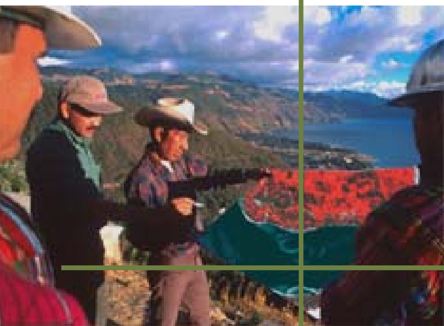


UNOSAT satellite imagery for all

Low-cost mapping tools for managing water hazards at the community level: the case of developing countries

Alain RETIERE

alain.retiere@unosat.org

United Nations / Austria / European Space Agency Symposium

SPACE SYSTEMS: PROTECTING AND RESTORING WATER RESOURCES
13-16 September 2005, Graz, Austria

Content

The Matagalpa project experience

The Chad project experience

The Matagalpa project

A short movie will tell better this long (still on-going) story

A practical approach to convert a disaster into a progress opportunity

A highly decentralized cooperation project between 2 cities

An UN inter-agency effort (ISDR, UNITAR, UNOPS, UNDP and more will join

Strong support from space agencies

Integrated learning, operational and training concept

The Chad project objectives

UNHCR is in charge of more than 200 000 refugees, who are located along Chad/Sudan border, and refugees continue to arrive every day in Chad.

UNOSAT has been requested to prepare maps based on satellite image analysis to assist UNHCR office in exploring potential for water in the refugee hosting areas in Eastern Chad.

Over an area of 650 x 150 km, a hydro-geological study- based satellite imagery interpretation is carried out in order to:

- **Improve water potential of existing camps**
- **Identify new potential sites**

Role of UNOSAT

1. Managing the project
2. In-depth discussions with UNHCR about the needs
3. Identification of potential specialized partners
4. Selection of expert specialist and contracting
5. Selection and ordering of satellite imagery, digital elevation model and complementing geo-data
6. Accountable for the quality of deliverables
7. Database cleaning, and GIS processes
8. Map's layout finalization
9. Longer term commitment with UNHCR, including follow up work (capacity building at the local level, transition and cooperation with development agencies)

Phase 1 - 2004

- 11 March → first meeting UNHCR-UNOSAT
- 12 March → Written proposal ready
- 20 April → Reception of Landsat imagery
- 16 June → Reception of JERS imagery
- 21 June → Reception of ERS imagery
- 25 June → Reception of 250k topo maps of the area of interest
- 2 July → Meeting in Geneva UNHCR-UNOSAT – Implementing partner: presentation of results
- 8 to 27 July → Ground truth and training fieldwork
- 28 July → final presentation and recommendations at UNHCR office

Data and methods used

2 Landsat 7 images → October 2000

9 JERS SAR images → 6 images November 1996
→ 3 images August 1996

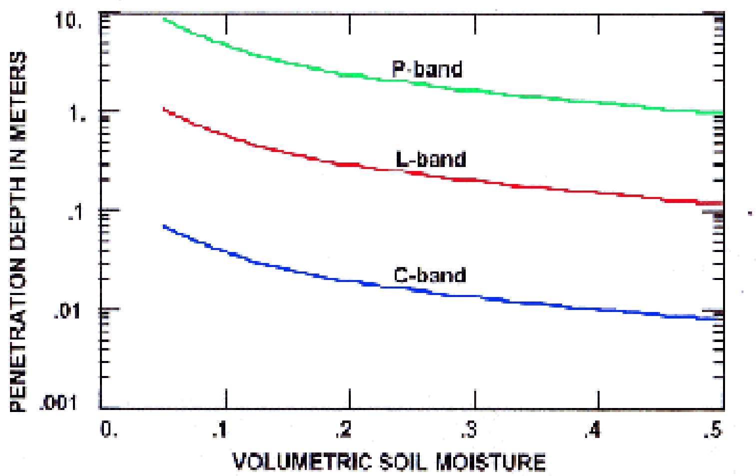
4 ERS SAR images → November 1998

SRTM Elevation data → 2002

1:50,000 scale topographic maps from Bern University

Water exploration process developed by implementing partner

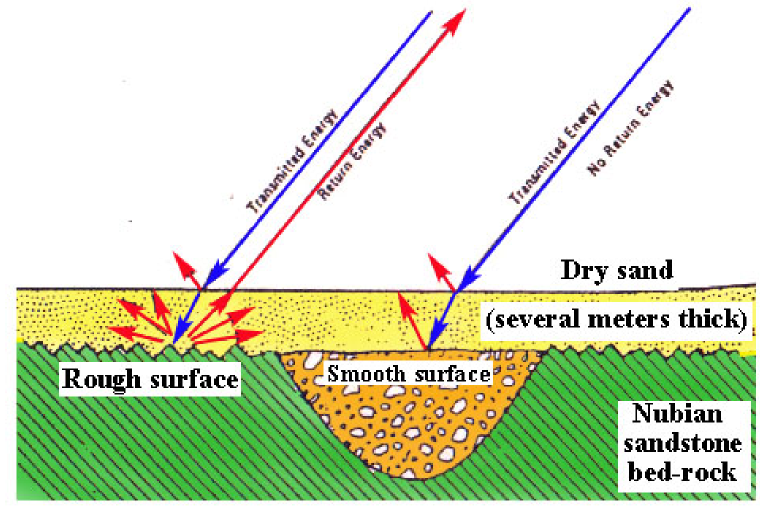
How can radar detect underground water?



$$\delta_p = \lambda_0 \sqrt{\varepsilon'} / 2\pi\varepsilon''$$

Penetration depths calculated as a function of volumetr moisture for C-, L-, and P-band assuming a sandy loam soil consist 51.5% sand, 35% silt and 13.5% clay (Ulaby et al., 1986).

