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A Presentation on "Delineating the coastal saline water intrusion zones using Electrical Resistivity Tomography (ERT)

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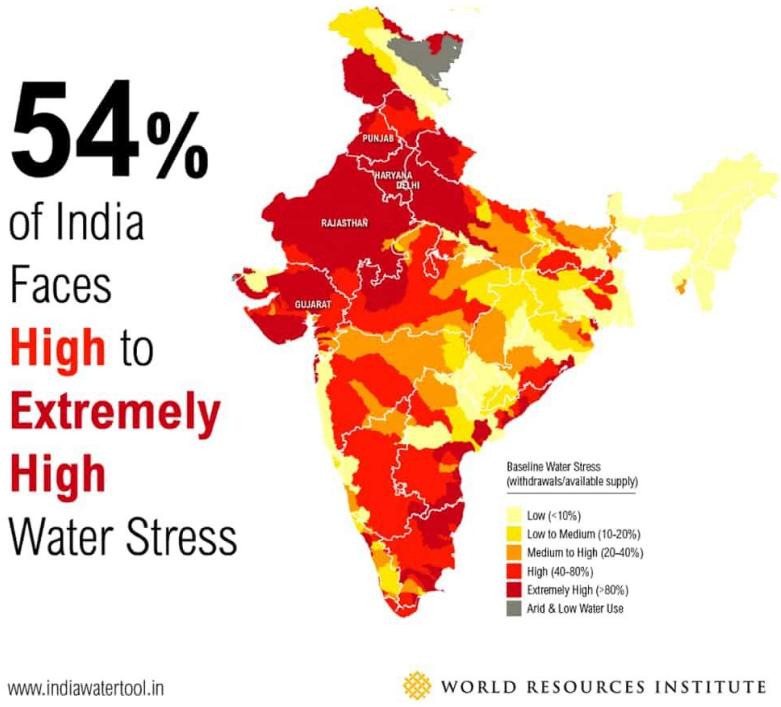
Outline

- Motivation
- Objective
- Study area: *A Coastal Environment*
- Geophysical Study: Electrical Resistivity Tomography (ERT)
- Results & Conclusion
- Scope of future work

Indian Groundwater Scenario

1. **Groundwater Crisis:** The UNESCO world Water Development Report states that India is the largest extractor of groundwater in the world, thus an ALARMING SITUATION.

2. Massive withdrawal of groundwater resources due to population growth and rapid industrialization has led to **Seawater intrusion** into the coastal aquifers across the globe.



Is there any efficient COASTAL GROUNDWATER MANAGEMENT System present?

Objective

- **Near surface Geophysical studies for mapping the saline water intrusion zones in coastal region:**
  Electrical Resistivity Tomography (ERT) (Initial Phase study)
- **Assessment of spatial & temporal variation of salinity in the study area.**
- **Investigation of probable causes of Seawater Intrusion in the study area.**

