→ EARTH OBSERVATION FOR SUSTAINABLE DEVELOPMENT

Water Resources Management

Myanmar World Water Day 2017
2017 Mar 13 | Naypyidaw, Myanmar

Space technology for river basin planning

Christian Tottrup, DHI GRAS

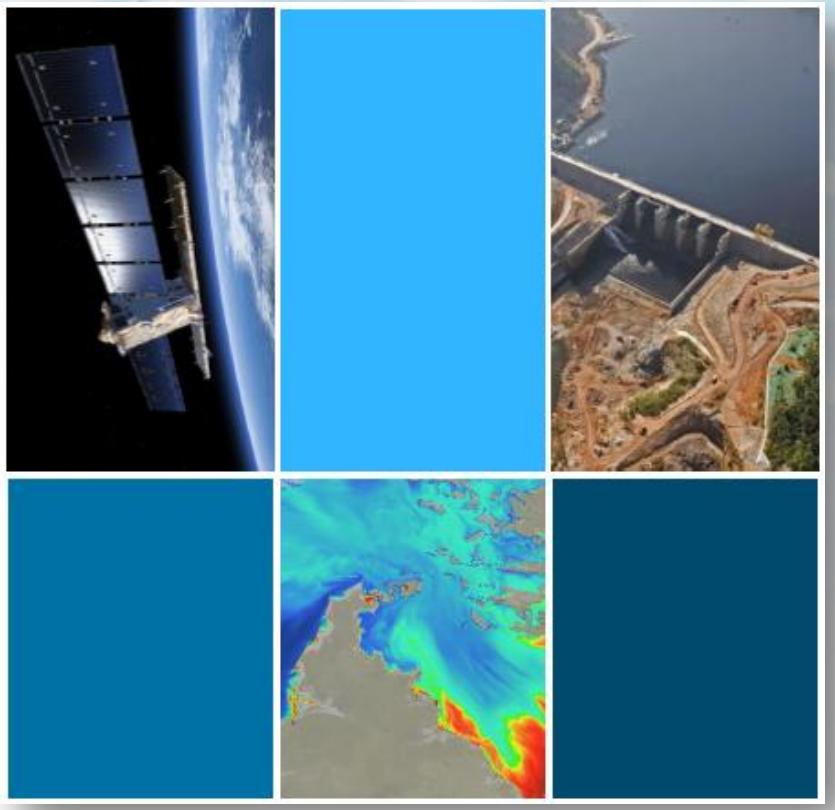
water resources management e04sd

DHI GRAS | GeoVille | DHI | Satelligence | eleaf | Starlab Living Science | adelphi | ITC University of Twente.

Background

- The successful and sustainable management of water resources requires access to reliable data and information on water related issues

- There is a growing awareness that Earth Observation data has the potential to serve these data needs



Why Earth Observation?

As a data collection tool Earth Observation has many advantages

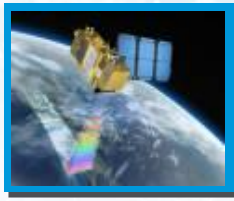
- **Continuous data acquisition**:
  - Earth Observation satellites allows continuous observation of the Earth surface and its changes on a regular basis
- **Historical archive**:
  - The existing archives of Earth Observation data allows an historical view of environmental issues (40+ years)
- **Multi-scale and multi-sensor capabilities**:
  - The different Earth Observation satellite allows the observation of the Earth at global, regional, national and local scales
  - The synergic use of optical and radar systems allows different types of environmental parameters and processes to be observed and monitored

Long term support for continous monitoring

The European Copernicus initiative,
securing satellite data access on the long term

Sentinel 1 – SAR imaging
All weather, day/night applications e.g. **floods**, **water bodies**, **wetlands**

2014 / 2015



Sentinel 2 – Multi-spectral imaging
Land applications: urban, forest, **agriculture**,…
Continuity of Landsat, SPOT

