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Mapping the defunct channels of the Nile delta: the impact on groundwater quality

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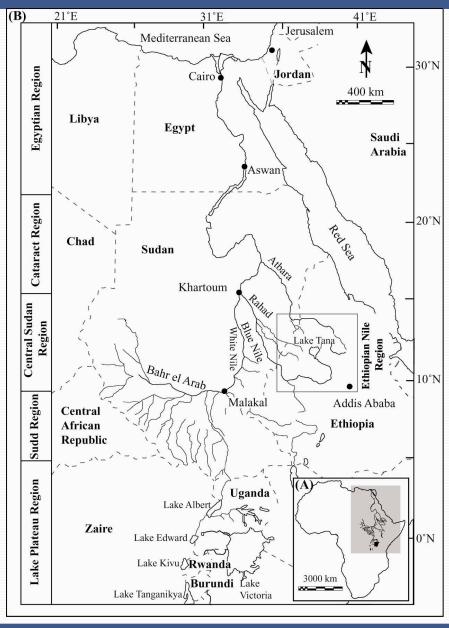
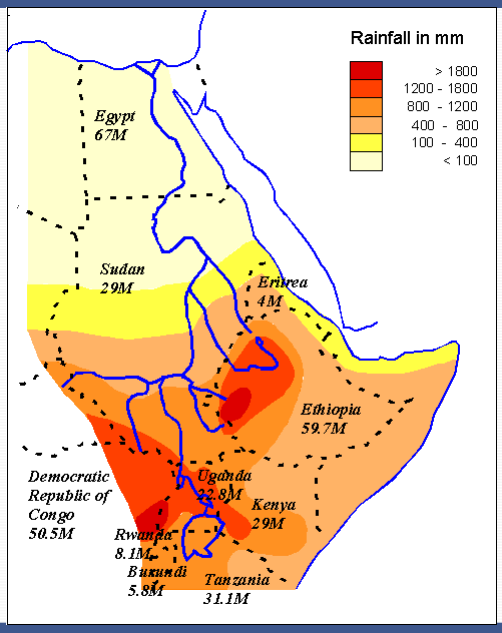
The Modern Nile River

Length	6 695 km
Elevation of the source	1 134 m
Average discharge	2 830 m^3/s
Area watershed	3 400 000 km^2

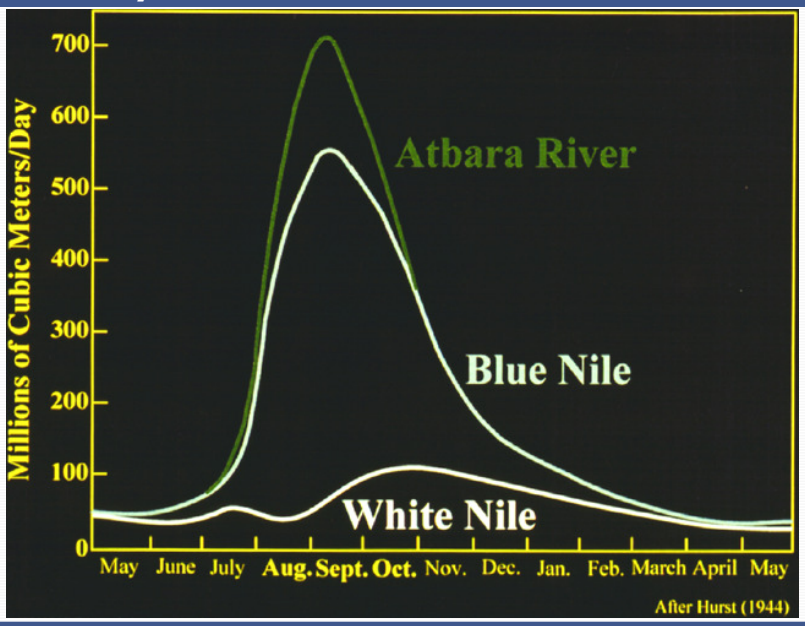


Courtesy of Gani and Abdelsalam

The Nile System Rain Fall



The Nile System Water Flow



The Nile during Quaternary climatic changes

- The Nile flow receded during the dry glacial periods, as the equatorial lakes were desiccated.
- Copious water and sediment supplies were delivered to the Nile in Egypt during the wet inter-glacial periods, the equatorial lakes have reintegrated into a mighty river system.
- Consequently, the Nile has developed much wider and higher flood plains.
- This was followed by a period of wadi and Nile downcutting to below modern floodplain level.

