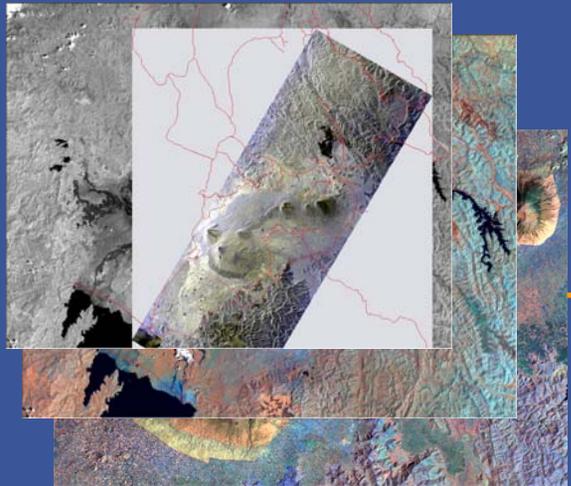


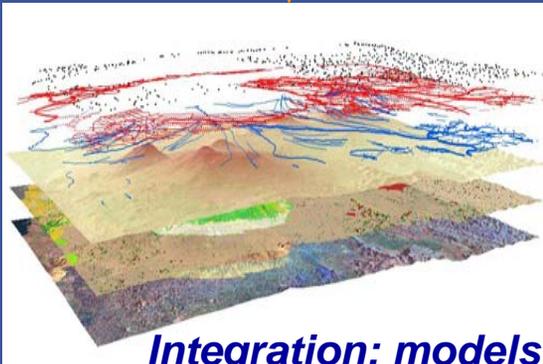
Towards Integrated Water Management in Africa: Space Technologies for Bridging the Water Information Gap

Luigi Fusco

***EO Science & Applications Department,
European Space Agency
ESA-ESRIN***

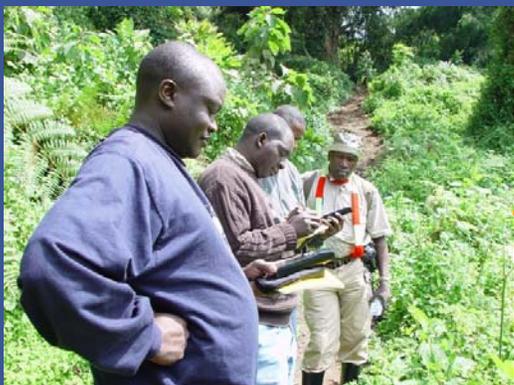


EO data

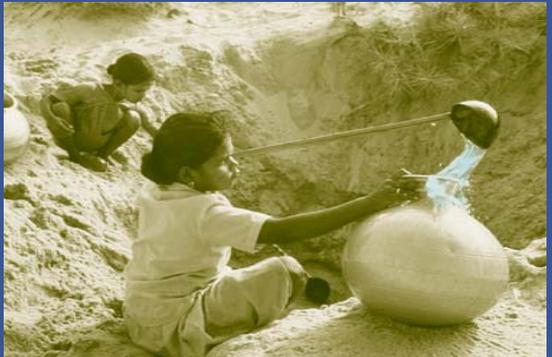
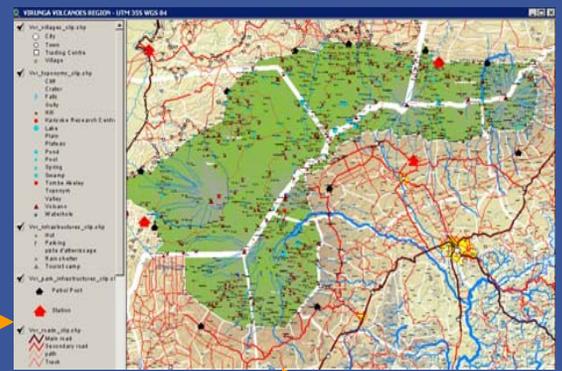


Integration: models

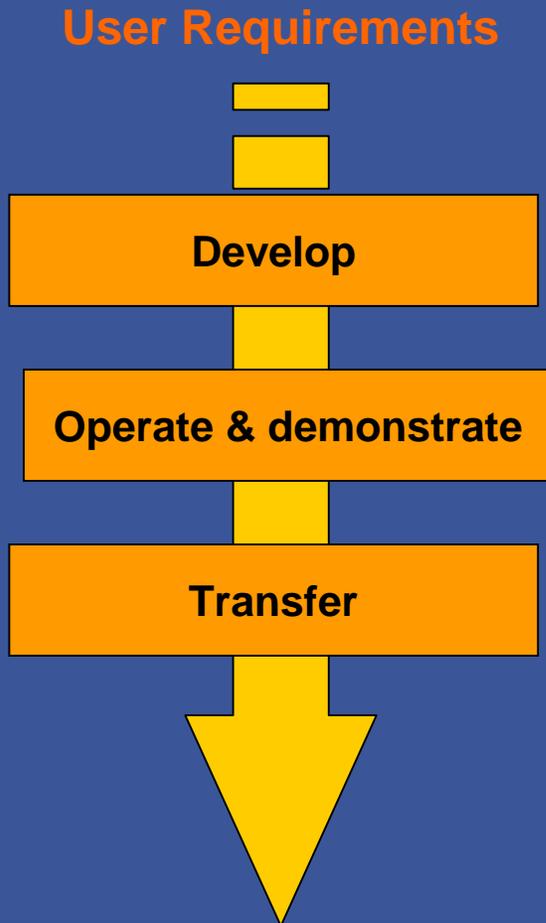
In-situ data



Better Information



Plans, decisions



DOT Approach:

- A consortium **develops** the System on the basis of the **User requirements**;
- The consortium **operates and demonstrates** the System (produces a number of final products);
- The system (and the database) is **transferred** to the user (Host Institution);
- The user (Host institution) operates the system;

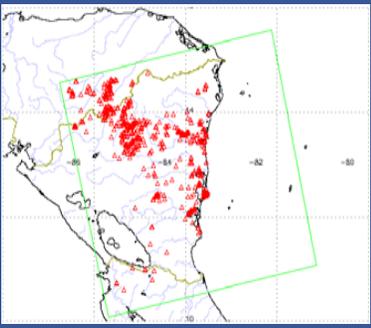
User Driven Approach

User Group: International and National authorities and NGOs are main actors in the projects devoting resources in terms on manpower and data access.



EO data

Service Development



Products

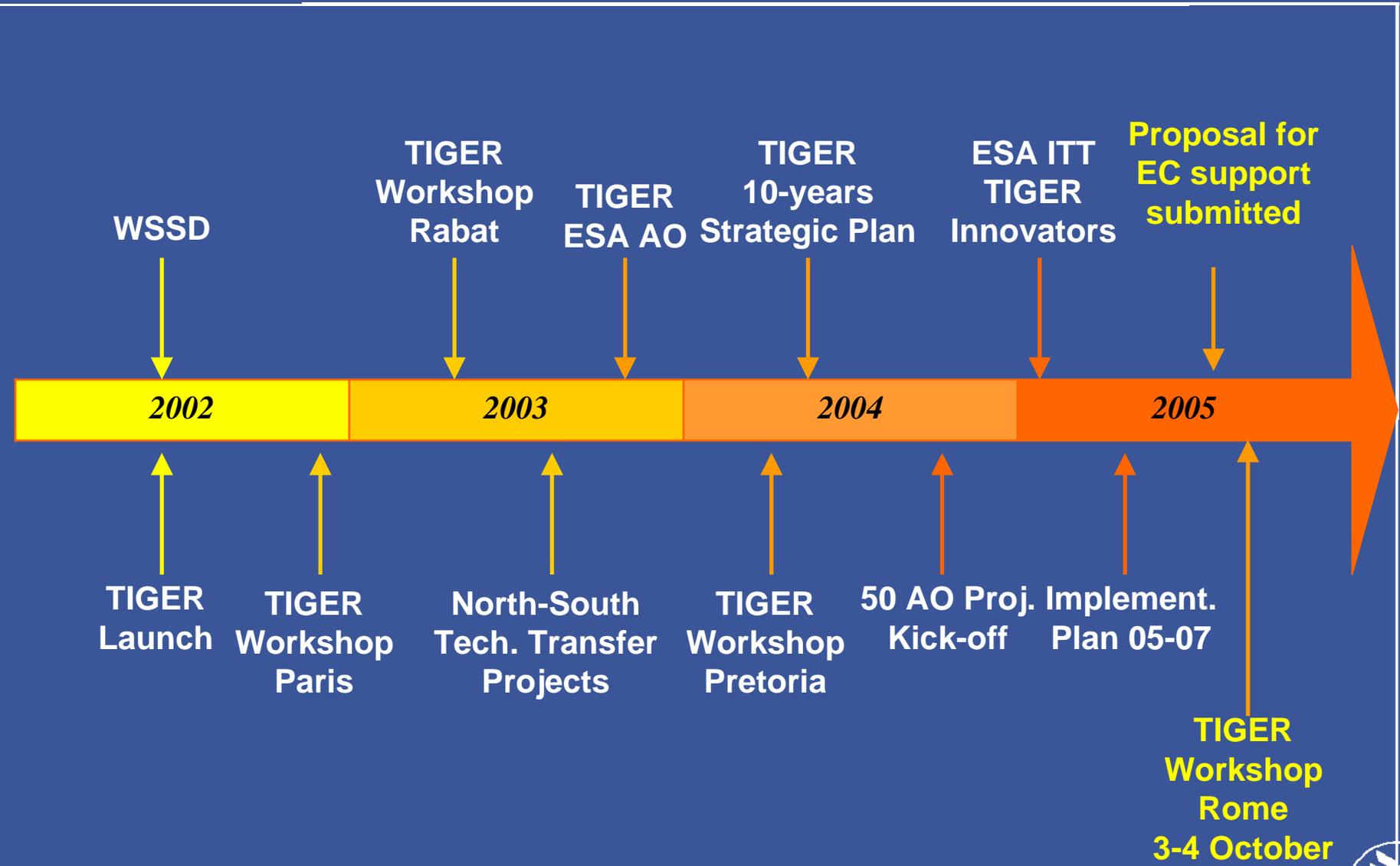


Service

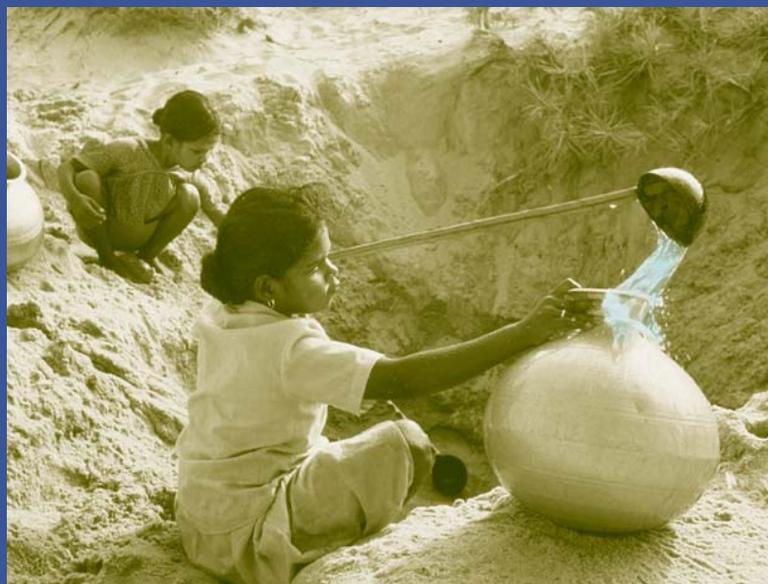
- The paucity and **poor quality of information on water & land resources** required for IWRM is considered a key limitation to achieve the WSSD goals;
- In 2002, ESA launched **TIGER** as a CEOS contribution **to implement the recommendations of the WSSD**;
- The goal of TIGER is to support African Water Authorities to improve **Integrated Water Resource Management** by exploiting the benefits of space technology **to overcome the geo-information gap**.