2015 / 2016

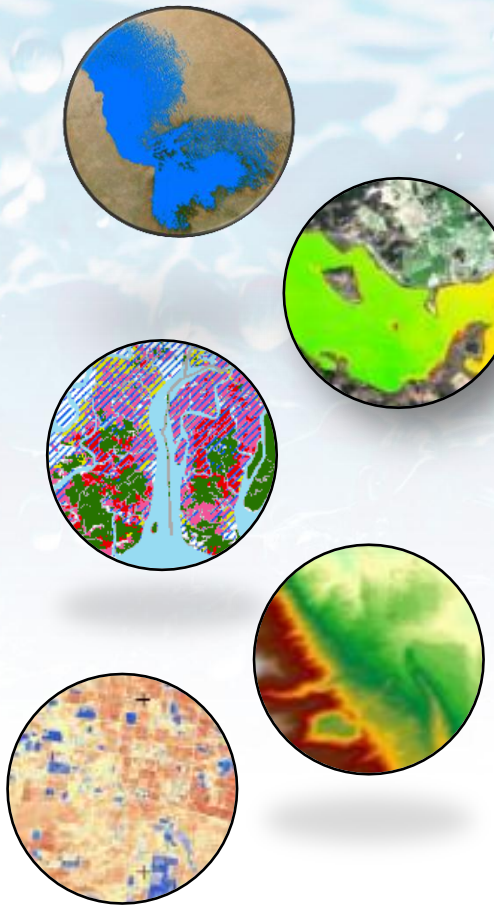
Sentinel 3 – Ocean and global land monitoring
Wide-swath ocean color, global vegetation, land/sea surface temperature, altimetry, **lake water quality**

2015/ 2016

+ Landsat, MODIS and more ….

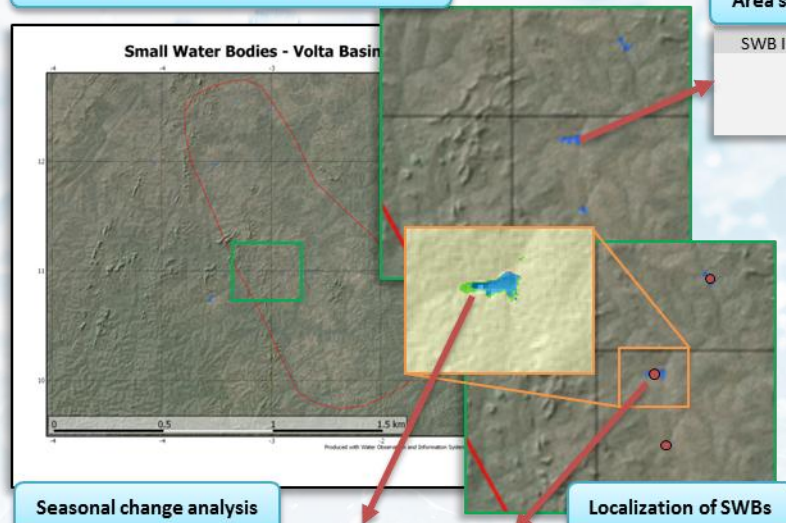
Subjects benefiting from Earth Observation

- Today a wide range of mature EO-based information services is available for mapping and monitoring key basin issues:
  - Overall land use and land use changes in the basin
  - Availability and quality of surface water
  - Flooding and drought events
  - Dynamics of rivers and deltas
  - Land degradation and soil erosion
  - Urbanization
  - Irrigation management support



Surface water monitoring

Small Water Body (SWB) mapping



Area statistics

SWB ID	AREA	PERIMETER
1	21171.4174	904.002332
2	183454.388	2946.96615
3	294551.767	3484.08552

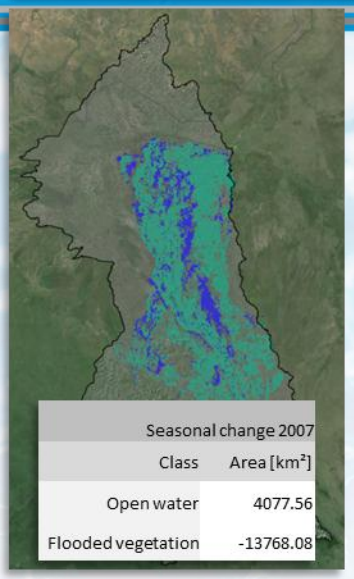
Seasonal change analysis

Class	Area [km²]
Decrease of small water bodies	0.49
Constant small water bodies	4.16
Increase of small water bodies	2.93

Localization of SWBs

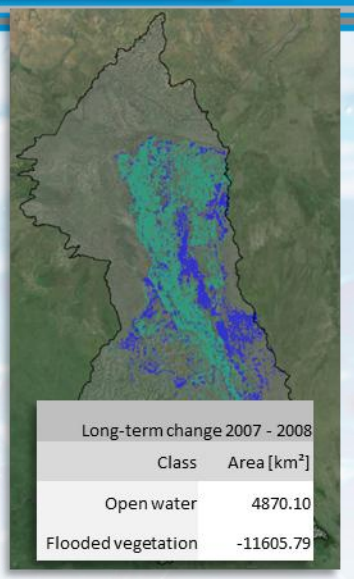
SWB ID	XCOORD	YCOORD
1	-3.369437	11.990526
2	-3.417772	11.98972
3	-3.416978	11.972579

