbation or stress** [Turner 2003]*"

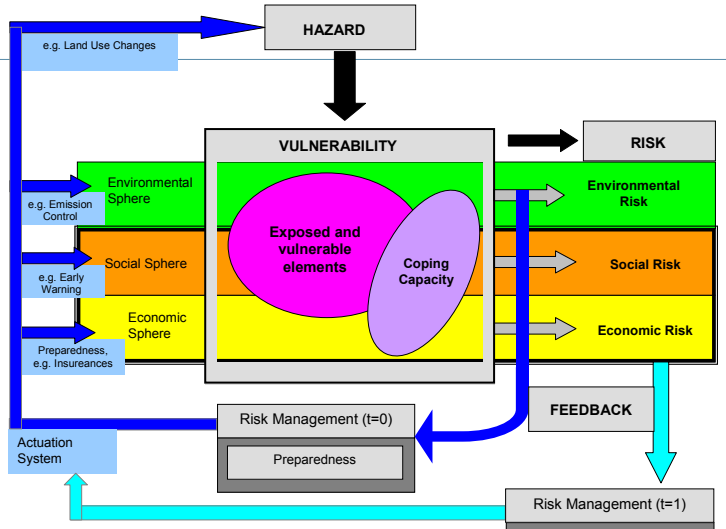
- **Vulnerability reduction** as a **key strategy for reducing disaster impact**

- Metrics, measures, and conceptual standards **NOT** yet **DEVELOPED** for coupled system and most system characteristics (e.g. sensitivity)

→ Basis for risk & hazard reduction and disaster mitigation policies



New concept



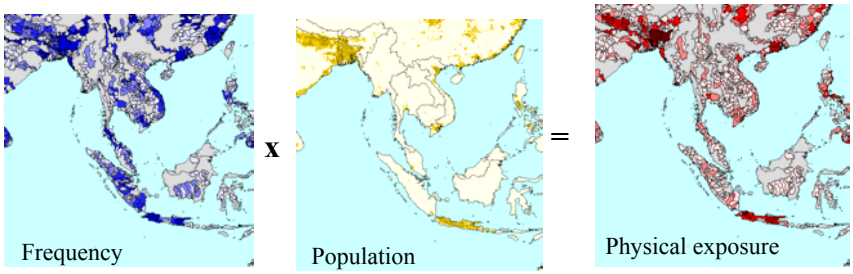
Source: after Bogardi, Birkmann, 2004; Cardona 2004

Global approach

The methodology of determine a Disaster Risk Index

$$\text{Risk} = \underbrace{\text{Frequency} \times \text{Exposed Population}}_{\text{Physical Exposure}} \times \text{Vulnerability}$$

Example for floods



Killed / Physical exposure = ~ Vulnerability

Human Security

- **Definition:** Coping capacity of individuals/societies
- **Linkage:** Stability will only be sustained if economic and social development combined with environmental protection is secured
- **Action:** Interventions based on monitoring changes in the environment are required
- **Support:** GMES (EC)

Resume 1

For reducing vulnerability and to strengthen the coping capacity we need to integrate assessments at different levels and sectors

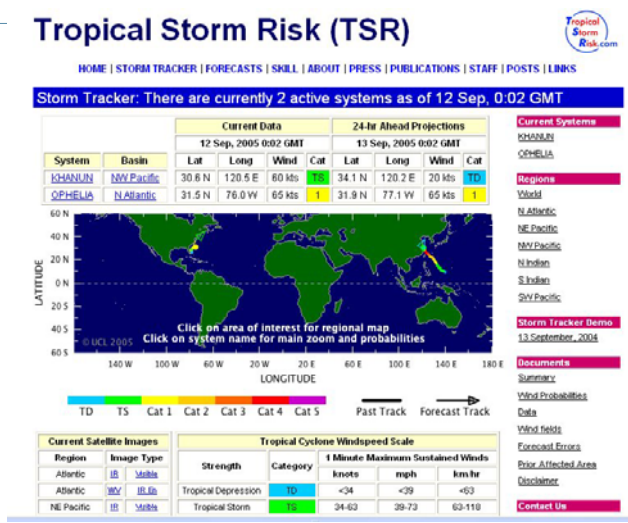
climate change, global change scenarios, regional observations, national monitoring data

