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FINDING GEOTHERMAL ANOMALIES USING ECOSTRESS DATA

UPDATE ON THE GEOHOT PROJECT

FIELD WORK MARCH 2022

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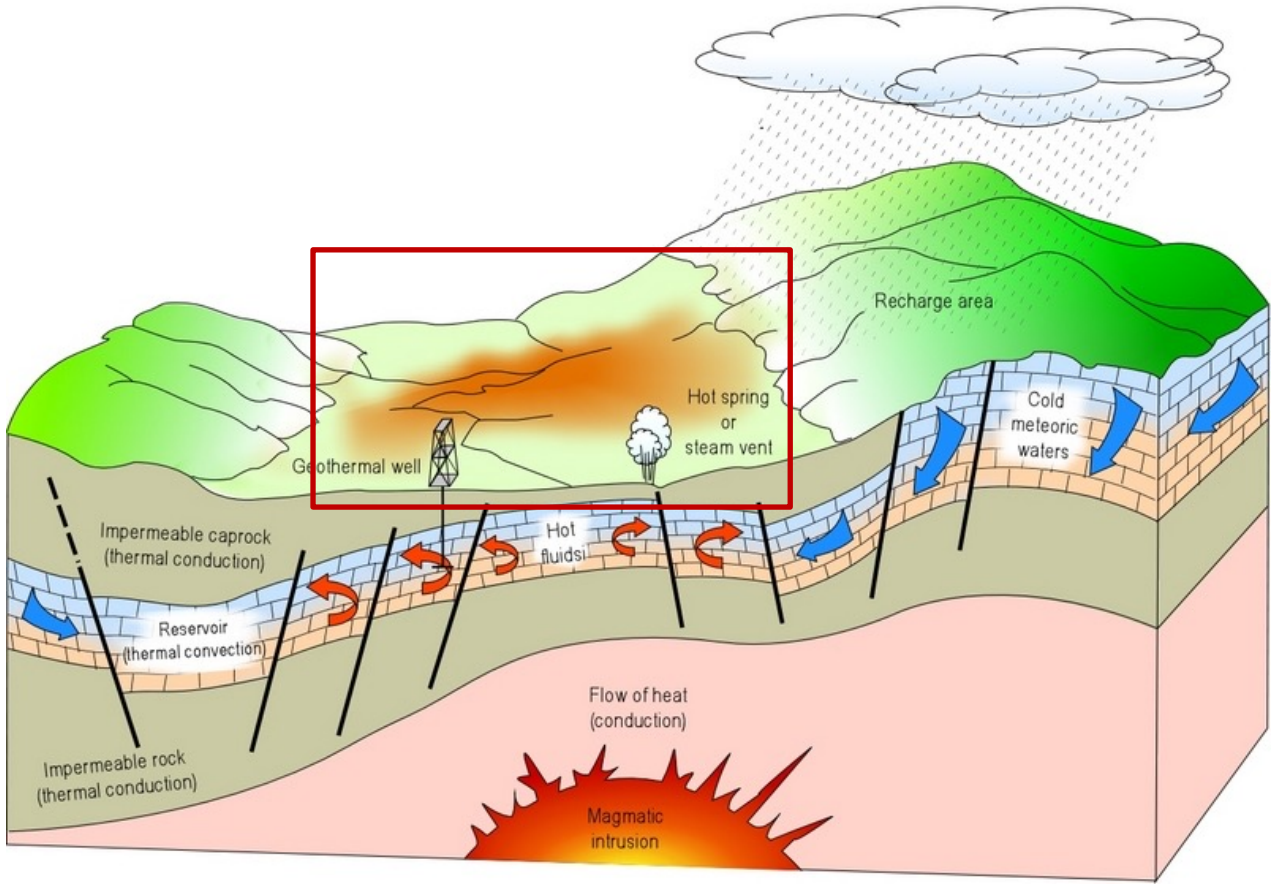
ECOSTRESS WORKSHOP APRIL 14, 2021