Long-term and seasonal variations of wetlands



Seasonal change 2007

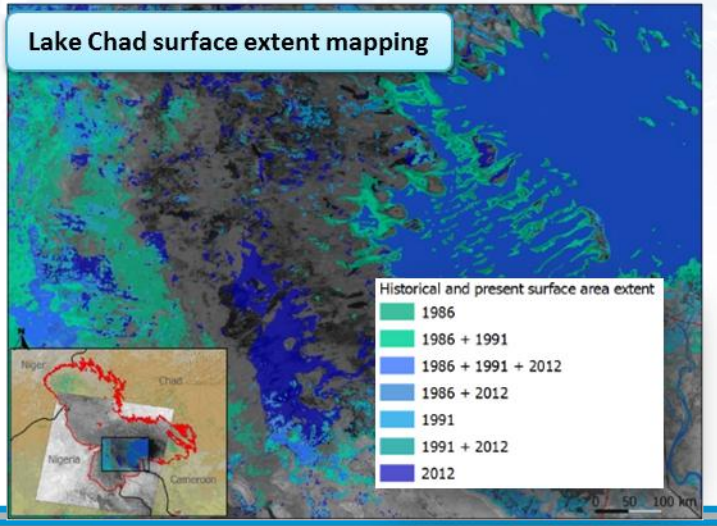
Class	Area [km²]
Open water	4077.56
Flooded vegetation	-13768.08



Long-term change 2007 - 2008

Class	Area [km²]
Open water	4870.10
Flooded vegetation	-11605.79

Lake Chad surface extent mapping

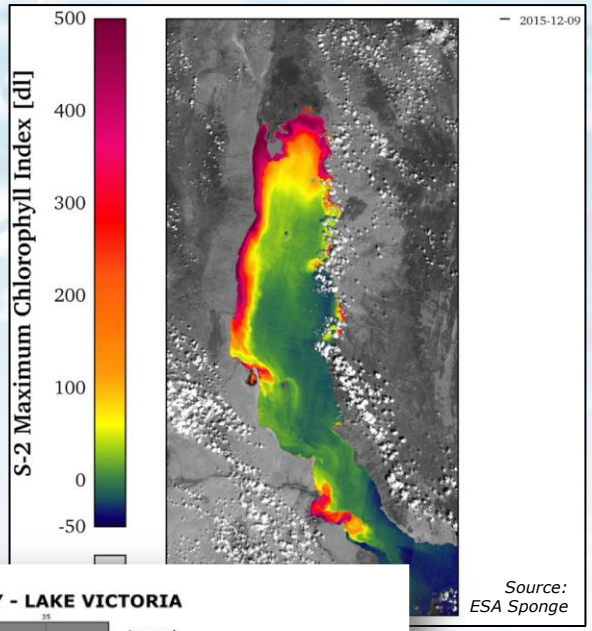


- Support small dam infrastructure planning and providing crucial knowledge for livestock watering
- Monitor impacts on critical ecosystems

