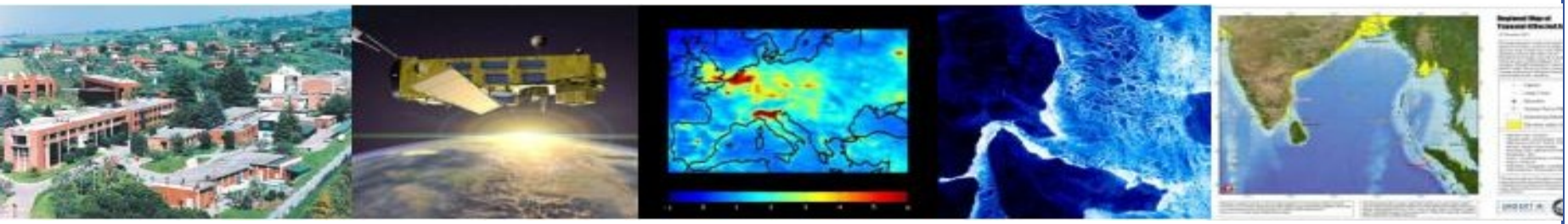
GEO Task WA-06-07b:

Capacity Building for Water Resource Management

Africa

TIGER Initiative
Towards an African
Water Observation Network



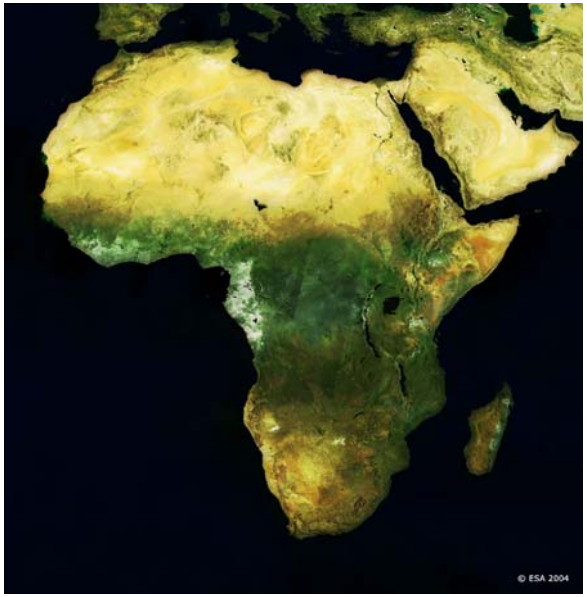
By **Diego Fernandez Prieto (ESA)**

Presented by **Ivan Petiteville (ESA)**

European Space Agency
Agence spatiale européenne

the Living Planet

The TIGER Initiative: Origin



- **TIGER is running since 2002, when ESA (*European Space Agency*) launched TIGER as a CEOS response to World Summit on Sustainable Development.**

- **The TIGER goal is to "*assist African countries to overcome problems faced in the collection, analysis and dissemination of water related geo-information by exploiting the advantages of Earth Observation technology*".**

- **TIGER is International initiative included in the GEO Work Plan;**

- **The African component of TIGER involve m*ore than 150 African experts that actively participate in TIGER projects and capacity building actions;***

- **Key partners includes CEOS (ESA (European Space Agency) - CSA (*Canadian Space Agency*)), the *African Ministerial Council on Water (integrated now into the AU structure), the African Development Bank, the African Union Commission and the UN-Africa Water Group (UNESCO, UN-ECA), DWAF, R. of South Africa.***

UNESCO · BANQUE AFRICAINE DE DEVELOPPEMENT / AFRICAN DEVELOPMENT BANK · Every drop counts / Count every drop / AMCOW / African Ministers' Council on Water · Economic Commission for Africa · CSA ASC · DEPARTMENT: WATER AFFAIRS AND FORESTRY · Ramsar · CEOS

Implementation

- *Development information services fully accepted and integrated into user daily activities is a complex task even in most developing countries (e.g., GMES efforts and investments).*

- *In Africa this objective is even more challenging because the human, technical and institutional capacity in the Continent;*

- *However, Africa is the region of the world where the need for water information is more urgent and vital;*

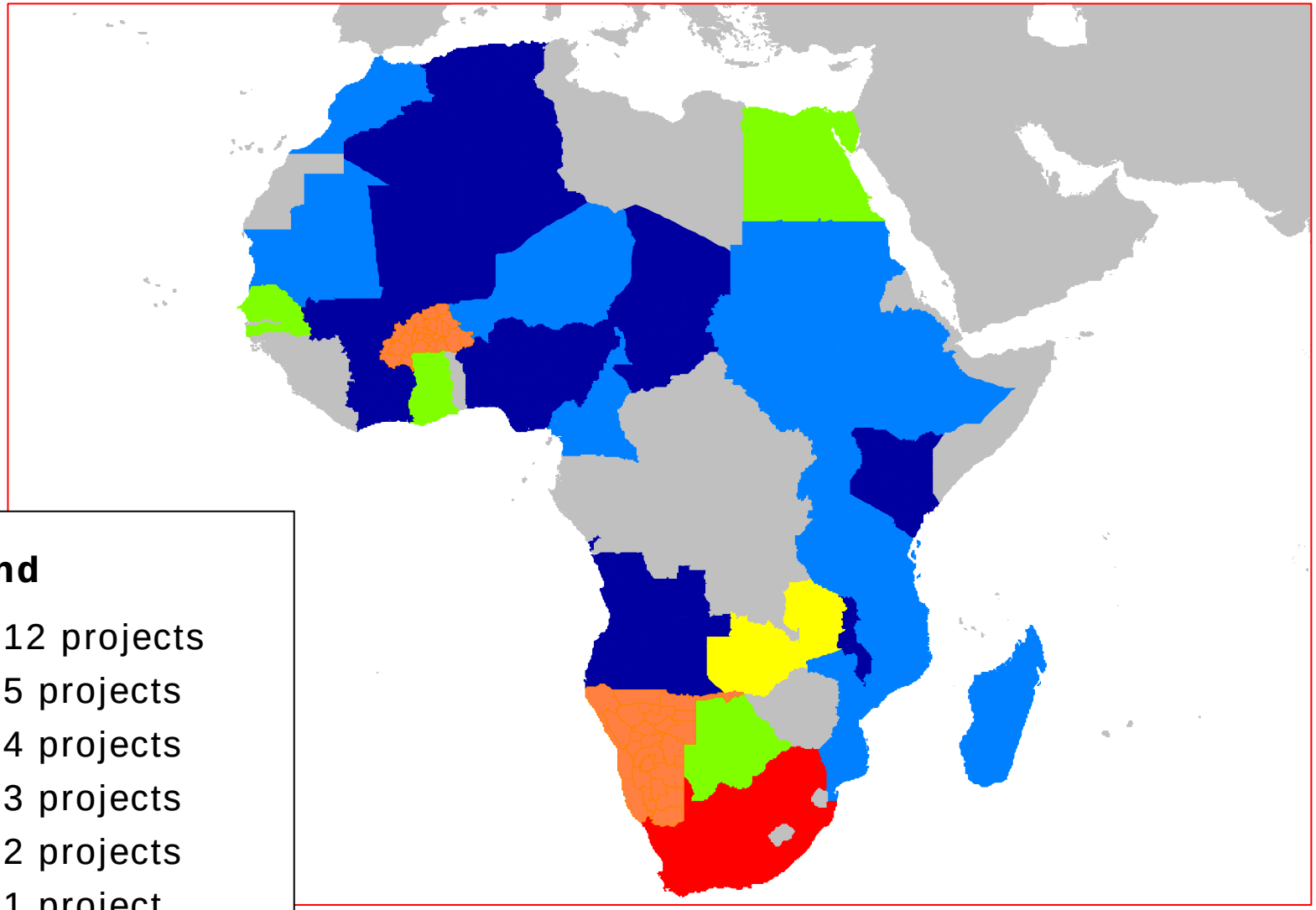
- *A long term process is required in order to allow African institutions to know, understand, use and get the full benefit of EO technology ;*

TIGER Phase 1: Scientific Component

- **Scientific Component:**
  - *Aimed at supporting African scientist, research centres and laboratories to advance towards the effective use of EO technology in water research and hydrological studies.*
  - *This is done through: 1) A large set of African lead research projects; 2) a strong capacity building component; 2) Free access to EO data; 3) dedicated software tools; 3) Scientific coordination and networking*
  - *From 2005-2008, 50 projects leaded by African scientists involving more than 150 institutions.*

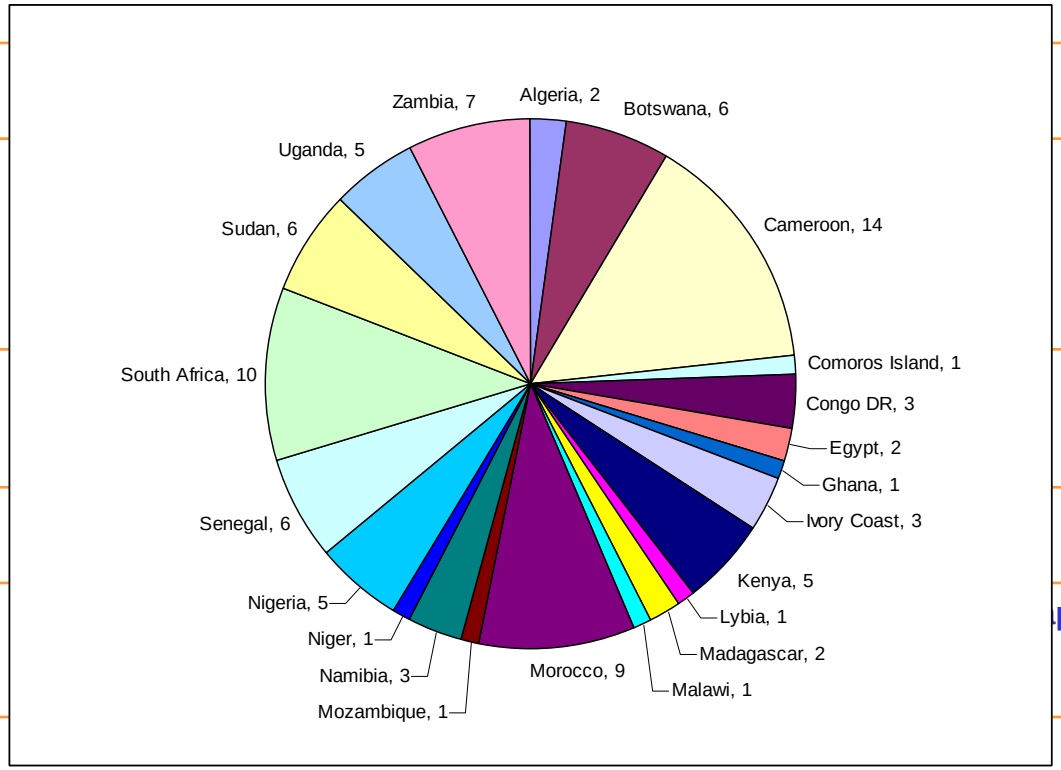
  - *More than 20 Training Sessions in African and Europe supported by CEOS, UNESCO, AfDB;*
  - *Dedicated Training Tool Kits: including courses, data and free Software tools;*
  - *TIGER Capacity Building Facility (leaded by ITC) created September 2006 offering: 1) Scientific coordination; 2) Dedicated courses (at ITC and in Africa); 3) Tailored technical support and research stages; 4) E-learning;*