Radar penetration through dry sediments



Channel filled with alluvium

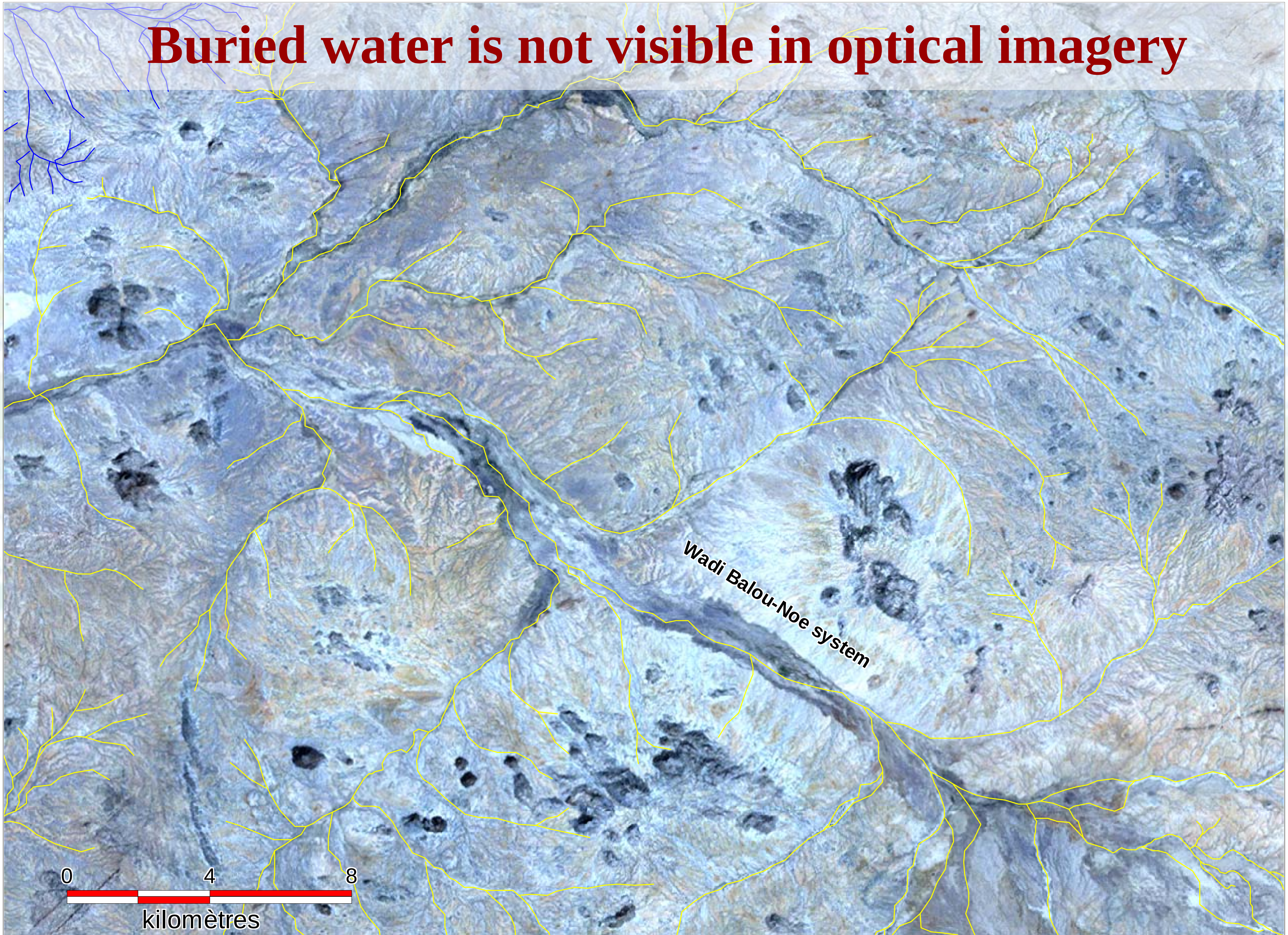
Buried moisture can be detected:

- up to 20 m with L band
- 50 cm with C band

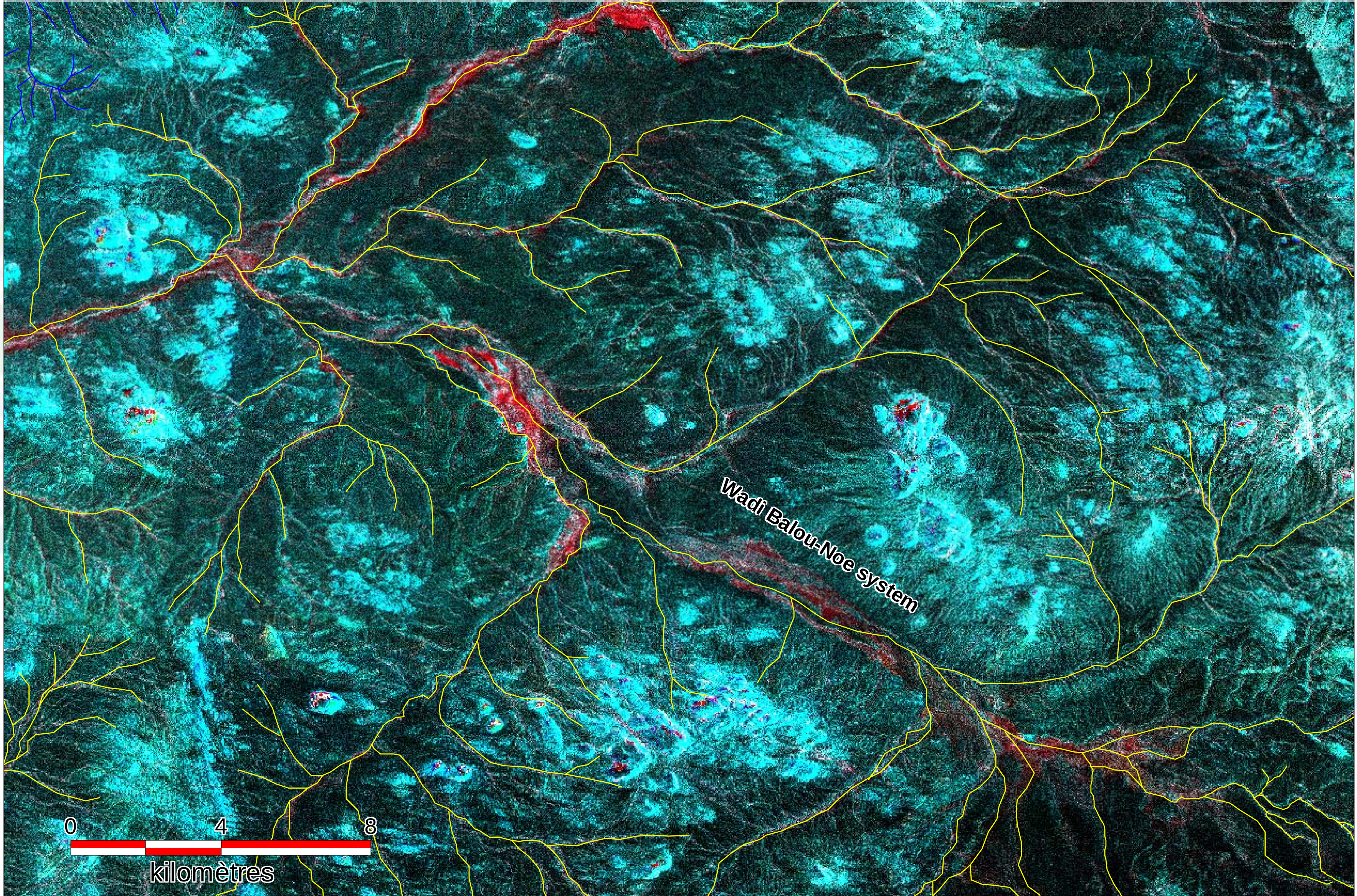
UNOSAT satellite imagery for all

UNITAR UNOPS

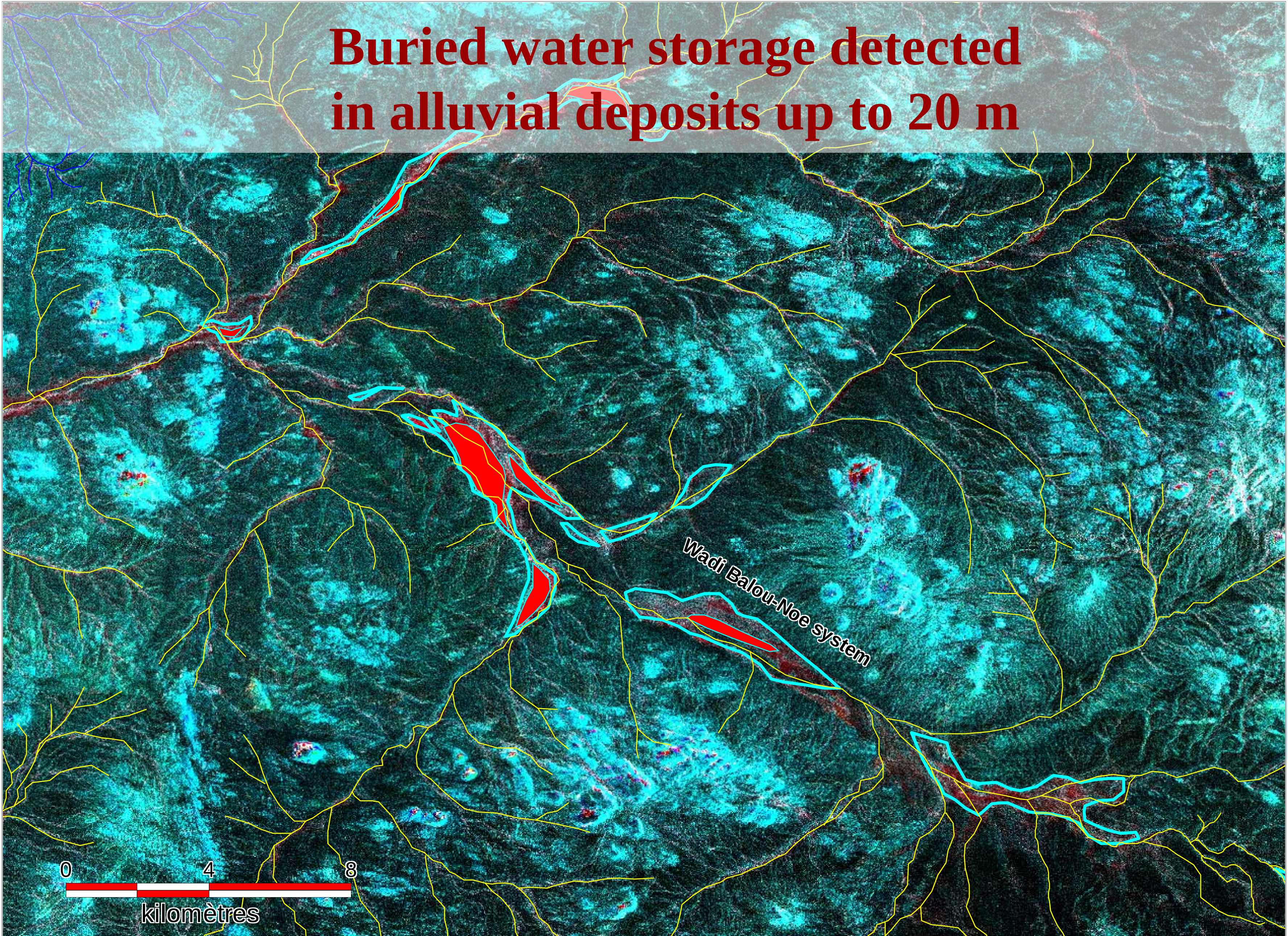
Buried water is not visible in optical imagery



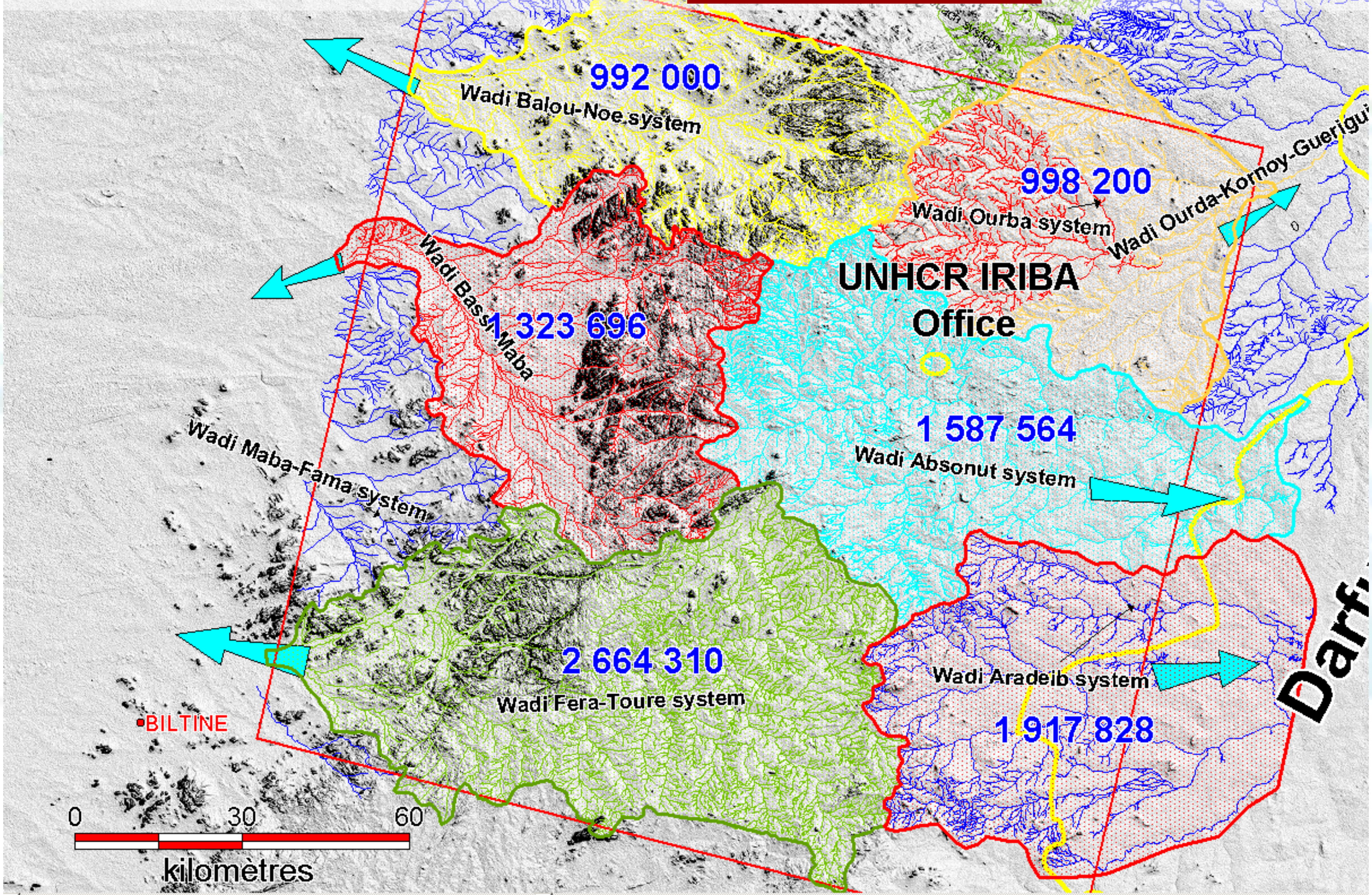
It can be detected underground by radar satellite