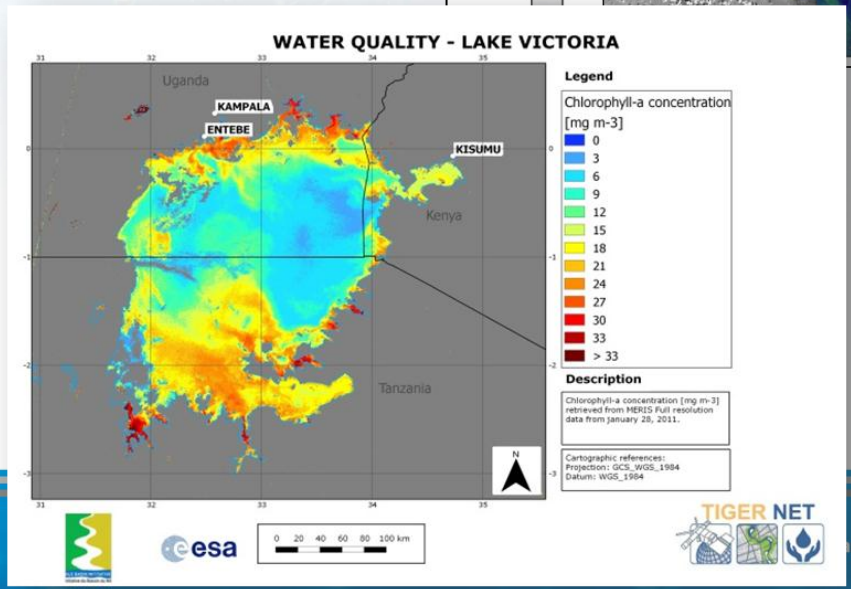
Water quality assessment

- Relevant parameters:
  - Chlorophyll concentration
  - Total Suspended Matter
  - Water surface temperature
- Previously restricted to coastal waters and large lakes but now feasible also for inland water bodies and river systems
- EO can also be used to monitor pollution sources and points of discharge into water bodies