and

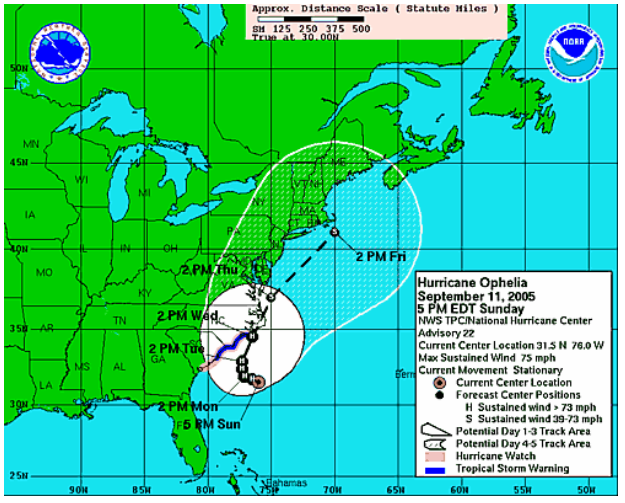
provide the synthesis in an appropriate format to local actors

so that they can perform effectively.

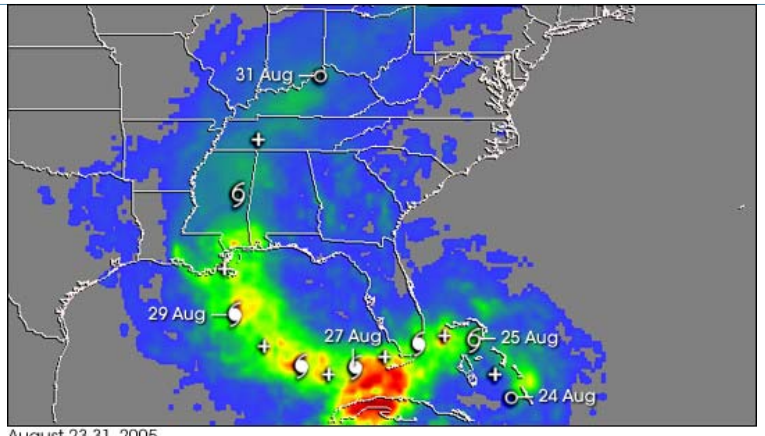
Hurricanes 1



Hurricanes 2 Orphelia



Hurricanes 3 Katrina

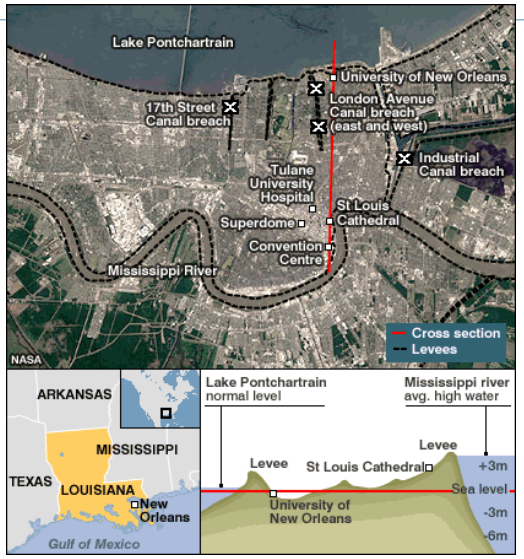


August 23-31, 2005

Rain Rate (mm/hr)

0 10 20 30 40 50

Hurricanes 4 Katrina



Hurricanes 5 Katrina

Hurricanes 6 Katrina

BANATSKI CUNAMI 2005.

BANAT TSUNAMI 2005

"Šta da ti kažem? Vidiš da mi je sve uzela, i zemlju kojom sam išao. Sada tumaram između neba i vode kojoj kraja nema".