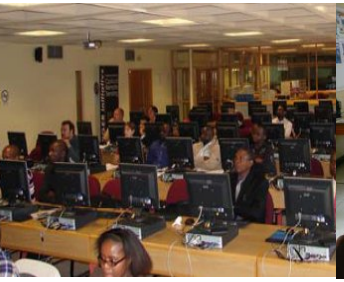
TIGER Phase 1: Water Research Network



TIGER Phase 1: Capacity Building Facility

Activity		participants (courses)
Core training		33 (58)
Applied courses		31 (39)
Research stages		21 (71 weeks)
Advanced courses	pe,	51 (2)

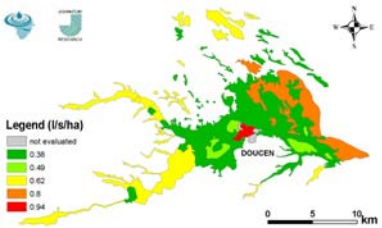


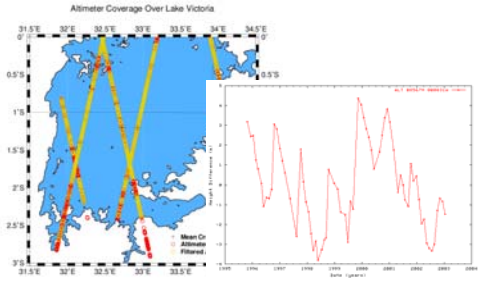


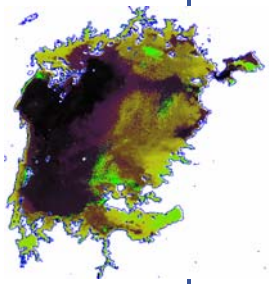


TIGER Phase 1: Service Development

- **Service Development Component:**
  - ***Support water authorities at national and basin scale to set up prototype information systems and services to improve Integrated Water Resource management;***
  - ***An initial service portfolio have been developed and demonstrated through 16 projects funded by ESA and CSA with more than 6MEuro in collaboration with more than 30 African users.***



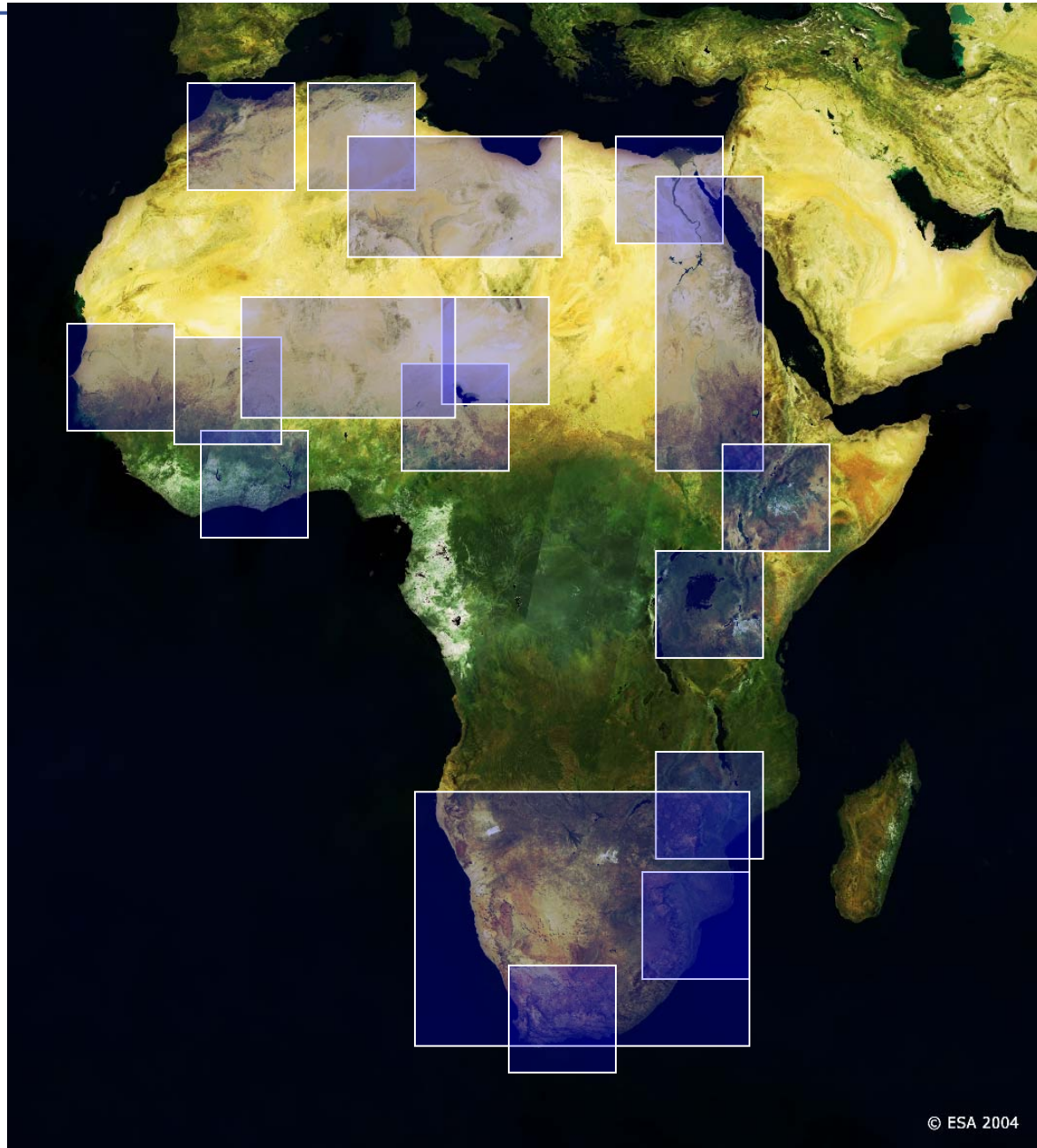




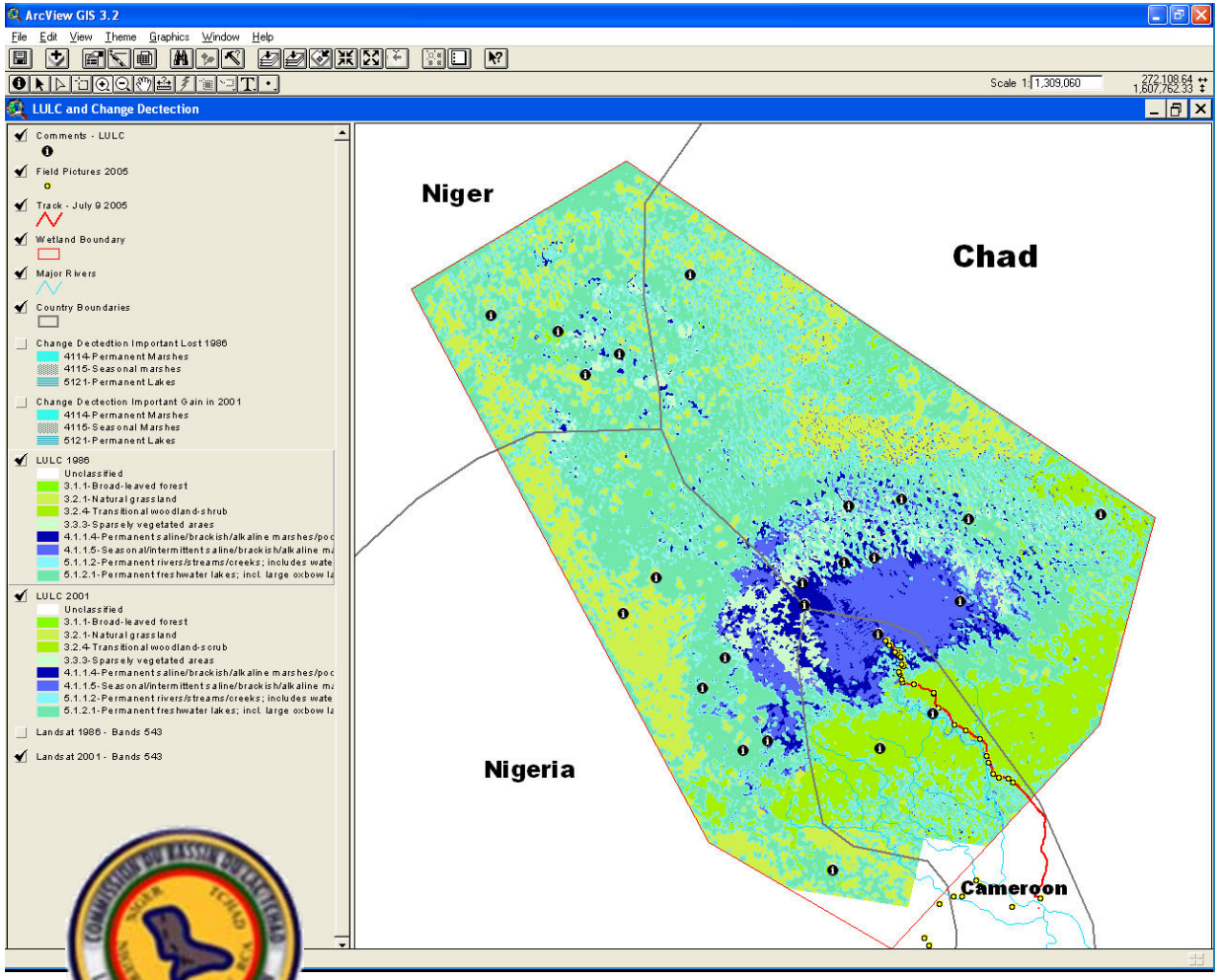
- **Activities have involved more than 30 African water authorities at both national and trans-boundary basin scales;**
- **Projects (funded under ESA DUE) followed a Develop-Demonstrate-Transfer (DDT) approach aimed at *empowering African users to take the lead in managing the transition towards an operational phase and ensuring sustainability in the long-term;***