Sentinel-2: 10 m resolution

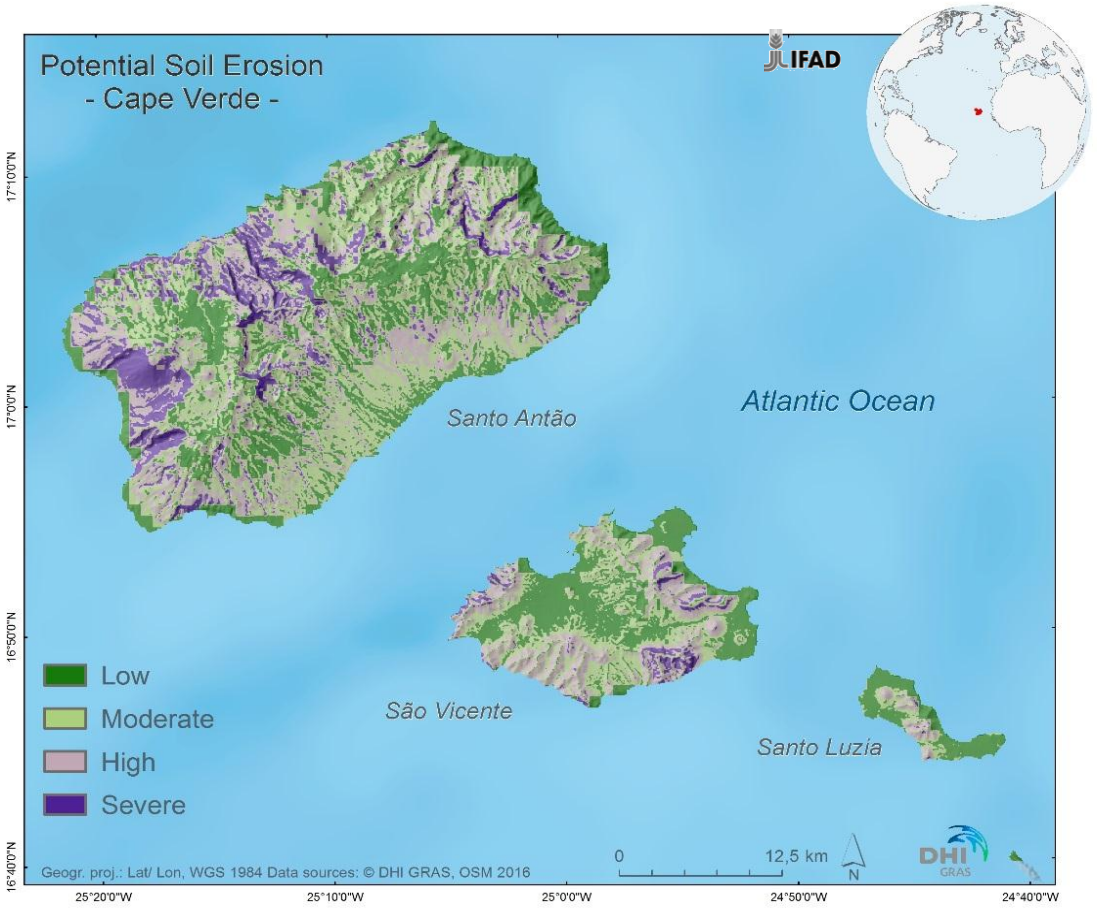


Source: ESA Sponge



MERIS: 300 m resolution

Soil loss assessment

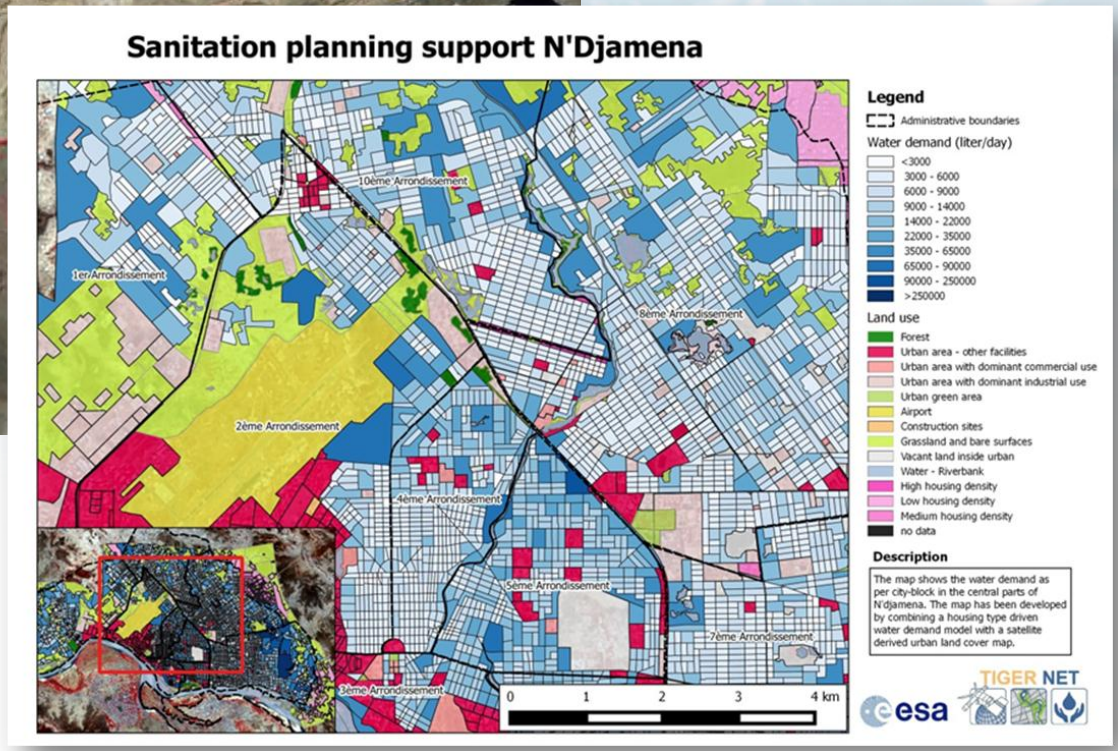


- Soil loss is a treat to agricultural development and also affects surface water resources through loss of water quality and quantity, increased flashfloods, and siltation of rivers and irrigation canals

In this example from Cape Verde an Earth Observation based soil loss assesment was used to target interventions by identifying vulnerable islands

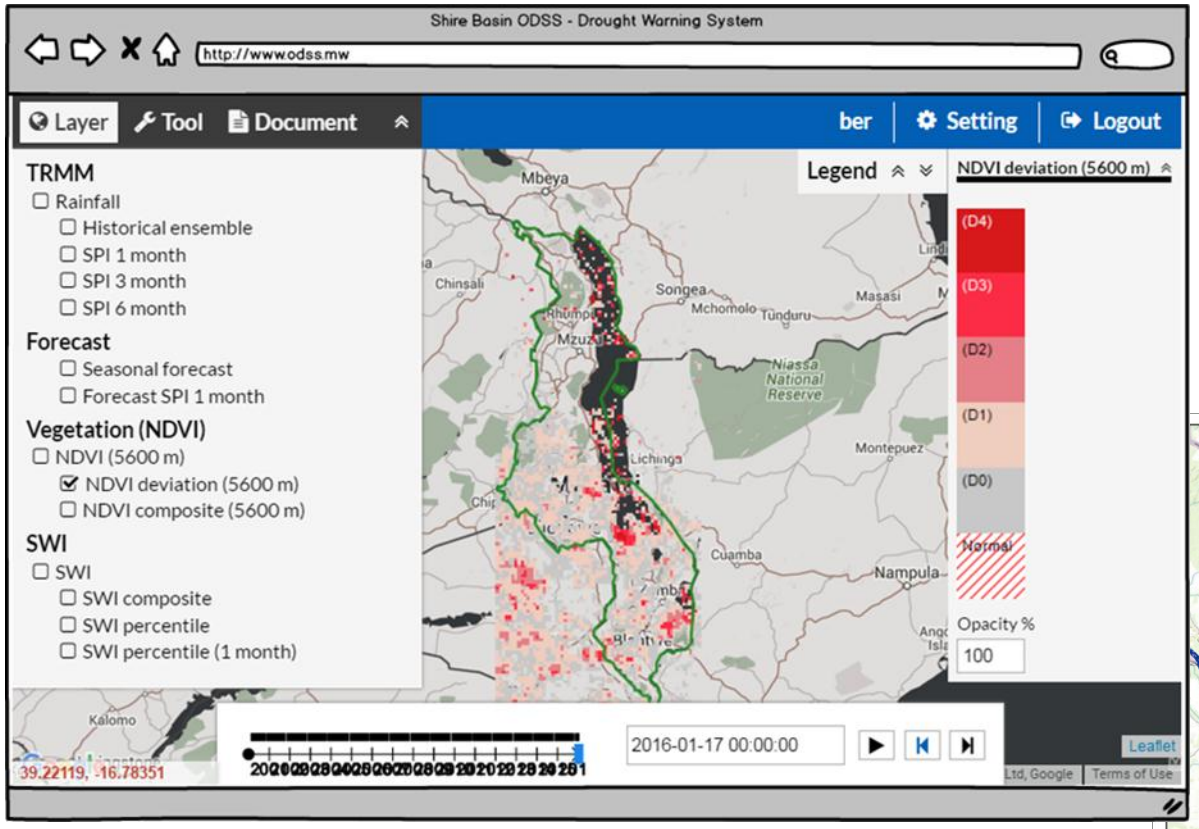
Urbanization
Supporting planning of water demand and supply