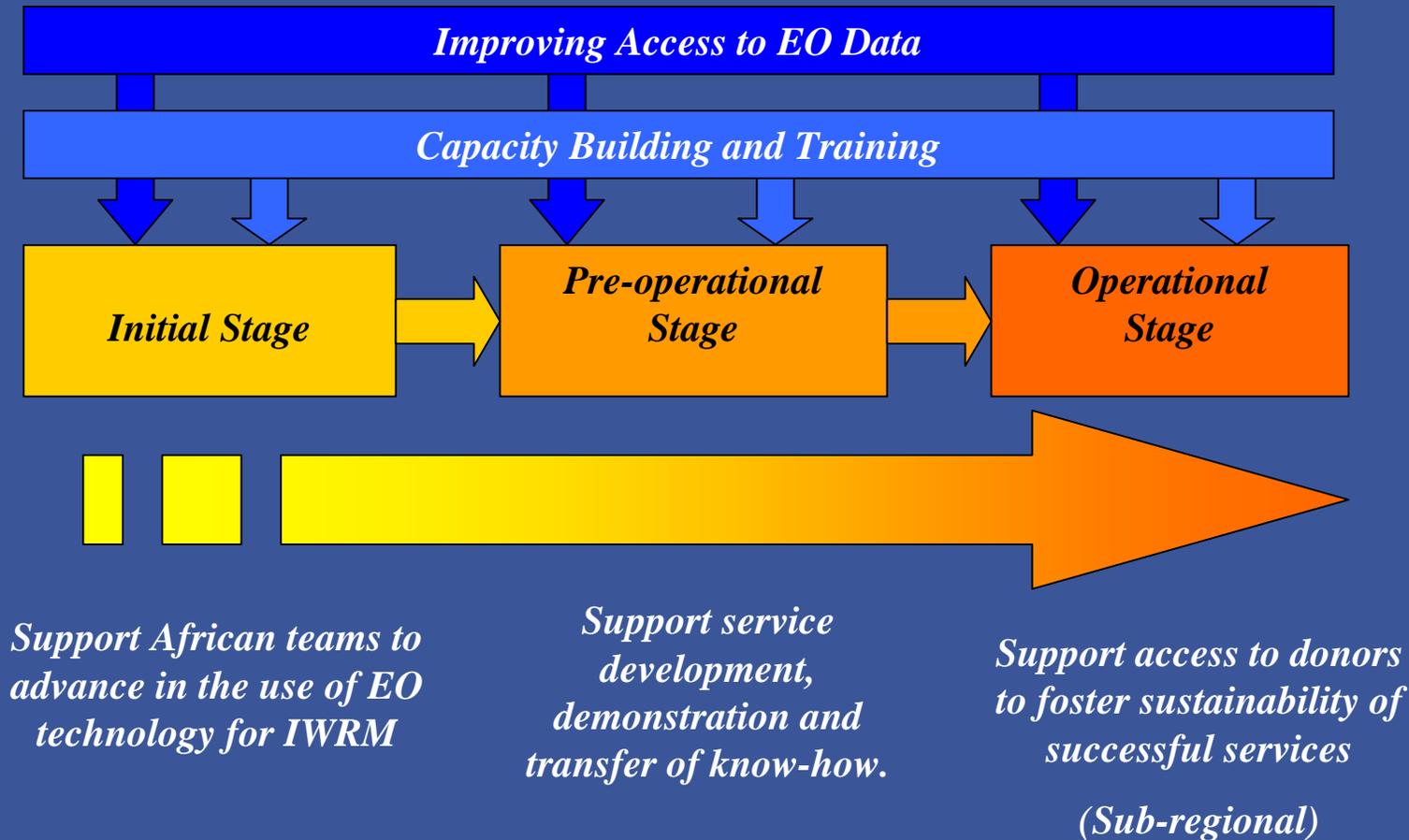
The TIGER Initiative: The history



- African component of TIGER:
 - *More than **200 African experts** in TIGER projects (from water authorities, technical centres and universities);*
 - *Key collaborators: CSIR, ESRI, CRTS;*
 - *Regional Technical centres (e.g., OSS, AGRHYMET);*



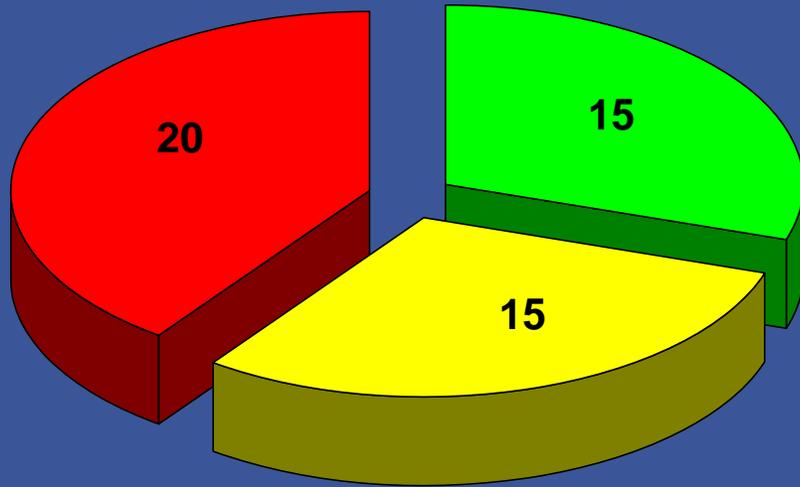
- The **CEOS partners** (e.g., CSA have launched 5 new projects dedicated to TIGER in 2005);
- **UNESCO** provides access to the hydrology community through its **IHP networks**.
- Other Int. Organisations: UNOOSA, UN-ECA, FAO;



- **Start-up projects:** Set of pilot projects aimed at supporting African technical centres (i.e., potential service providers) to advance in the use of EO technology for IWRM.
- In 2004, **African institutions were invited to submit concrete proposals for Pilot Projects** (through an ESA Announcement of Opportunity).

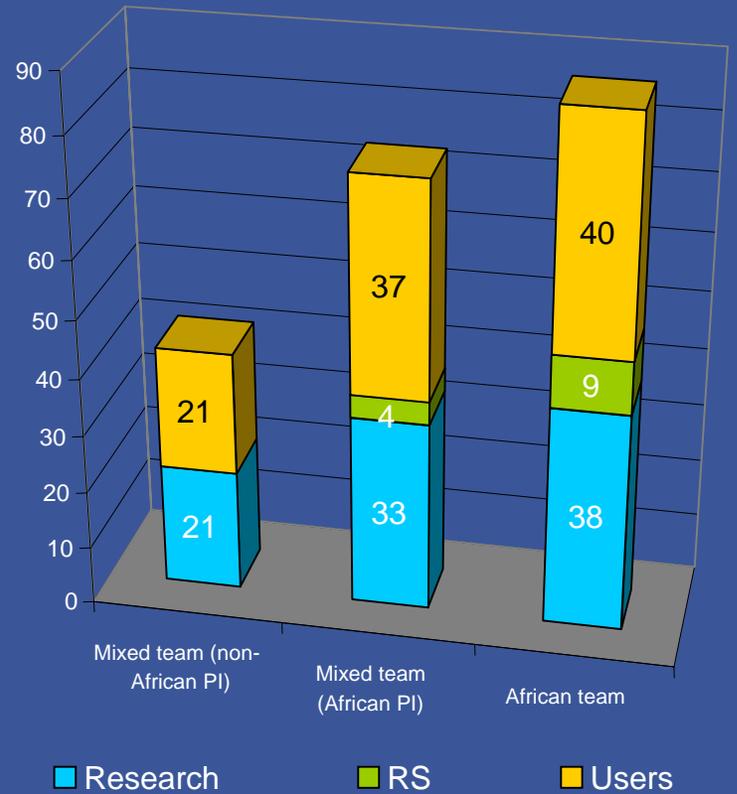


- 95 project proposals submitted by more than **300 African experts** dealing with water management issues;
- 50 projects based on specific user needs have been selected and launched in 2005;
- The **50 African teams** will be supported with:
 - **Free ESA data (2000 MERIS & ASAR);**
 - **Training;**



■ Mixed team (African PI)
 ■ Mixed team (non-African PI)
 ■ African team

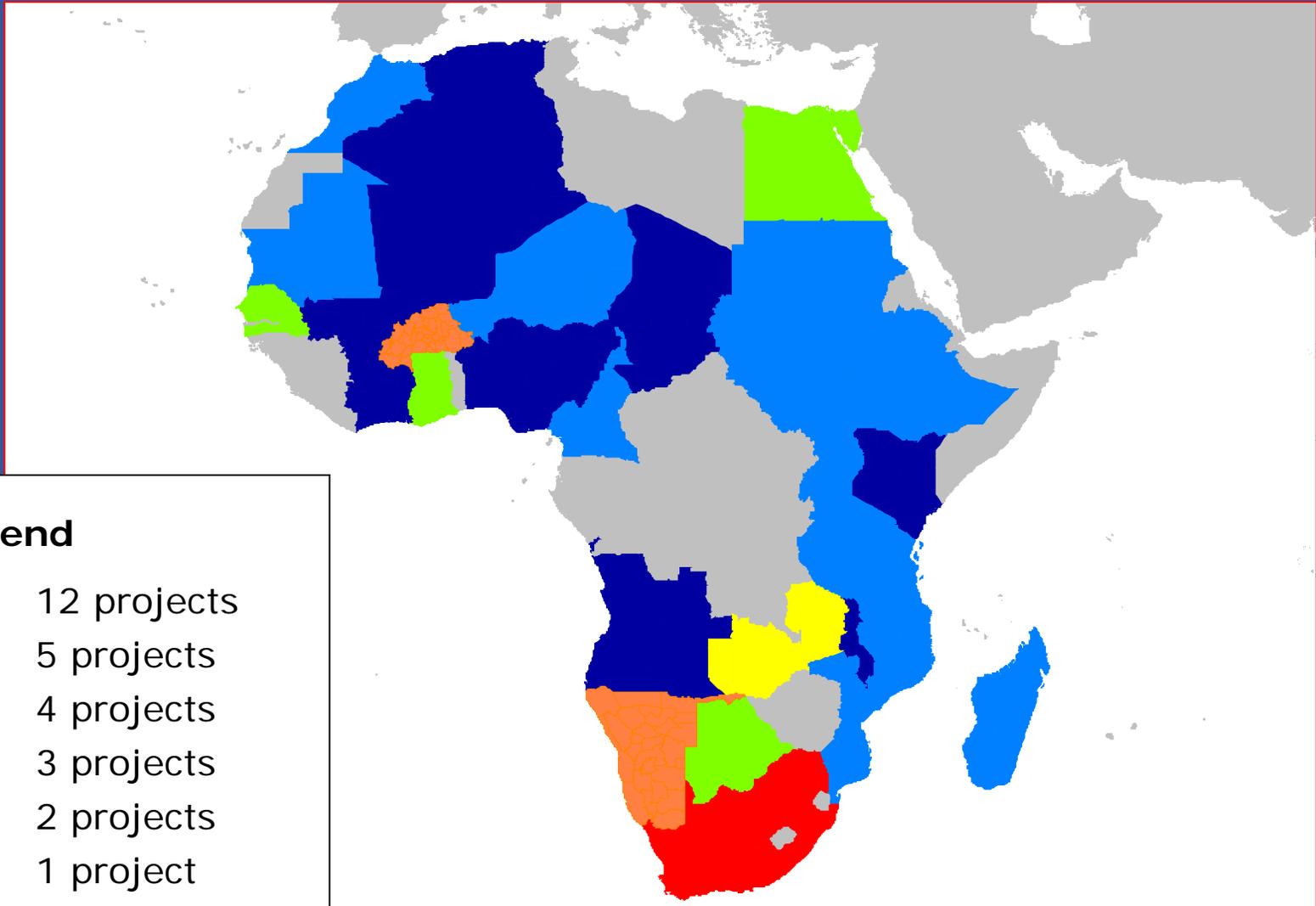
Geographic composition of the AO teams



Mixed team (non-African PI)
 Mixed team (African PI)
 African team

■ Research
 ■ RS
 ■ Users

Composition of the AO teams



Legend

-  12 projects
-  5 projects
-  4 projects
-  3 projects
-  2 projects
-  1 project

- During 2003/2004, ESA launched a number of **TT Projects funded with more than 3.5 MEuro.**
- These projects are carried out in close collaboration with almost 20 African Institutions (**North-South partnerships**) by using a **User Driven Approach**



- CSA has launched in 2004 **3/5 new TT projects;**
- Some info service under implementation:
 - **Wetlands** management;
 - Ground water and **aquifer management;**
 - **Rivers and lakes water levels;**
 - Sanitation and **epidemiology.**

