Aarhus Geophysics

Airborne ElectroMagnetics (AEM). An invaluable tool for groundwater management

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Aarhus Geophysics Aps
From data to knowledge

Intro to Aarhus Geophysics Aps

- About
  - Headquarters in Aarhus, branch in Italy
- Business
  - Consultancy, software and training in AEM applied to groundwater management
- Mission
  - To provide best, quantitative, results to groundwater management
- Clients
  - Water authorities, consultants, mining companies, research bodies, worldwide

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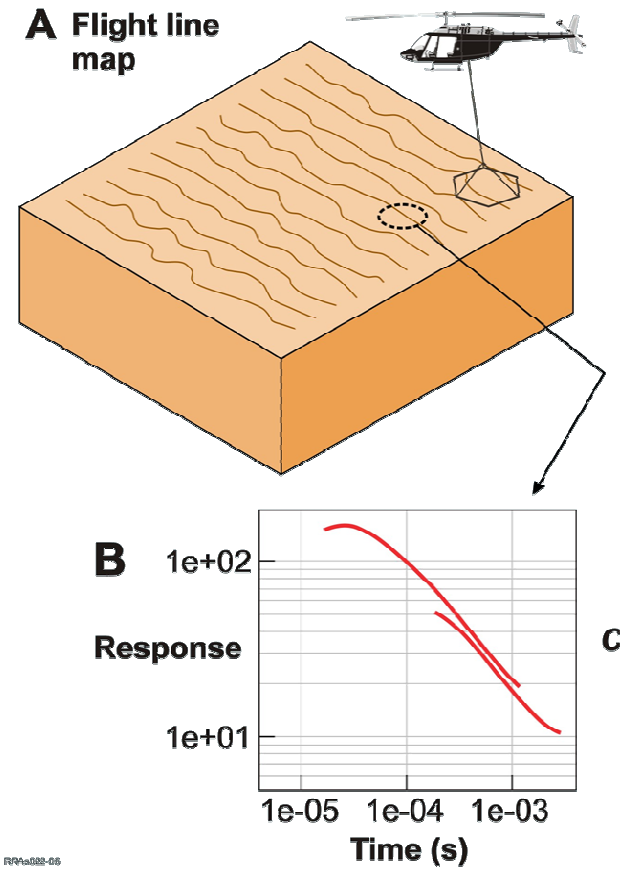
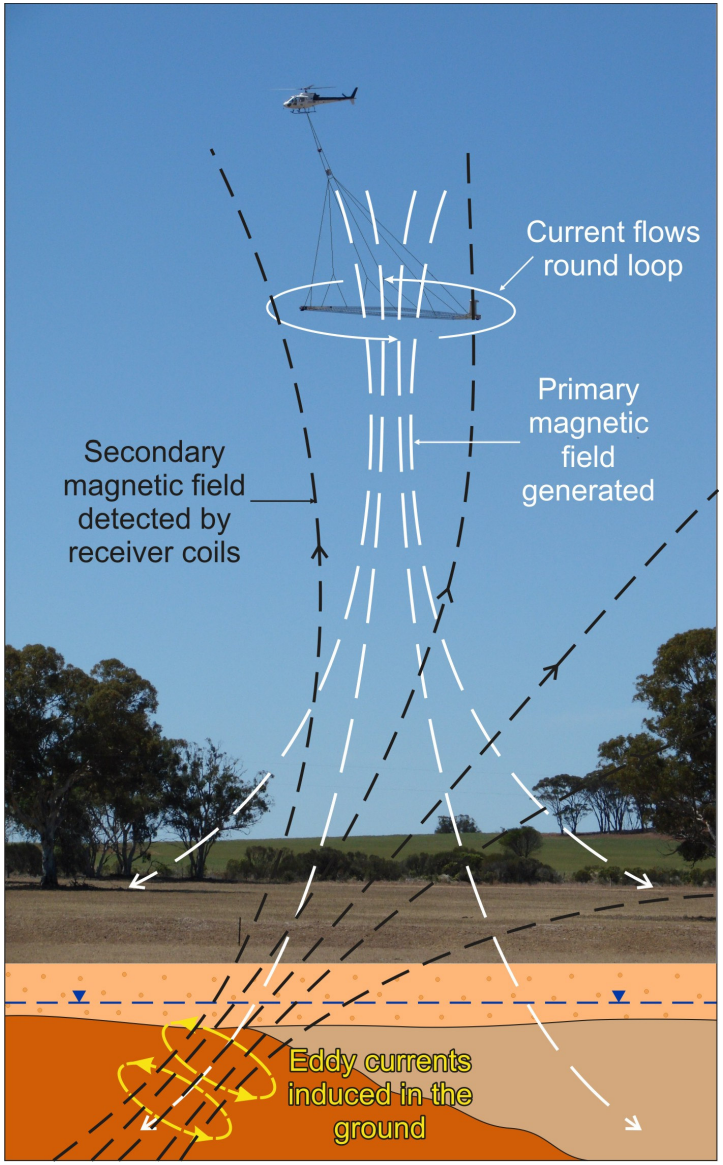
What is AEM

- Airborne ElectroMagnetics is a mature geophysical methodology
- It measures from helicopters or aeroplanes the 3D electrical conductivity of the subsurface
- This is translated into large scale, high resolution models of the hydrogeology, down to depths of hundreds of metres
- Easily integrated with other data

How does it work: data acquisition





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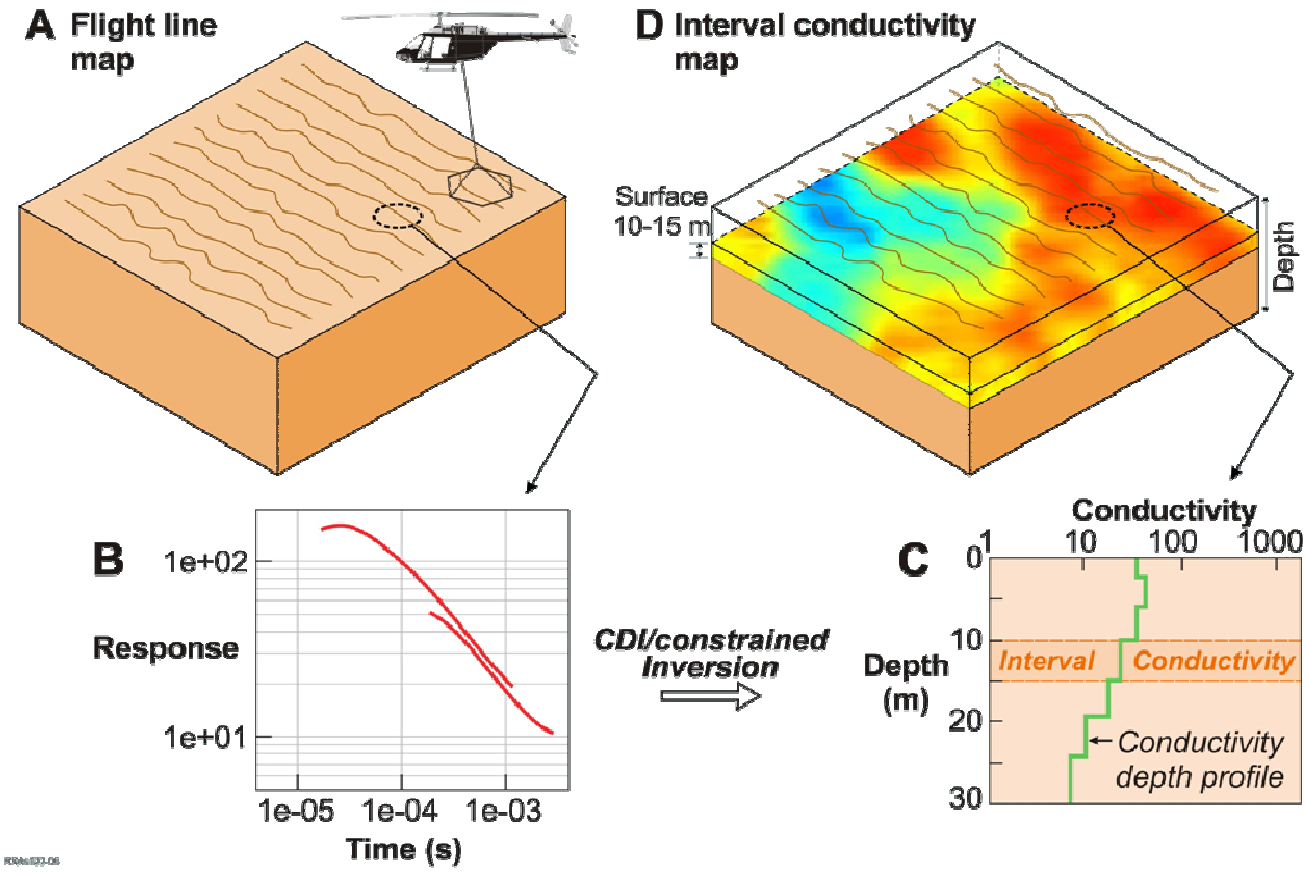
How does it work: from data to geoelectrical models