ITC
FACULTY OF GEO-INFORMATION SCIENCE AND EARTH OBSERVATION

DETECTING GEOTHERMALLY ACTIVE AREAS



Conceptual geothermal system with steam extraction for electricity production and surface manifestations
source: Geothermal-energy.org

- RS techniques typically focus on surface manifestation such as surface mineral alteration
- Usage of satellite thermal imagery is limited, due to pixel size, and time of overpass
- Using ECOSTRESS can be a solution

GEOTHERMAL ANOMALY DETECTION METHODS

Two groups of methods

- Methods using only the thermal imagery
  - Kernel based
  - Usually contextual thresholding

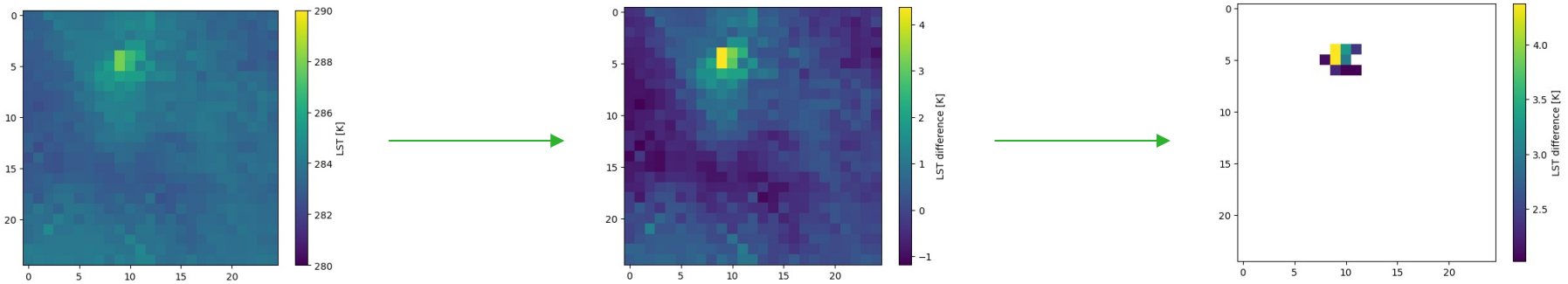
GeoHot project

- Methods using data fusion
  - AI based
  - Usually base on multiple factors from different wavelengths