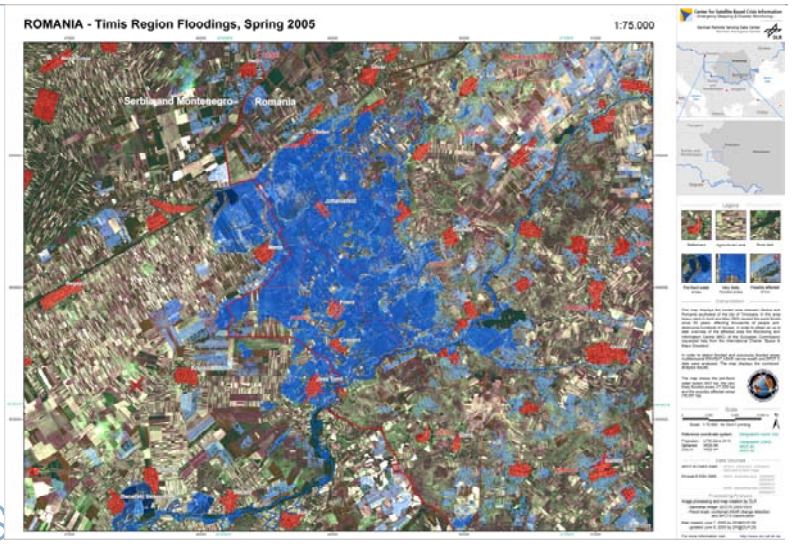
Stanovnik Jaše Tomića

"What can I say? Can't you see that water took everything from me, even earth that I walked on? Now I wander somewhere between sky and endless water."