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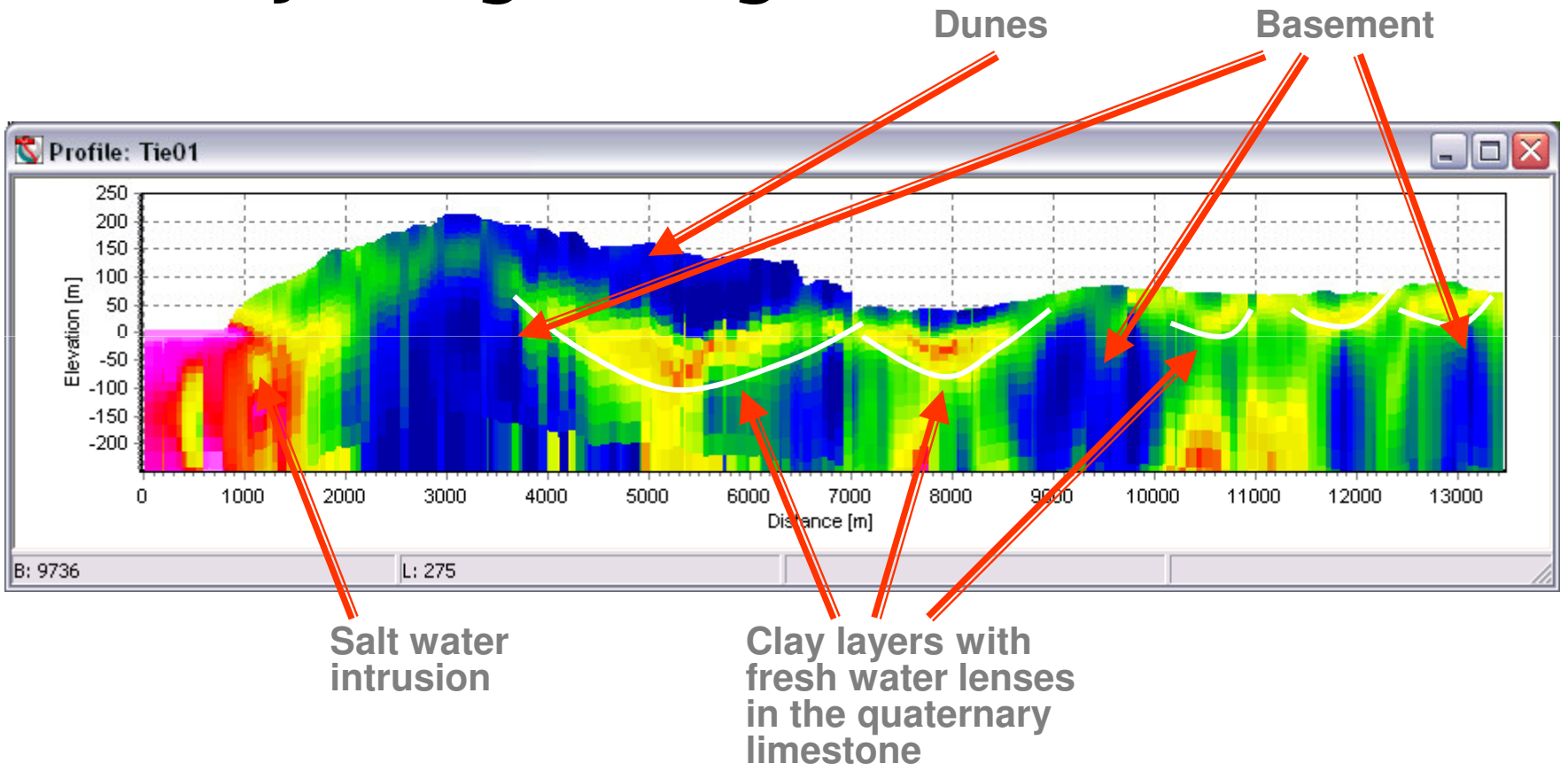
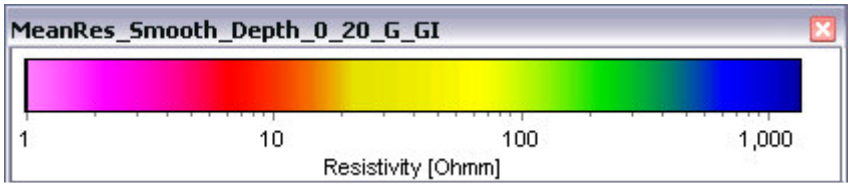
How does it work: from geoelectrical to hydrogeological models