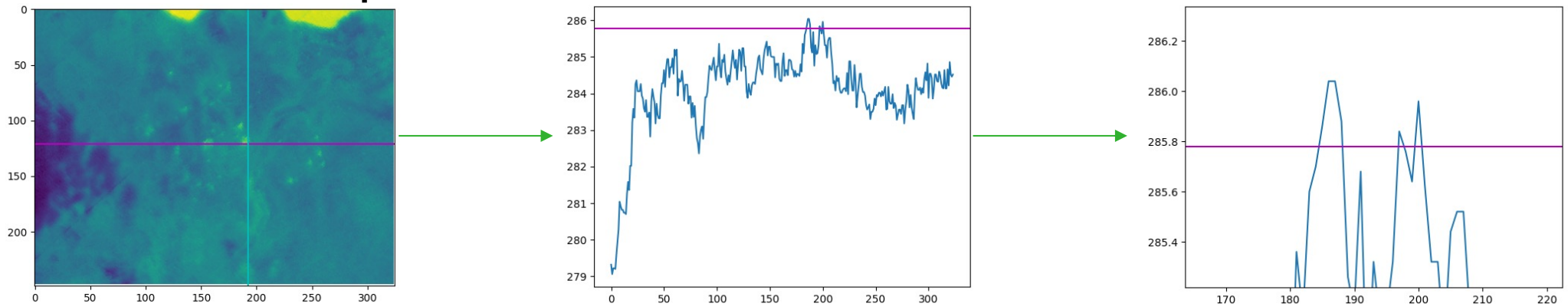
Side project

DETECTION USING THERMAL IMAGERY ONLY

- Comparison of two detection methods
  - The adapted Zhang (2004) method



  - A “line-sample” method



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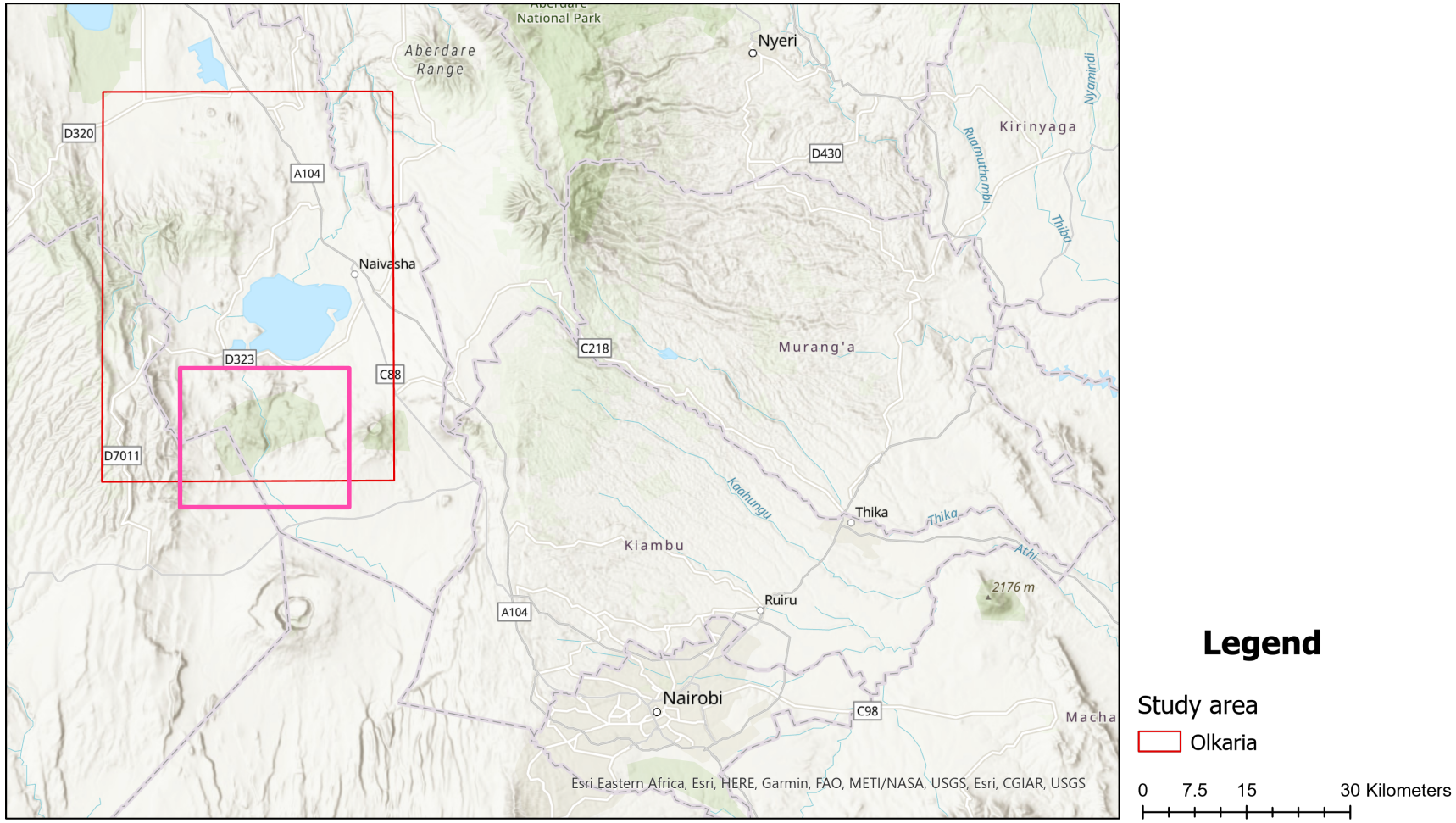
STUDY AREA – OLKARIA, KENYA



