Algeria exploiting space for the management of the transboundary aquifer NWSAS (SASS)

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Framework

- **TIGER**

**Aquifer** = is one of the demonstrator project of ESA/UNESCO Initiative “Earth Observation for Integrated water Resources Management in Africa” known as TIGER

**Initiative with focus:** Space – Water – Africa

- **ESA**

**Aquifer** is funded with 1,000,000 Euros by the ESA’s Data User Element (DUE)
AQUIFER : Project Objective

- support the involved national authorities and international institutions to
- better manage internationally shared aquifers

Geographic scope: AQUIFER deals with 02 important internationally shared aquifers:
- 1. NWSAS(SASS) Aquifer System – Northern Africa
- 2. Iullemeden Aquifer System – Sahel
Aquifer - Geographic Frame
Aquifer TEAM

USER CO-ORDINATOR
Observatoire du Sahel et du Sahara (OSS)

USER GROUP
Mali: Ministère des Mines, de l'Energie et de l'Eau
Niger: Le Ministère de l'Hydraulique, de l'Environnement et de la Lutte Contre la Désertification
Nigeria: Federal Ministry of Water Resources & Rural Development
Algeria: Agence Nationale des Ressources Hydrauliques
Libya: General Water Authority
Tunisia: Direction Générale des Ressources en Eau

INDUSTRY PARTNERS
GAF AG, Germany
Scot, France
Joanneum Research, Austria
Telespazio, Italy
University of Jena, Germany
Vista, Germany

LOCAL PROVIDERS
The AGRHYMET Regional Centre, Niger
Centre National des Techniques Spatiales, Algeria
Center for Remote Sensing & Space Science, Libya
Centre National de Télédétection, Tunisia

EXTERNAL ADVICE
ESA/ESRIN
Issues – North Western Sahara Aquifer System-SASS

SASS groundwater resource is sufficient for many centuries to come (500-600 years at projected consumption rates)

**BUT**

- **largely over exploited** – no sustainable water management:
  - global water abstraction is 3x larger as natural recharge
  - projections for 2050 indicate a ratio of abstraction vs. recharge and imbalance surpasses factor of 15
- **water level decline** increased cost for lifting and distributing water, necessity for relocation of pumping sites
- **end of artesian conditions** over parts of the basin
- reduced natural outflow an the Tunisian Outlet: **risk of salt water intrusions** along the coast
- **deterioration of water quality, salinity** in areas with important water extraction
- **soil salination** – e.g. soils cultivated in traditional oases are increasingly affected
- Aggravated by growing **population pressure** and development of irrigation schemes
Areas to be covered in NWSAS (SASS)
Earth Observation (EO) from space – benefits/limitations

1. Assets :
   - Area-wide coverage = cost efficient mapping /monitoring on an area-wide basis
   - Is truly transboundary in nature
   - Can provide an uniform spatial data layer to correlate/extrapolate isolated field data
   - Objective measurement
   - Radar: cloud penetrating – all weather

2. Constraints :
   - Require ground truth for calibration
   - Require data assimilation - combination with ancillary data - GIS –

Specifically for Ground water management:
   - Satellite remote sensing is basically confined to the surface:
     - Measure reflectance values of surface features
     - Radar and thermal sensor detect features cm, dm, a few metres below the surface
   - EO works but indirectly (proxies) or has to rely on secondary effects
Earth Observation is not a stand-alone tool

EO Data
- DEM
  - Catchment Analysis
  - Risk Analysis
- GIS
  - Water Potential
  - Water Management
  - Modelling

Thematic Information
- GIS
- Surface Water
- Tectonics
- etc.

Ancillary Data
- Geological Maps
- Well Data
- etc.

Administrative Data
- Water Demand
- Water Use
- Water Rights etc.
Prototype Products

Prototypes products based on satellite imagery (limited in geographic coverage to the selected prototype areas) are generated and made available for assessment and feedback by the users.

1. Land use / Landcover Mapping
2. Water Abstraction Estimate
3. Digital Elevation Models
4. Capacity Building
First results:
1-Land use / Land cover Product

SASS:

Used for determination of cropped area, area of irrigation).

Change maps used to monitor soil deterioration and evolution of agricultural sector.

Mapping of salt crust / wetlands

Determination of risk areas, where pollution can affect ground water
First results:

2- Water Abstraction Estimate

- The product: “Water Abstraction Estimation” is an estimation of the optimal amount of water to be extracted and applied to the irrigation scheme to satisfy the crop water demand during the growing season 2005.

- Direct use for analysing water abstractions from an internationally shared aquifer.

- Future input for the consultation mechanism of a transboundary aquifer.
First results:

3- Digital Terrain Model (DTM)

Local, high resolution: Oued Rhir

Expected Benefits of the DTM

• Input to SASS ground water model to improve accuracy and to enable improved modelling
• Help in determining where drainage waters from oases are flowing
• Determination of flow accumulation (local depressions)
• Delineation of water sheds

Basin-wide: SASS: ~ 1.000.000 km²
Ground Truth Campaign

A ground truth campaign was performed by ANRH and CNTS with participation from experts from Europe.
First results:

4- Capacity Building: - Workshops

Training and on-site cooperation (joint on the job work) has been performed with ANRH, CNTS and all the users.
Conclusion and next steps

- **Role of Earth Observation**
  - can be a supporting tool
  - is not stand alone – requires groundtruth, ancillary data and GIS

- **ANRH and other user organisations have to**
  - Assess results – provide feedback
  - further ground truth for better calibration and assessment

- **Extension of the products**
  - All products (including the „science“ products)
    - **Water and vegetation monitoring over entire aquifer**
      - Support the trilateral decision making and future treaty verification
      - Mapping and monitoring of wetlands – mares – desertification
      - transboundary management of the whole Aquifer
    - **Subsidence mapping & monitoring and refined water abstraction**
      - Identification and mapping of risk areas
      - Assessment of changes induced by ground water abstraction
  - Geographically – extend to areas of interest (1000,000 km²/basin-wide)
  - Training – joint on-the-job work
  - Evaluation of the AquiferEx data (airborne: hyperspectral and radar)

For more info: [www2.gaf.de/Aquifer](http://www2.gaf.de/Aquifer)