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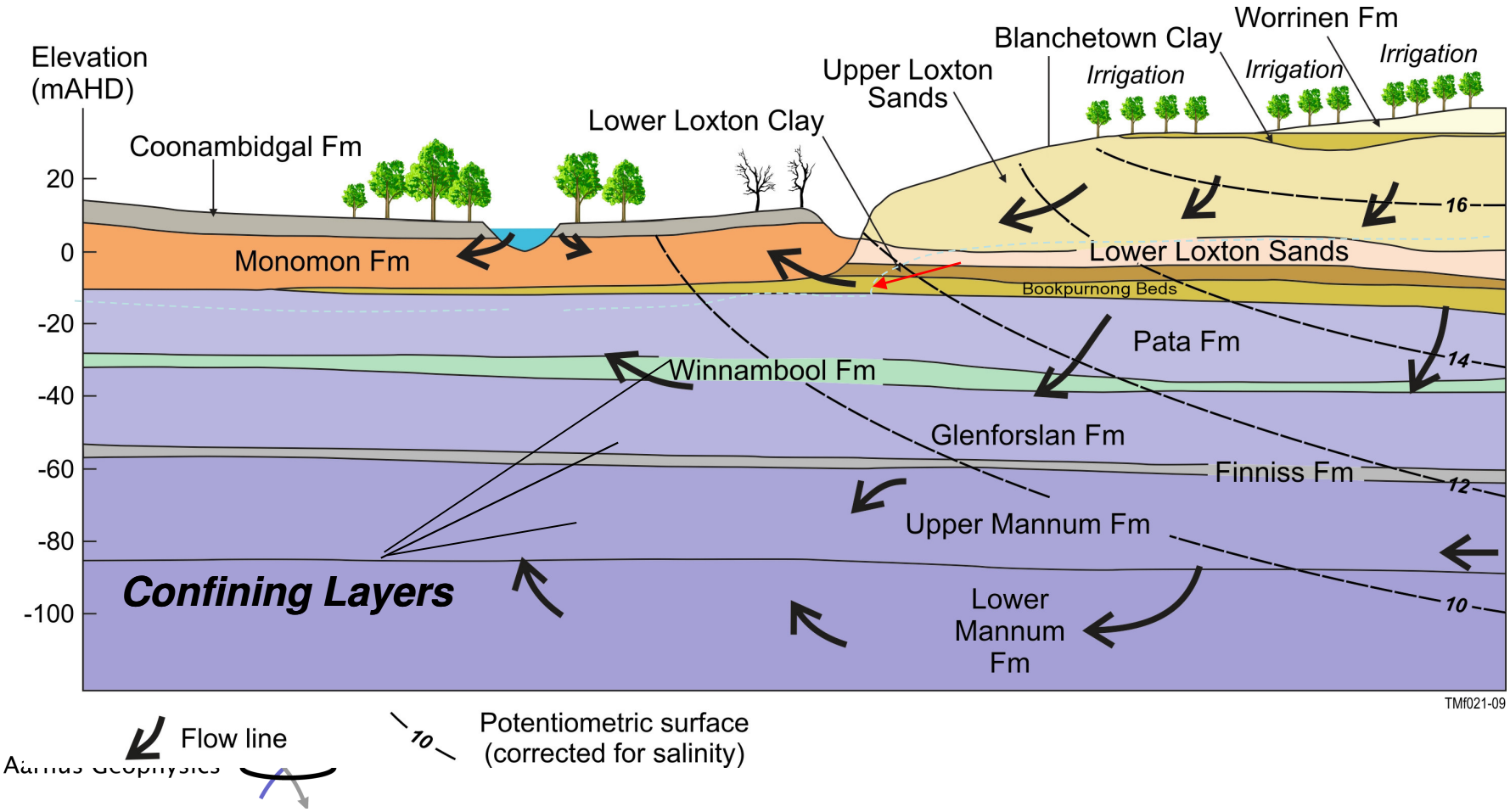
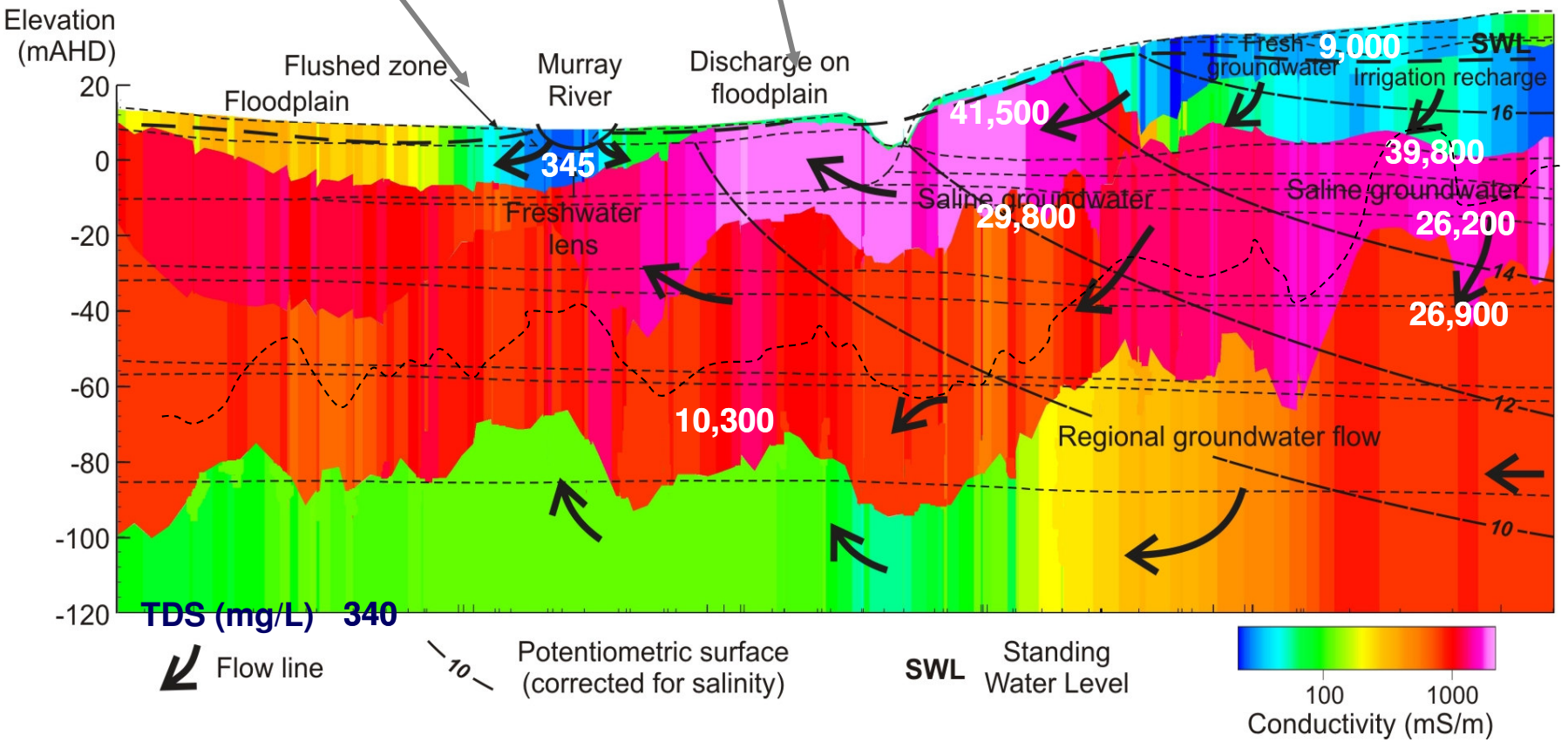
Typical groundwater applications

- Aquifers mapping
  - Hydrogeological models at basin scale
  - Groundwater quality
- Aquifers vulnerability mapping
  - to farming, industry, overextraction activities
- Groundwater salinization monitoring
  - Coastal saline intrusion
  - Dry land soil salinization
- Planning of new extraction wells
- Study of surface/groundwater interactions
  - Wetlands, lagoons, rivers, lakes