- The hydro-geological evolution have largely been reconstructed in different parts of the Nile basin using variety of tools and techniques.

The Nile Delta:

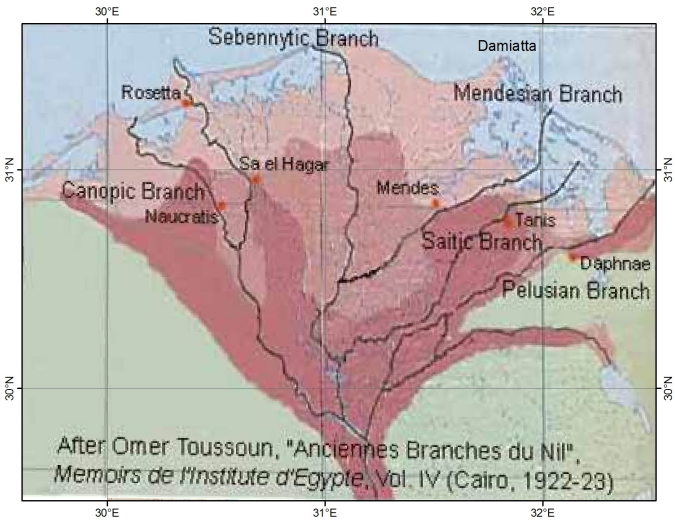
❑The old Nile River distributaries in the delta region were described by ancient historians and geographers such as, Herodotus in 484-425 B.C., and El Idrisi in the 11th centaury A.D.

❑Generally , seven to eight distributaries were interpreted; the Pelusiac headed east toward El-Tina plain in Sinia and the Canopic was the most western one.

❑Many of these branches were silted up, except Damietta branch to the east and Rosetta to the west.

❑ The expected buried channels were largely traced by the geoelectrical resistivity tests, bore holes interpolations and interpretation of remote sensing data.

The Paleo-branches of the Nile Delta



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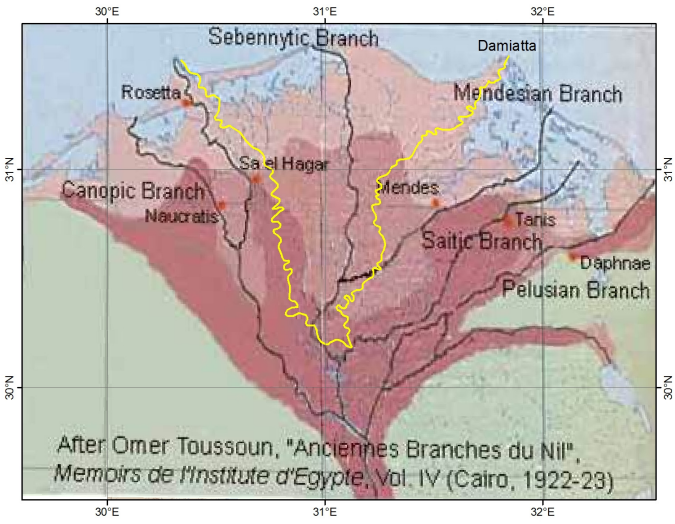
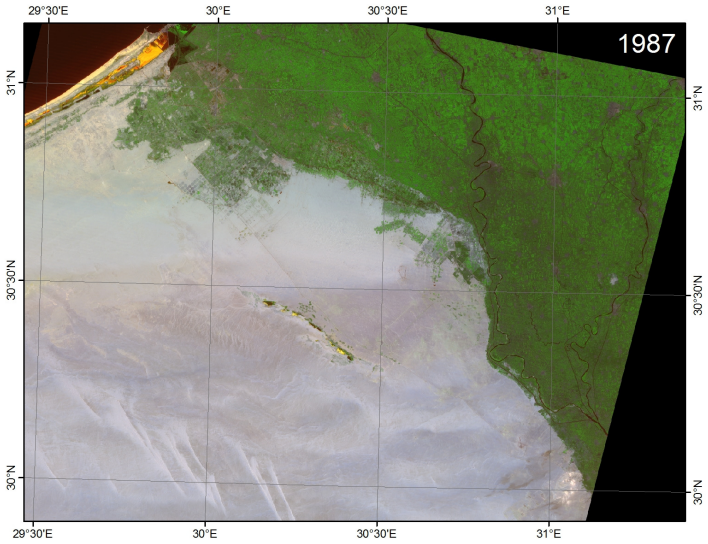