- **Main Objectives:**

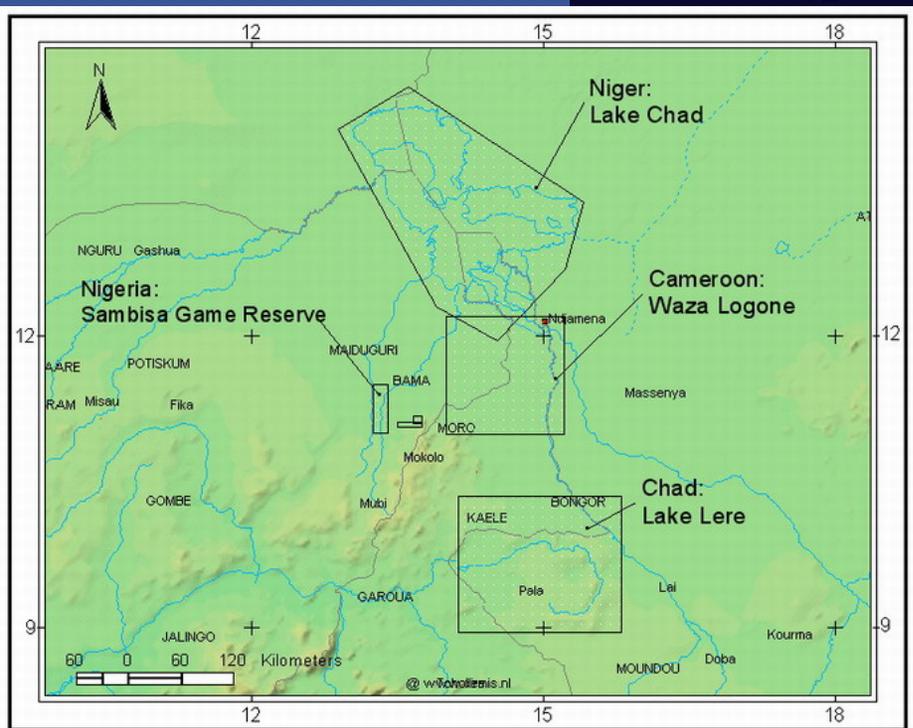
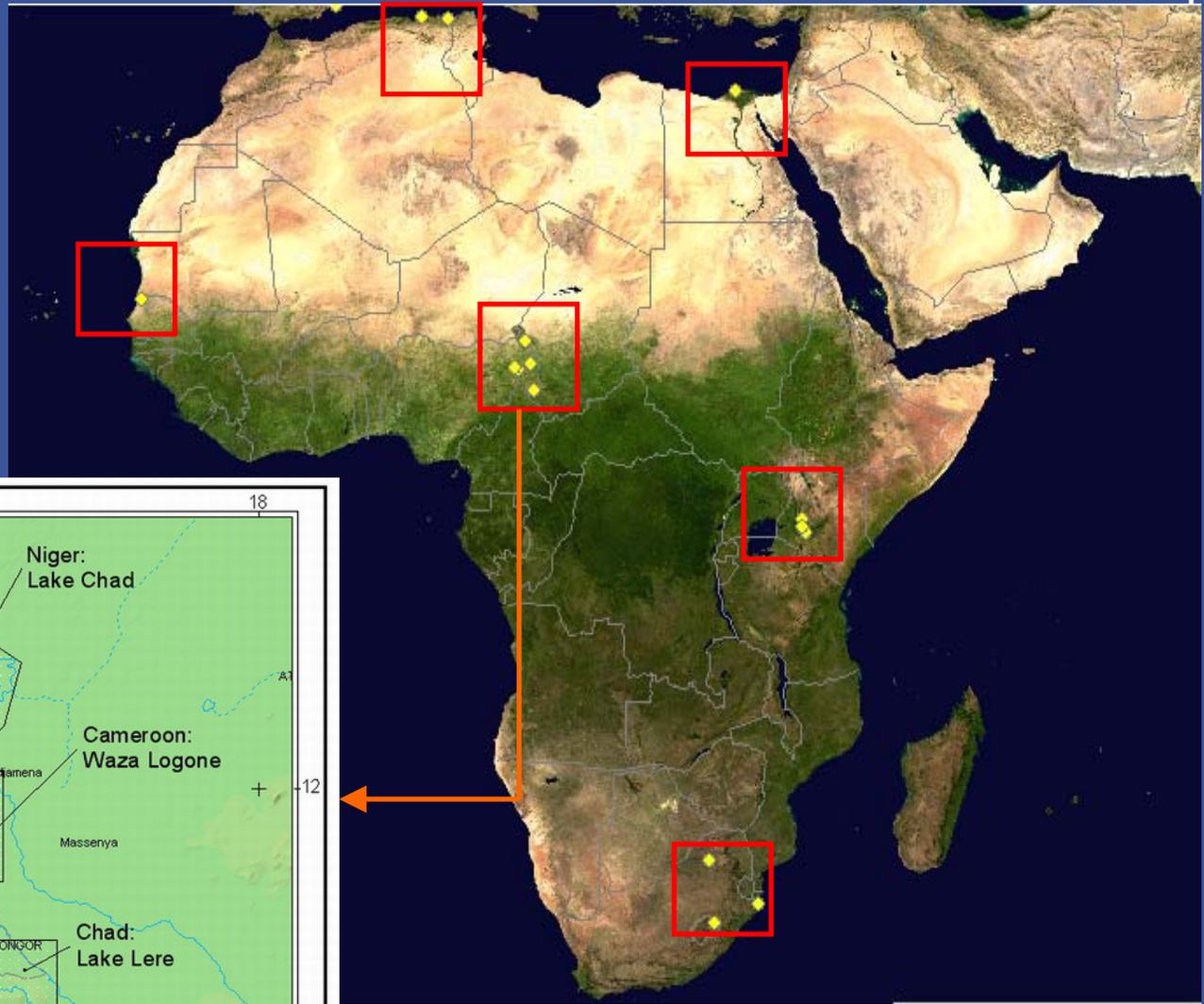
- ✓ *Short-term: Develop user-oriented information system (based on EO-technology) to support the National and Local authorities in managing Ramsar sites;*

- ✓ *Long-term: contribute to establish a solid basis for the operational use of EO technology in wetland management worldwide;*



- **Budget:** 1MEuro;
- **Duration:** 24 months;
- **Kick-off:** November 2003;
- **Geographical coverage:** Around 50 Ramsar sites worldwide mainly in Europe and Africa;
- **Implementation:**
 - ✓ International Team: Atlantis (CND), Synoptics (NL), WI (Int.) and RRS (D);

- **User Group:**
 - ✓ 10 countries: Algeria, Egypt, Senegal, South Africa, Kenya and the Lake Chad Commission Members.
- **Wetlands:**
 - ✓ 15 wetlands sites;

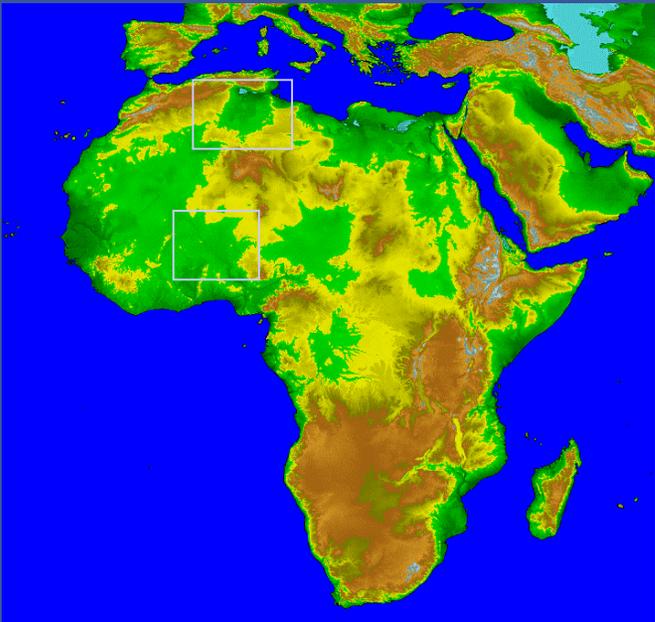


Objective: Support the management of trans-boundary aquifers in Africa

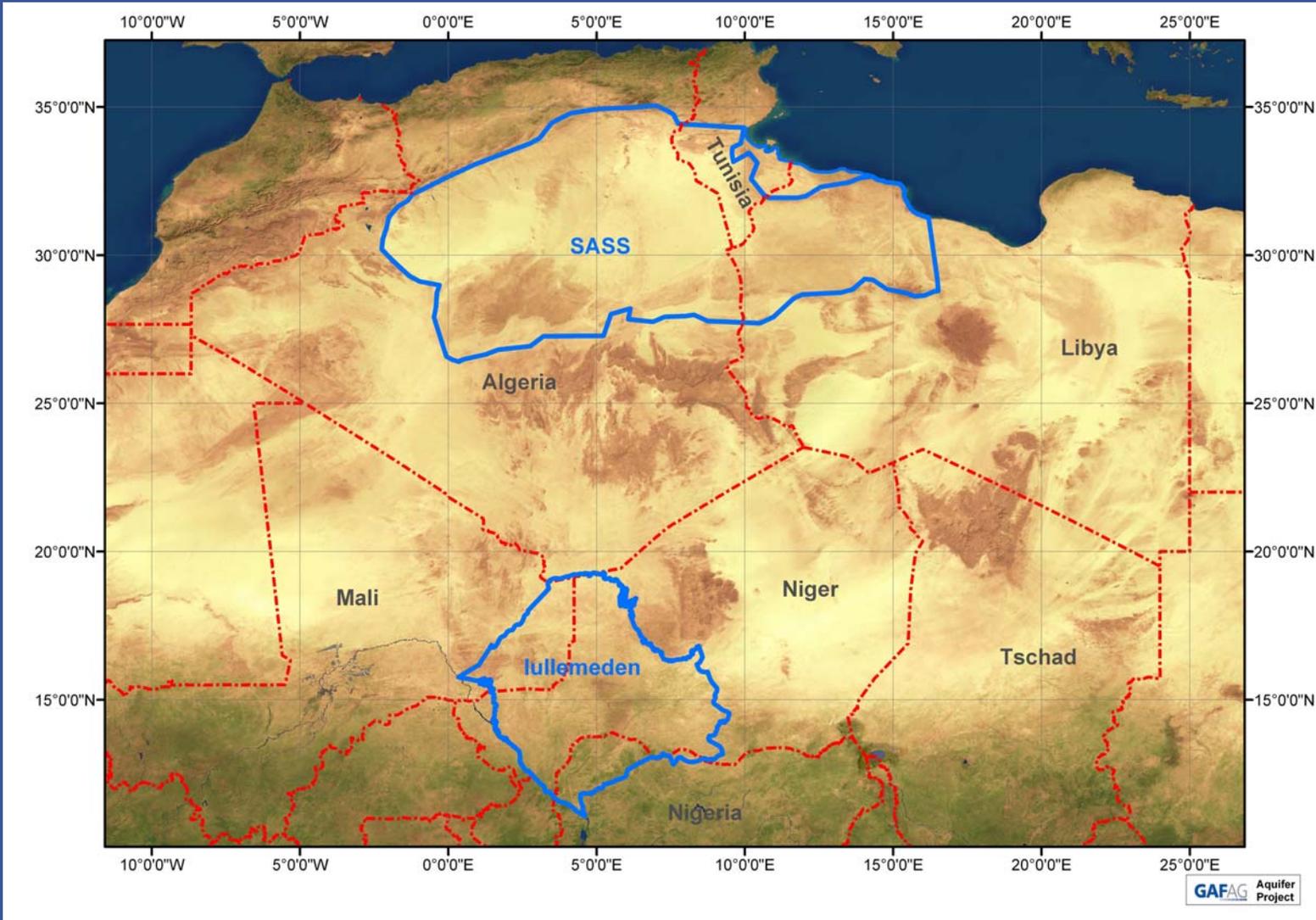
Develop and demonstrate products and services