Legend

Study area

Olkaria

0 7.5 15 30 Kilometers

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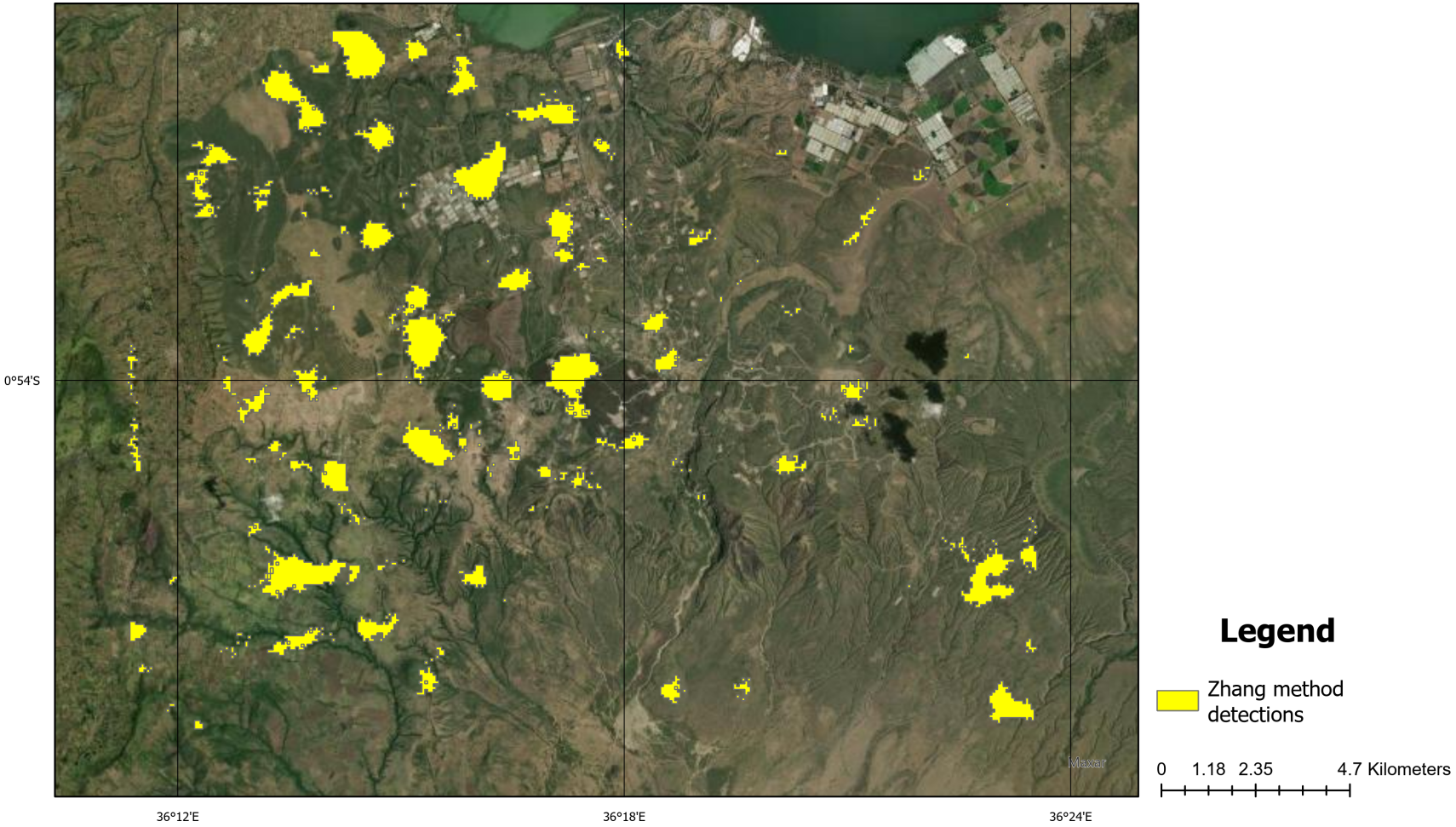
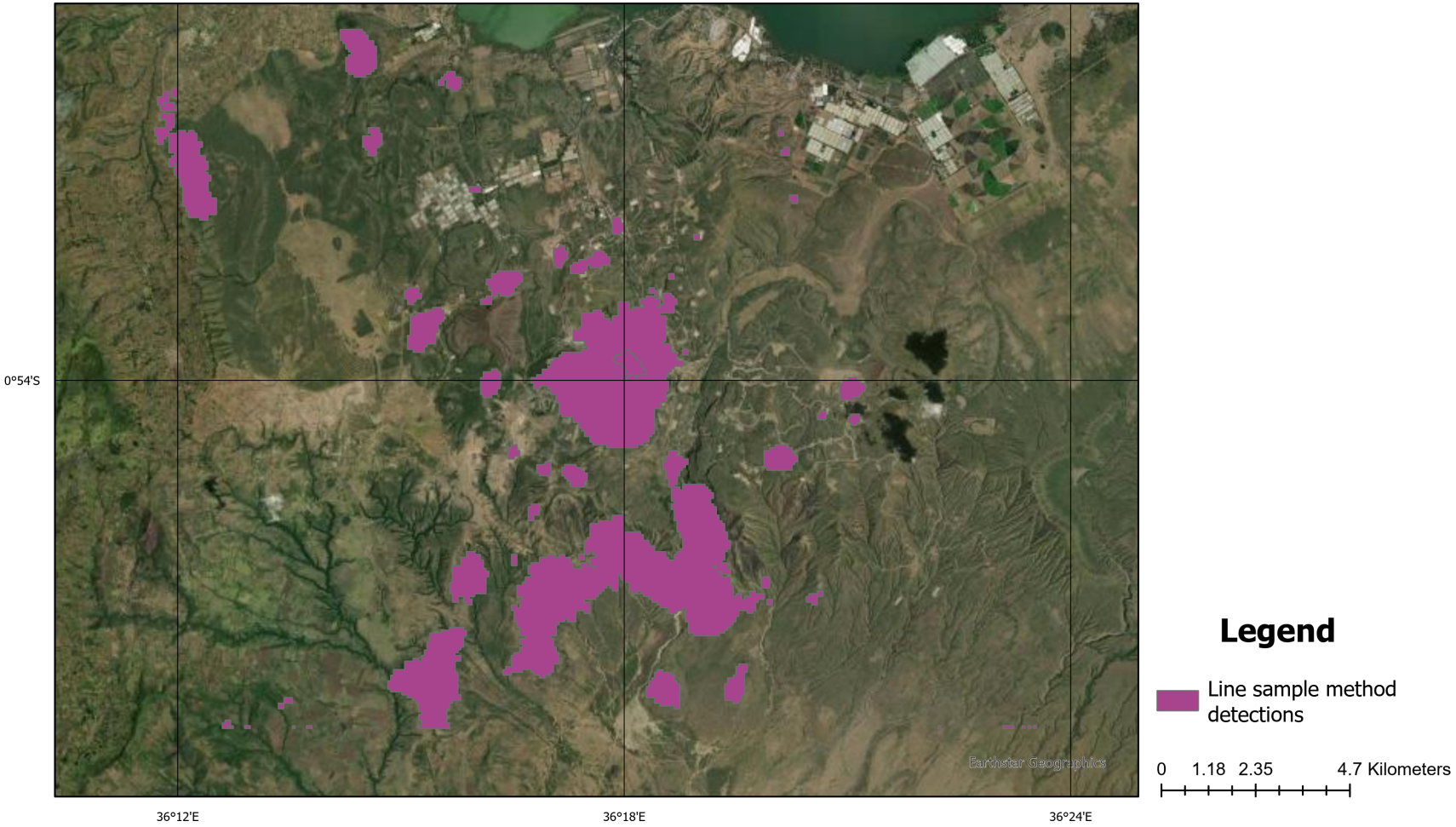