Monitoring land reclamation of the old deltaic deposits



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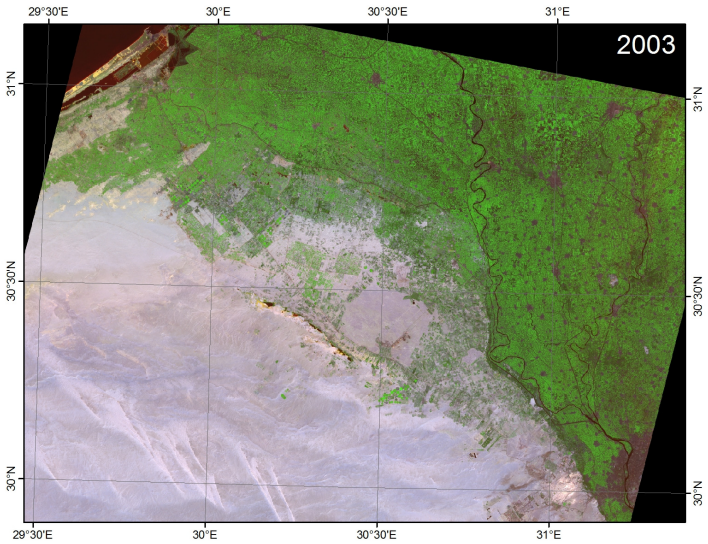
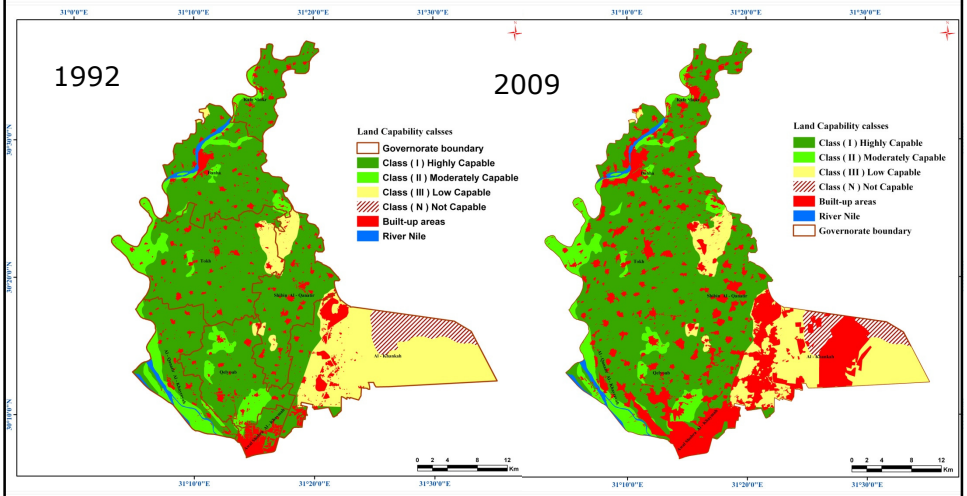


Monitoring urban sprawl



Challenges

- water resources is under severe stresses, and groundwater is being heavily extracted from the Nile aquifer.

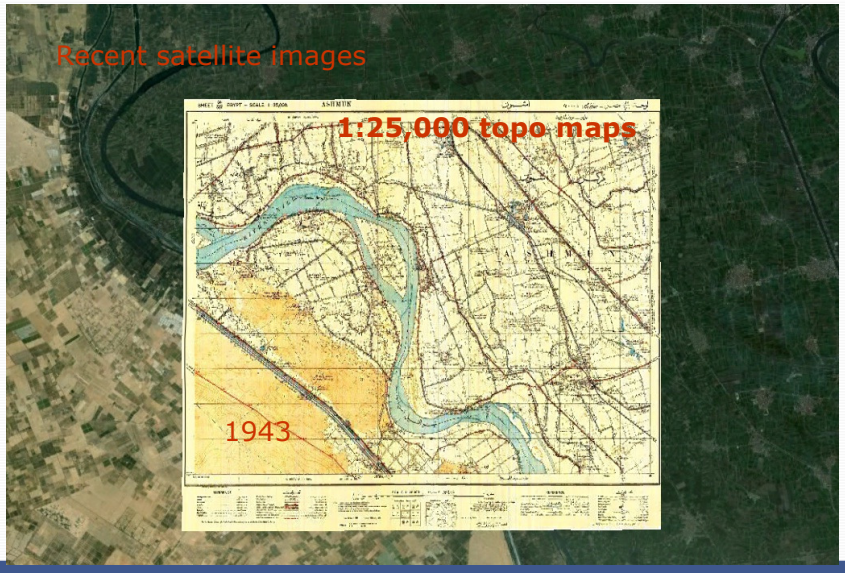
- The shallow Nile aquifer is renewable and characterized by its high productivity rate of (100 to 300 cub m per hour) with relatively shallow wells at relatively low pumping cost.