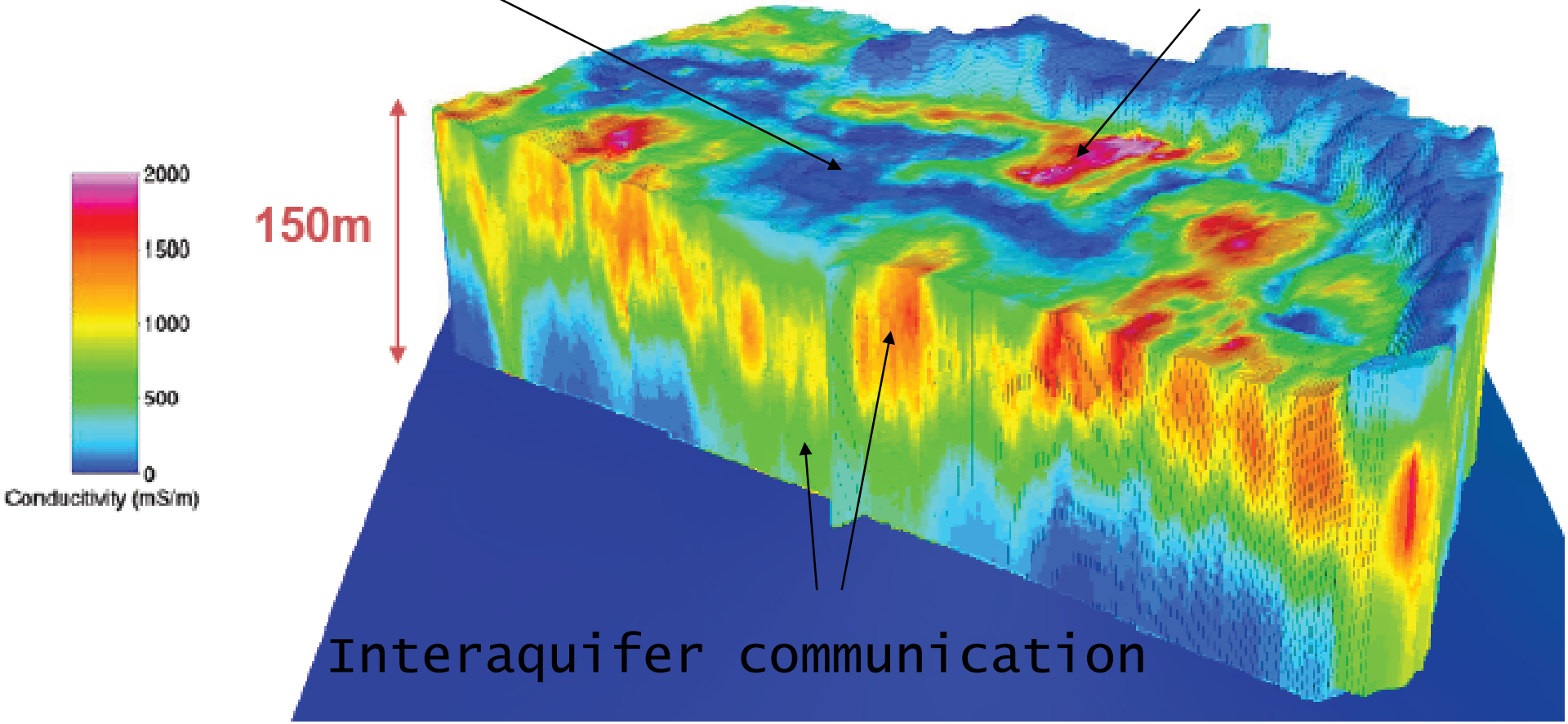
Example: Soil and groundwater salinization in Australia



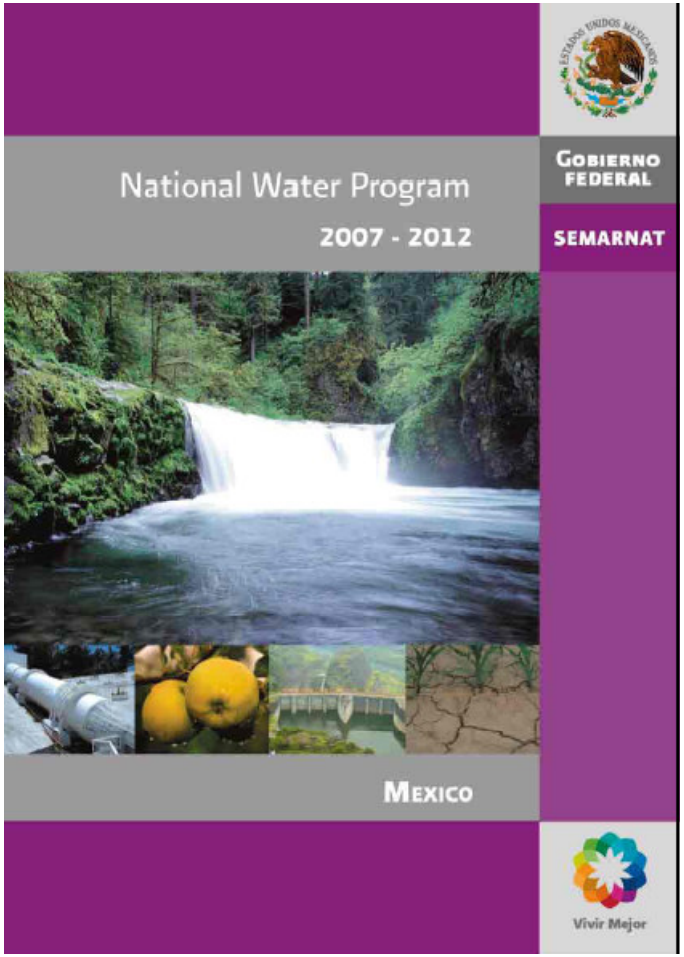
Results from AEM survey

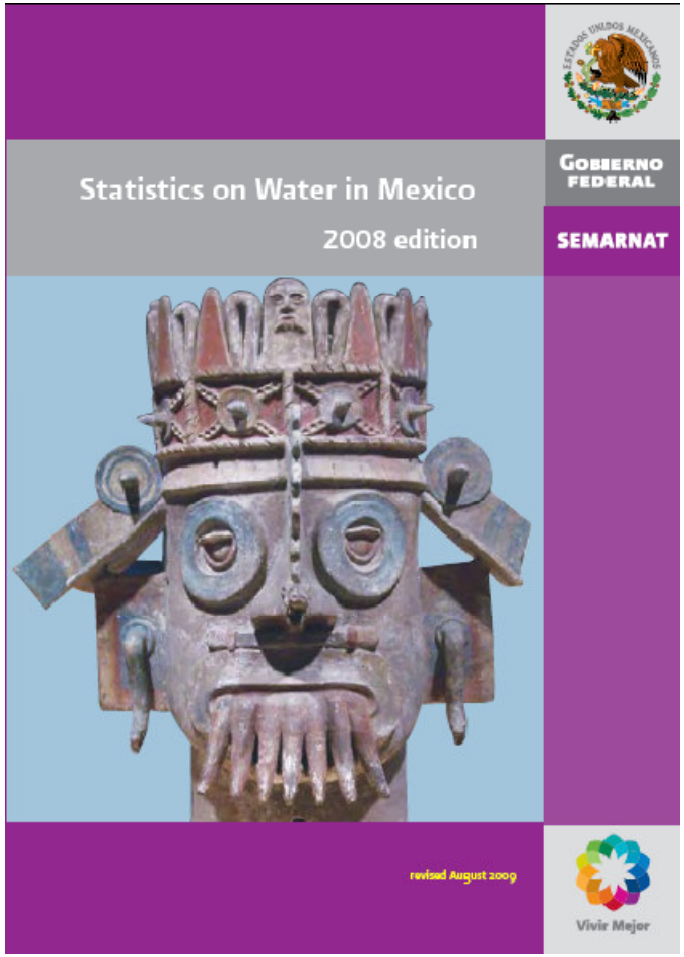


3D volumetric description



Can it be useful in Mexico ?