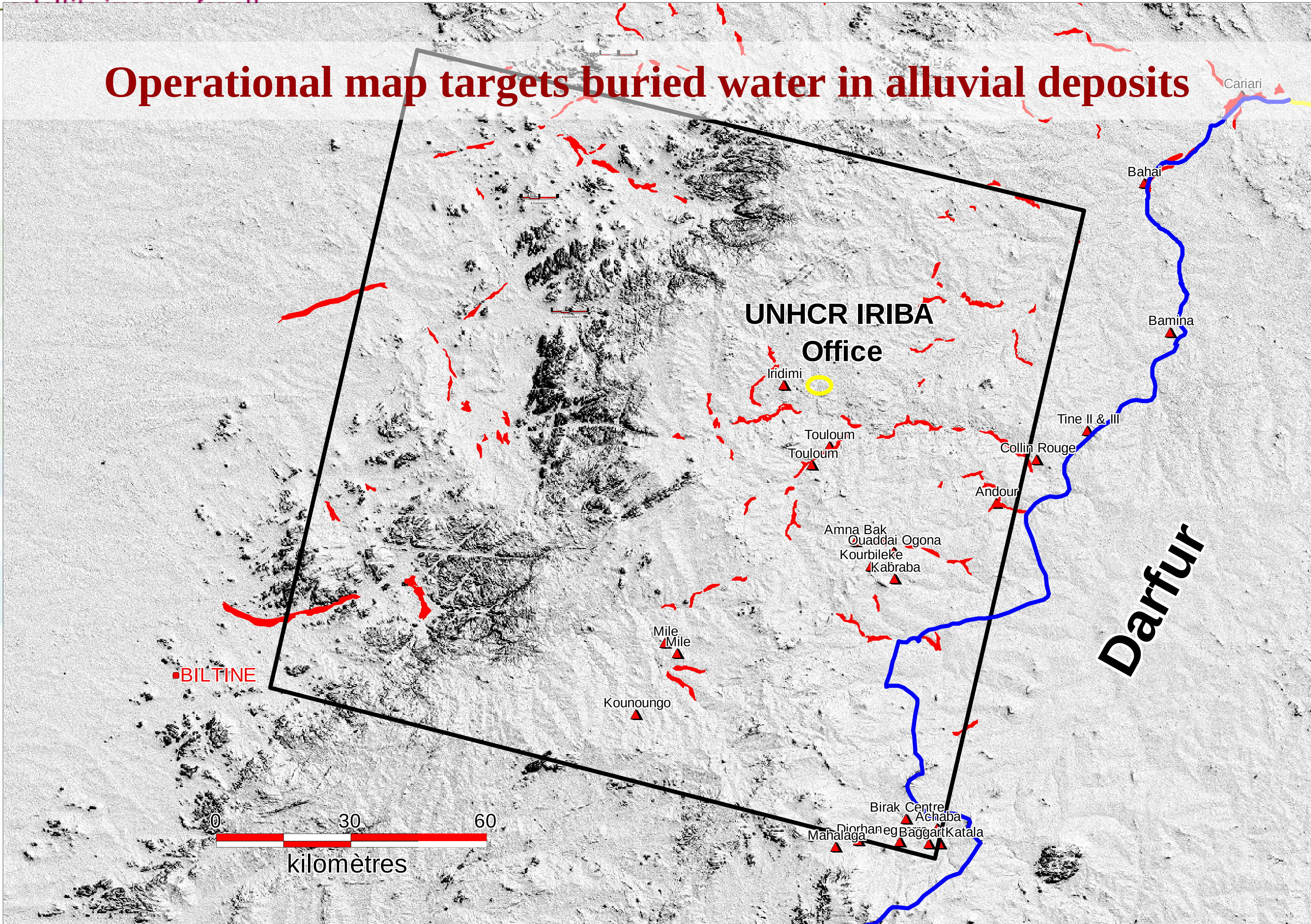
Buried water storage detected in alluvial deposits up to 20 m