TIGER Phase 1: Service Delivery 2005-2008

- *Base mapping: e.g., surface waters;*
- *Water quality;*
- *Soil moisture information service;*
- *Water levels information service;*
- *Catchments characterisation;*
- *Ground water exploration;*
- *Water consumption: e.g., irrigation;*



TIGER Phase 1 Examples: Lake Chad



Lake Chad
Information System

Training Session
Lake Naivasha,
Kenya

European Space Agency
Agence spatiale européenne

the Living Planet

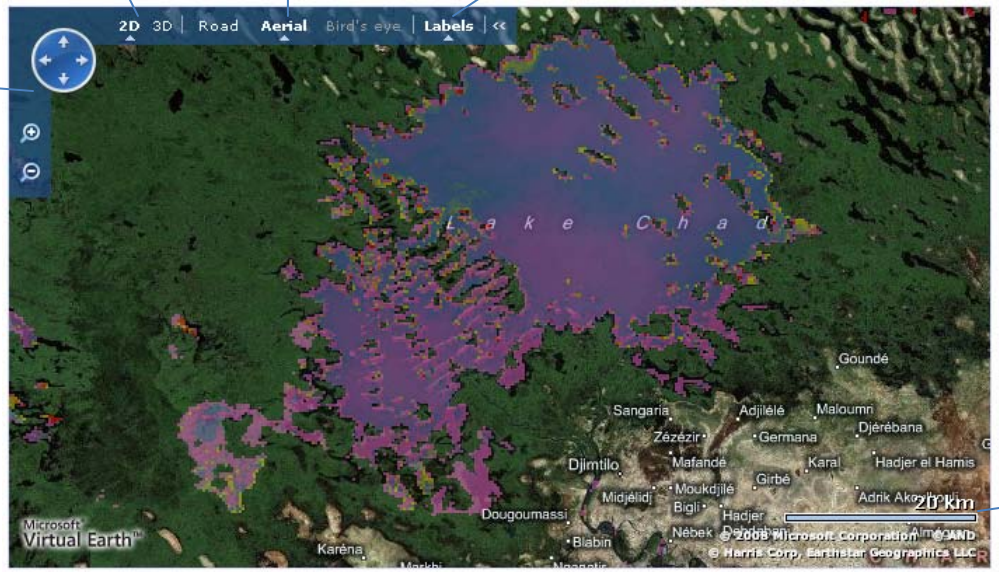
TIGER Phase 1 Examples: Lake Chad

Satellite/topo map view

2D/3D map view

Labels on/off

Map navigation



Scale bar

Transparency settings

Transparancy 0 % 25 % 50 % 75 %

TerraSphere

Abstract	Draw Layer	Legend	FTP
Chlorophyll 10 october 2007 [MERIS]	☑	0.0 — 20.0 mg/m3	ftp
Chlorophyll 7 october 2007 [MERIS]	☐	0.0 — 20.0 mg/m3	ftp
Chlorophyll 4 october 2007 [MERIS]	☐	0.0 — 20.0 mg/m3	ftp