Study area: A coastal environment

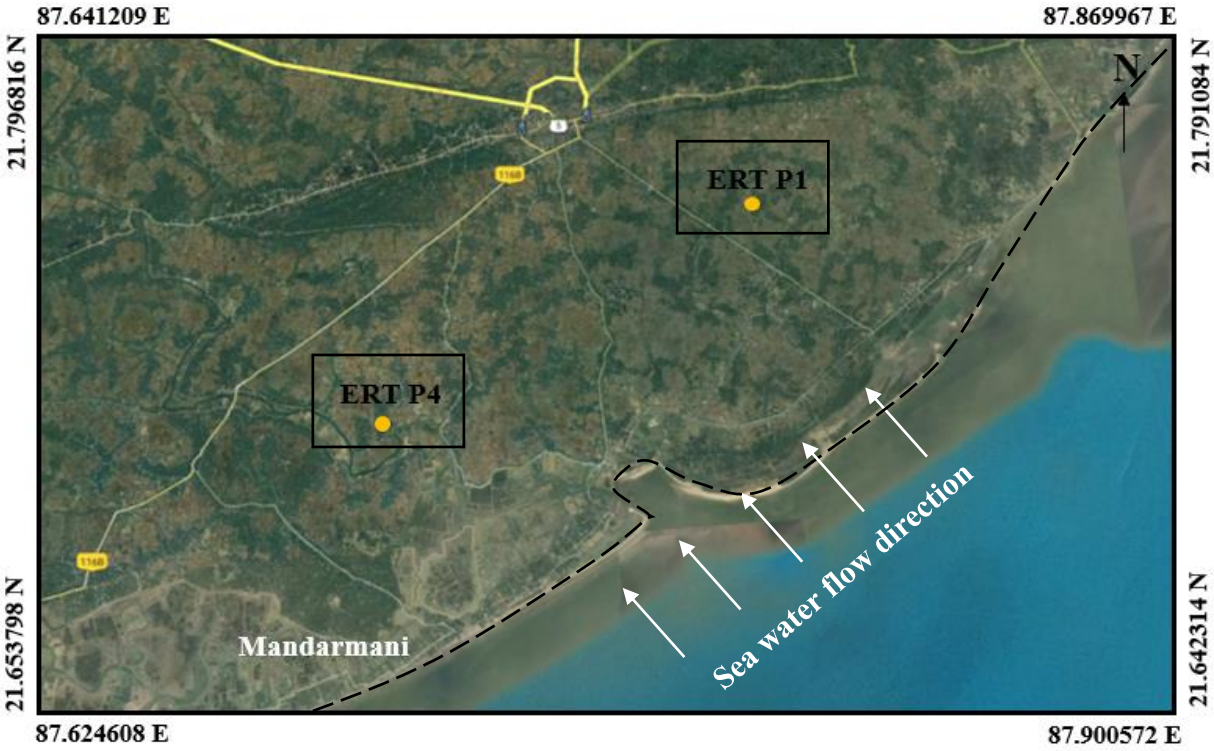


Figure 1. Location of ERT Profile 1 & Profile 4 in the study area

Methodology: ERT Survey

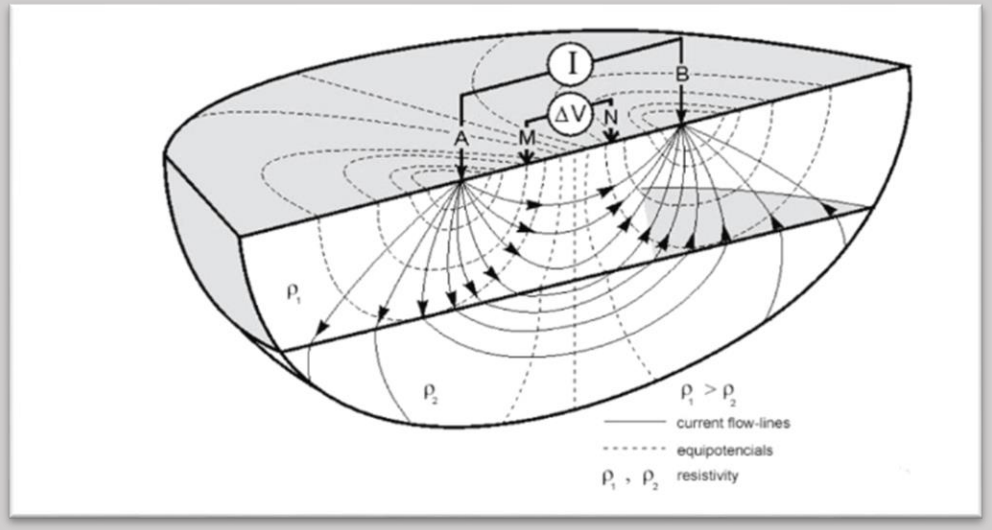