Water input is more than 10^3 M^3/year: much of it is lost or hidden



Operational map targets buried water in alluvial deposits



Site case: Iridimi Refugee Camp

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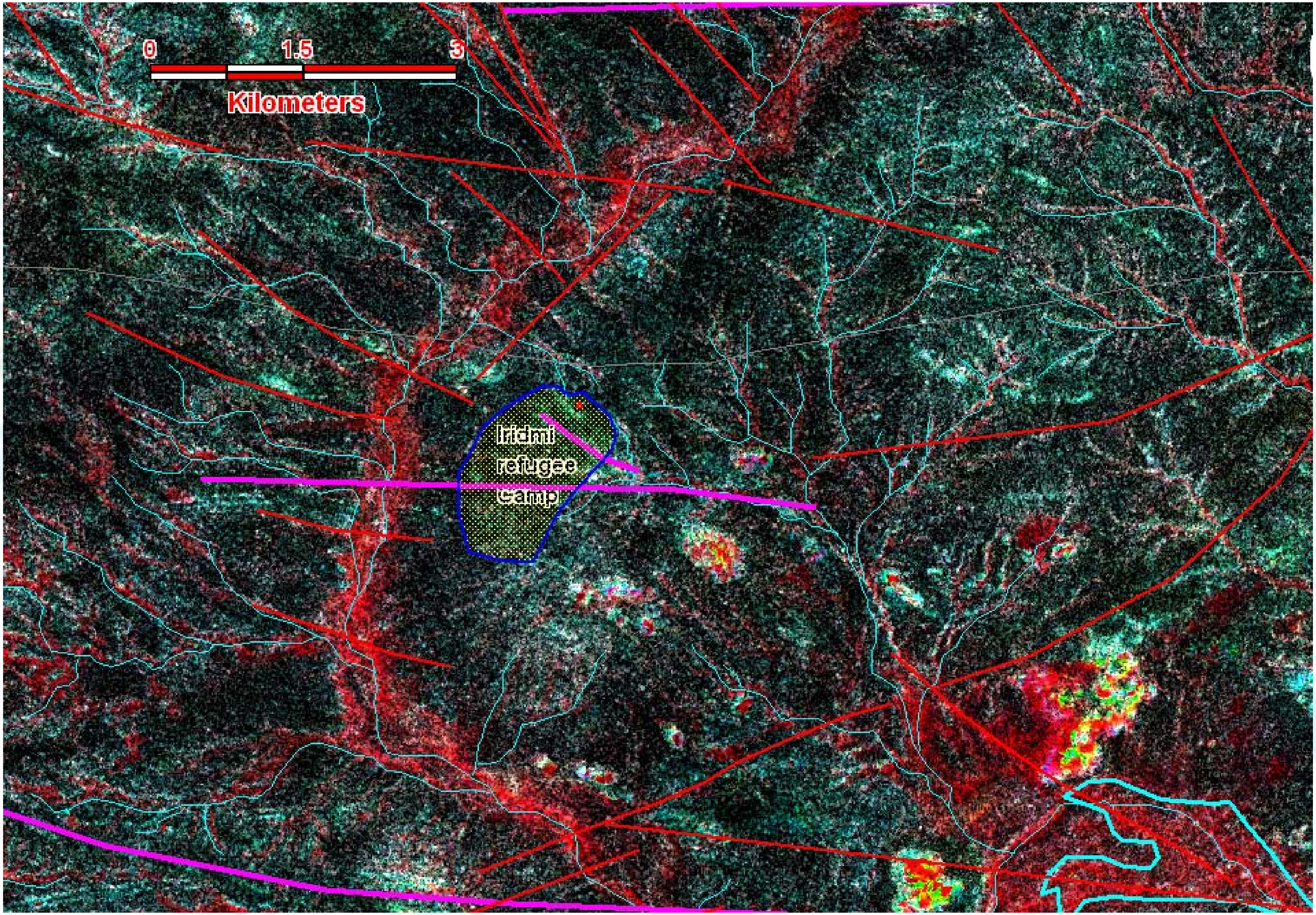
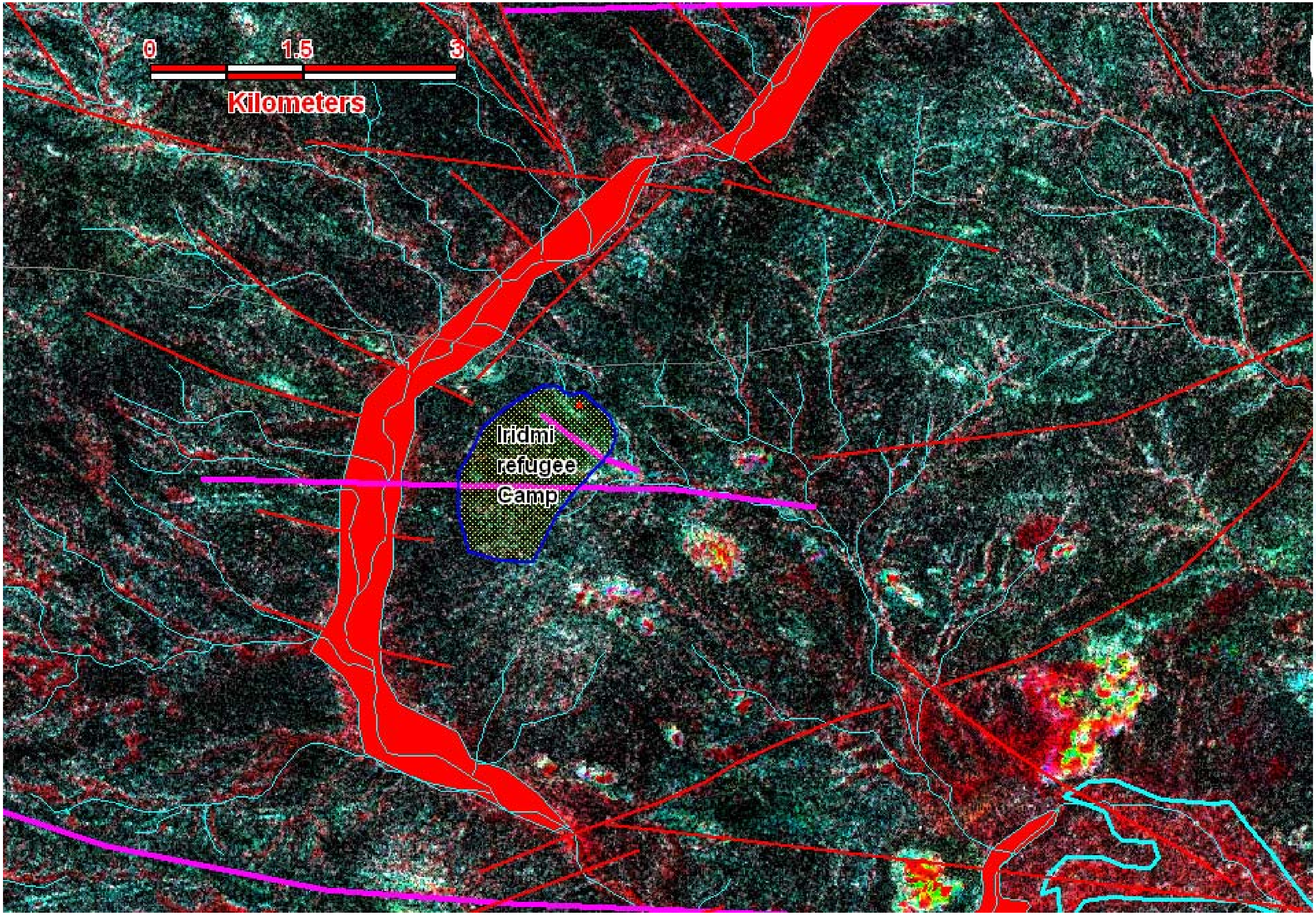
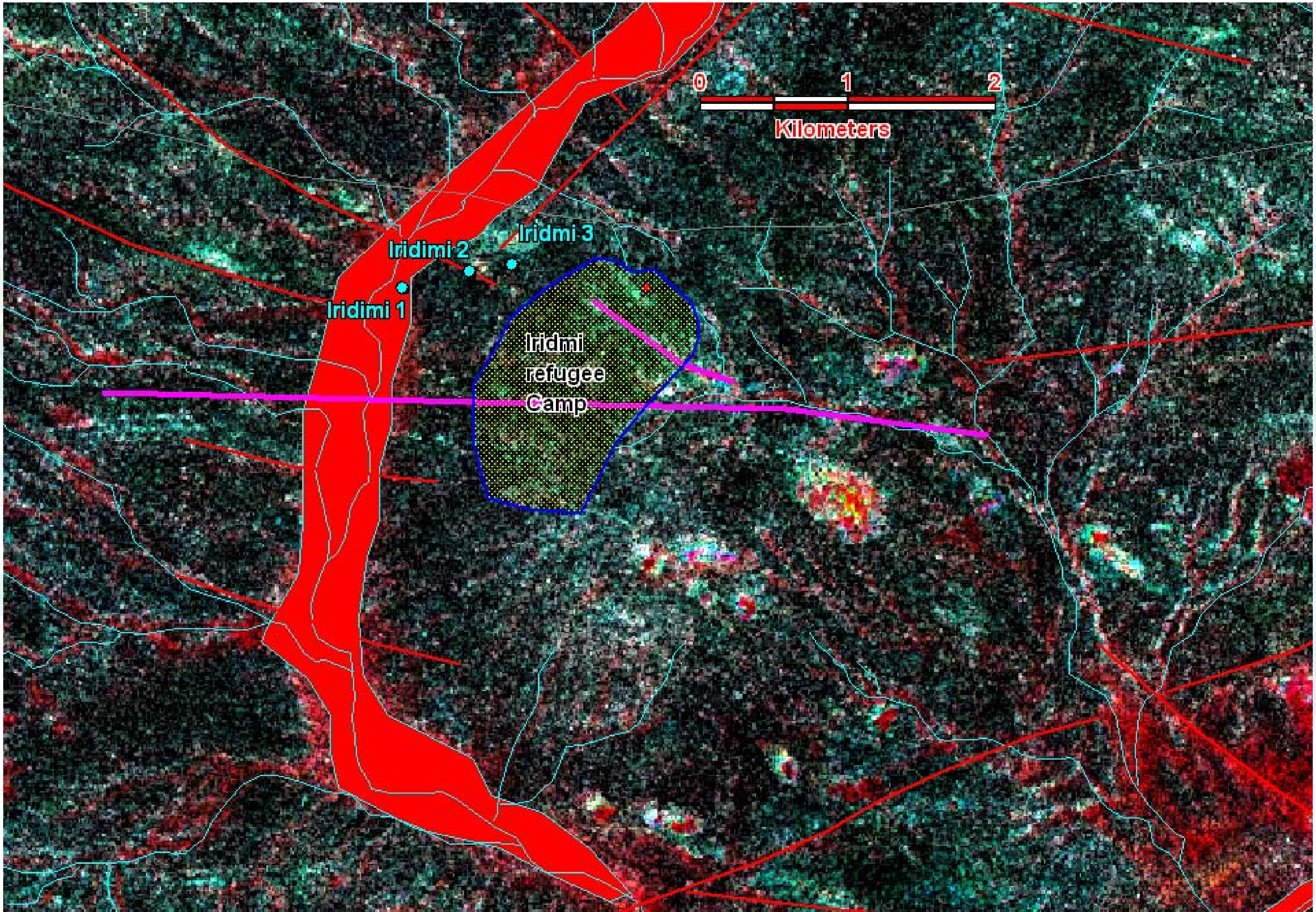
The Iridimi wadi is controled by dykes and faults