List of products found

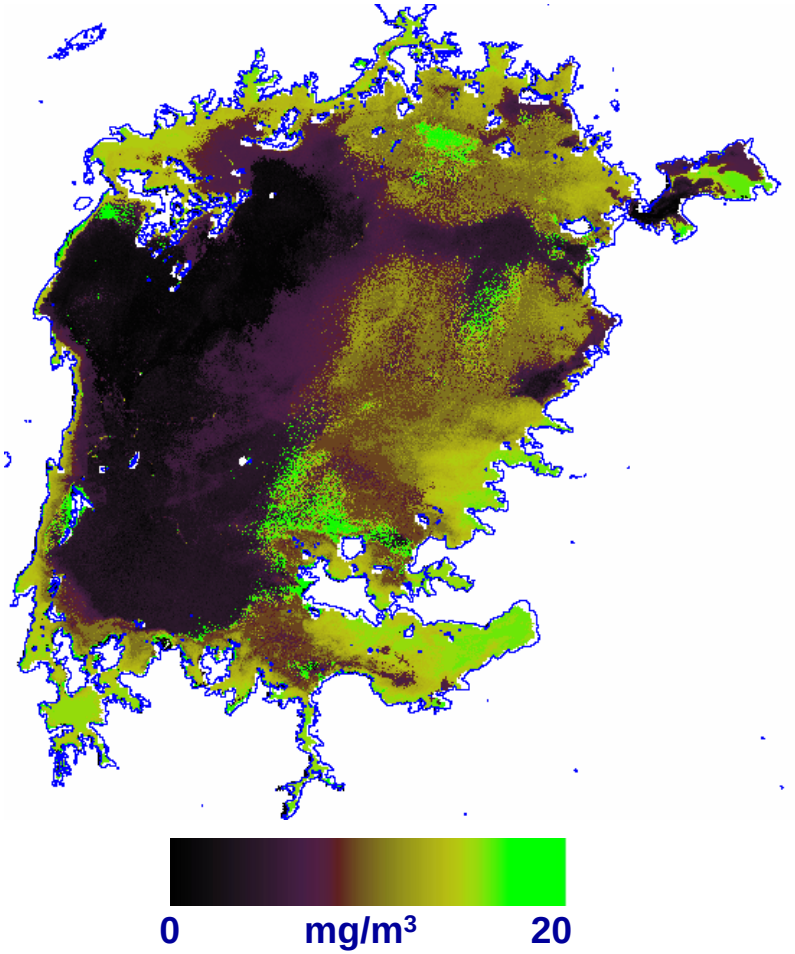
Layer selection

Legend

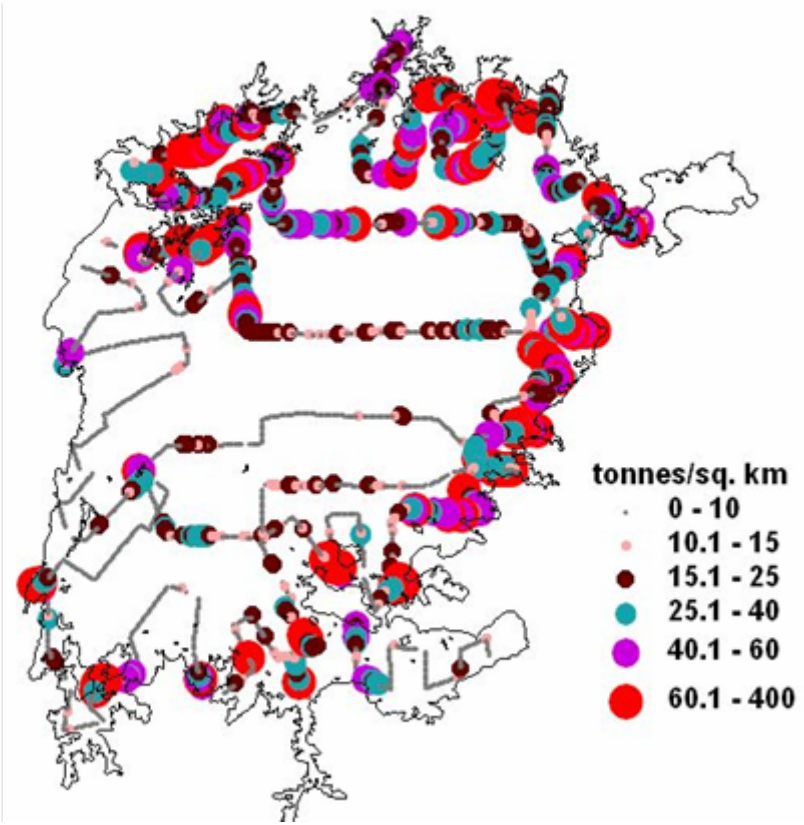
Download button

TIGER Phase 1 Examples: Lake Victoria

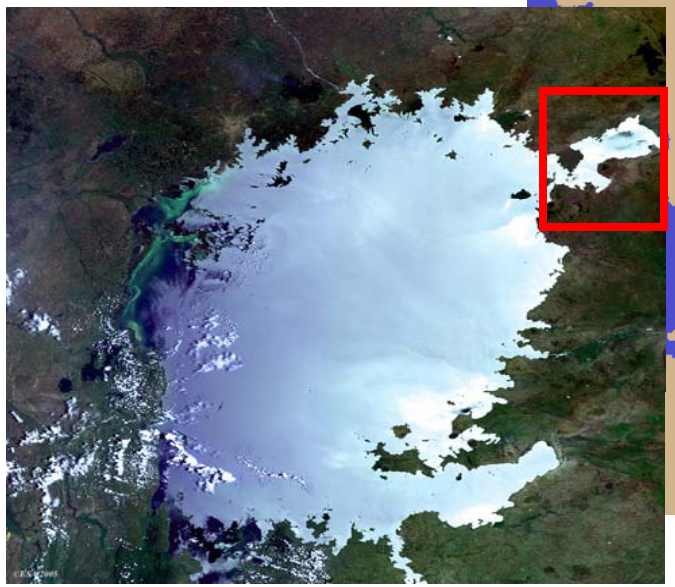
Remote Sensing data
Total chlorophyll



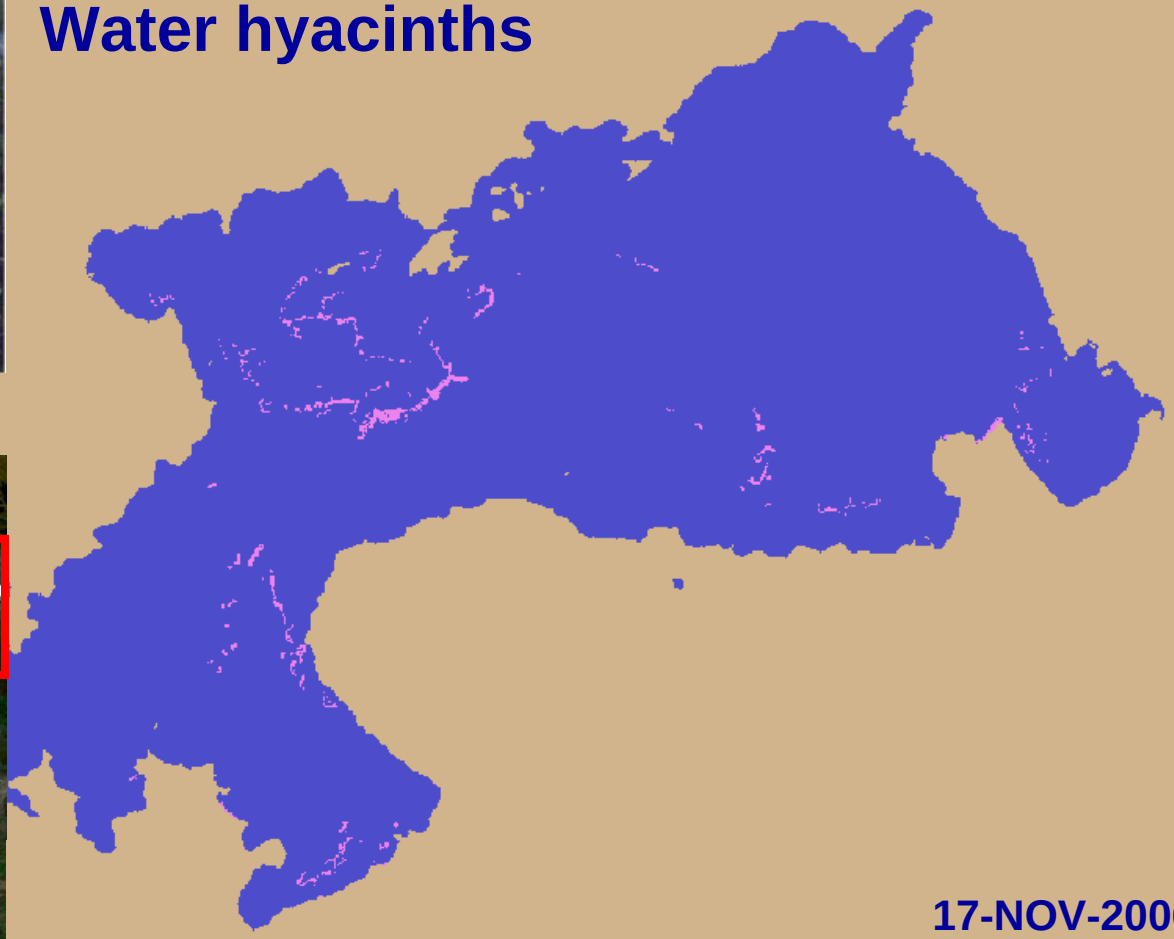
Spatial distribution of the pelagic *R. argentea*



TIGER Phase 1 Examples: Lake Victoria



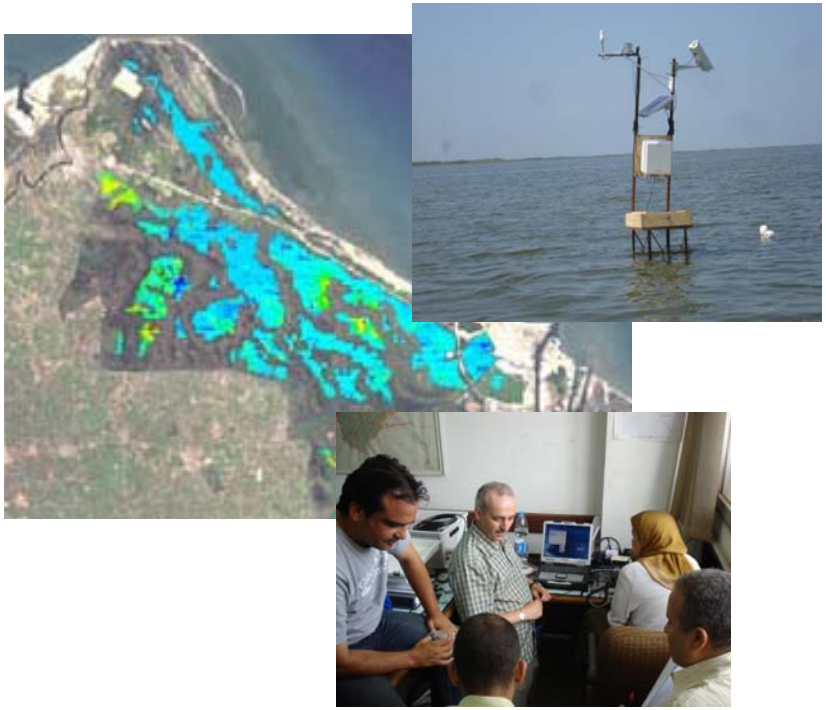
Water hyacinths



Winam Gulf (Lake Victoria) – From ASAR

TIGER Phase 1 Examples: Egypt

- **Objective: Develop and implement a water quality information service based on EO data in Lake Mazala, Egypt;**
- **User group:**
  - ✓ **Drainage Research Institute (Egypt);**
  - ✓ **Ministry of Water Resources (Egypt);**
- **Prime: C-CORE;**



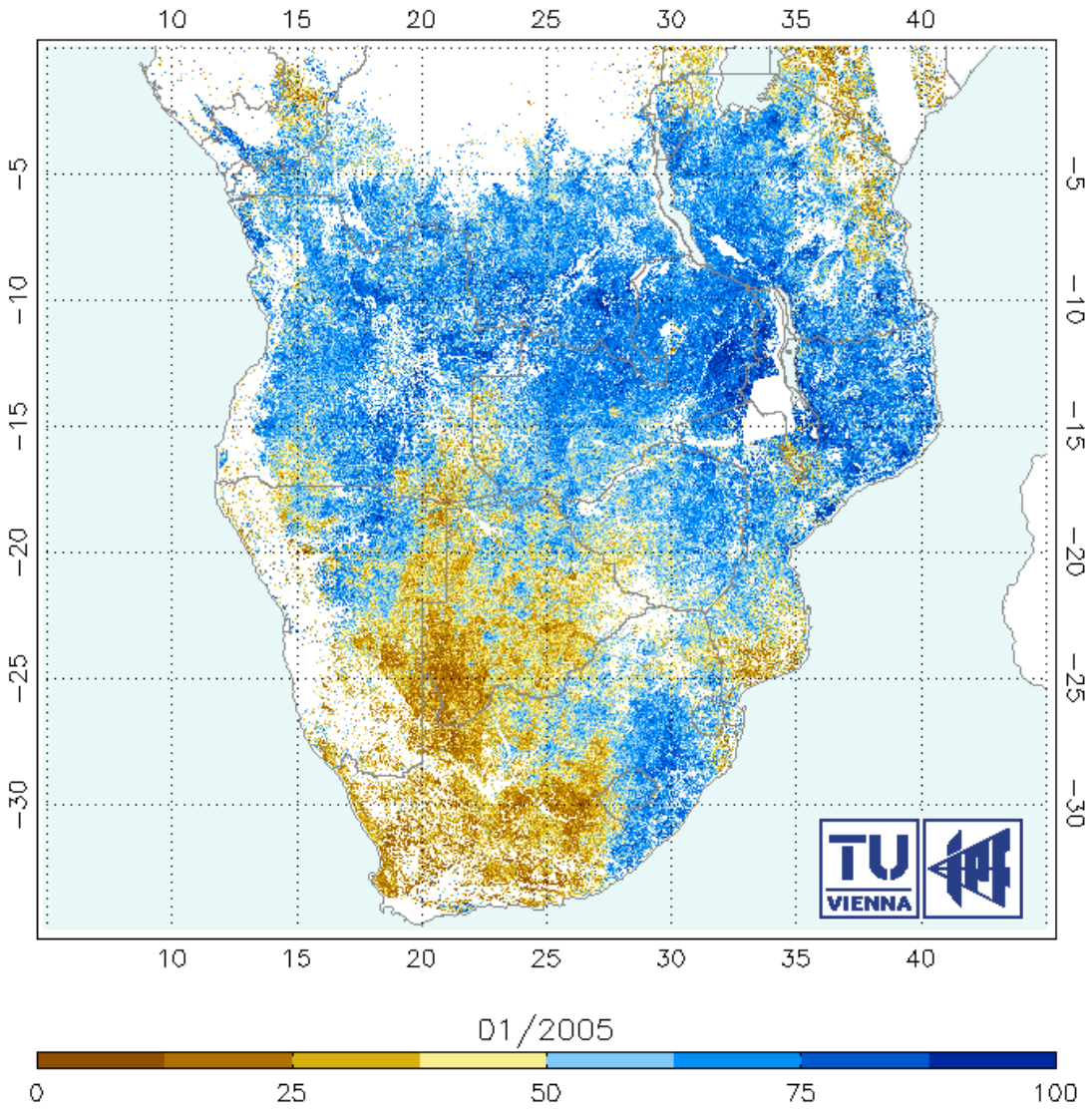
- **Budget: 450 Keuro**
- **Water Information Products:**
  - ✓ ***Turbidity,***
  - ✓ ***Chlorophyll;***
  - ✓ ***Organic matter;***
  - ✓ ***Algae blooms warning;***

TIGER Phase 1 Examples: Egypt

- Lack of in-situ observation network hinders calibration of EO data;
- Under this conditions only relative information products can be delivered to the users.
- This hinders the full applicability and usefulness of this technology in Africa;
- An enhanced system based on the integration of EO technology and automatic telecom supported in-situ stations is under development;
- In-situ stations will send water quality RT measurements to a processing center in Egypt where the data will be integrated with EO data (MERIS images);

Installation of one of the in-situ stations in August 2009.