- About 6.1 BCM/yr are annually extracted from the aquifer for supplementary irrigation, municipal and industrial water supplies.

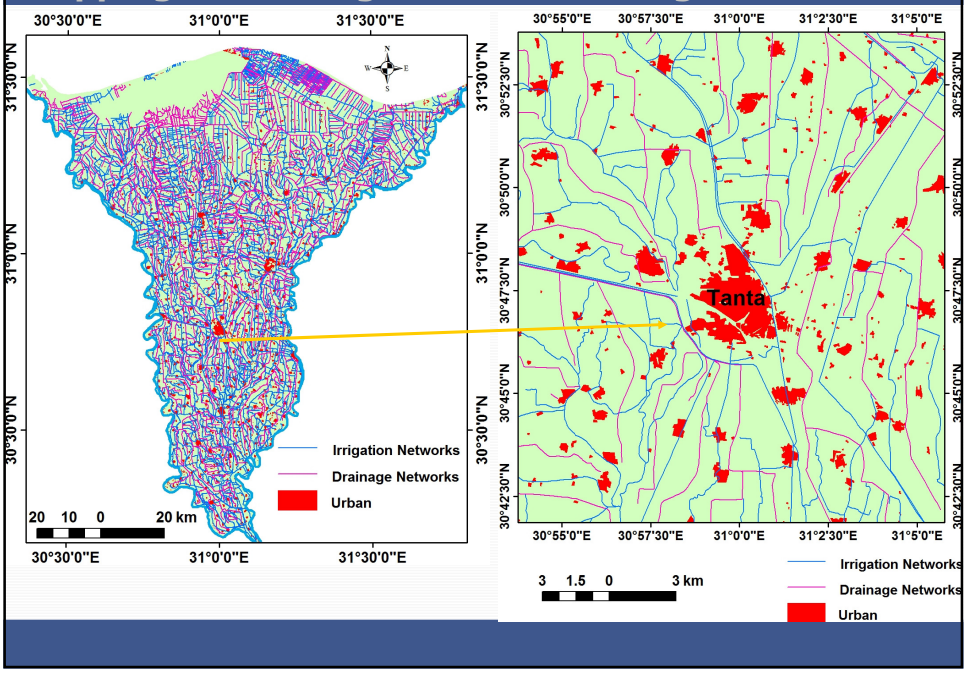
- Drinking water supplies for major towns and rural areas have been estimated at 4.6 BCM in 2000, where approximately 97% of urban population and 70% of rural of Egypt are connected to pipe-water supplies

- Being a shallow aquifer it is extremely vulnerable to pollution and contamination by surface induced sources (e.g. industrial effluent, return drainage, sewage and untreated waste water).

Recent changes of the landuse and landcover:



Mapping of the irrigation and drainage channels:

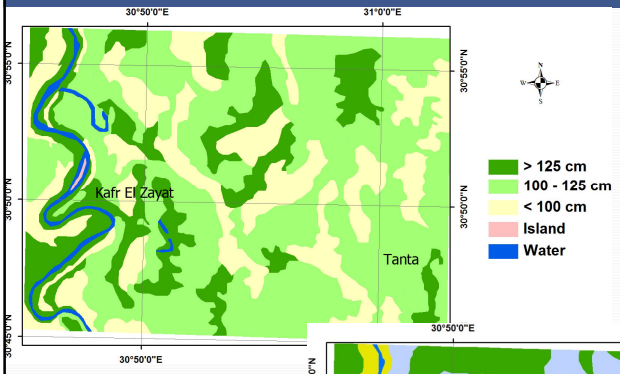


Expansion on silted-up channels:

Visual interpretation of paleo-channels:

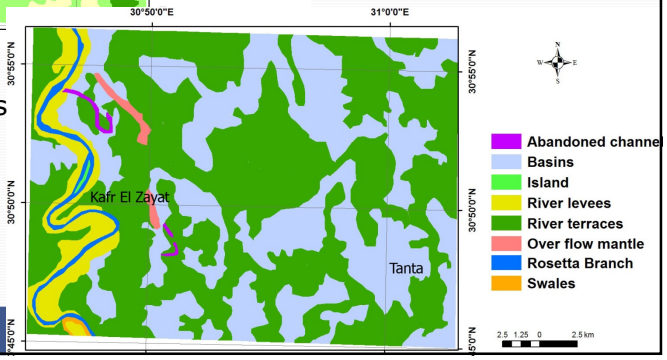
- Parcels of the fields are arranged in sinuous loops resembling channel meanders.
- Soil compositions are different than surrounding.