Jasa Tomic Resident

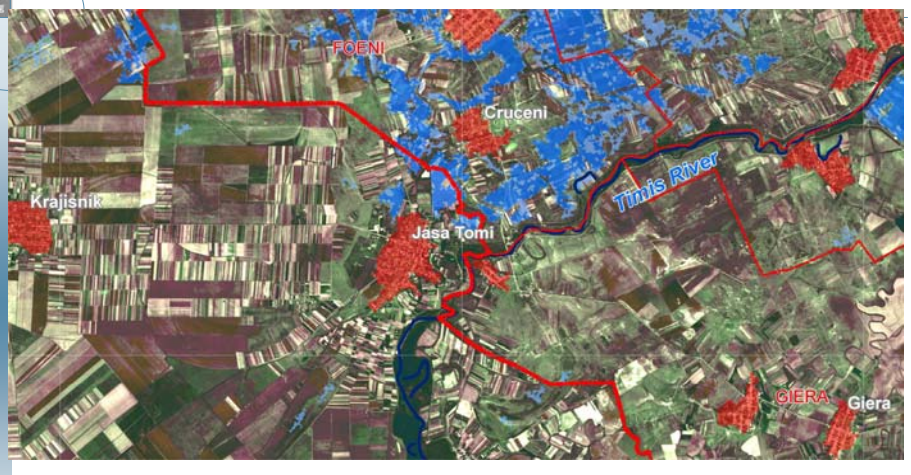
Universität Salzburg

Tamis River – Satellite Data



ZGIS

Tamis River – Satellite Data



Tamis River – Satellite Data

Romanian communes (Timis Region) affected by spring 2005 flooding

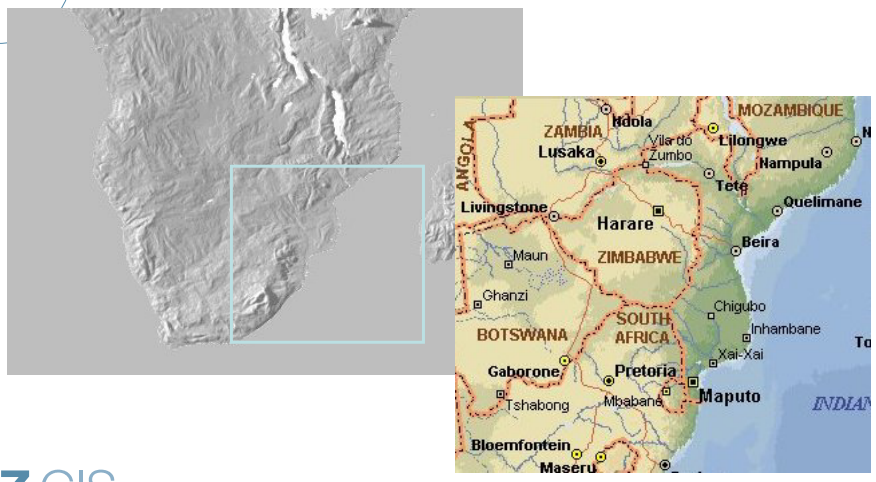
- Please note: analysis results consider only areas covered by DLR satellite maps. See satellite maps for comparison.
- Results for May 2005 are derived from a combined analysis (SPOT5, May 22 and Envisat/ASAR, May 12)
- Results for June 6, 2005 are derived from Envisat/ASAR analysis

commune	total commune area [ha]	area covered by DLR sat map [ha]	pre-flood water [ha]	May 2005		June 6, 2005	
				very likely flooded [ha]	possibly flooded [ha]	very likely flooded [ha]	possibly flooded [ha]
Sanmihaiu Roman	7,547	1,443	0.0	1	191	0	0
Sag	9,549	7,526	1.1	48	1,587	0	4
Uivar	19,436	16,806	2.9	6,130	1,902	1,770	1,311
Cenei	12,619	348	0.0	12	134	0	0
Jebel	10,621	48	0.0	0	12	0	0
Foeni	6,430	6,430	2.3	4,172	611	1,171	812
Guilvaz	10,307	10,307	1.1	3,213	1,847	418	499
Peciu Nou	12,945	12,917	0.0	390	1,616	4	42
Banloc	17,314	11,396	0.0	20	1,577	0	5
Giera	9,181	9,083	1.4	106	475	0	5
Ciacova	25,198	21,762	5.5	692	2,605	272	107
Total	**141,147**	**98,065**	**14.4**	**14,783**	**12,557**	**3,634**	**2,785**

Source: DLR 2005 (zki@dlr.de)

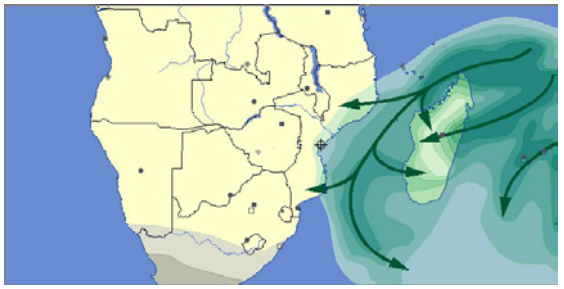
Results based on satellite imagery provided by the International Charter 'Space and Major Disasters' and commune boundaries provided by JRC.