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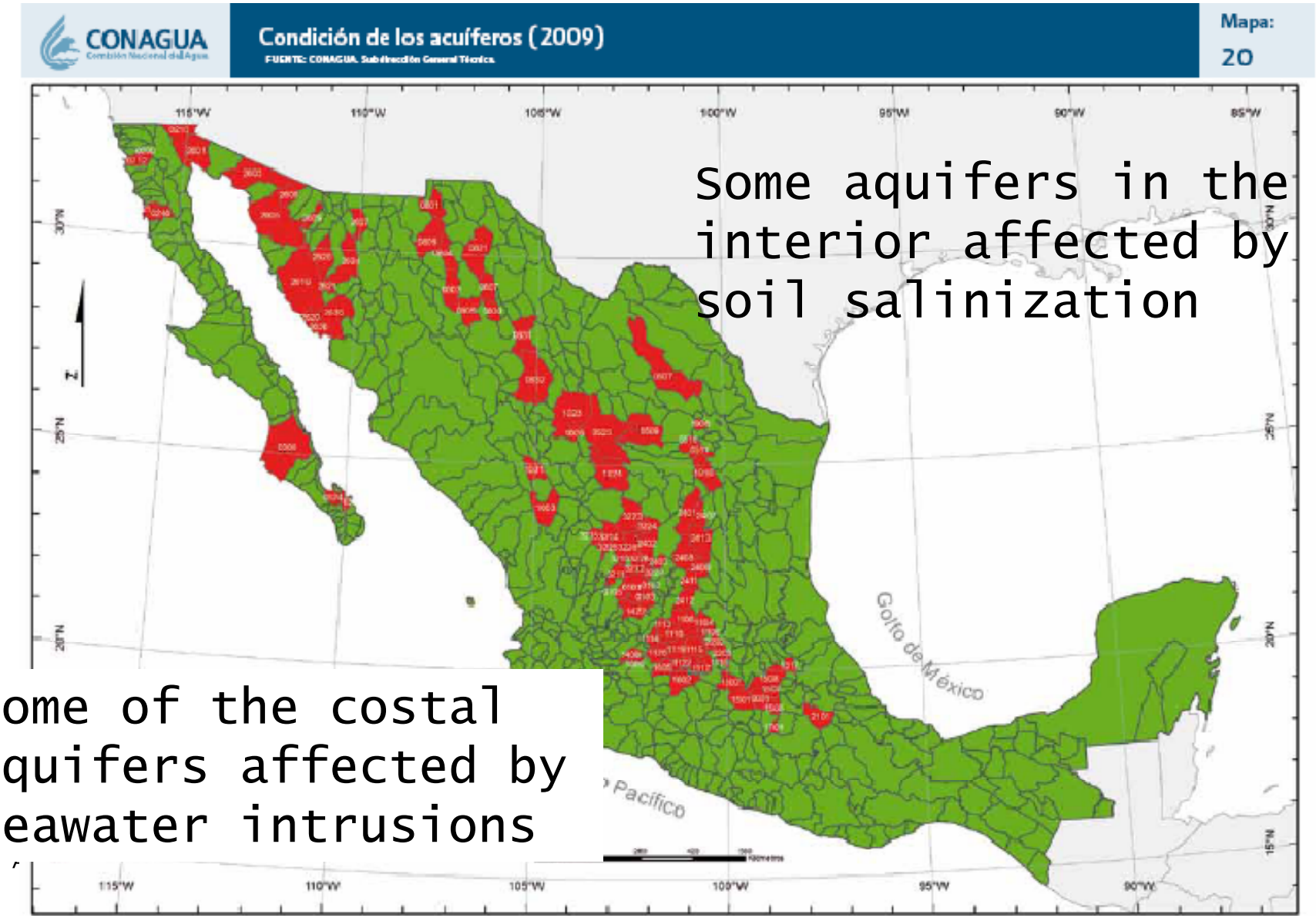
Water stress

Overexploited acquifers



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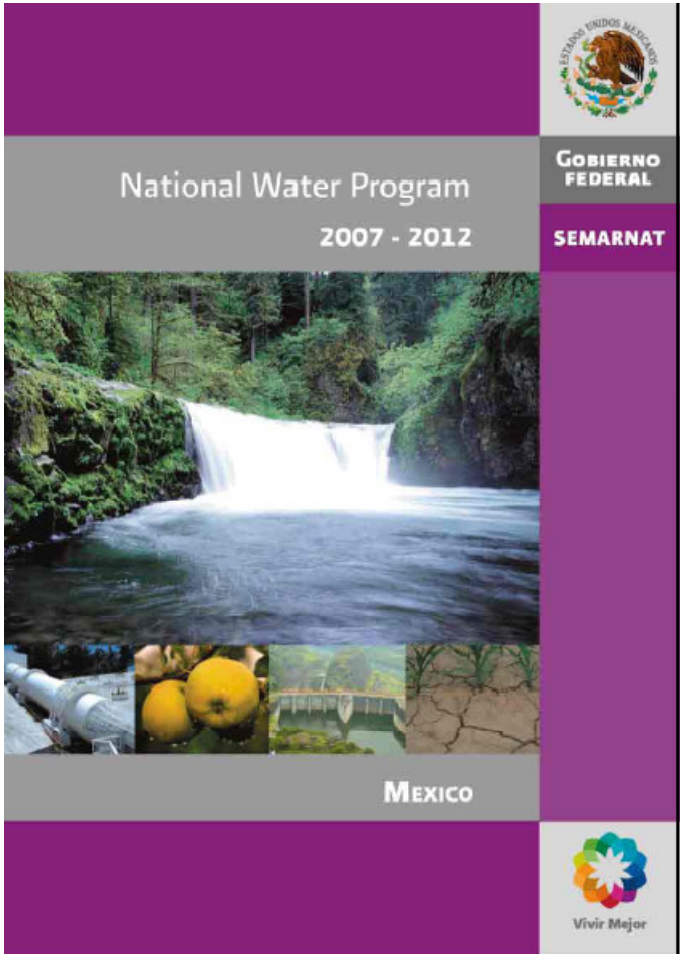

In the face of this scenario, it is necessary to promote geohydrological exploration in search of new sources; observation of the behavior of water levels in aquifers, as part of integrated monitoring of the water cycle; measurement of withdrawals and natural discharges of aquifers; monitoring of their natural quality and their deterioration caused by anthropogenic activities; and assessment of aquifers' features, renewal, and water availability.

Moreover, so as to increase water availability, it is necessary to develop projects for artificial aquifer recharge, evapotranspiration management, collection and desalination of brackish or salt water in coastal zones or closed river basins, and the combined use of surface waters and groundwaters, among others.