Support, develop and demonstrate local production

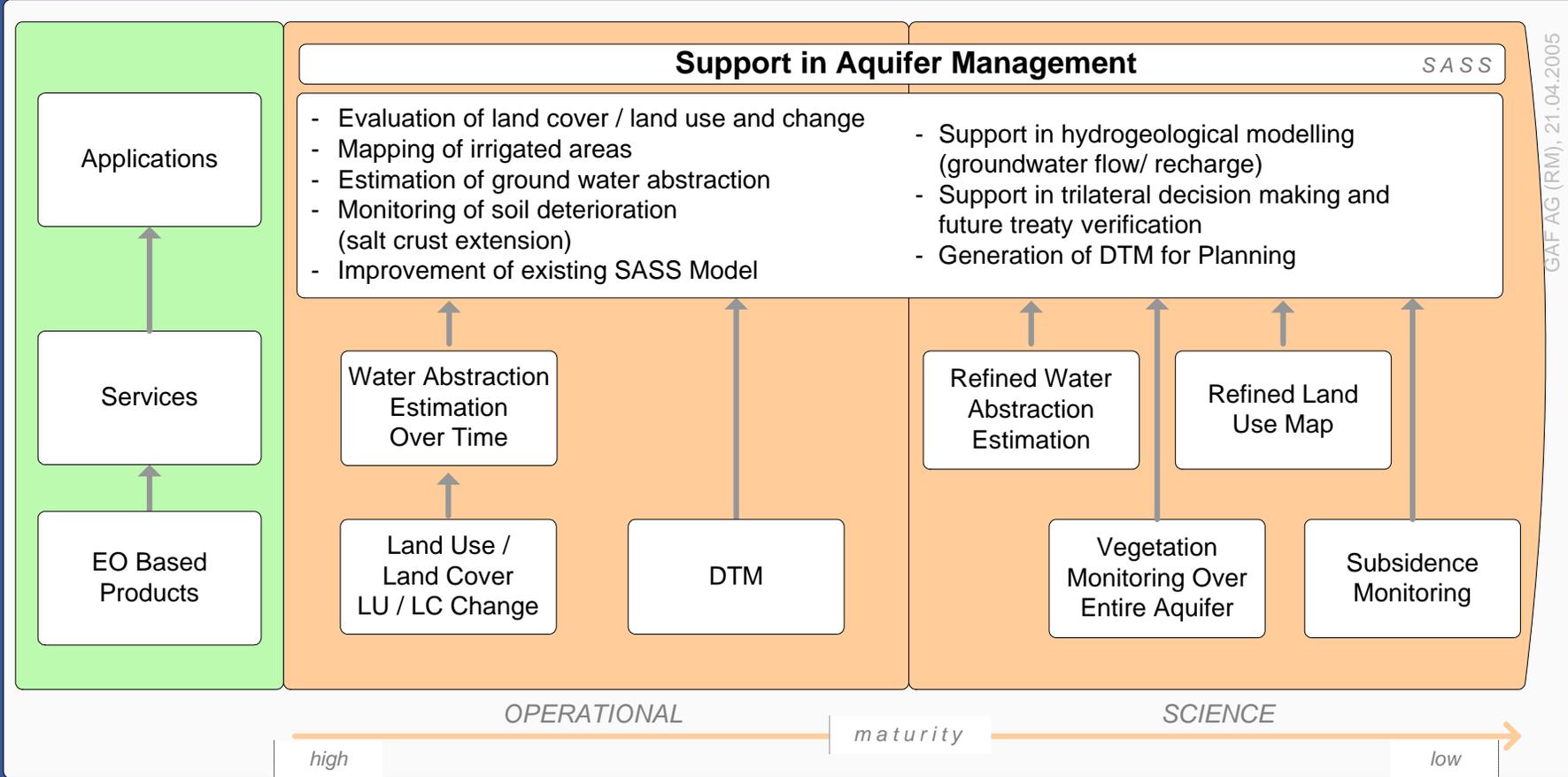
1 M€ - September 2004 to June 2007



- Carried out by an international consortium lead by the German company GAF;
- Users: Ministries in Algeria, Libya, Mali, Niger, Nigeria, Tunisia;
- User coordinator: OSS;
- 4 African service providers;

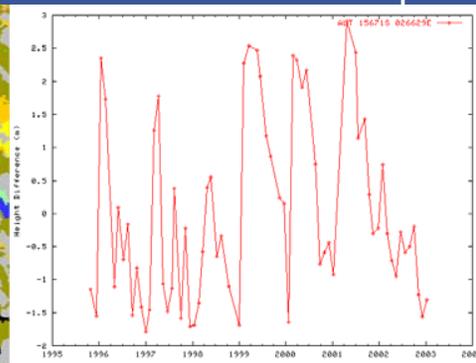
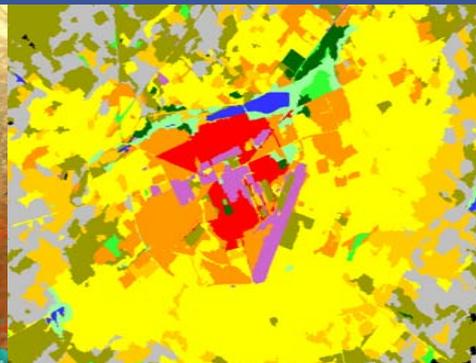
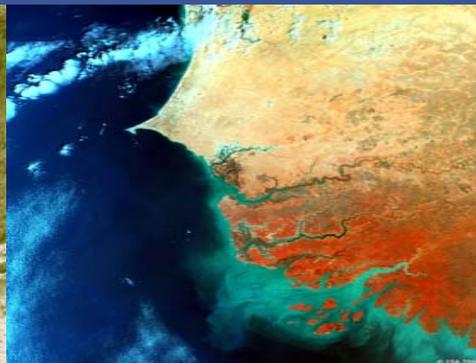
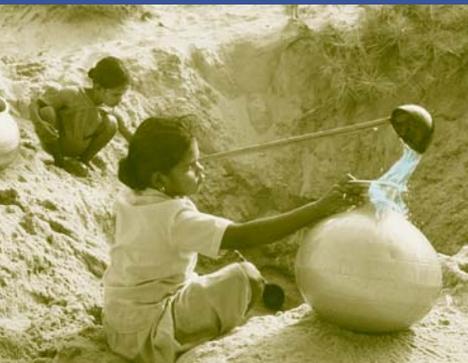


Surface: Approx. 1 Mkm² each

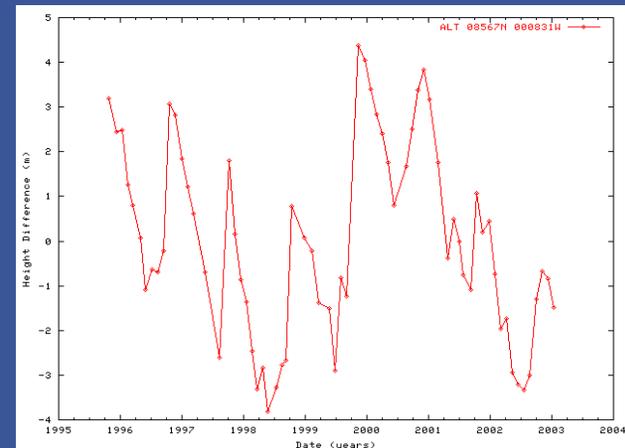
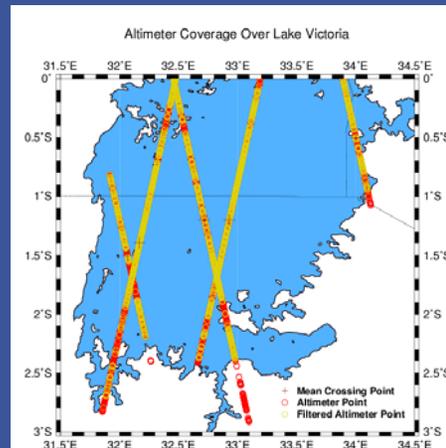
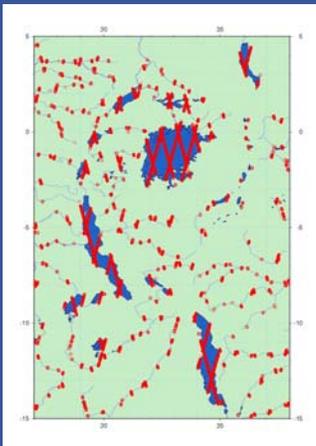


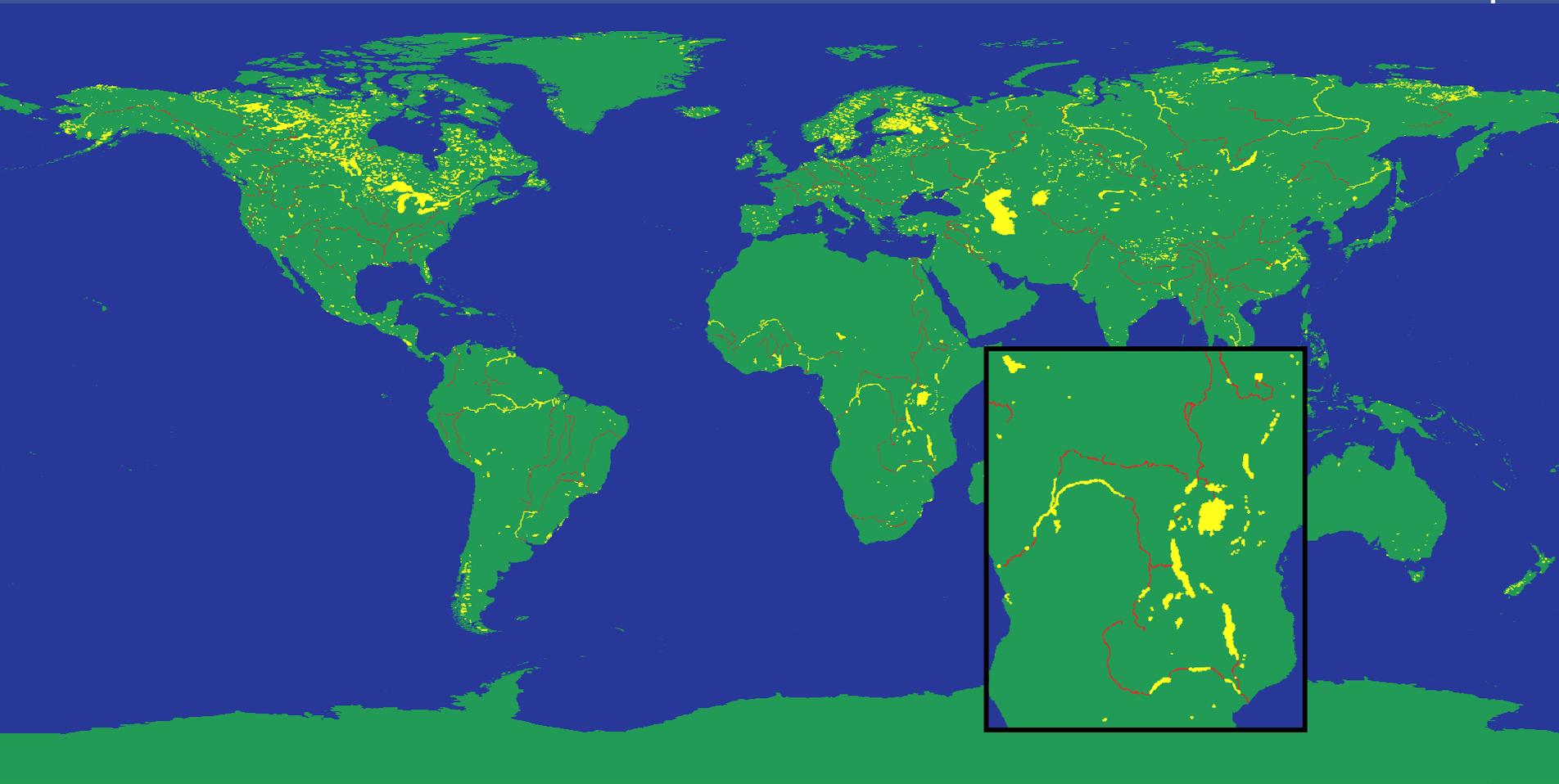
GAF AG (RM), 21.04.2005

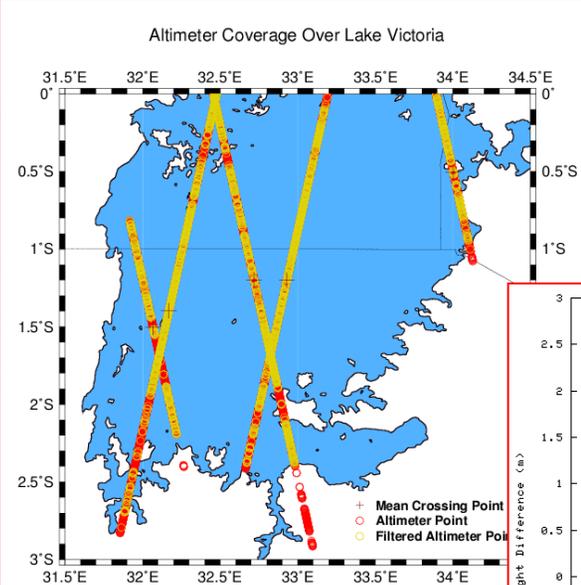
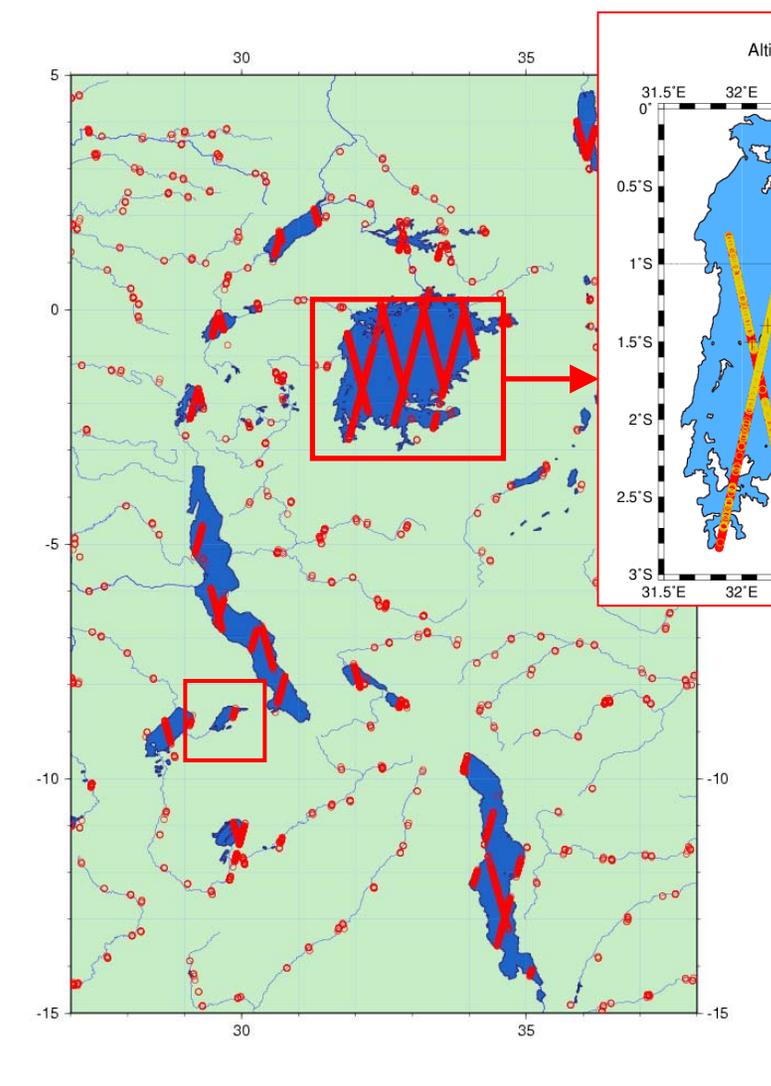
- **Fostering the African Ownership (leadership of African Water Authorities):**
 - TIGER Executive Bureau in Africa;
 - Sub-regional evolution of the programme implementation (led by African partners);
- **Develop efficient mechanisms for technology and know-how transfer to African Service providers: from pre-operational to operational stage;**
- **Develop mechanisms for improving access to low-cost EO-data in Africa;**
- **Develop a strong capacity building component in TIGER: Human, technical and institutional capacity;**
- **Fostering partnership with development agencies and donor organisations;**