TIGER Phase 1 Examples: Soil Moisture

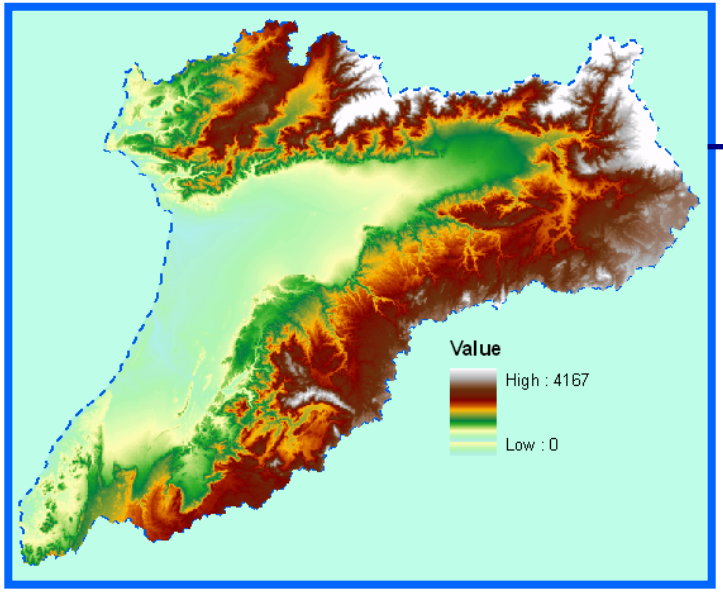


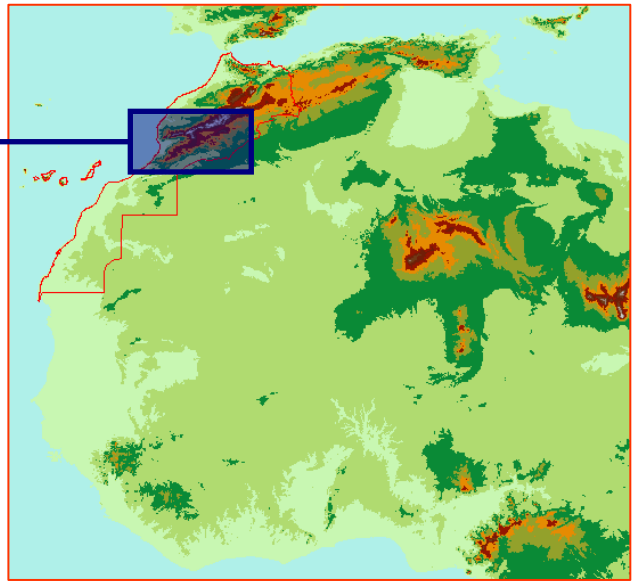
Objective:

Provide a soil moisture information service for all the SADC area based on ENVISAT ASAR GM data.

The image shows the monthly average soil moisture % values relative to the local maximum and minimum observed during 2006.

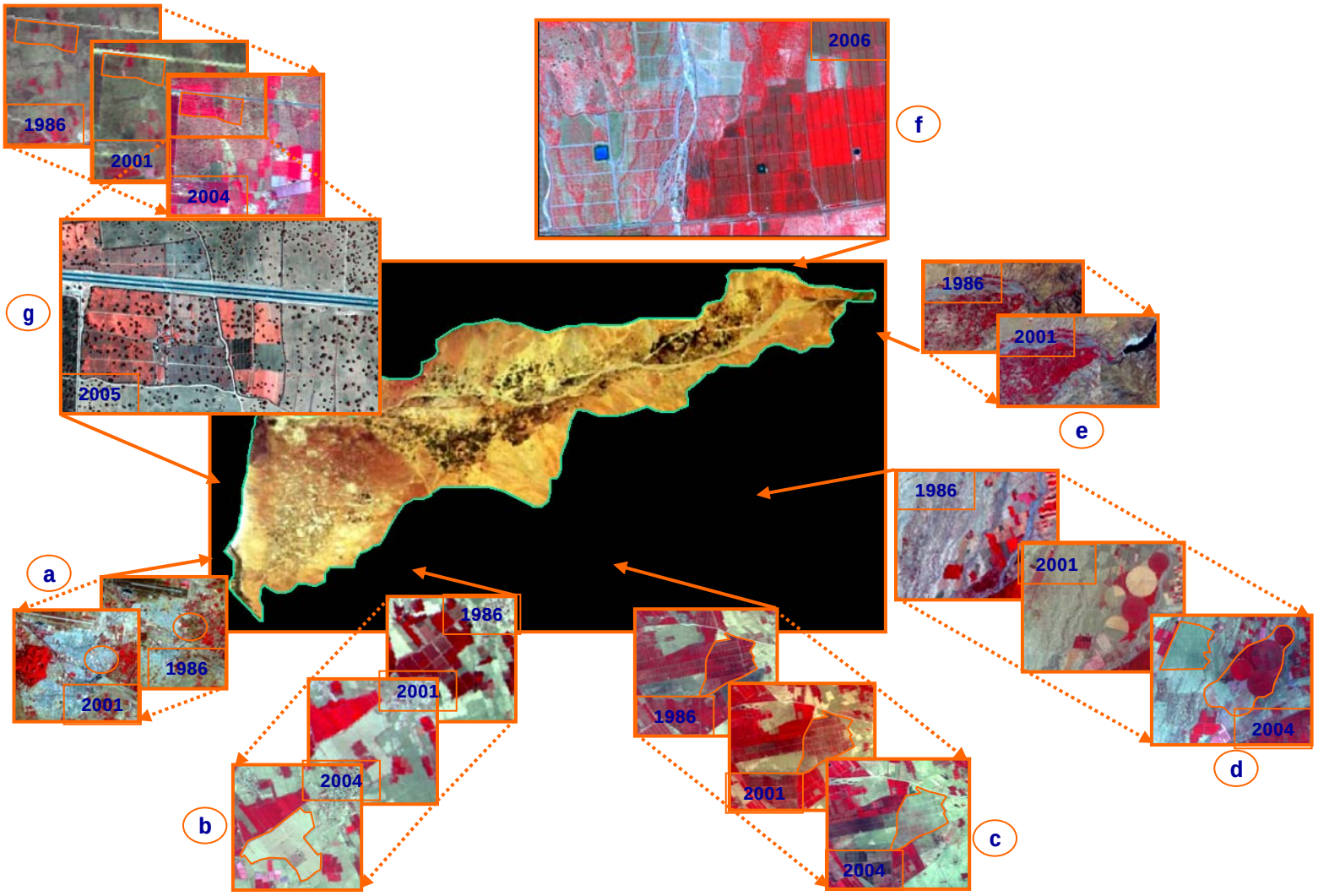
TIGER Phase 1 Examples: Souss-Massa Project (Morocco)





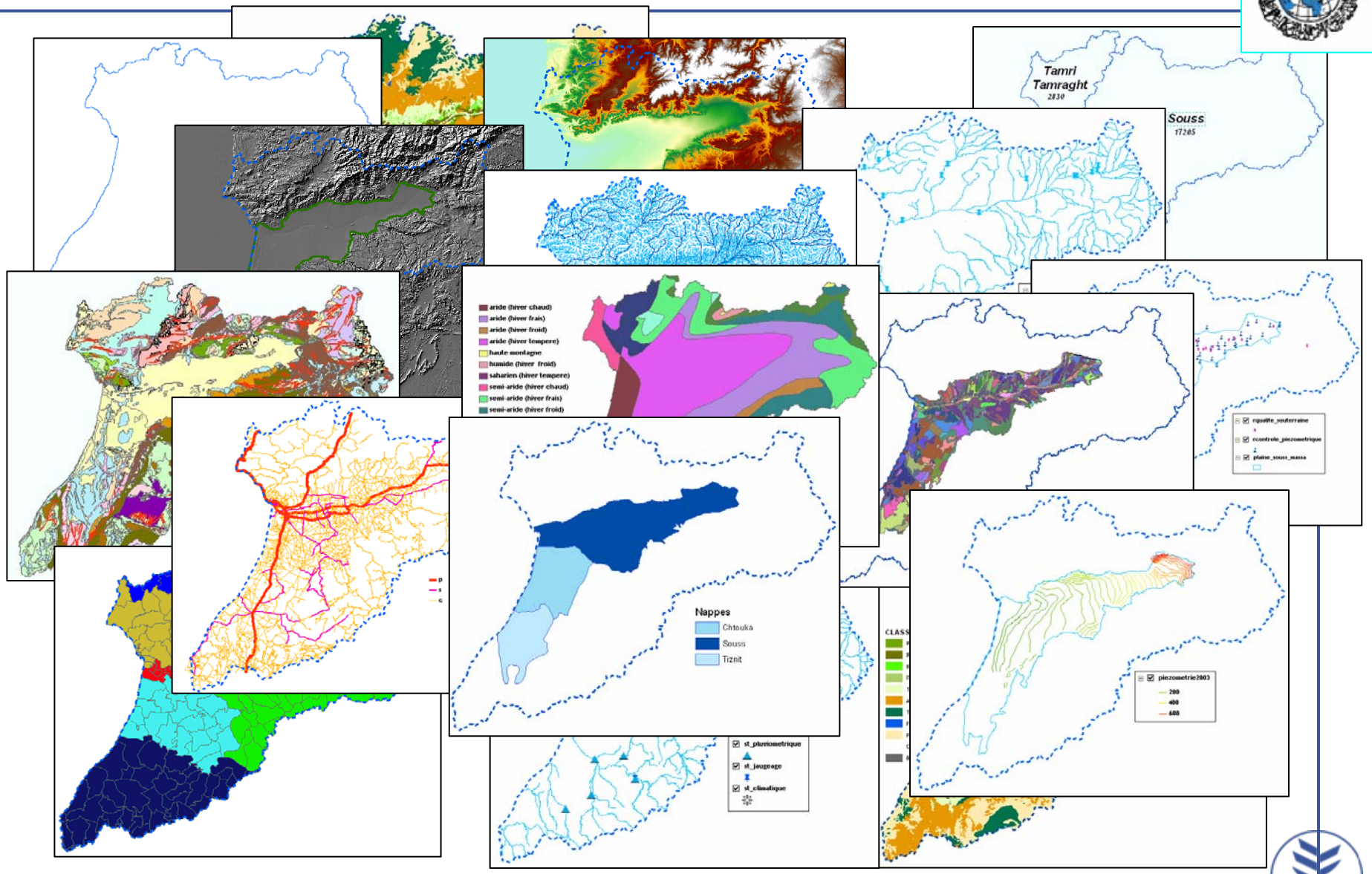
Agricultures and farmer need to travel several miles to access water for irrigation in one of the major river basins in Morocco (Souss-Massa)

TIGER Phase 1 Examples: Souss-Massa Project (Morocco)



a- Urbanization, b- Soils degradation, c- Groundwater over-exploitation, d- Groundwater conservation, e- Densification of irrigated zones, f- Growing irrigated zones, g- Forest.