Mapping the best water potential spot in the wadi



Only the productive NCA boreholes are located in the red zone



UNOSAT satellite imagery for all

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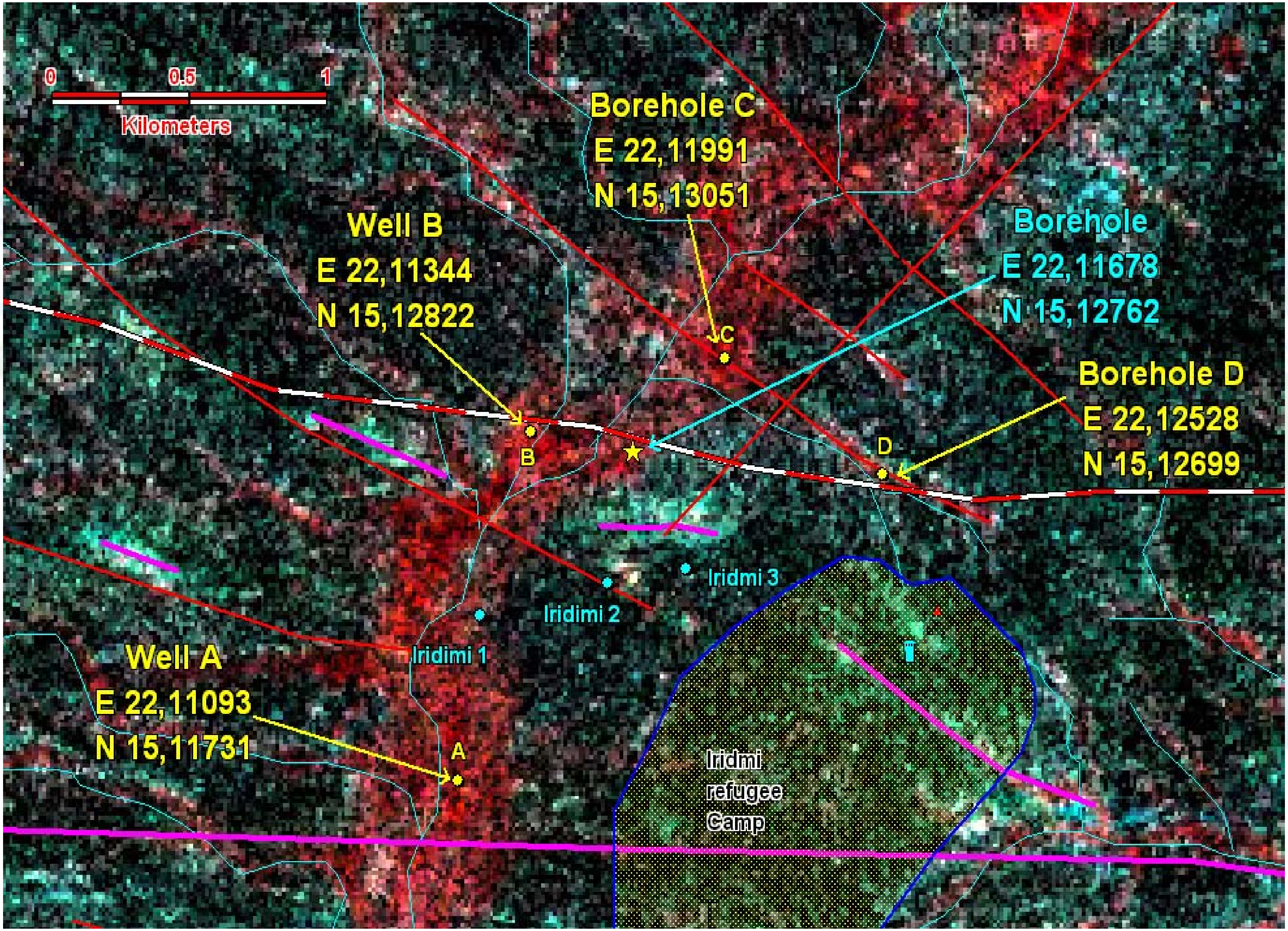
Target proposed: 2 wells and 2 boreholes (yellow dots)