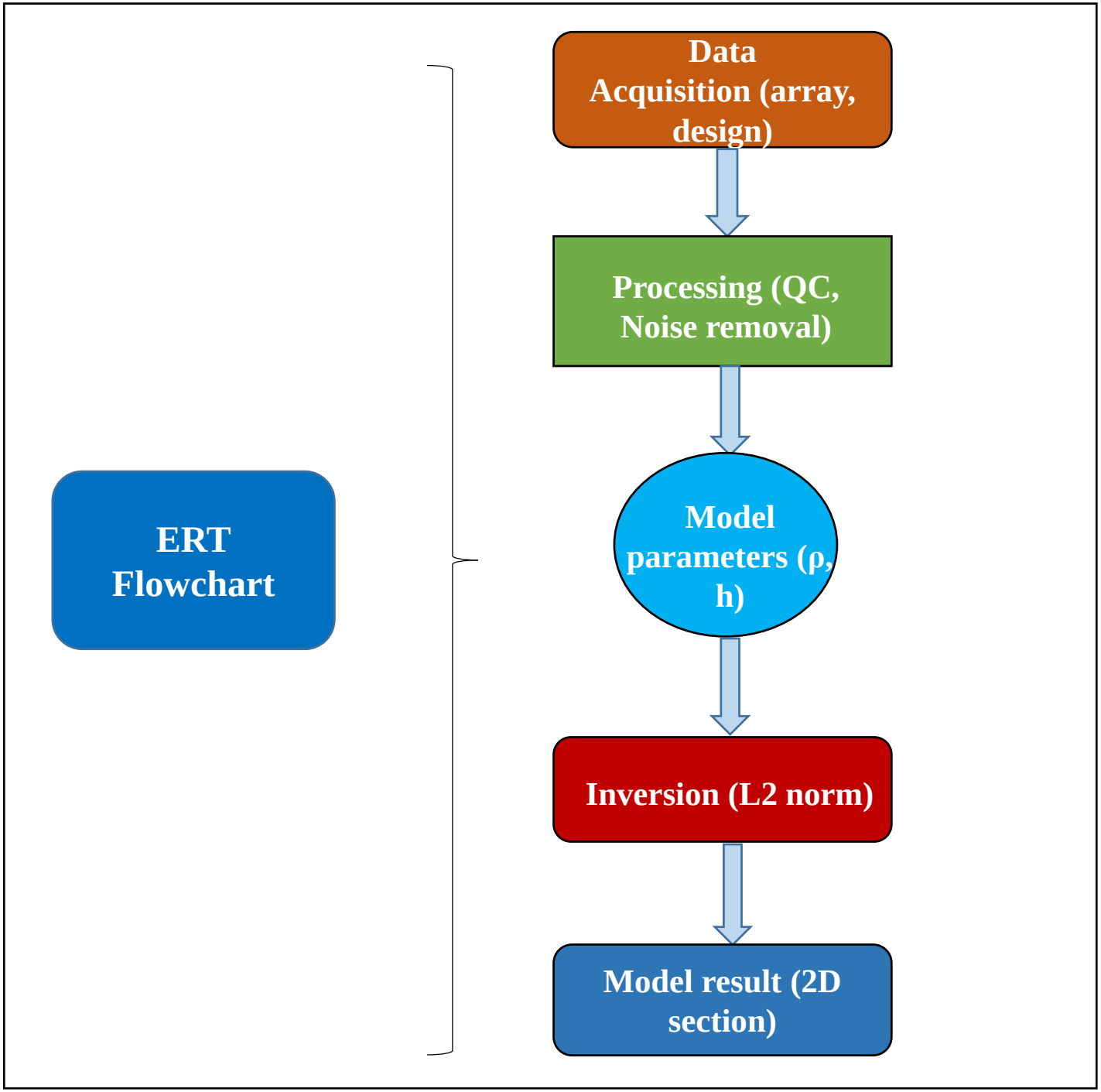


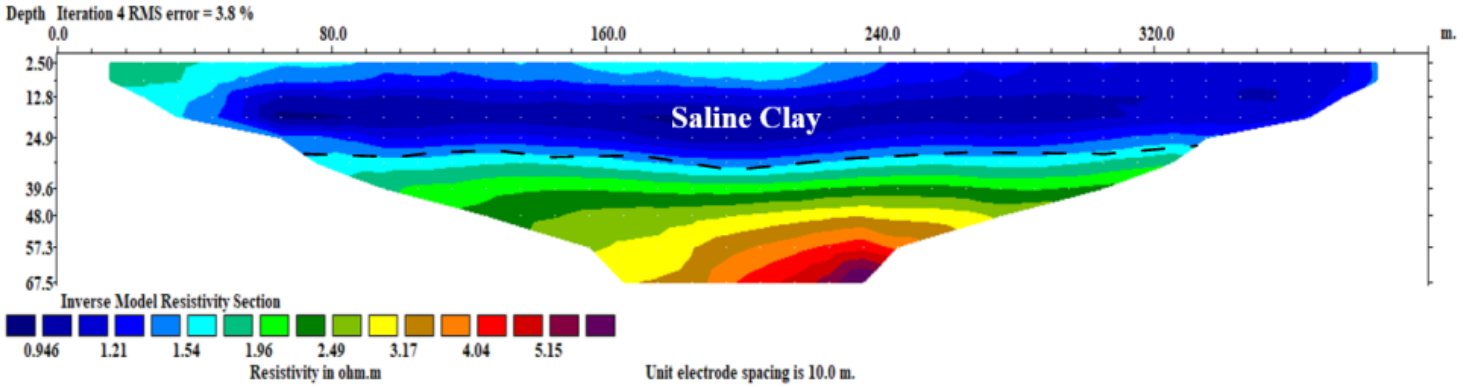
Figure 2. Basic Principle of Electrical Resistivity method (After Seidel and Lange,2007)