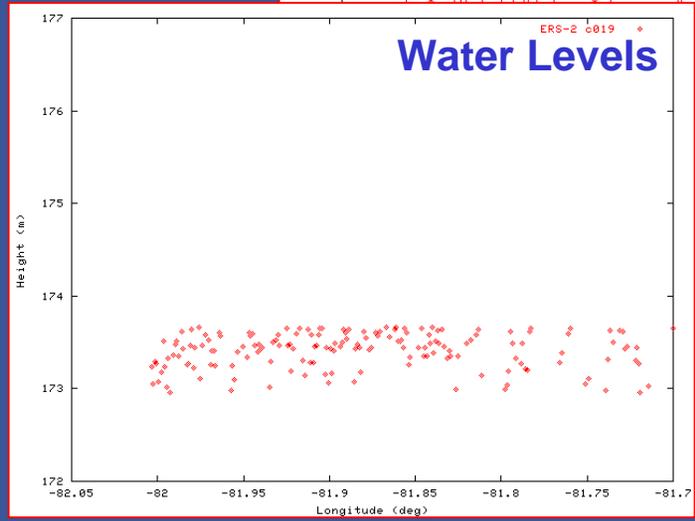
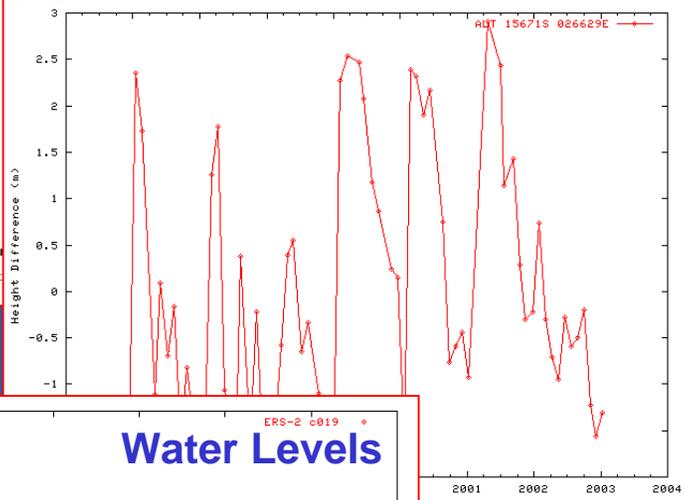
- **Objective:** provide a near-real time information service to water authorities on rivers and lakes water levels;
- Satellite altimeters such as ERS-1/2, Topex, Jason-1 and Envisat were designed to retrieve ocean heights to an accuracy of a few cms.
- A system has now been developed which allows heights to be obtained over inland water, currently to an accuracy of 10-20cms. This accuracy is expected to improve.

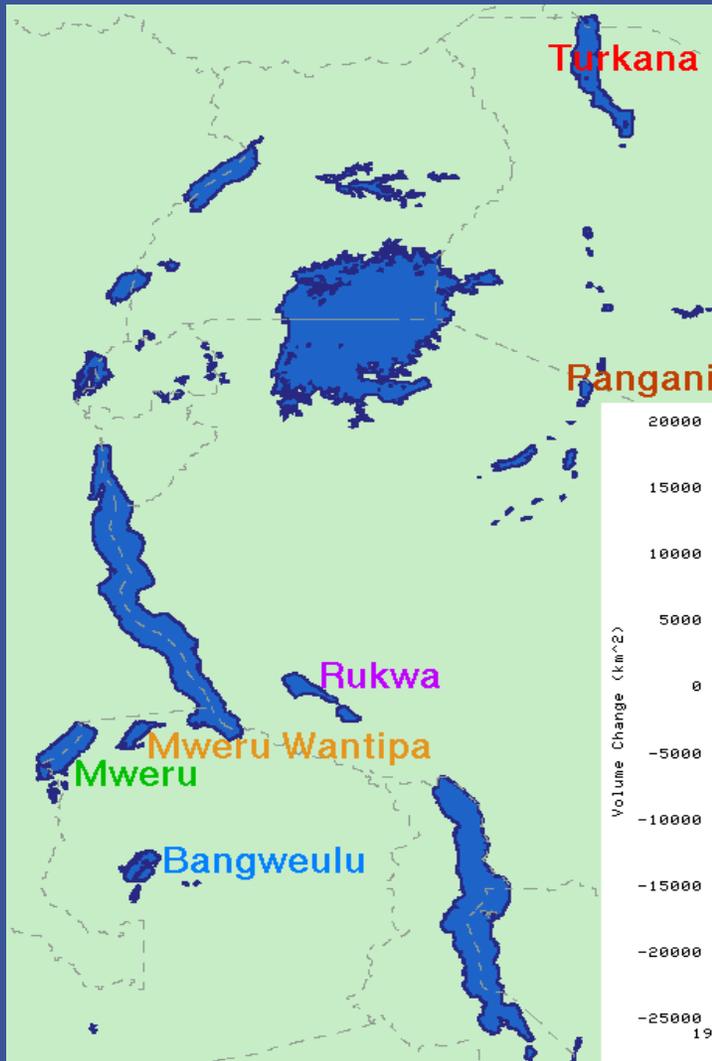




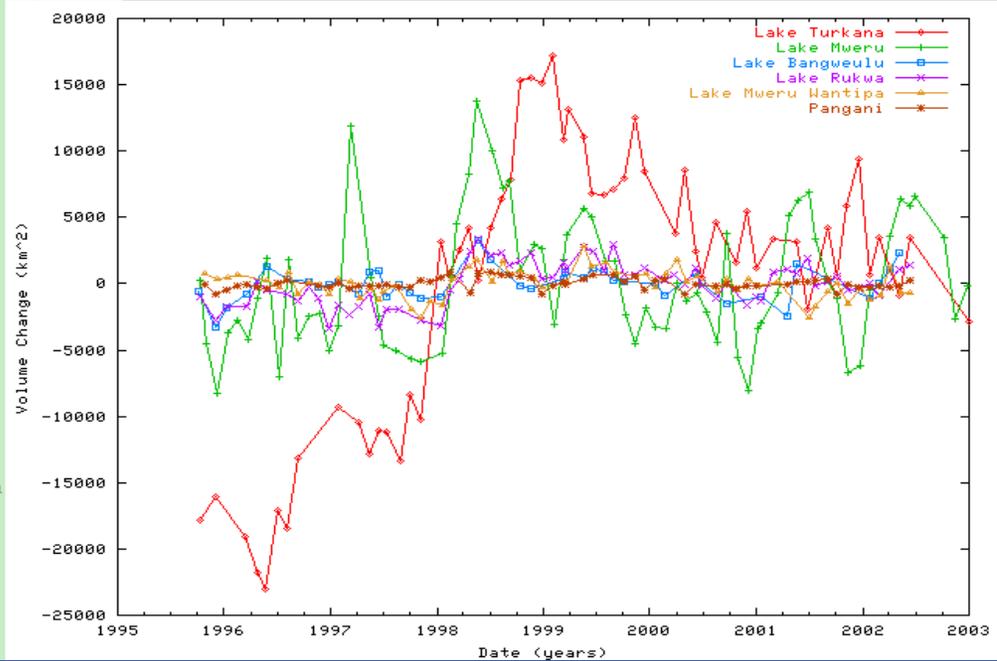


Time series of height differences





East African Lakes Volume Change



Epidemio provides environmental information from Earth Observation to support epidemiologists in the study, monitoring and early warning of human disease.

Services

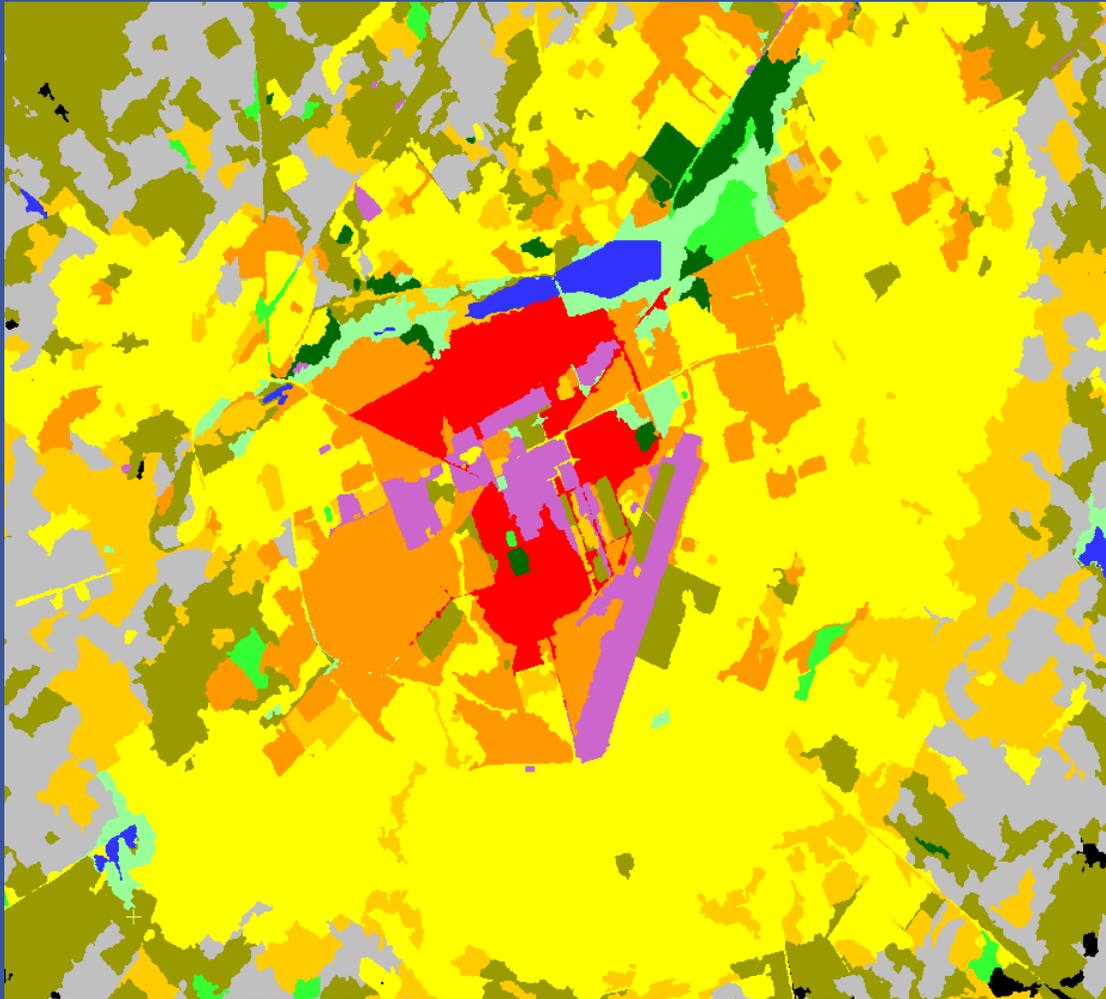
- DEM, water bodies, and land surface temperature for malaria early-warning
- Wind blown dust for meningococcal meningitis early warning
- Vegetation monitoring to target field work on the ebola reservoir
- Urban mapping and cartography to support WHO public health planning