Conclusion

There is no shortage of water
just a lack of watershed management

Key recommendations

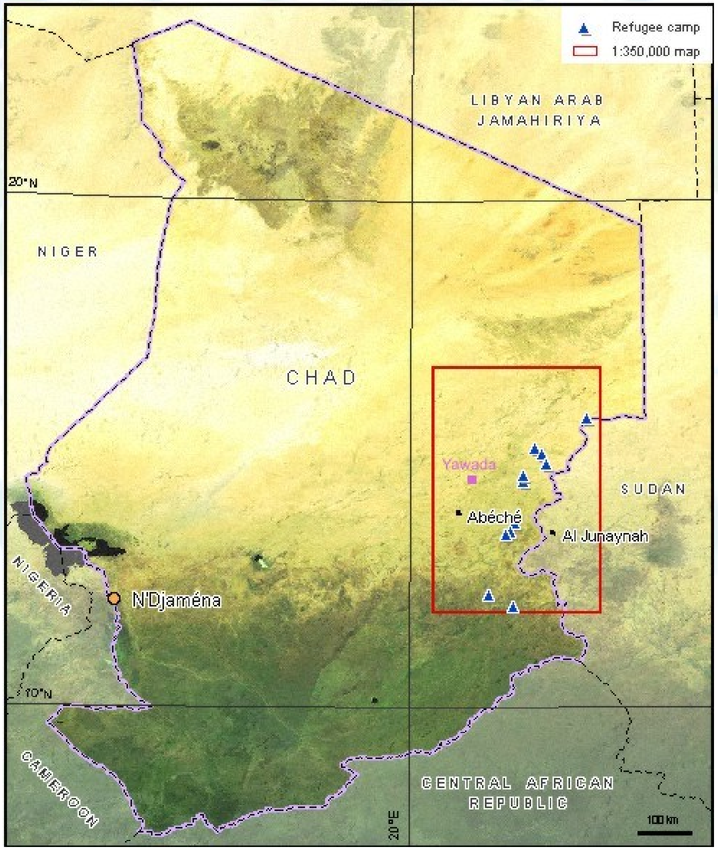
For crisis management, drilling target are:
-Within alluvial sediments along wadis.
-Under fractured basalt layers for taping in hidden water reservoirs

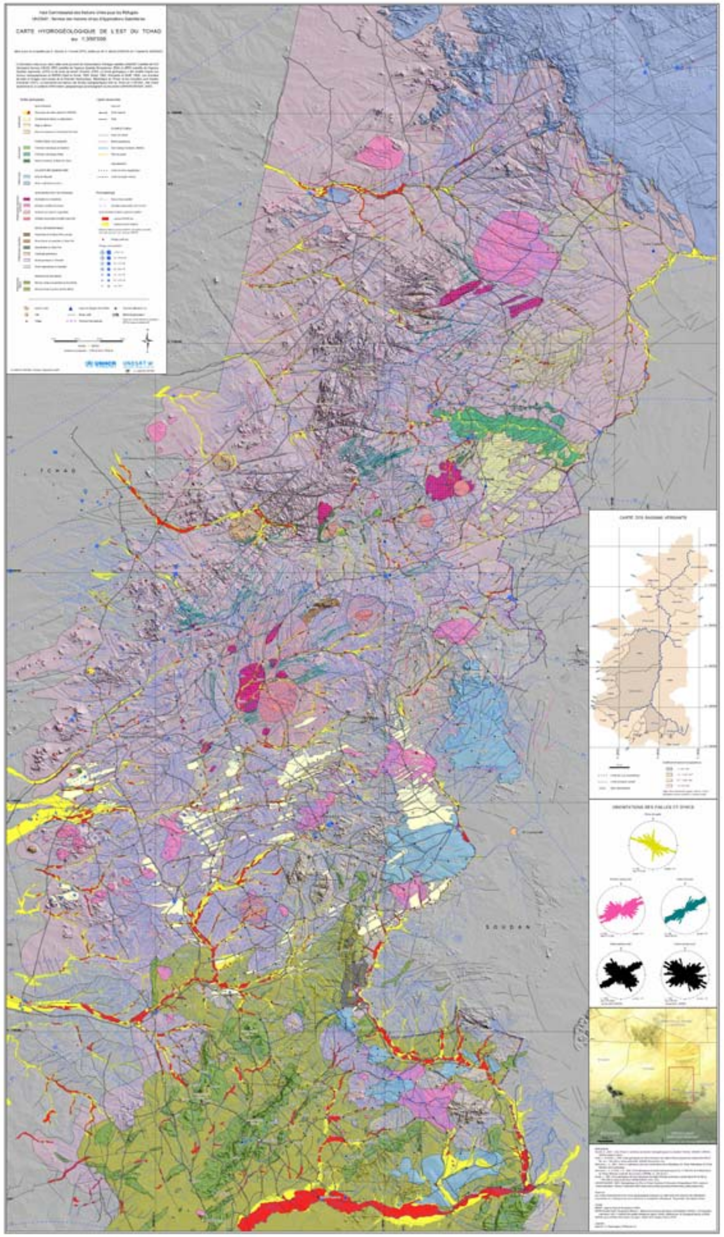
Long term sustainable development:
Build dams in selected locations to reinforce water reserves
and increase the faults storage potential for the associated wells.