TIGER Phase 1 Examples: Souss-Massa Project (Morocco)

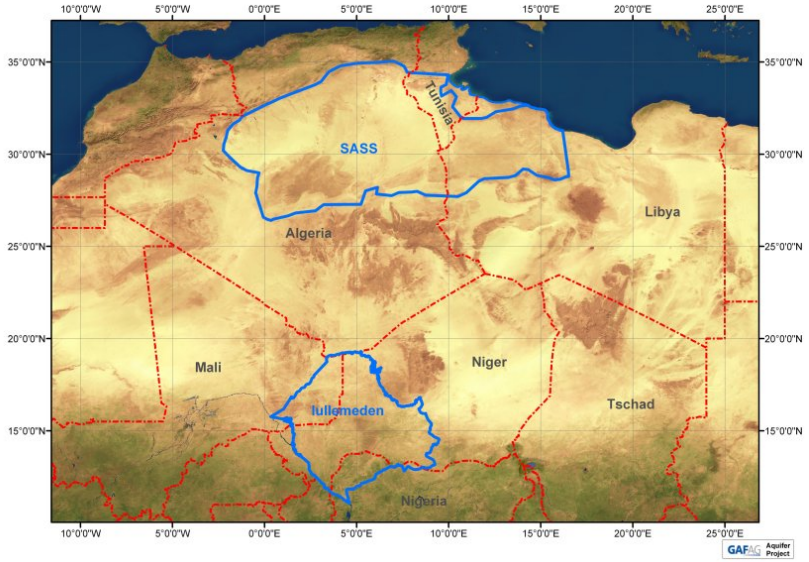


TIGER Phase 1 Examples: AQUIFER

Objective:

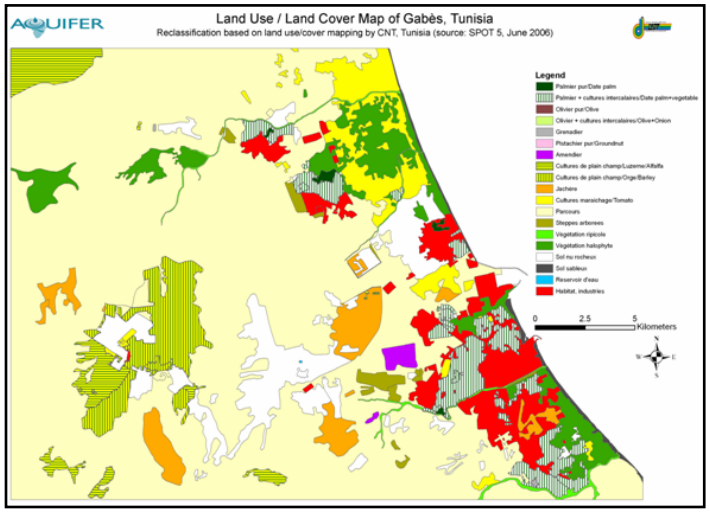
- **Develop and demonstrate products and services based on EO technology to support the management of trans-boundary aquifers in Africa (SASS and Iullemeden areas);**
- **Transfer the system to local service providers and promote local operations;**

Budget: 1,000,000 Euro;

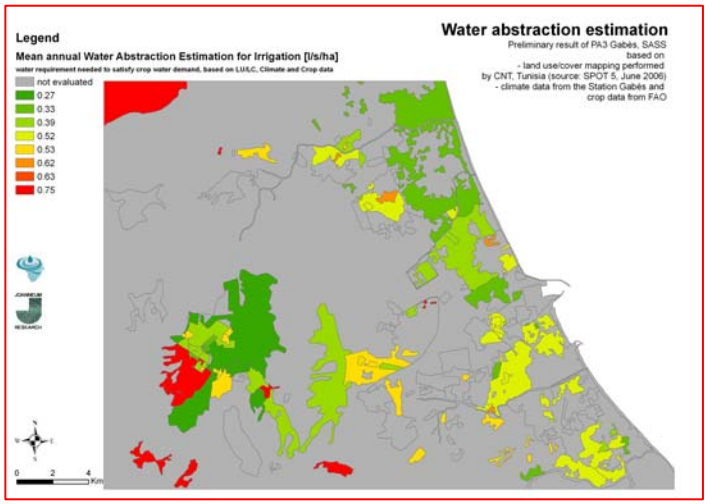


- **Carried out by an international consortium leaded by the German company GAF;**
- **Users: Ministries in Algeria, Libya, Mali, Niger, Nigeria, Tunisia;**
- **User coordinator: OSS;**
- **Local providers: AGRHYMET, Remote sensing centers in Tunisia, Libya and Algeria.**

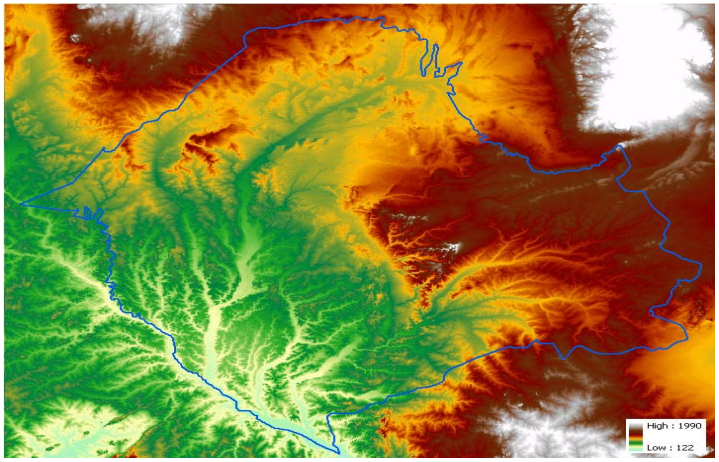
TIGER Phase 1 Examples: AQUIFER



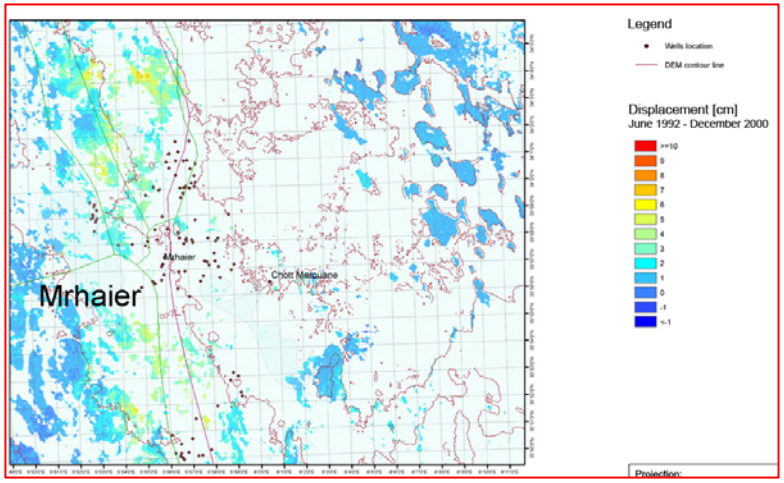
Irrigation and crops maps



Water abstraction estimation



DEMs



Subsidence mapping

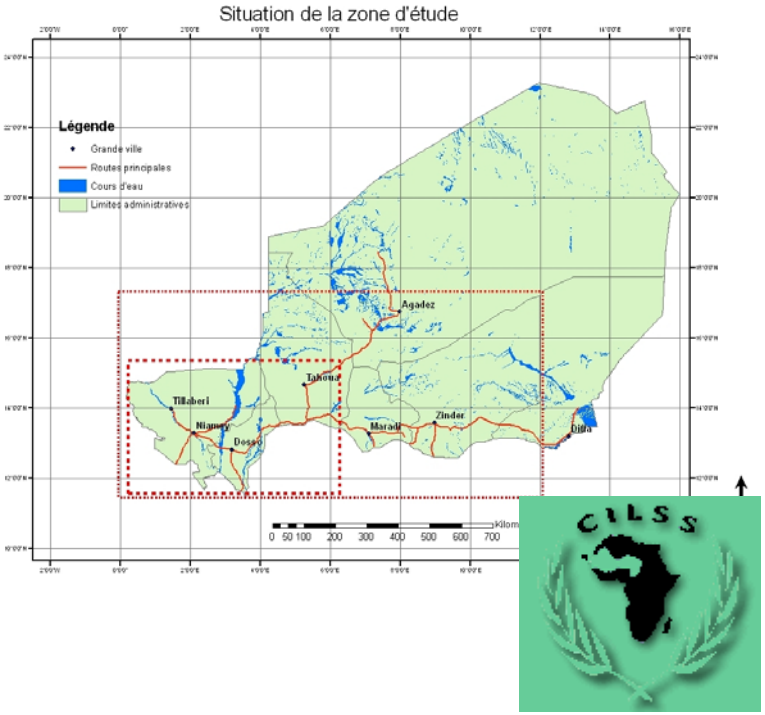
TIGER Phase 1 Examples: WADE (Sahel)

Problem:

- **Water scarcity and lack of precipitation is a problem in the Sahel area..**
- **There is an urgent need to user authorities to identify both surface temporal water bodies and potential areas for ground water.**

Objective:

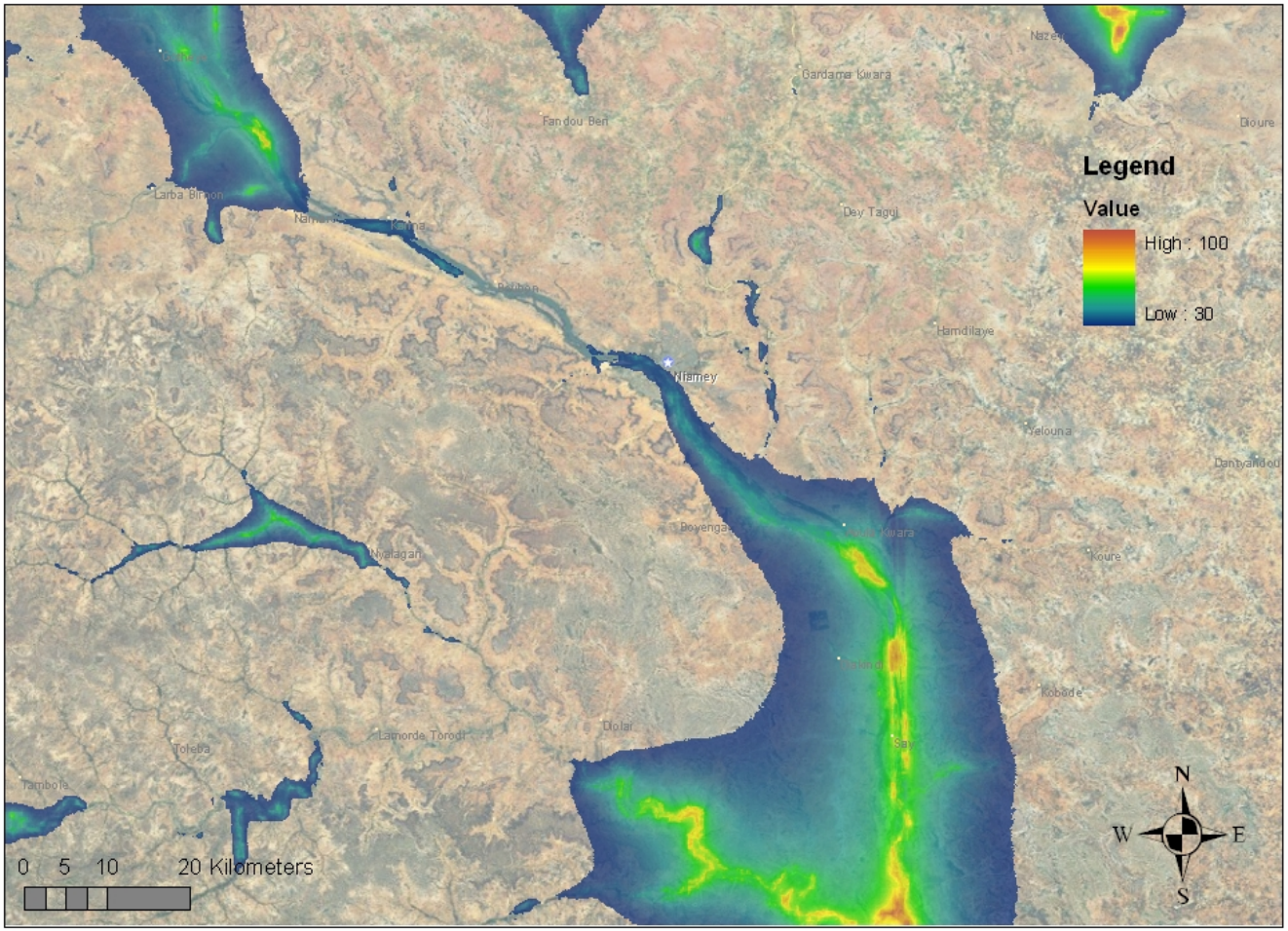
- **Improve seasonal surface water mapping with focus on ephemeral water bodies.**
- **Identify areas with a high potential for ground water (possible drilling areas).**



- **Budget: 100,000 Euro**
- **Prime: ACS (IT);**
- **Users: AGHRYMET, Niger**

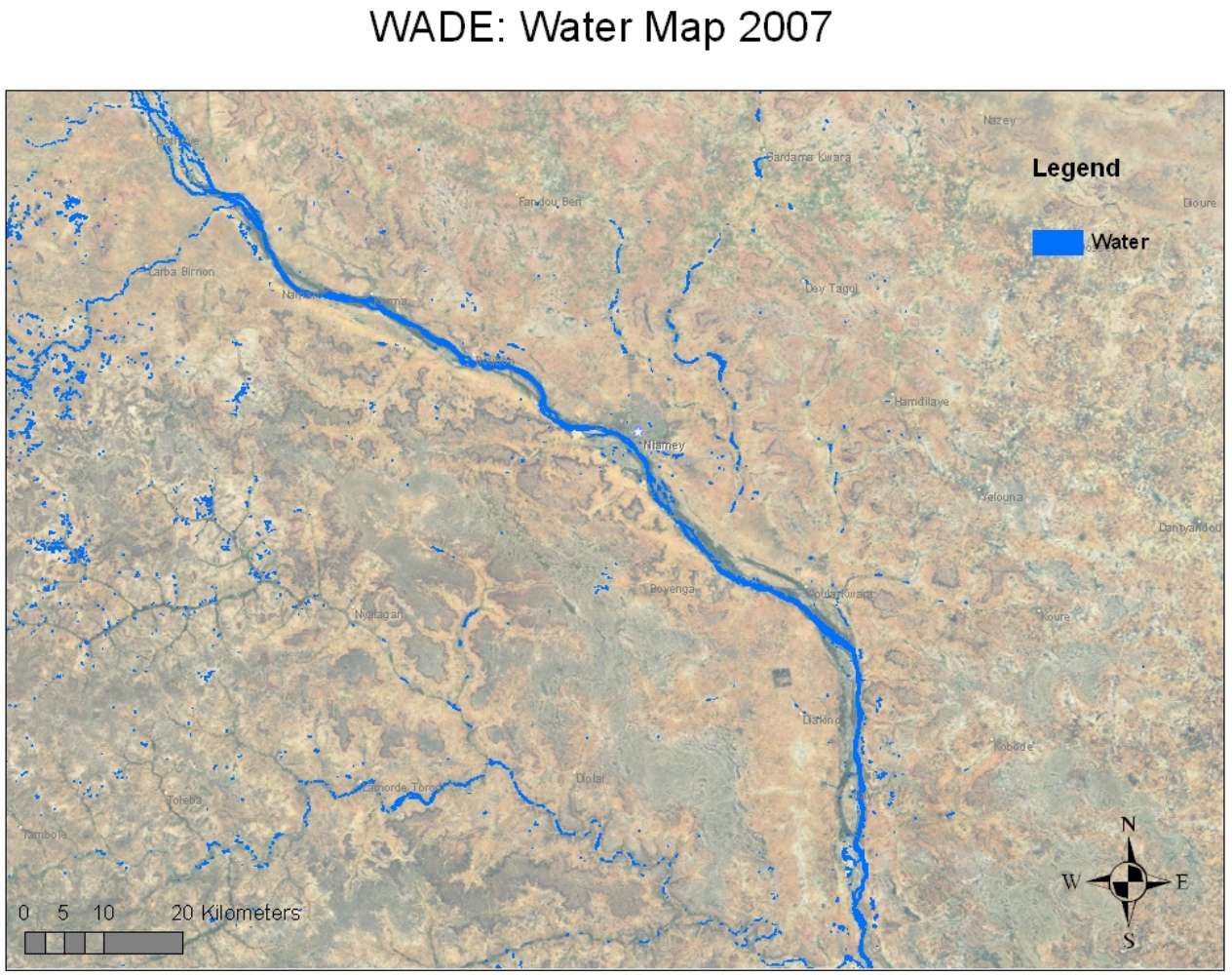
TIGER Phase 1 Examples: WADE (Sahel)

WADE: Suitability for Ground Water 2007



Map based on the use of ASAR data to extract potential recharge areas

TIGER Phase 1 Examples: WADE (Sahel)



Surface water map (ASAR data) identifying small and ephemeral water bodies

El Mundo, 21st January 2008

Me gustan más los sueños del futuro que la Historia del pasado (Thomas Jefferson)

MIÉRCOLES 21 DE ENERO DE 2009 · Año XIII · Número 4.074

EL MUNDO

www.elmundo.es

EDICIÓN: NACIONAL

«Él seguía apu

Habla el empleado de Gas

'Trabajo dur
juego limpio,

Barack Obama da su receta pa

PABLO PARDO / Washington
Especial para EL MUNDO

Barack Obama ya es presidente de Estados Unidos. Y su primer mensaje al país y al mundo ha sido claro: estamos en un momento histórico muy difícil, en un «invierno de penurias» del que, para salir, es necesario recurrir a «los valores de los que depende nuestro éxito: trabajo duro y honradez, valentía y juego limpio, tolerancia y curiosidad, lealtad y patriotismo».

Así se dirigió el nuevo presidente de Estados Unidos a los dos millones de ciudadanos que se concentraron en el Mall, el gigantesco parque de Washington situado frente al Capitolio, para verle jurar el cargo. Sigue en página 20
Editorial en página 3

Obama jura el cargo ante el presid

Wall Street cae
un 4%, récord
en un día de
investidura

J.G. GALLEGO / Madrid

El efecto Obama no tuvo apenas incidencia en otra nefasta sesión de Wall Street, que perdió ayer un 4% en lo que ya es la mayor caída en la investidura de un presidente de EEUU. Después del discurso inaugural, el Dow Jones quedó sepultado por los desplomes de la banca. Sigue en página 33

La Comunidad liga
a la guerra sucia en

Esperanza Aguirre presenta denuncias an
los seguimientos efectuados a su vicepresi

LUIS ÁNGEL SANZ / FERNANDO LÁZARO
PEDRO BLASCO / Madrid

La guerra sucia por el poder dentro de Caja Madrid podría estar detrás del espionaje del que ha sido objeto durante ocho meses el vicepresidente primero del Gobierno de la Comunidad de Madrid, Ignacio González.