User Group

- WHO
- Pasteur Madagascar
- CIRMF (Gabon)
- CERMES (Niger)
- Himal (Kenya, Uganda)
- London School of Hygiene and Tropical Medicine
- University of Oxford



Prototype Urban Map for Ouagadougou, Burkina Faso



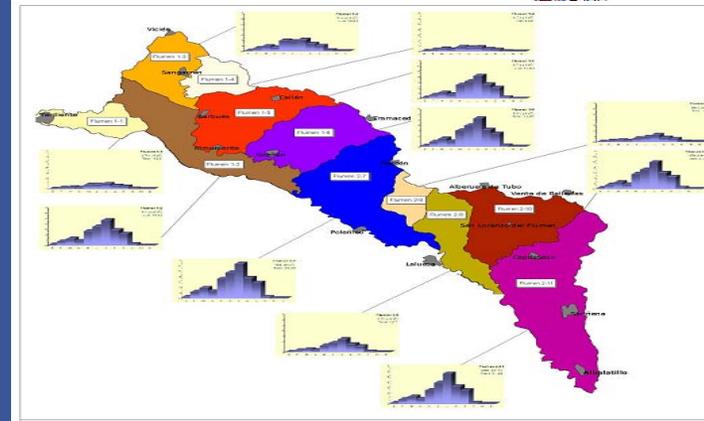
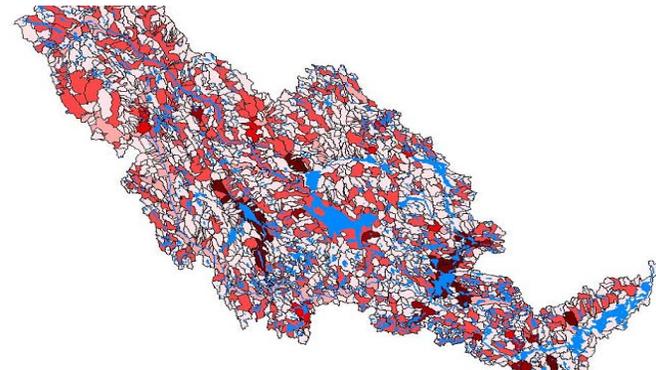
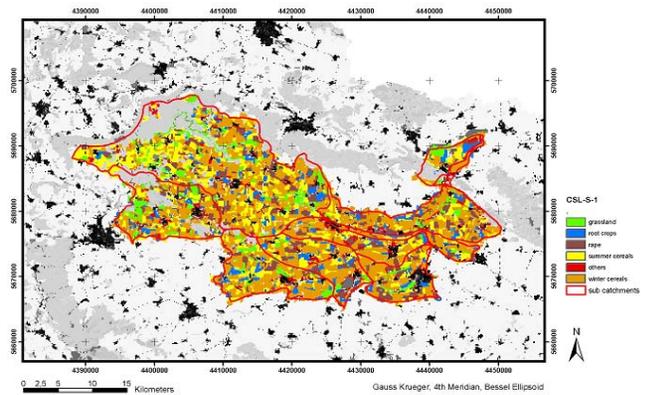
Prototype classification of SPOT-5 image (early results)

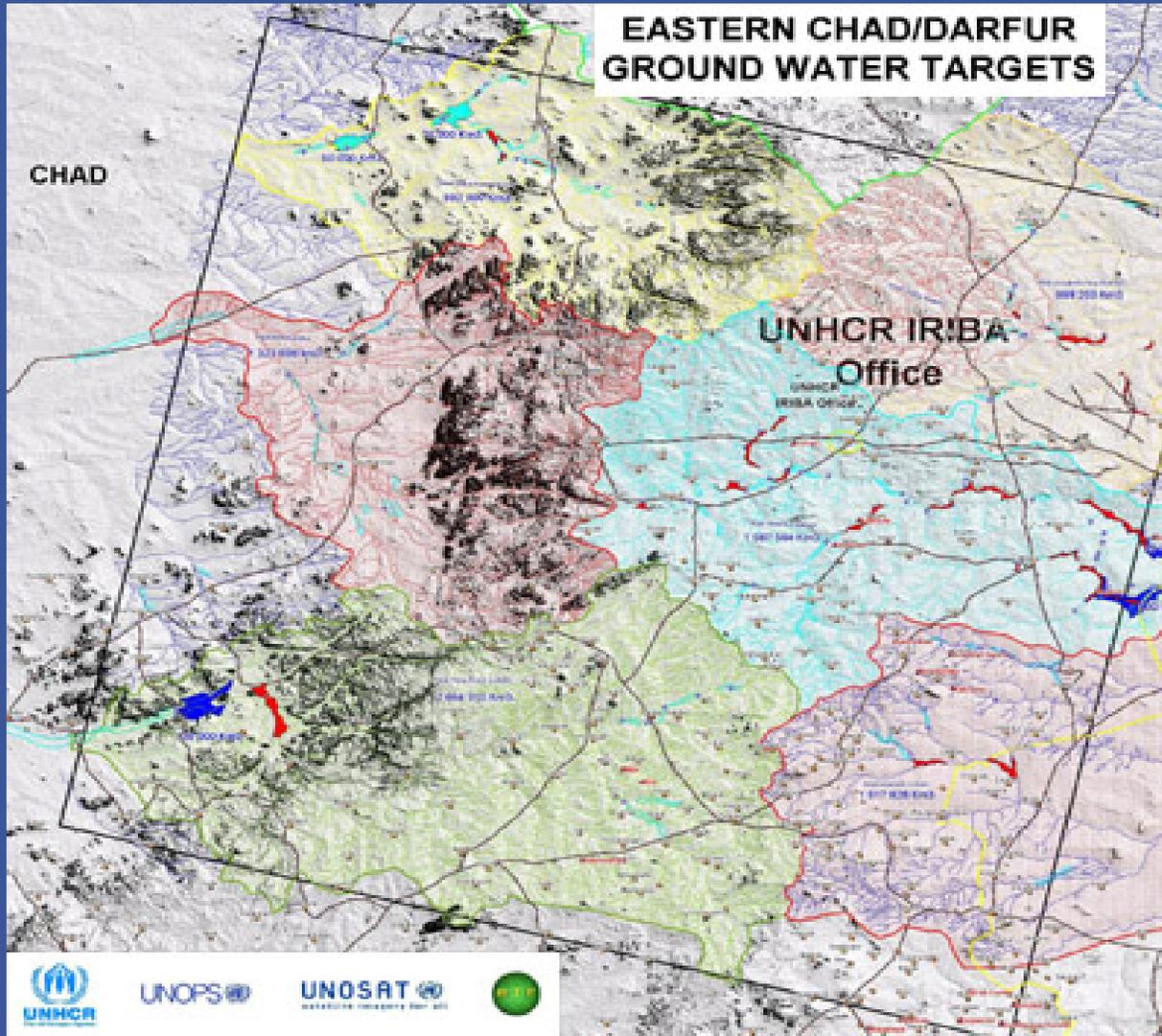
- Water
- Potential Wetlands
- Open Spaces/Vegetated
- Open Spaces/Bare Soil
- Wooded Areas
- Non-Wooded Areas
- Urban Dense
- Urban Medium Dense
- Urban Diffuse
- Commercial and Industrial Zones
- Villages
- Unidentified

- **Environmental and Natural Resources Management:**

- Soil contamination;
- Water consumption;
- Environmental indicators;
- Food Security;

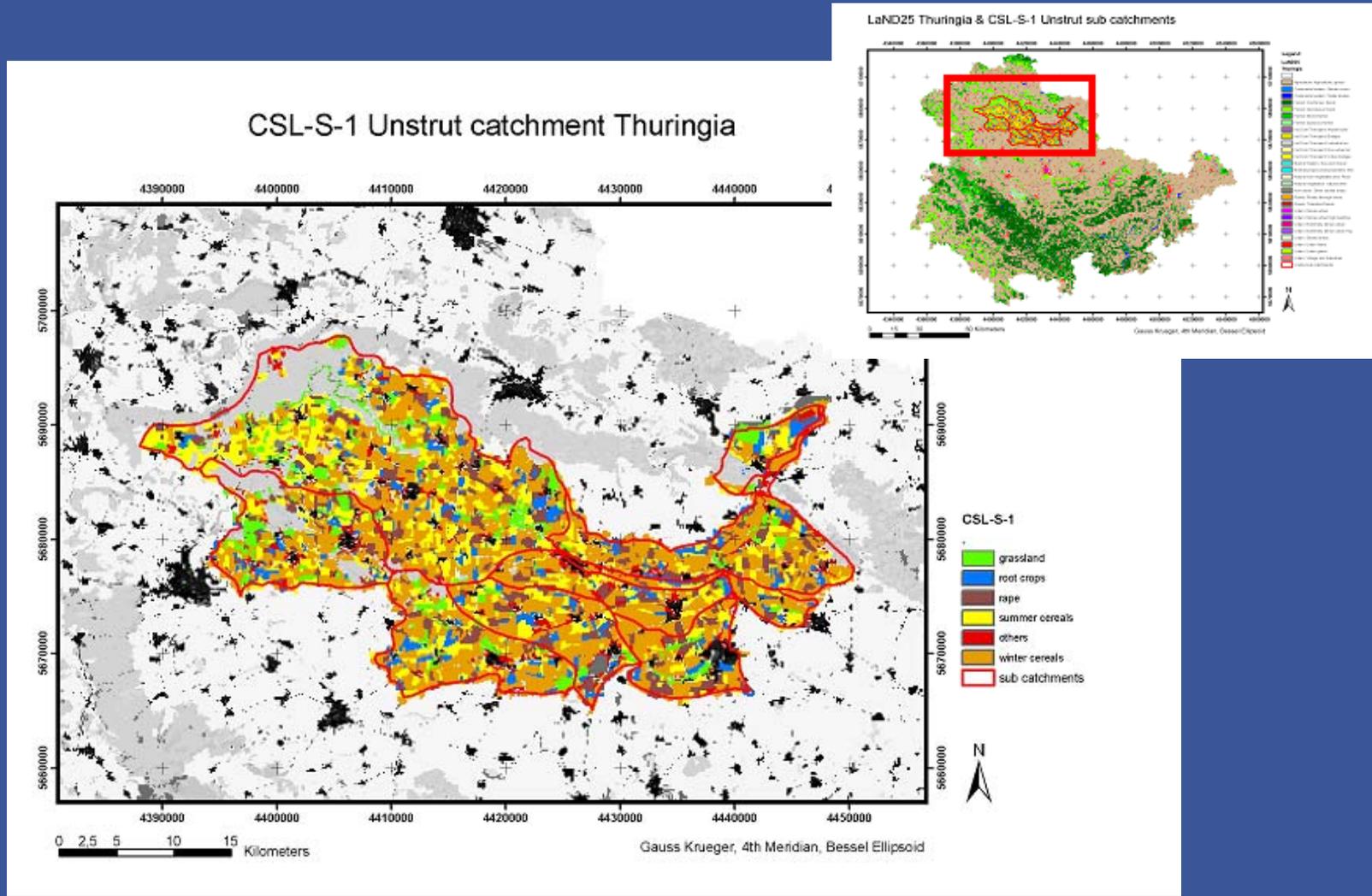
CSL-S-1 Unstrut catchment Thuringia

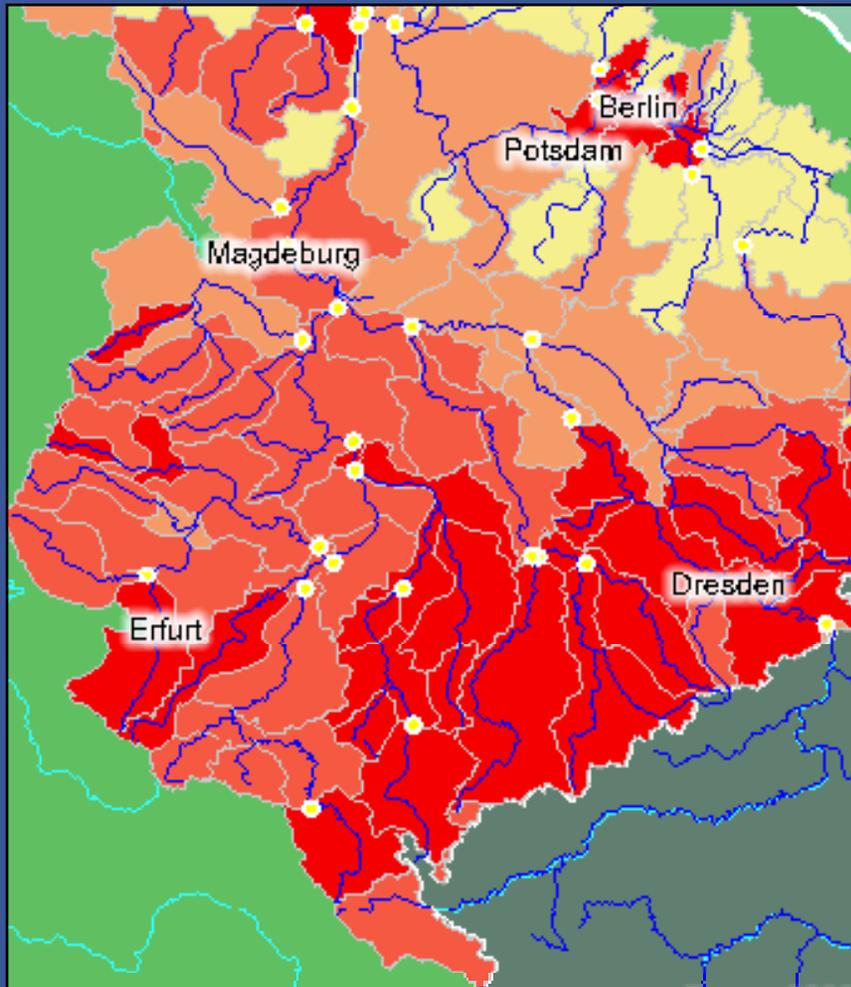




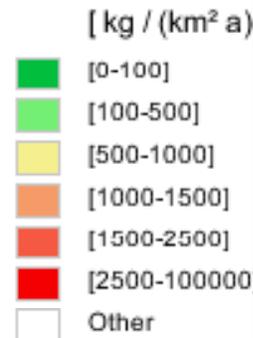
Information provided:

- *Drainage network, watershed*
- *Proposed locations for new well drilling*

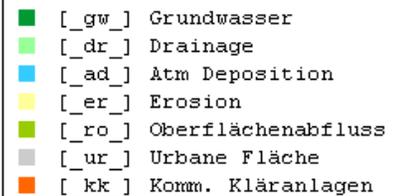
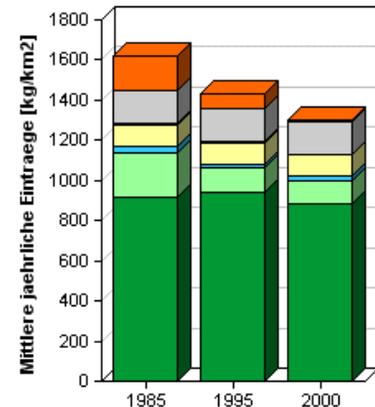




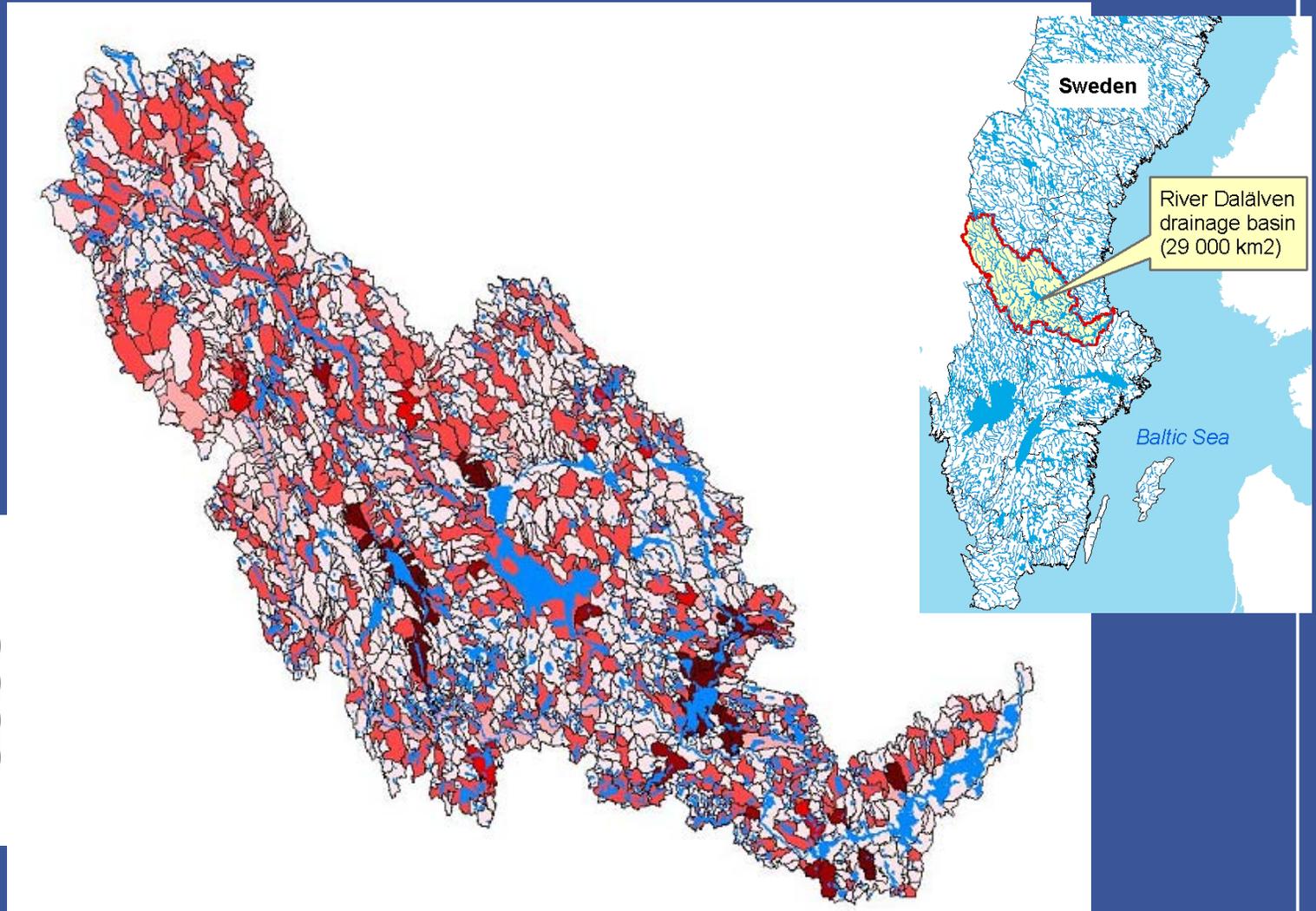
Average Specific Nitrogen Leakage
Elbe Catchment 1985
(Total Emissions)

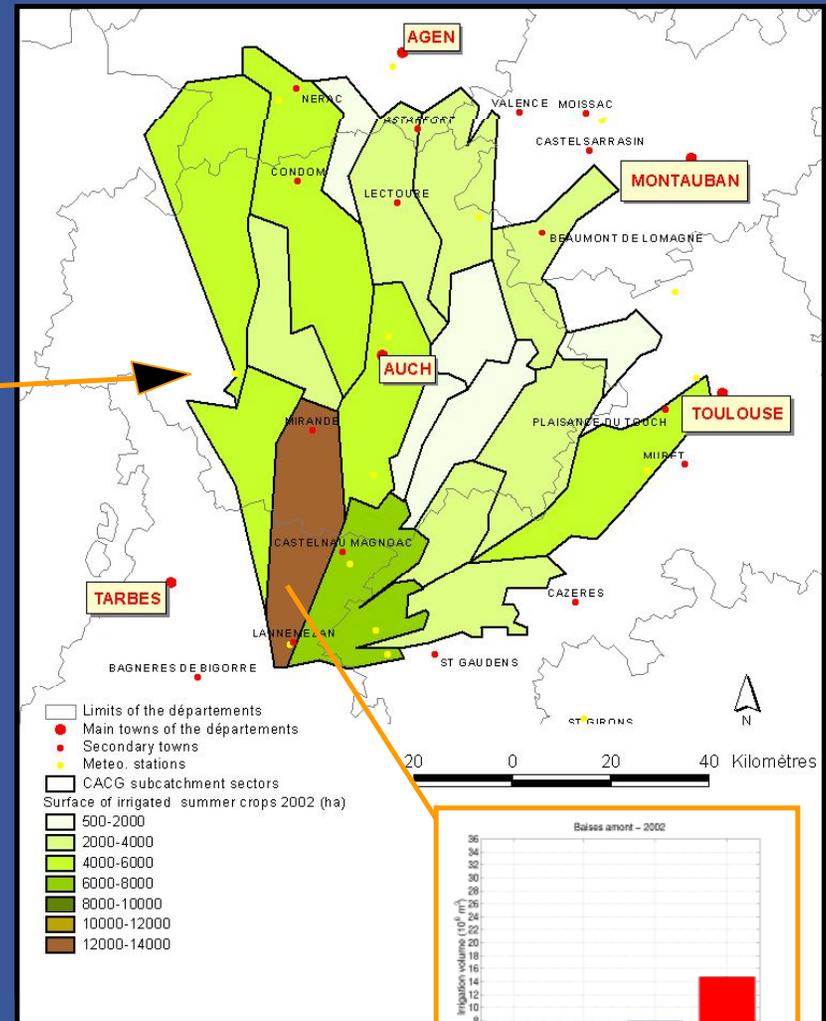


Spezifische N-Einträge [kg/(km²*a)]
in das bearbeitete Teileinzugsgebiet:
'MG Unstrut oh Riethgen'



Agriculture Intensity: Water consumption

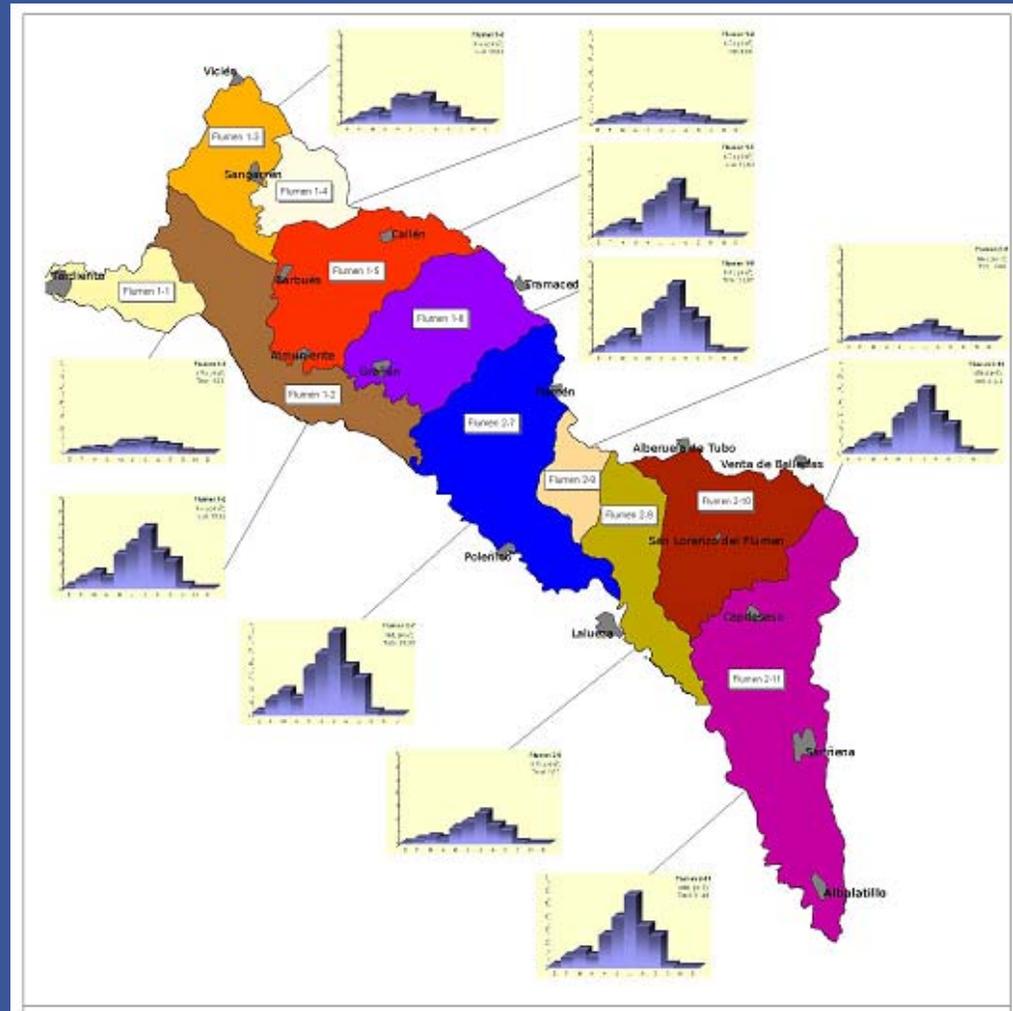
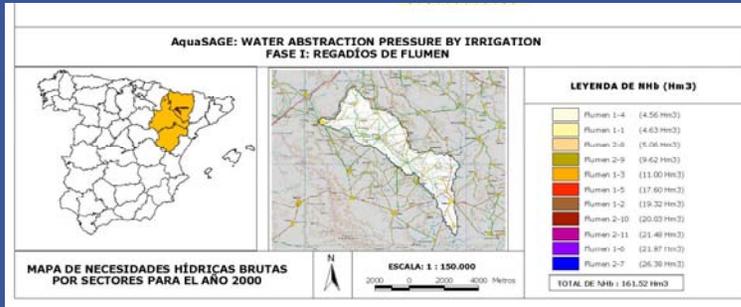




Irrigated surfaces
2002 / Neste system
(France).