Southern Africa, Mozambique



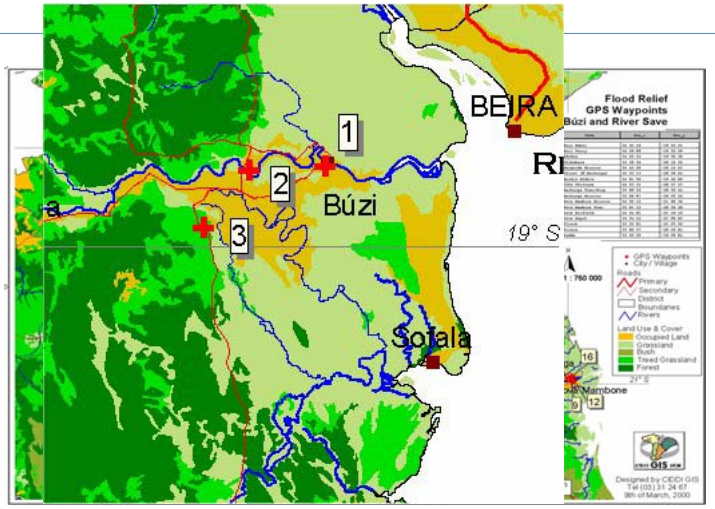
Buzi, Mozambique - Situation

- District of Buzi
- Southern Africa, Mozambique



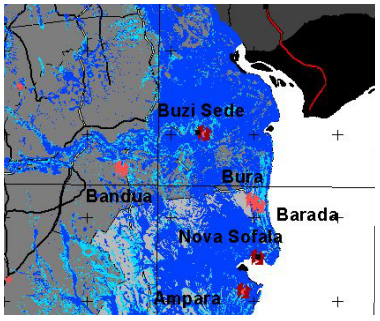
- Size: 7224,7 km²
- Population: 146.171
  (INE, Census 1997, calculations for 2002)

Buzi, Mozambique - Situation



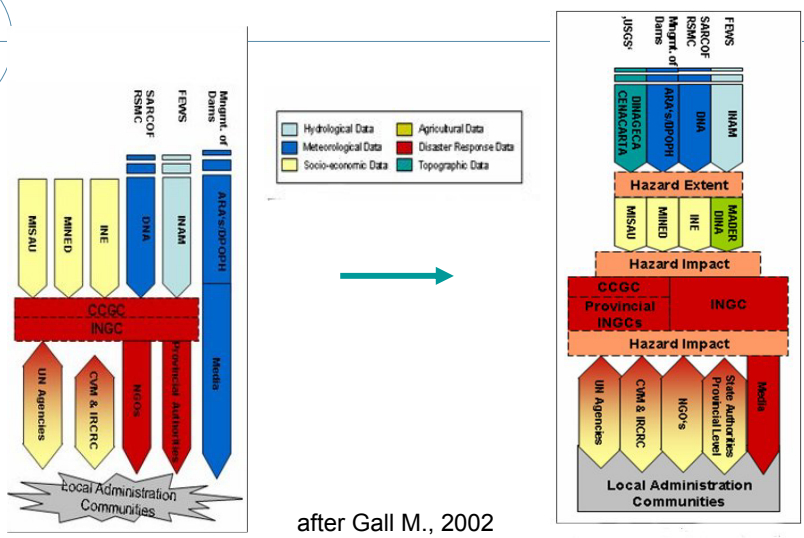
Buzi, Mozambique - Situation

- Threats: Cyclone, Floods, Drought, Erosion; HIV,…



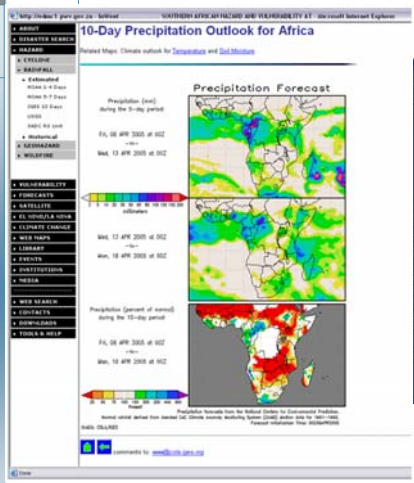
- Floods & Cyclone: 2000, 2001, 2002
- Drought: 2005