Soil characteristics of the Nile delta



- Depth to soil water table

- Physiographic units of the soil



Pumping groundwater of the buried channels:

- Most of the buried channels are undetected, and thousands of private wells and key municipal urban supplies wells are tapping the groundwater of these buried channels.
- Considerable areas of the artificial drainage networks, which receives both treated and raw sewage are in direct contact with these buried channels.
- There is a significant increase in the seepage of polluted water of the drainage lines into the underlying aquifer of the paleo and buried channels.
- The quality of groundwater supplies extracted from major buried channels are deteriorating, and thus created severe anthropogenic for the inhabitants.

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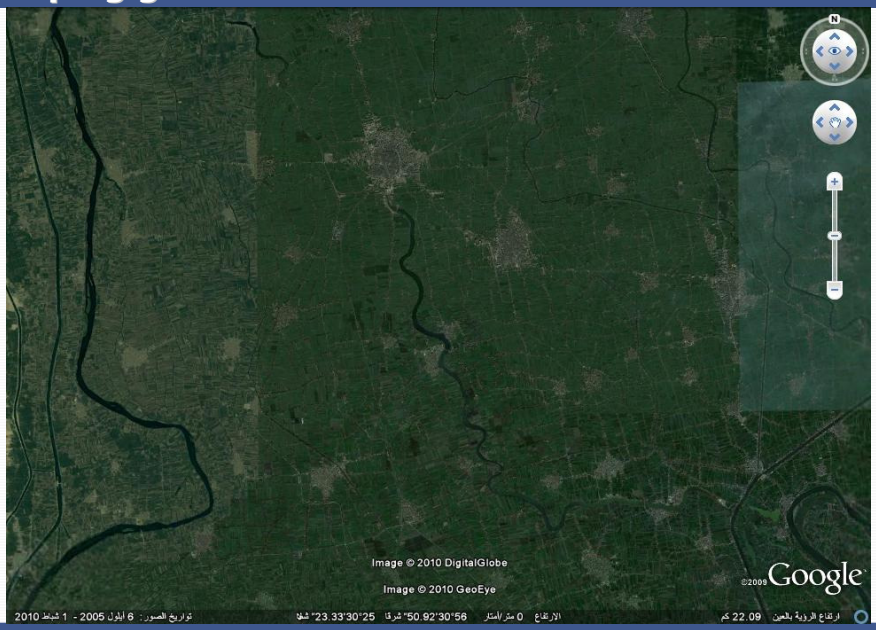
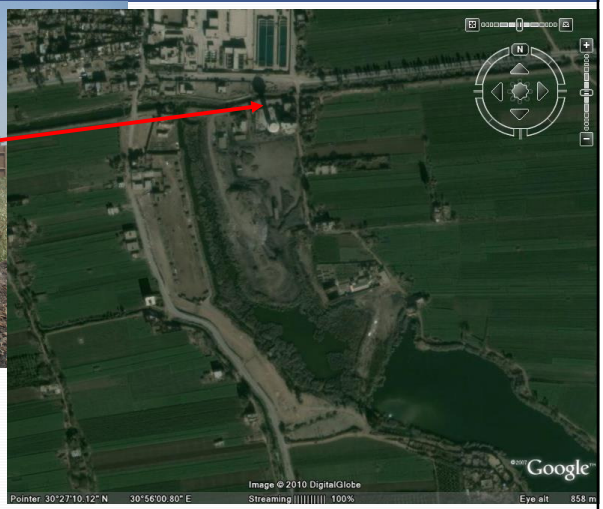


The contamination of groundwater:



- The key ground-water supply station of Menouf city is located within abandoned distributary, which is being used as a drainage and exploited for fish farming

Key findings:

- The Quaternary developments of the Nile delta are complex and play a key role in the distribution of groundwater aquifers.
- The preliminary maps of the paleo-distributaries of the Nile delta have to be updated; the lateral movements of meanders and cutoff in channels have to be better understood and considered.
- Integrating remote sensing data, soil analyses, geophysical methods and hydro-chemical analyses of water samples are required to improve the hydro-geological processes of the Nile delta and its impact on the groundwater quality.
- The interpretation of the paleo-channels is also of wider implication on the understanding of distribution of archaeological sites.

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Thankyou

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