Historic observations can be used to monitor long-term urbanization processes



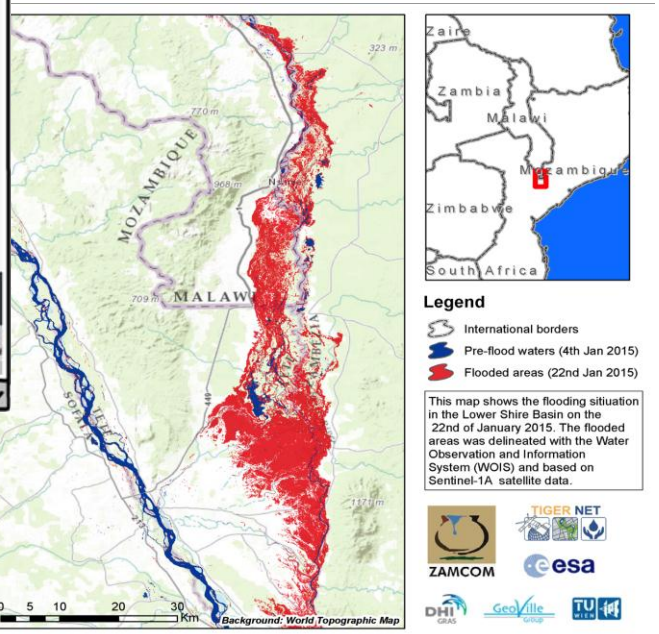
Detailed mapping support water demand and supply planning and vulnerability and exposure to disasters

Flood & Drought Monitoring
Disaster management & response



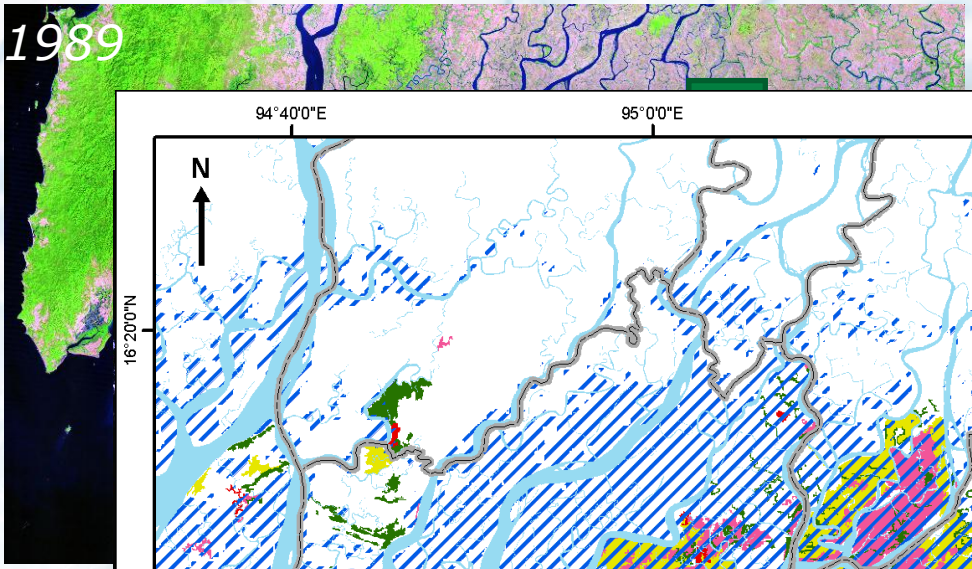
Evaluate the current drought status based on:

- *Climate*
- *Vegetation*
- *Soil moisture*



Dynamic flood mapping with near-real time satellite information

Delta vulnerability and planning
Hurricane Nargis



Flood extent

Around half of the flooded area comprised reclaimed mangroves, mostly cleared since 1989

Support for Basin reporting with the Water Observation and Information System (WOIS)

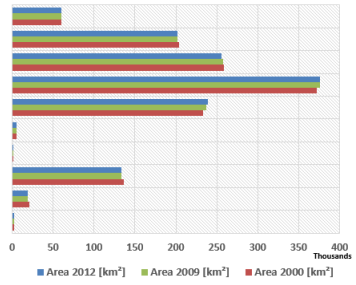
- "*Earth Observation and the WOIS allow us to assess environmental variables by catchment over the whole basin for the 1st State of the Lake Chad Basin Report*"

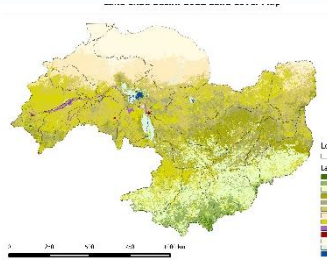
Mohammed Bila,
Head of the Lake Chad Basin Observatory, LCBC

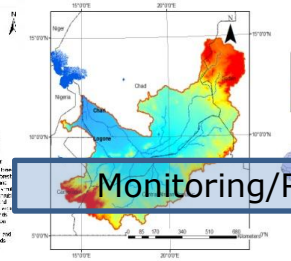
EO information used:

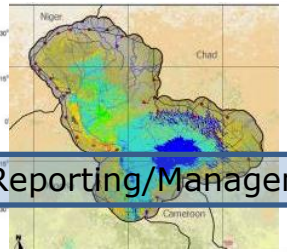
- Land use/land cover
- Land degradation
- Drought (rainfall, soil moisture)
- Lake water quality

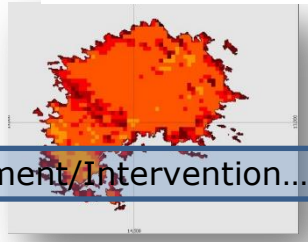
Land cover [km2]	Area 2012 [km²]	Area 2009 [km²]	Area 2000 [km²]
Closed to open forest	59626	59815	60005
Woodland	202233	202090	203453
Closed to open shrubland	255561	257499	258964
Closed to open grassland	375884	376222	372175
Croplands	239182	237316	232807
Irrigation	5791	5742	5297
Urban	783	779	704
Barren land	133069	133060	136521
Wetlands	19054	18674	20856
Water	2438	2393	2809