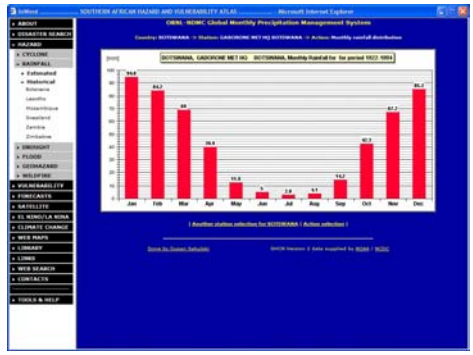
Information flow



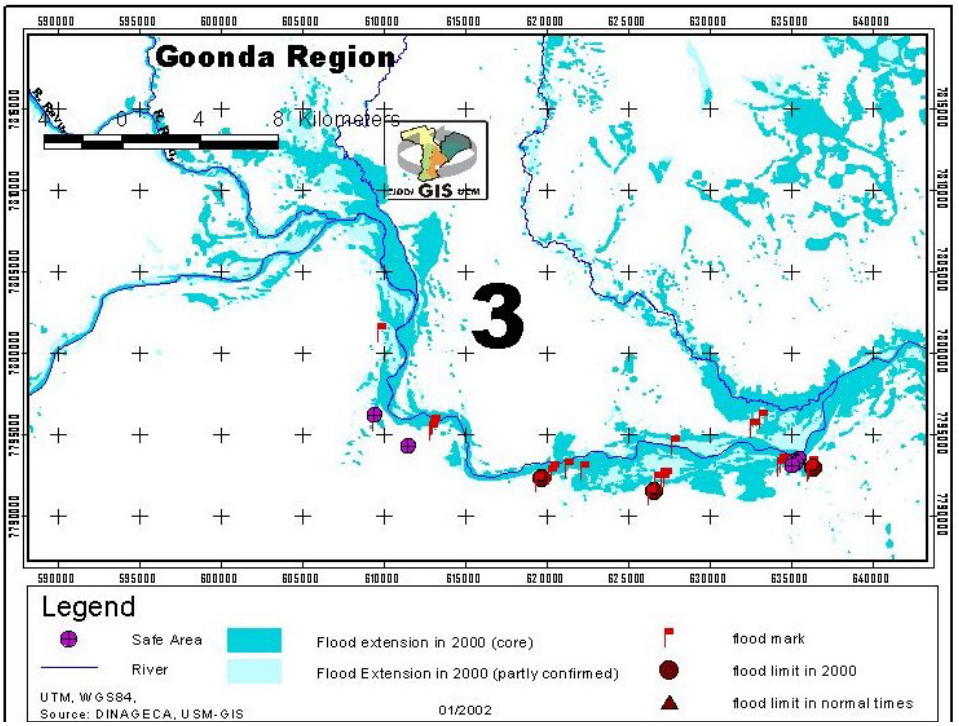
after Gall M., 2002

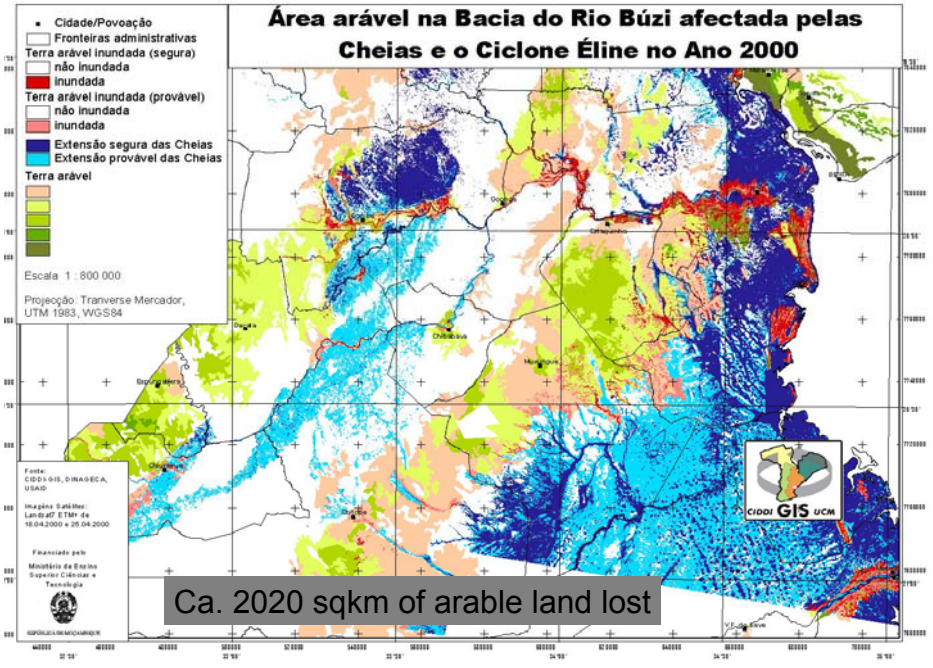
SADC Vulnerability Atlas



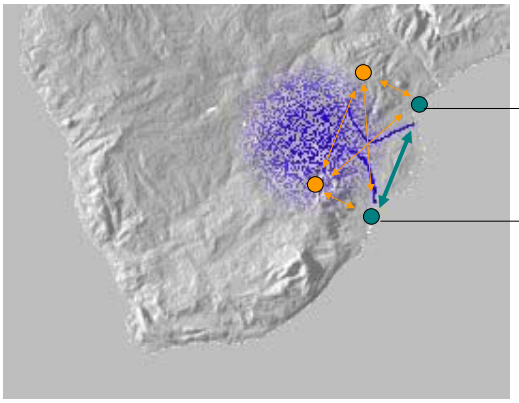


- http://edmc1.pwv.gov.za/sadc/

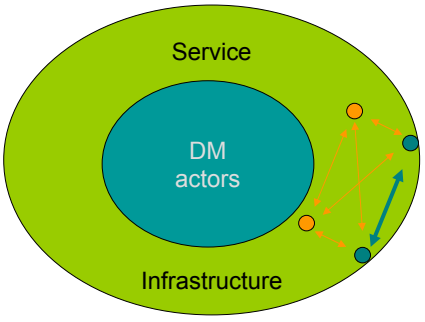

Goonda Region
4 0 4 8 Kilometers
3
Legend
Safe Area
River
Flood extension in 2000 (core)
Flood Extension in 2000 (partly confirmed)
flood mark
flood limit in 2000
flood limit in normal times
UTM, WGS84,
Source: DINAGECA, USM-GIS
01/2002


Área arável na Bacia do Rio Búzi afectada pelas Cheias e o Ciclone Éline no Ano 2000
Cidade/Povoação
Fronteiras administrativas
Terra arável inundada (segura)
não inundada
inundada
Terra arável inundada (provável)
não inundada
inundada
Extensão segura das Cheias
Extensão provável das Cheias
Terra arável