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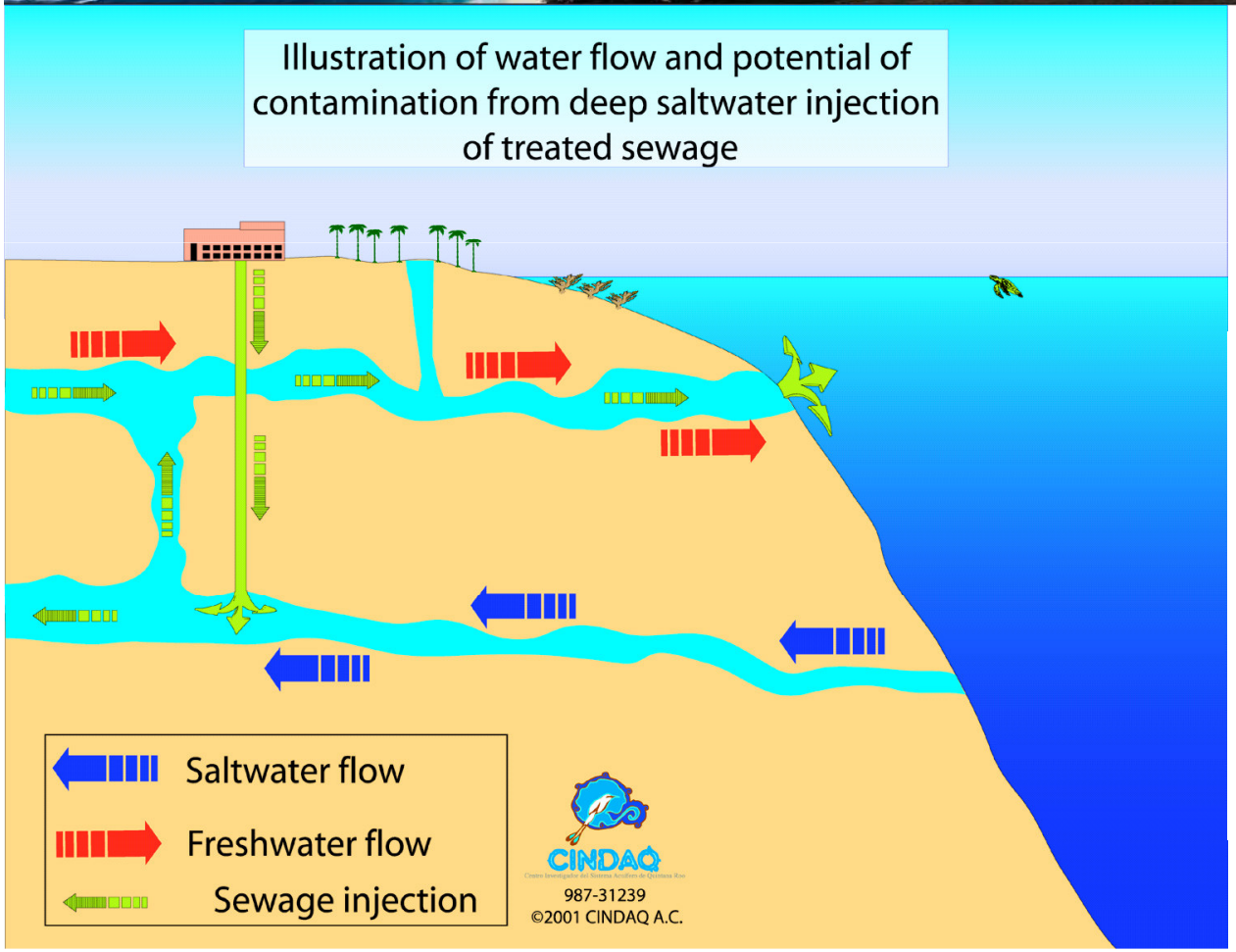
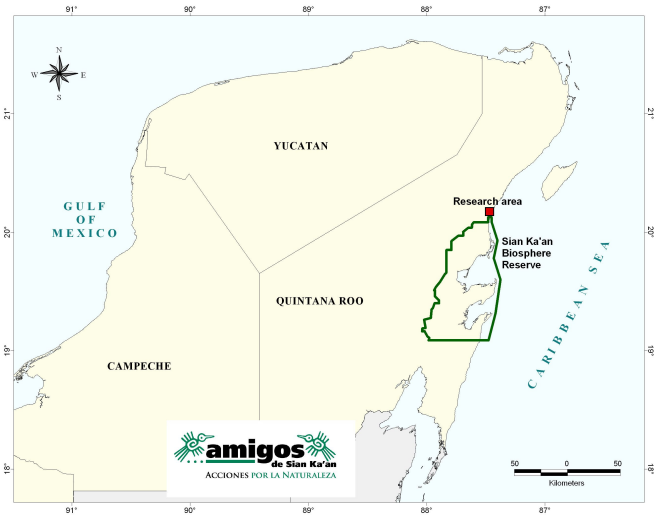
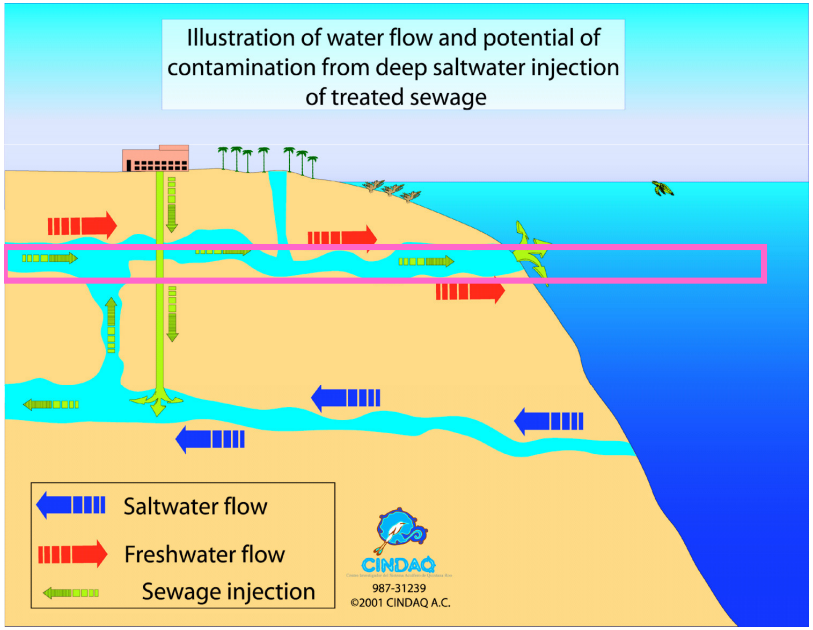
AEM applied to endangered Karst aquifers in Yucatan



Project of Amigos de Sian Ka'an,
in cooperation with DTU and Austrian Geological Survey