Monthly and total
irrigation volumes.

© Astrium SAS

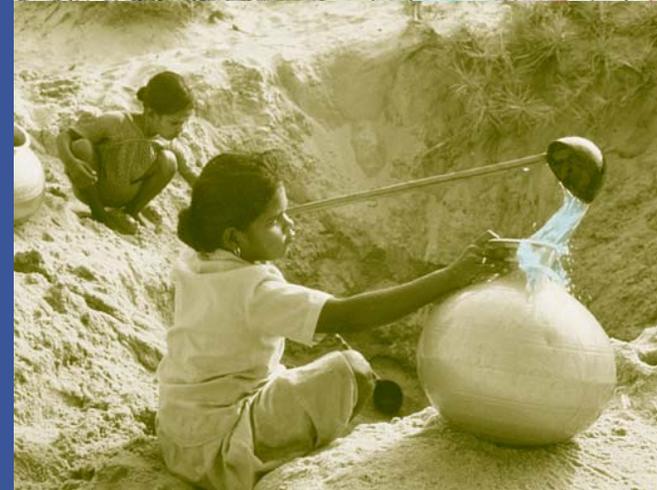
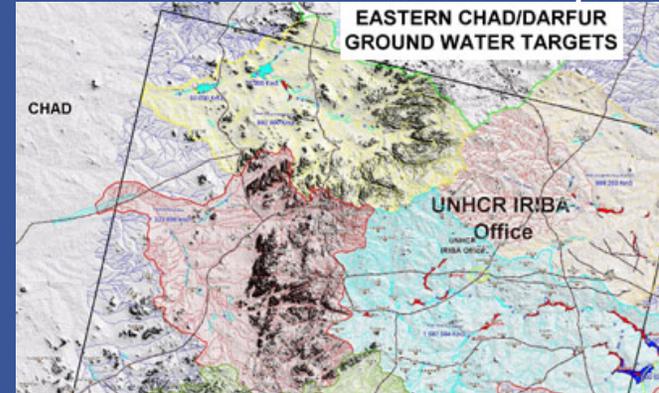


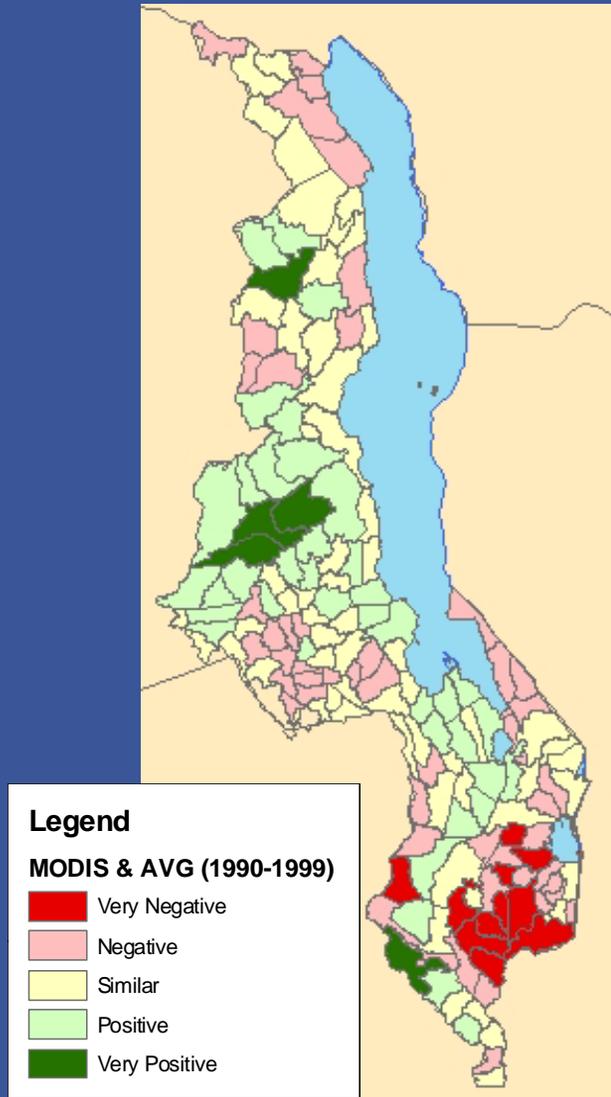
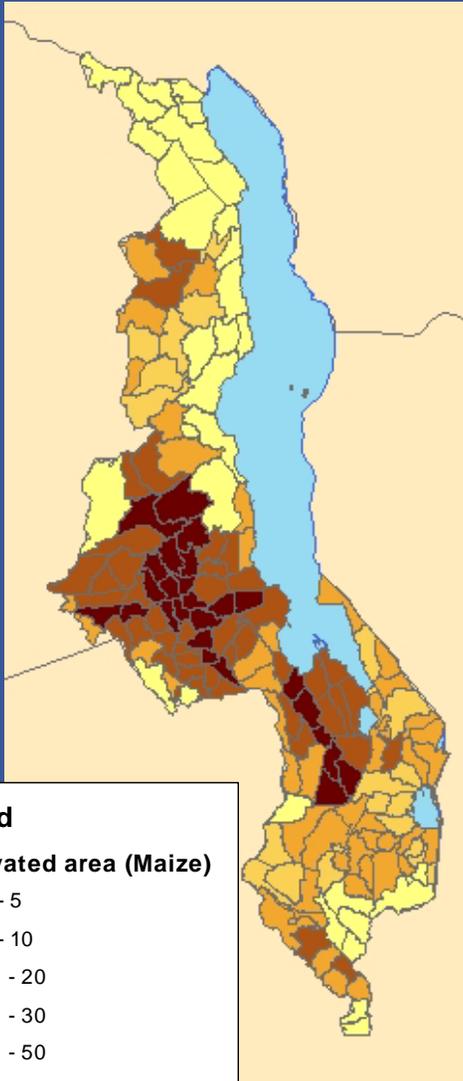
Irrigation Volumes. Flumen Irrigation Unit (Spain)

© Tragsatec SA

- **Sustainable Development and Humanitarian Aid:**

- Support to agriculture management in developing countries;
- Food security;
- Support to humanitarian aid;

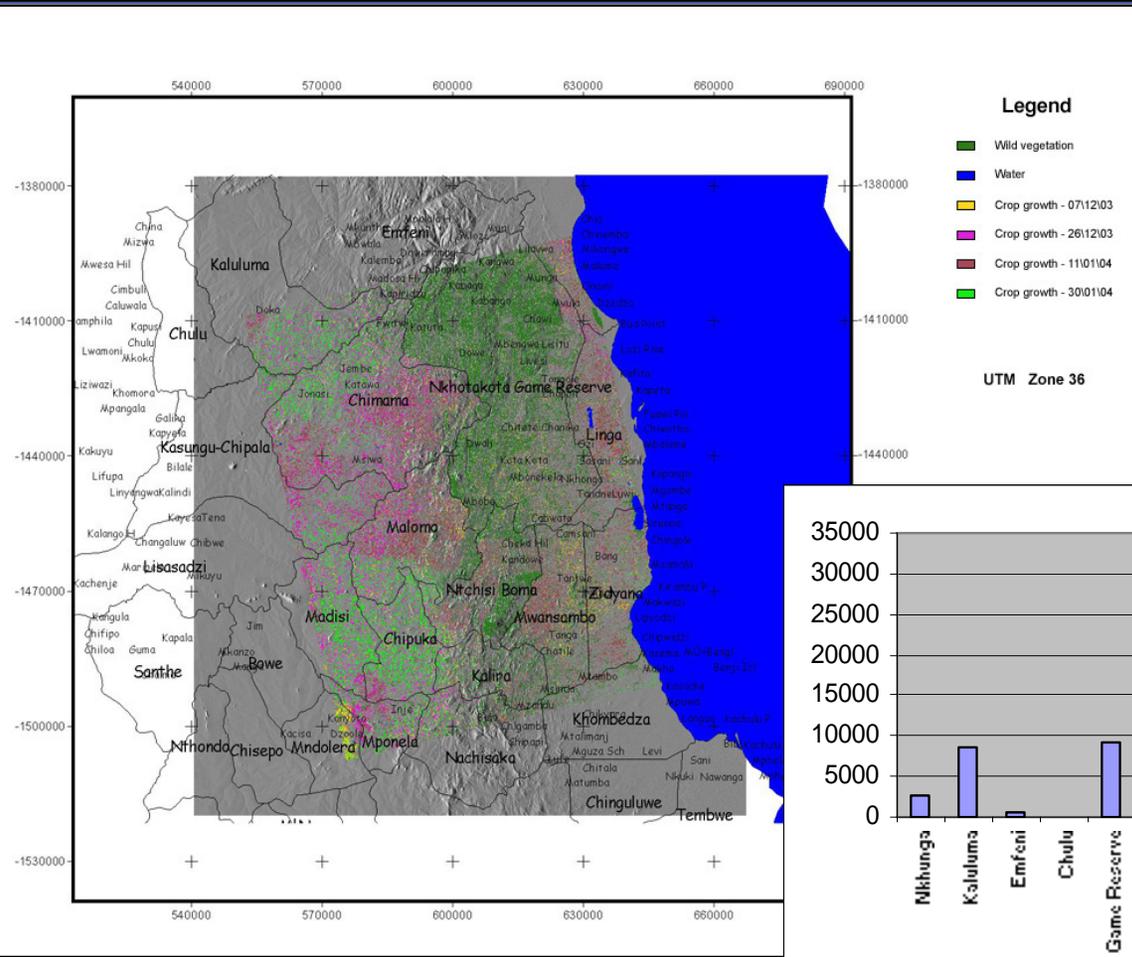




Information provided:

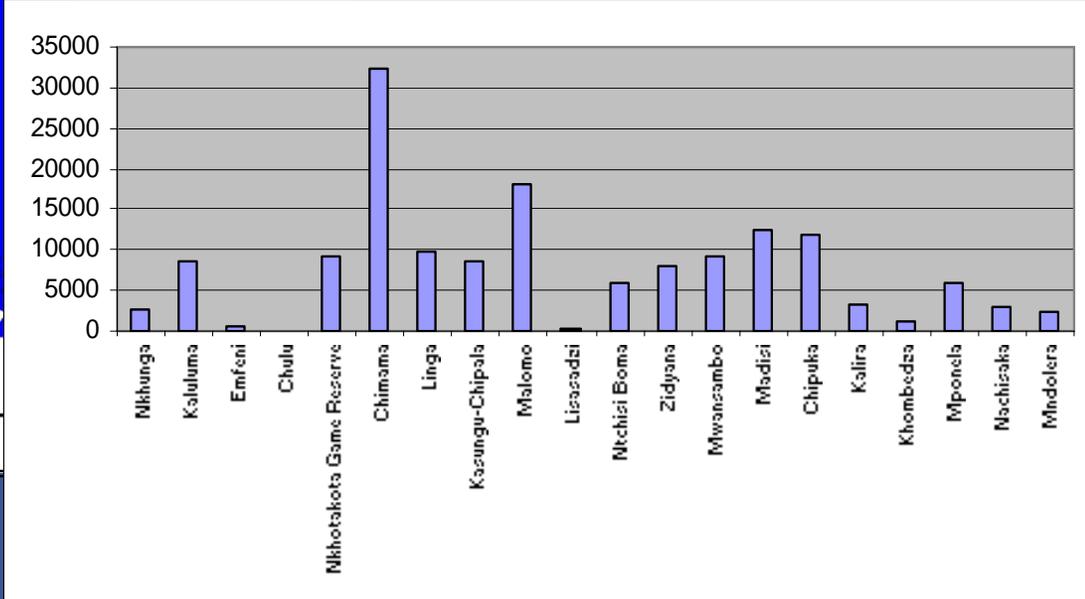
National scale resource base mapping & crop production forecasting:

- High resolution crop type/area + agrometeorological modelling;
- More accurate information for national ministries and international donors;



Information provided: Accurate production assessment:

- Crop planting date monitoring;
- High resolution crop type/area;
- Agrometeorological modelling;
- Rapid service via SAR;





Information provided:

- Topographic maps
- Thematic maps
- Rapid damage assessment