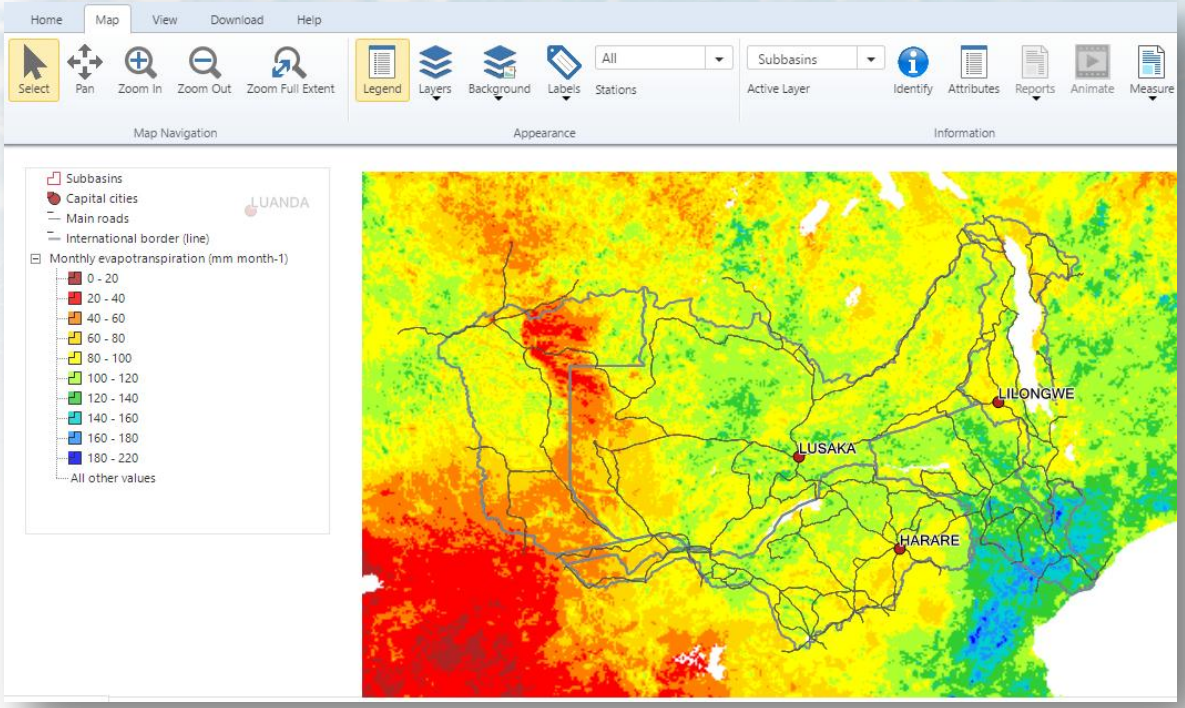


Monitoring/Reporting/Management/Intervention…

WOIS

Zambezi Water Resources Information System

- Providing the member states with an efficient and timely means of sharing data and information on water resources in the basin



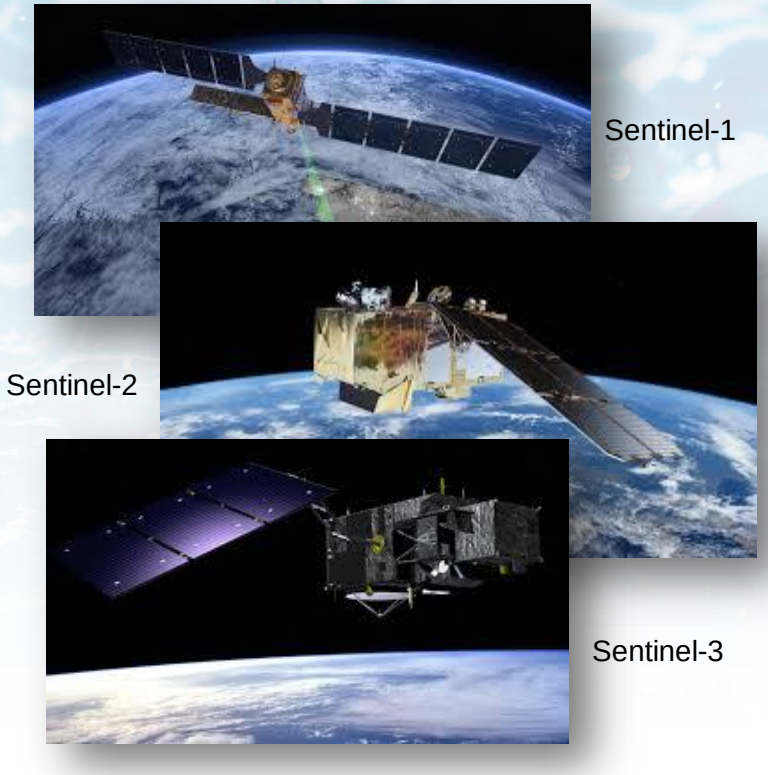
EO data:

- Rainfall
- Soil moisture
- Vegetation
- Evapotranspiration
- Land surface temp.
- Flood frequency
- Water quality
- Land cover
- Tree cover

Conclusion

- There is a new generation of satellite sensors becoming available which deliver free and open data with unprecedented spatial and temporal resolutions

- These data, combined with data from long-term archives, can and should be put into practice to support water resource management



About EO4SD

- EO4SD — Earth Observation for Sustainable Development — is an ESA initiative started in spring 2016 and focusing on top-priority international development issues including water resource management
- The main objective of the EO4SD on water resource management is to demonstrate the benefit and utility of EO-based information in support of IWRM and in the context of international development projects and activities

EO4SD will work together with World Bank, Asian Development Bank and local stakeholders in Myanmar during 2017-2019 period