5 m depth slice from HEM



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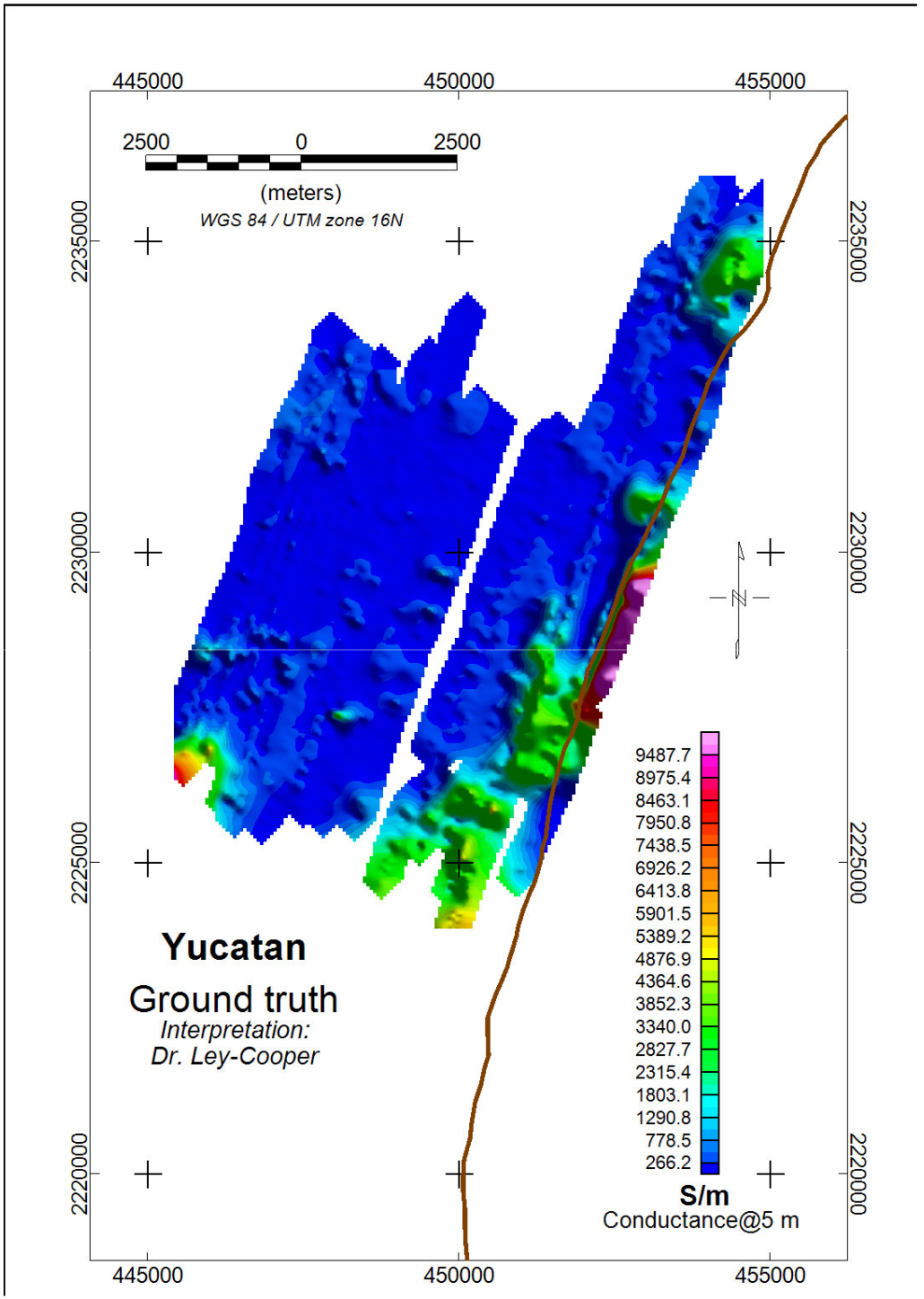
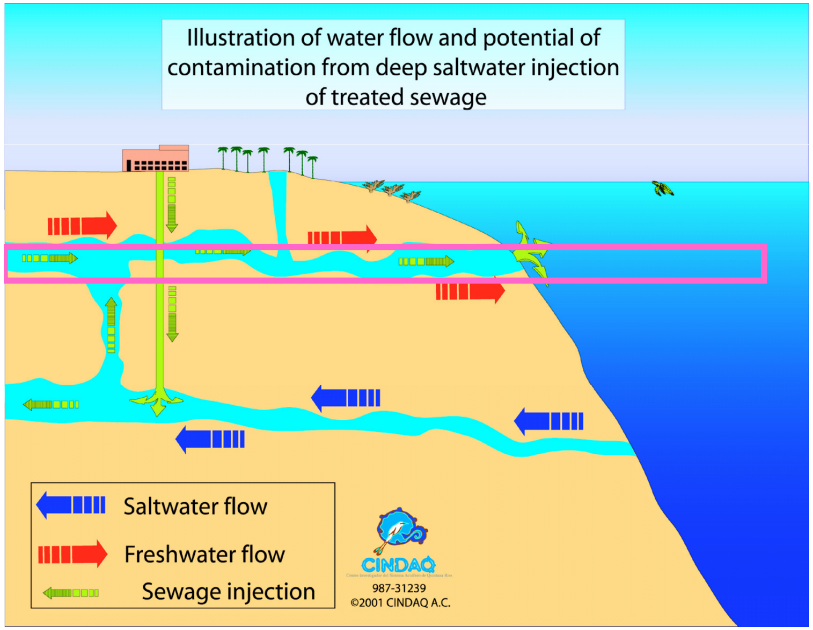