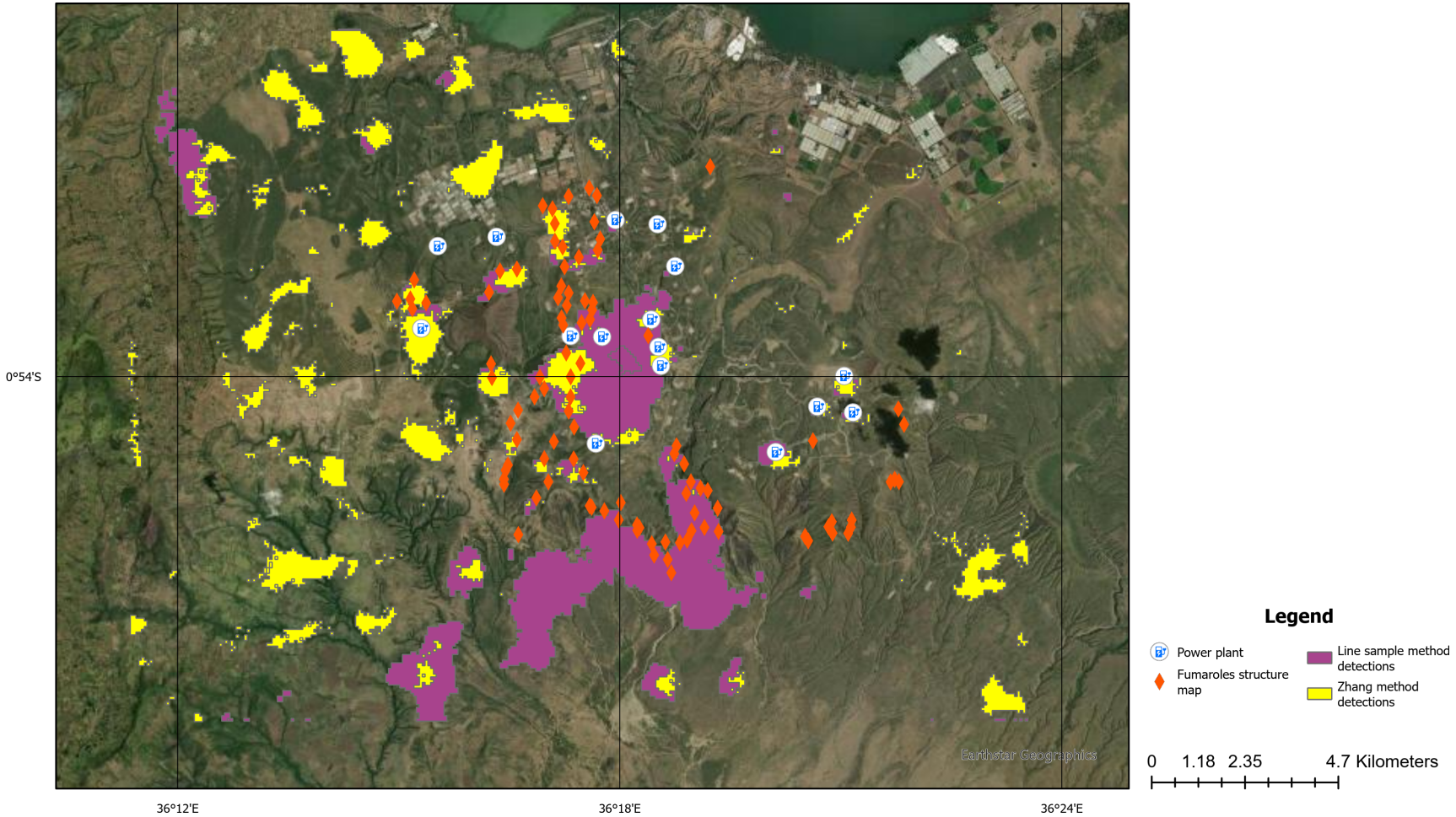
THE ADAPTED ZHANG (2004) METHOD