Field Photograph: Resistivity meter setup

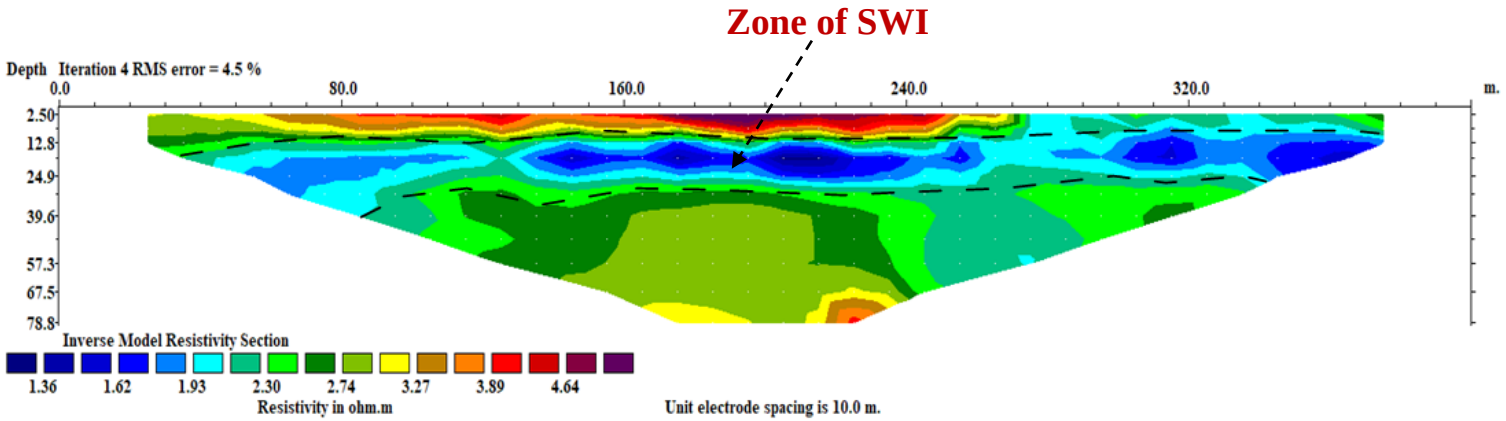

ERT Flowchart
Data Acquisition (array, design)
Processing (QC, Noise removal)
Model parameters (ρ, h)
Inversion (L2 norm)
Model result (2D section)

Results

ERT Profile 1: Wenner array



ERT Profile 4: Gradient array



Conclusion

Key Findings:

1. Due to the over-extraction of groundwater, shallow aquifers (30m bgl) are affected mainly by salinity problems.

2. The primary cause of the SWI problem in this area is due to Salt pan industries, Fish Farming, recent cyclone effect (Amphan).

3. In recent time, due to traditional paddy crop cultivation, the no. of boreholes are increased to meet the water demand.

Field Photograph

Scope of future work

1. **A time-lapse 3D ERT Survey needs to be planned for complete monitoring of Saline water flow.**

2. **A Machine learning algorithm can be developed for the predictive relation of salinity vs resistivity.**

Solution????

ERT is a efficient tool for investigating subsurface flow condition which can be very helpful in monitoring salinity problem. Joint Inversion of ERT with Time domain EM can provide a better understanding of coastal aquifers.