5 m depth slice from HEM compared with data from speleological expeditions



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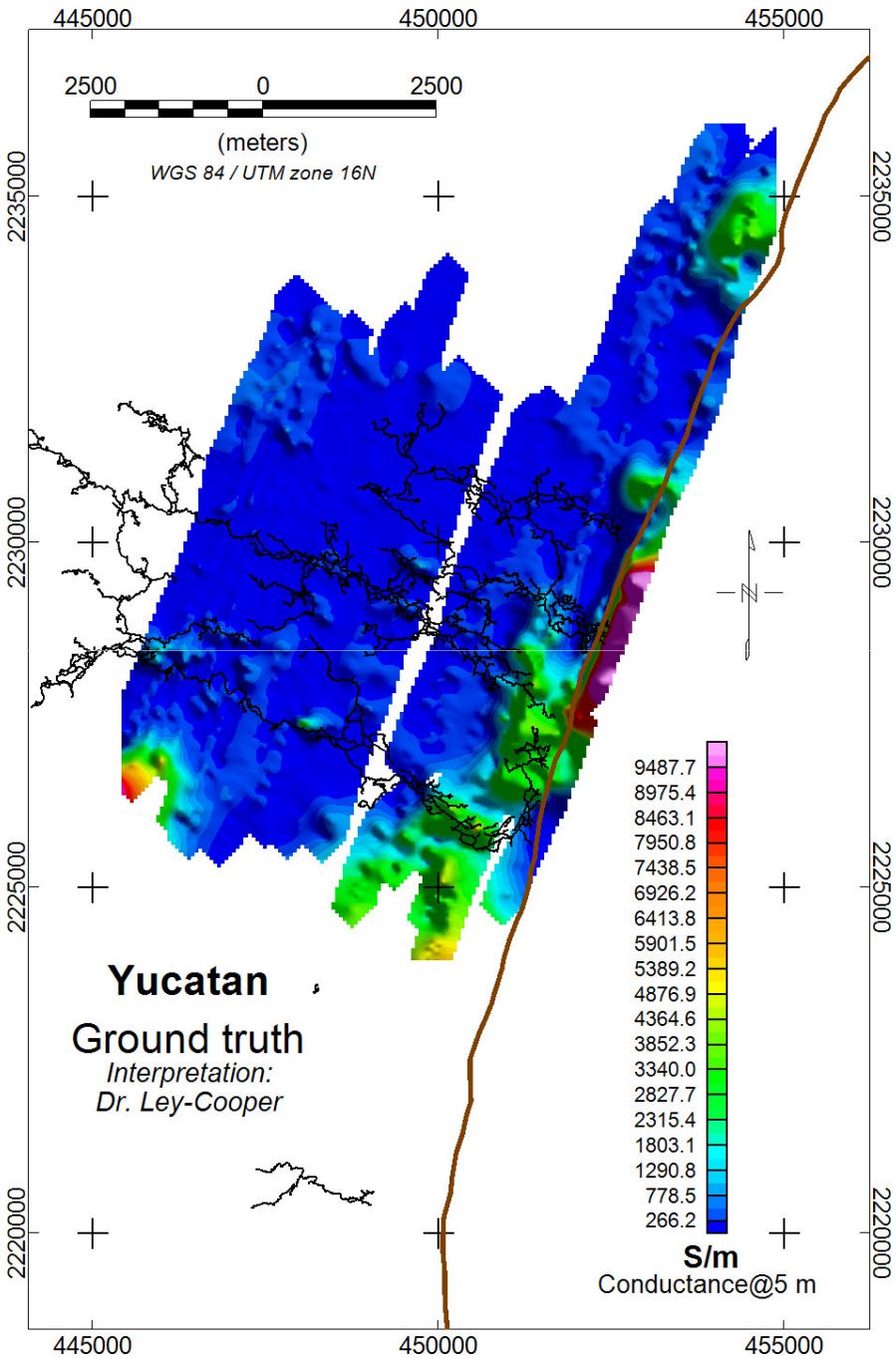
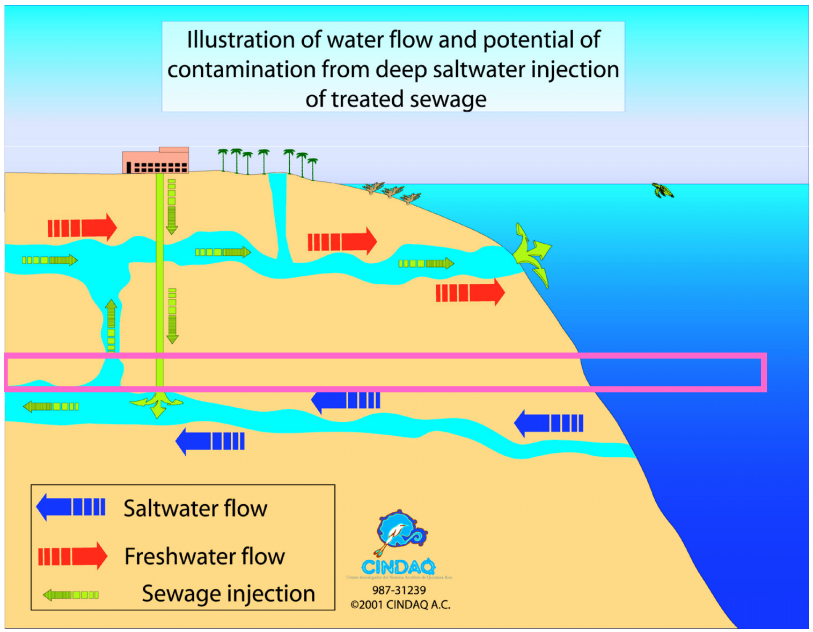


15 m depth slice from HEM compared with data from speleological expeditions



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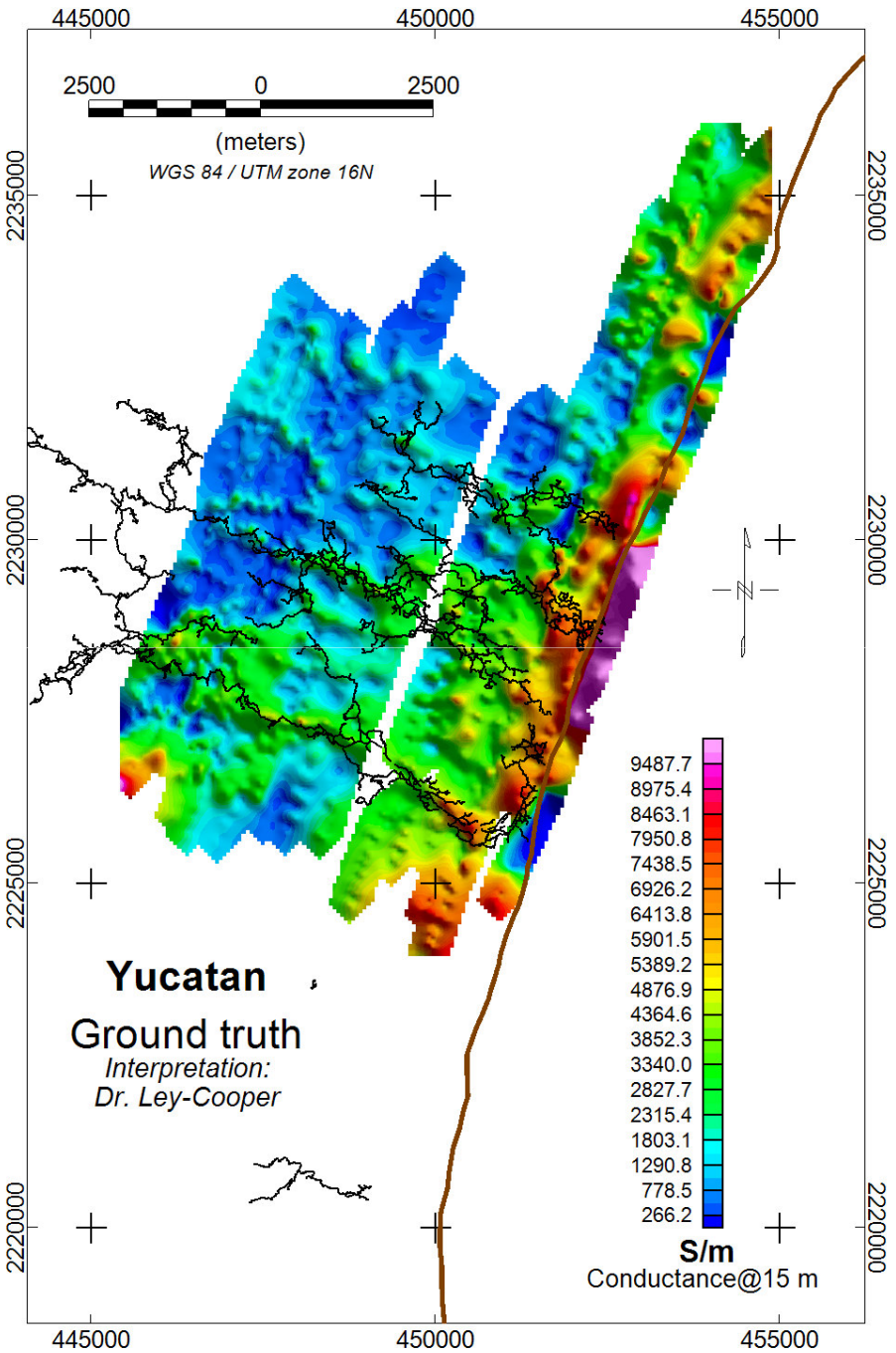

Conclusions

- AEM perfectly suitable for groundwater management program
  - Covers large areas
  - “Easy” logistic
  - Cost effective
  - High data density and penetration depth
  - Can be integrated with other data
- Some critical issues
  - Planning of the survey
  - QC of AEM data acquired by contractors
  - Proper data processing and modelling

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