Por lo menos, así lo piensan la
sidenta madrileña, Esperanza A
rre, y gran parte de su equipo.
Los dos dossieres que se cono
ron ayer incluyen fotografías del

La sospecha de que Prada orde
a González le costó el cargo /P

Mapa de las aguas subterráneas en Niamey en 2007. Los colores indican la cantidad (azul, menos; rojo, más). /ESA

Los satélites 'ven' los acuíferos ocultos de África

La ESA ayuda a encontrar agua en Níger, uno de los países más pobres del planeta

ROSA M. TRISTÁN / Madrid

Hace 8.000 años, toda la extensión de lo que hoy es Níger eran bosques que alimentaban y cobijaban a sus habitantes. Hoy, su población, unos 13 millones de personas, se mueren de hambre y de sed, porque a medida que el Sáhara avanza sobre sus aldeas, lluvias y pozos son más escasos.

La tecnología espacial hace ya unos años que está al servicio de esta necesidad vital de tener agua con la iniciativa TIGER de la Agencia Espacial Europea (ESA), puesta en marcha en 2002 con motivo de la Cumbre por el Desarrollo Sostenible en Johannesburgo. Desde entonces, los datos de los satélites se han utilizado para identificar estos recursos tanto en superficie como subterráneos en África, una aportación cuyos resultados están siendo muy valiosos, según el primer balance que ahora hace público la ESA.

Para demostrar la validez de este sistema, se integraron todos los datos recopilados por dos satélites europeos entre 1993 y el año 2007 en un área de unos 100.000 kilómetros cuadrados en el oeste de Níger.

Toda esta información ha servido para generar mapas exactos en los que se clasifican las áreas que tienen acuíferos cada año. Esta actualización es precisa porque en Níger las lluvias cambian de lugar y su intensidad anualmente, lo que afecta a la agricultura y, por tanto, a la seguridad alimentaria en esta zona del Sahel, una franja fronteriza entre el desierto y el trópico.

En concreto, los satélites detectaron con total precisión el 100% de las áreas con aguas permanentes y cerca del 75% las aguas semipermanentes, es decir, las que se secan durante ciertos periodos por falta de pluviosidad.

La comprobación de los resultados se realizó en casi un centenar de puntos por el centro regional AGRHYMET, una institución formada en 1971 por nueve estados subsaharianos para controlar los efectos de la desertificación en la agricultura de sus países.

«Monitorizar estos acuíferos es esencial para irrigar áreas agrícolas en las regiones más áridas. Estamos muy satisfechos de que el proyecto alcance resultados porque esta información será básica para poder gestionar el agua», ha señalado Issifou Alfari, responsable de este proyecto.

La satisfacción de Alfari está más que justificada en un país donde sólo el 4% de la tierra es cultivable y la temperatura media anual supera los 30º C. No es de extrañar que siempre ocupe el último o penúltimo lugar del índice humano de desarrollo de la ONU.

Los satélites europeos implicados en este proyecto fueron el ERS (European Remote Sensing), lanzado al espacio en 1995 (que comenzó a fallar en 2001) y su sucesor, el Envisat, que lleva a bordo el radar SAR, de gran utilidad para detectar las áreas con agua, aunque se encuentre filtrada bajo tierra.

Todos los datos que se han estado enviando en estos últimos años han sido procesados con un Sistema Avanzado de Computerización (ACS) en la sede de la ESA en Roma, donde han desarrollado el programa WADE (siglas en inglés de Asesoramiento sobre Recursos de Agua con la Utilización del SAR en el Desierto y territorios áridos de África Occidental).

El WADE se diseñó en colaboración con las autoridades locales de Níger y representantes del AGRHYMET para que no hubiera problemas a la hora de aprovechar sus resultados *in situ*.

En noviembre del año pasado, el programa WADE fue instalado en las oficinas que este organismo tiene en Niamey, la capital del país.

EL MUNDO

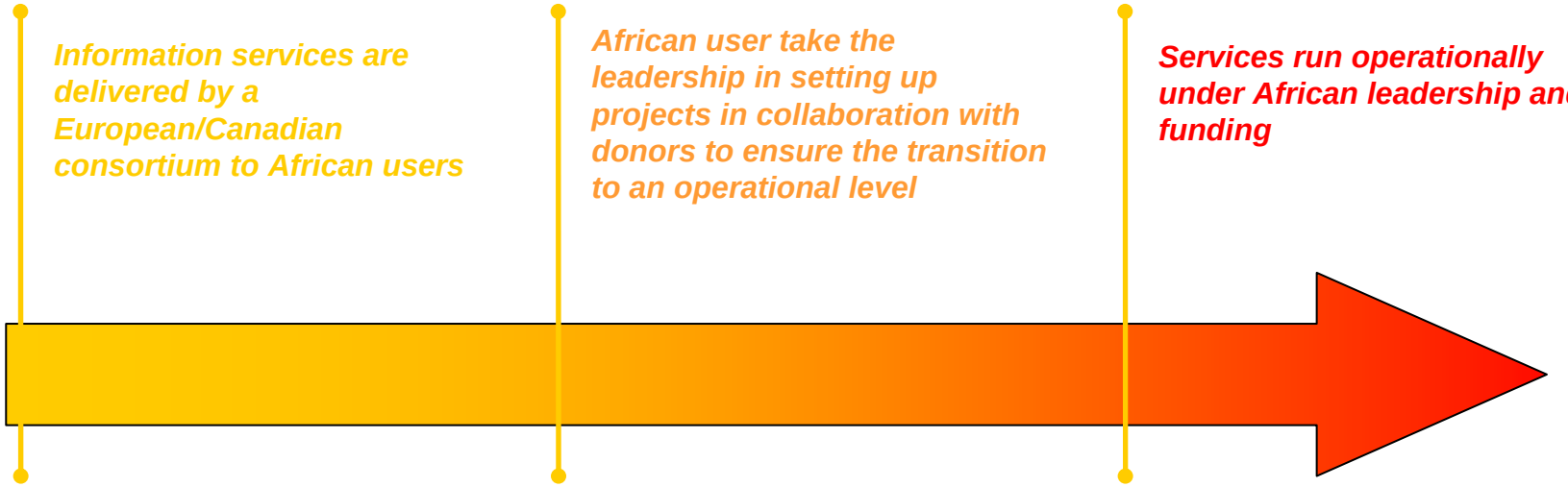
Las ONG se sirven de la tecnología

Algunas ONG han comenzado a utilizar la tecnología espacial. Acción contra el Hambre, desde el año 2007, facilita navegadores con GPS a los pastores de Mali, un país del Sahel vecino de Níger, y con los mismos problemas de desertificación. De este modo averiguan, vía satélite, donde están los pastos más verdes para su ganado. También se les informa de la localización de pozos. La compañía SPOT les facilita la imagen de la biomasa cada 15 días.

TIGER tiene otros cuatro proyectos de ayuda a la gestión del agua en África. El objetivo de todos ellos es desarrollar tecnologías de bajo coste que, gracias a la observación de la Tierra desde el espacio, puedan ayudar a las autoridades a conservar y gestionar sus escasos recursos de agua.

Towards Operations: African Leadership

- The transition to the operational phase is lead by African partners (users) and donors.
- African users are supported to lead and launch projects in collaboration with development partners and donors in order to ensure the transition from the pre-operational (demonstration) to the operational stage;
- TIGER Service sustainability Model developed in collaboration with the African development bank



Service Sustainability: African Leadership/African Funding

- **A initial portfolio of projects are under development in collaboration with the African Development Bank;**
- ***A first project has been approved by the African Water Facility of the AfDB for funding (GEO-Aquifer, follow-up of the ESA AQUIFER project);***

Project	Executing Agency	Status proposal
GEO-AQUIFER	*OSS*	*Funded by AWF*
Lake Chad	*Lake Chad Basin Co.*	*Funded by AWF*
Lake Victoria	*Lake Victoria Basin Co.*	*Under Evaluation by AfDB*

African Political Support: Towards a Phase 2

“ International initiatives like […] TIGER which provide useful tools to the countries to strengthen their capacities for ensuring water security should be encouraged and supported. “

From the Results of the 1st African Water Week
Organized by the African Ministerial Council on Water
And the African Water Facility in Tunis, March 2008

TIGER Phase 2 Implementation

- **Water Research Component (*Water Assessment in Africa under Climate Variability*):**
  - **Support African scientist, technical centres and water authorities to develop the tools, the knowledge and the capacity to exploit EO technology for improving the assessment and monitoring water resources, enhancing water governance and ensuring efficiency of policy interventions for climatic change adaptation;**
  - **A number of African lead projects will be selected via a call for proposals (AO);**
  - **Selected projects will benefit from data access and the participation to the TCBF.**

- **Water Management Component (Support African partners to lead the transition towards operations):**
  - **Support water authorities at national and basin scale to lead the transition from a pre-operational/demonstration stage towards operational information services based on ESA data;**
  - **Activities will be carried out under the leadership of Africa institutions and in partnership with donors (e.g., African Development Bank).**

TIGER Phase 2 Implementation

Status:

- The official lunch of the phase 2 was done by **ESA, AMCOW and AWF**, in a dedicated side event at the **World Water Forum** in Istanbul in March 2009;
- A waiver, ensuring free data access (ESA and 3rd party missions) to TIGER projects was approved by ESA Member States;
- A **Call for Proposals** was issued addressing African scientist and technical centres in collaboration with water authorities;
- **20 projects has been selected** to be supported via the TIGER Capacity Building Facility;
- The **TIGER Capacity Building Facility II** was launched in July 2009 (800K). The Facility is responsible for providing training and tailored capacity building to the 20 TIGER projects.

Team: ITC (NDL), Univ. of Lisbon (P), Univ. of Delft (NDL) and VITO (B), AGRHYMET (N), RCMRD (K) and WRC (SA):

- First Workshop in the Netherlands, December 2009 (kick-off);
- First Training (ESA, CSA) in April 2009 (at the Water Research Center, Egypt);
- Next workshop and training in Nairobi (end of 2010);

TIGER Phase 2 Implementation

Countries Involved:

- Burkina Faso
- Chad
- DRC
- Egypt
- Ghana
- Kenya
- Madagascar
- Mali
- Morocco
- Namibia
- Republic of Congo
- Senegal
- South Africa
- Zambia