THE “LINE-SAMPLE” METHOD



COMPARISON OF THE METHODS



FIELD WORK IN OLKARIA, MARCH 2022

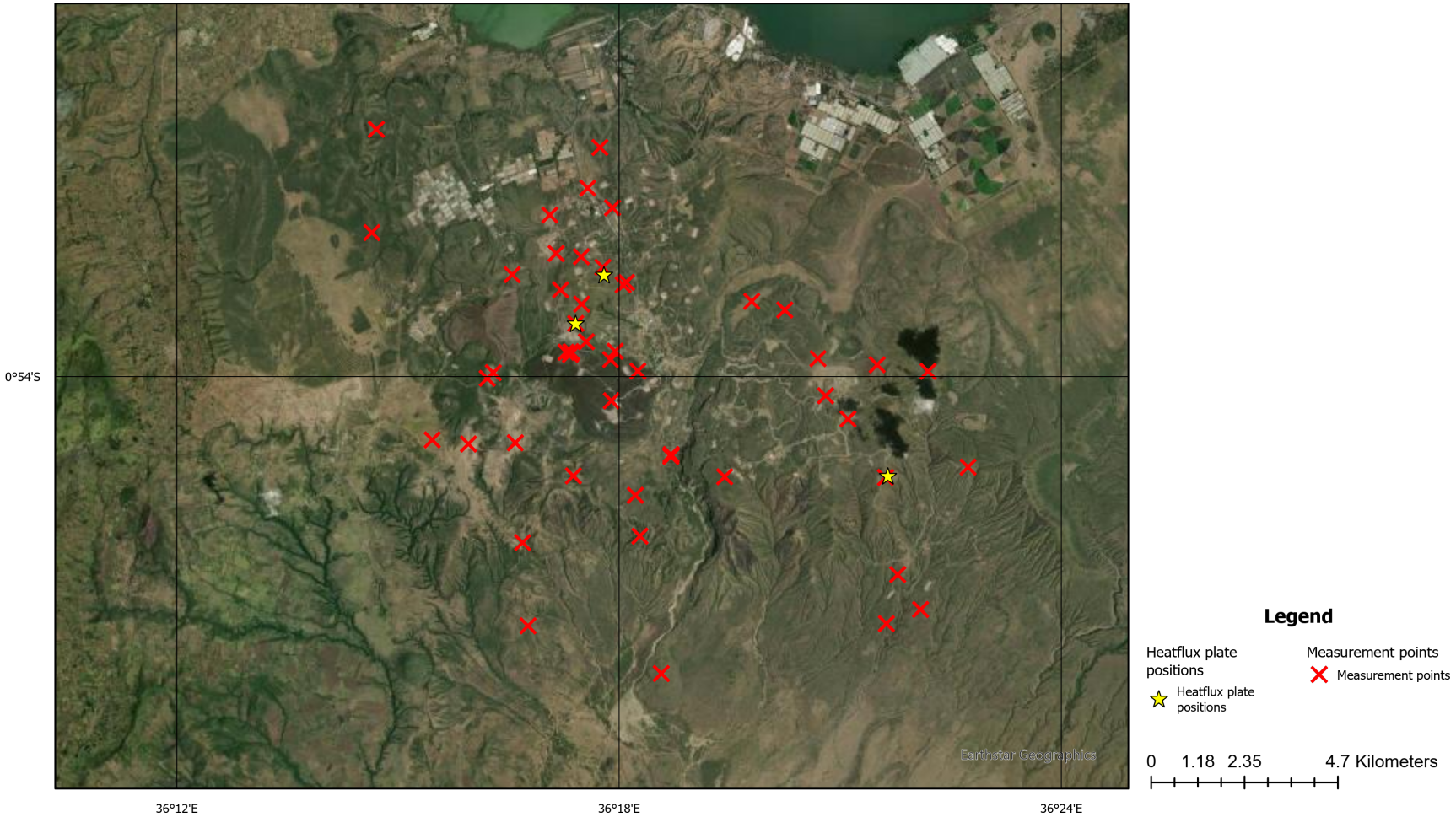
Temperature measurement

- > 50 temperature loggers
- buried at 20 cm depth
- 6-8 weeks measurement time
- 15 minute interval

Heat flux measurement

- 3 heat flux plates:
  - at strong geothermal hotspot
  - at weak geothermal hotspot
  - at non-geothermal area
- buried at 20 cm depth
- with a temperature logger above and below (at 10 cm and 60 cm)