References:

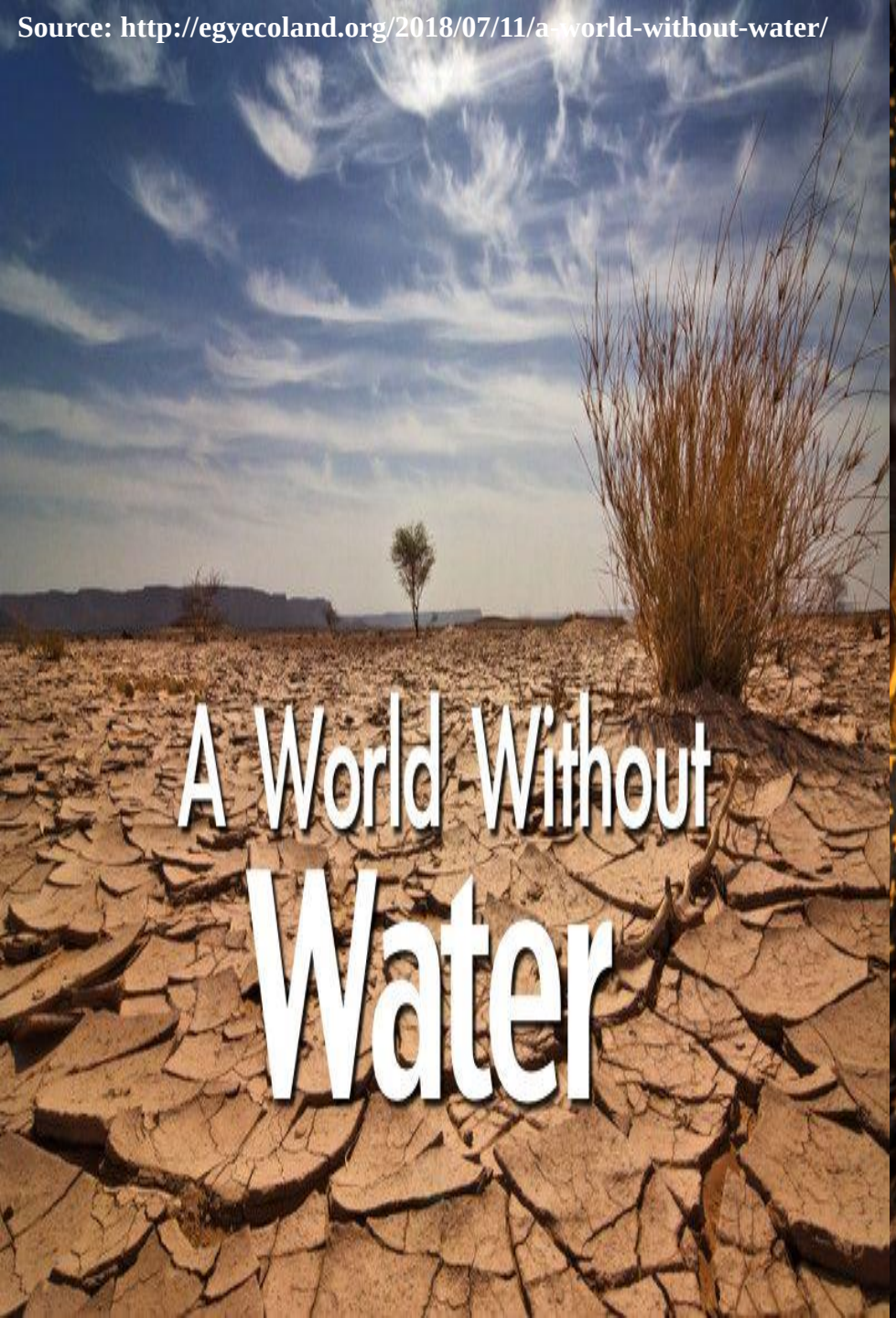
1. Acharya, T., Kumbhakar, S., Prasad, R., Mondal, S.,& Biswas, A. (2019). Delineation of potential groundwater recharge zones in the coastal area of north-eastern India using geoinformatics. Sustainable Water Resources Management, 5(2), 533–540.

2. CGWB. (2015). Technical Report, Ground water year book of West Bengal & Andaman & Nicobar islands (2015-2016) Eastern region, Kolkata, Govt. of India, 190p

3. Loke, M. H. (2001). Electrical imaging surveys for environmental and engineering studies. A practical guide to 2-D and 3-D surveys. RES2DINV manual.

4. Seidel, K., Lange, G. (2007). Direct Current Resistivity Methods. In: Environmental Geology. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-540-74671-3_8

Source: http://egyecoland.org/2018/07/11/a-world-without-water/



Source: https://borgenproject.org/top-4-technologies-solving-water-scarcity/