Phase 2 - 2005

Extension of the coverage

Updating and upgrading of the hydro geological map





Phase 3 – 2006 onwards: an open partnership

1/ Creation and consolidation of remote sensing and GIS within the regional and local offices of the National Water Authority

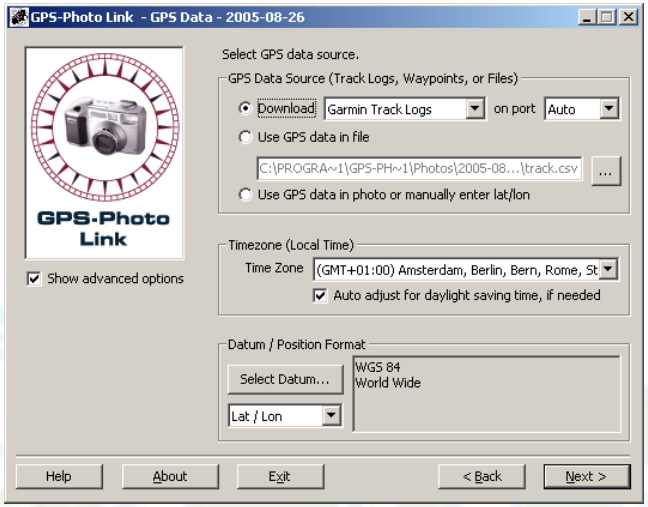
2/ Helping water management to be at the core of the regional, municipal and committee political and technical agenda

Final comments on new technologies
Key points are

- Low cost, but reliable and easy access
- Take internet connection bandwidth into account
- Recent years have seen a significant increase in available tools, data and user-friendliness

2 examples

- GPS linked to digital camera tool
- Flatness index modeling tool for geological-based ground water potential



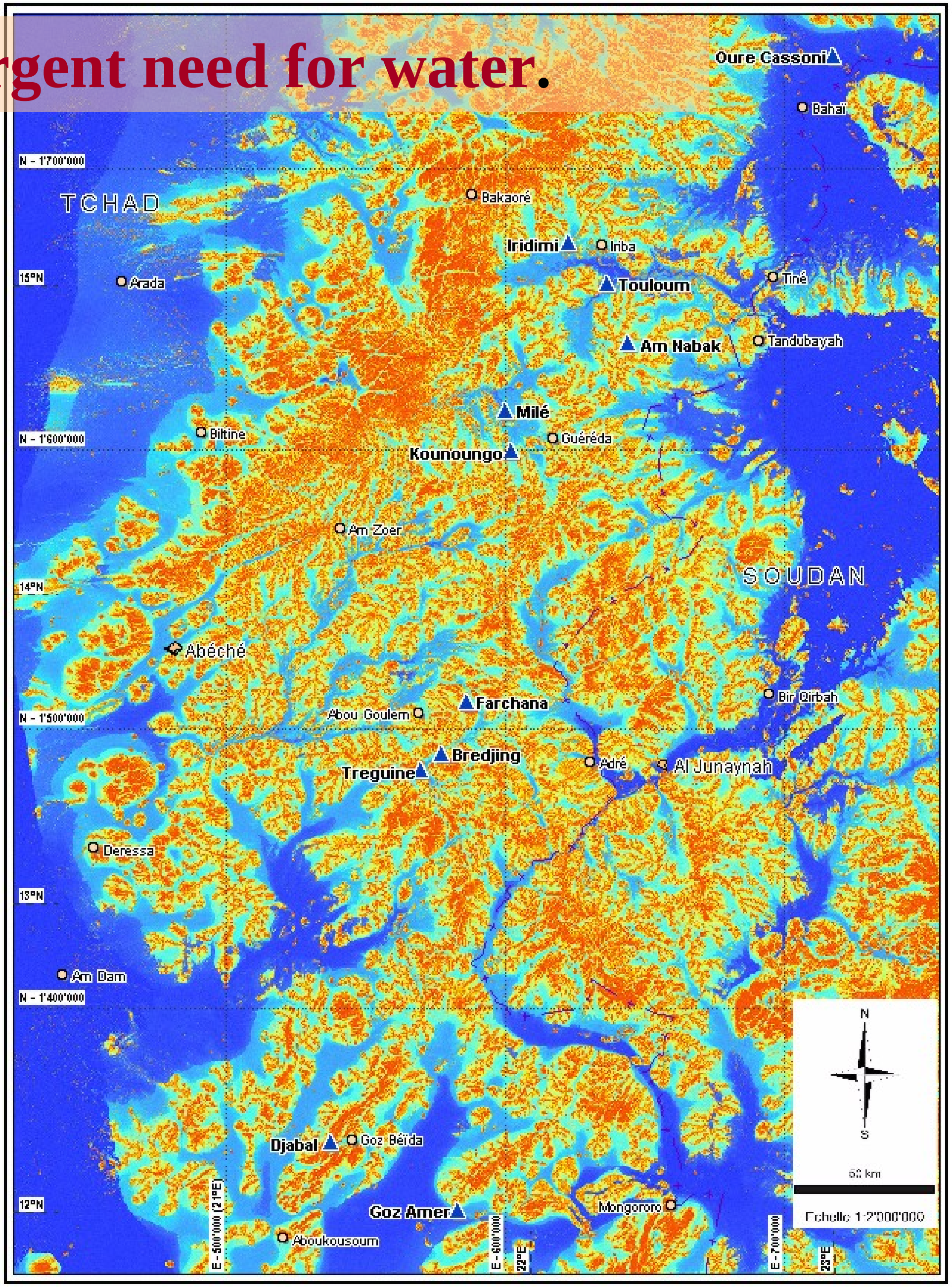
Low cost software synchronizes GPS data with digital photos to ensure each GPS point is recorded with photo.

Can transfer lat/long coordinates, direction etc. onto photo.

Refugee camps in Chad. Urgent need for water.

Flatness index modeling based on free SRTM data and free algorithm.

Red indicates high level of erosion and low ground water potential. Blue indicates flatter geological structures with higher potential for exploitable ground water reserves.



Many thanks for your attention

info@unosat.org

http://www.unosat.org