Escala 1 : 800 000
Projecção: Tranverse Mercador, UTM 1983, WGS84
Ca. 2020 sqkm of arable land lost

Institutional requirements



Institutional requirements

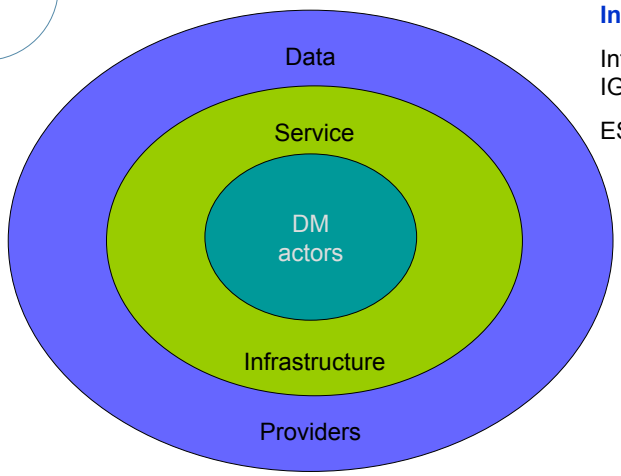


Projects:

Institution building: Z_GIS (Austria), FEWSNET (US),

Regional network: AMESD, SADC RRSU, OXFAM-ROSA, UN OOSA DM

Institutional requirements



Initiatives:

International Charter,
IGOS-P, EUMETSAT,

ESA-TIGER

Resume 2

- Satellite systems at a high technological standard alone are not sufficient
- Network between data providers and users is needed
- Capacity to extract, deliver and receive information has to be strengthened
- Institutional structures and agreements have to exist to allow information to flow

Contacts

- **Centre for Geoinformatics, Salzburg University:**
  www.zgis.at
- Peter Zeil:
  peter.zeil@sbg.ac.at