FIELD WORK IN OLKARIA, MARCH 2022



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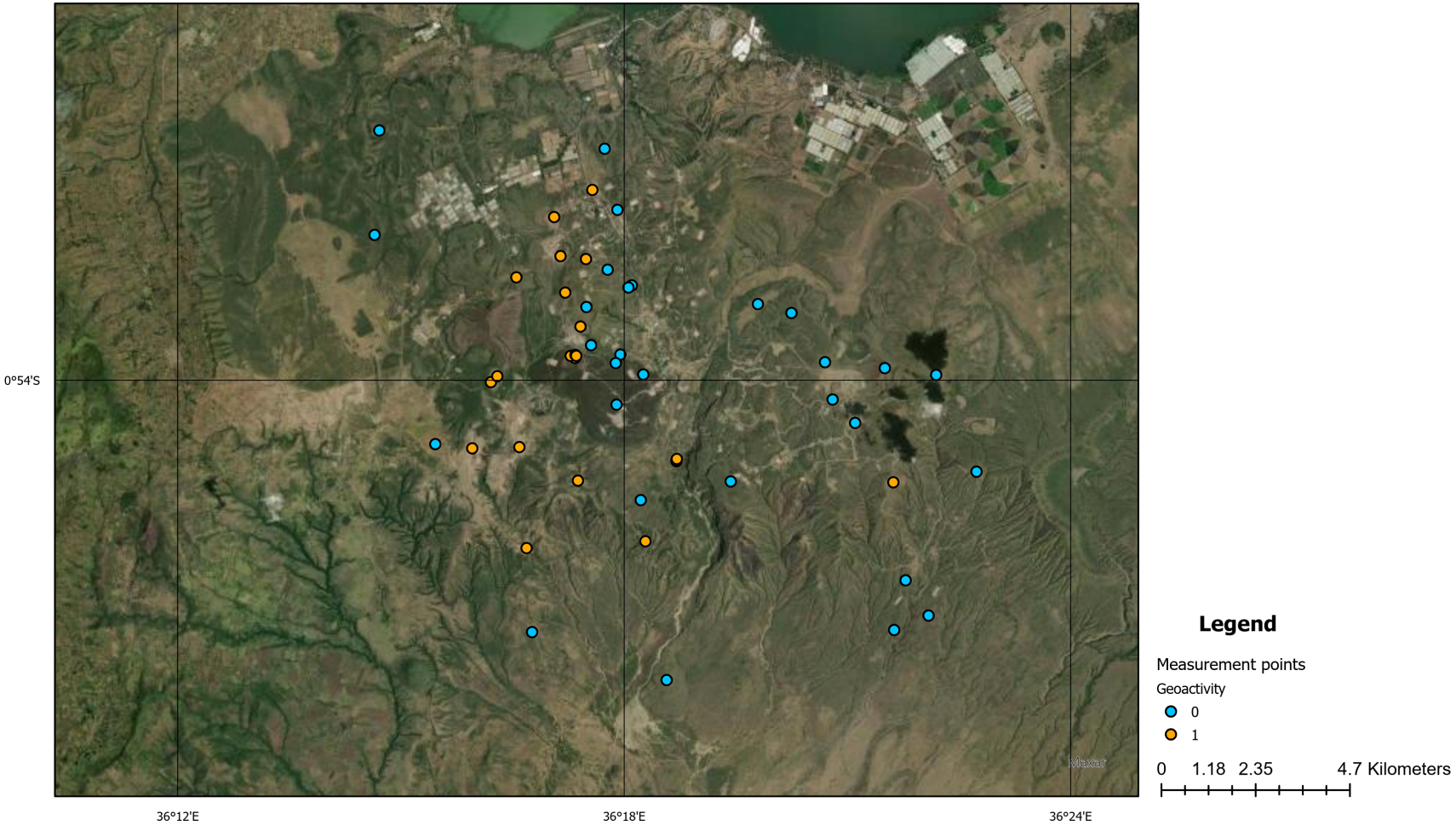
FIELD WORK - PRELIMINARY RESULTS



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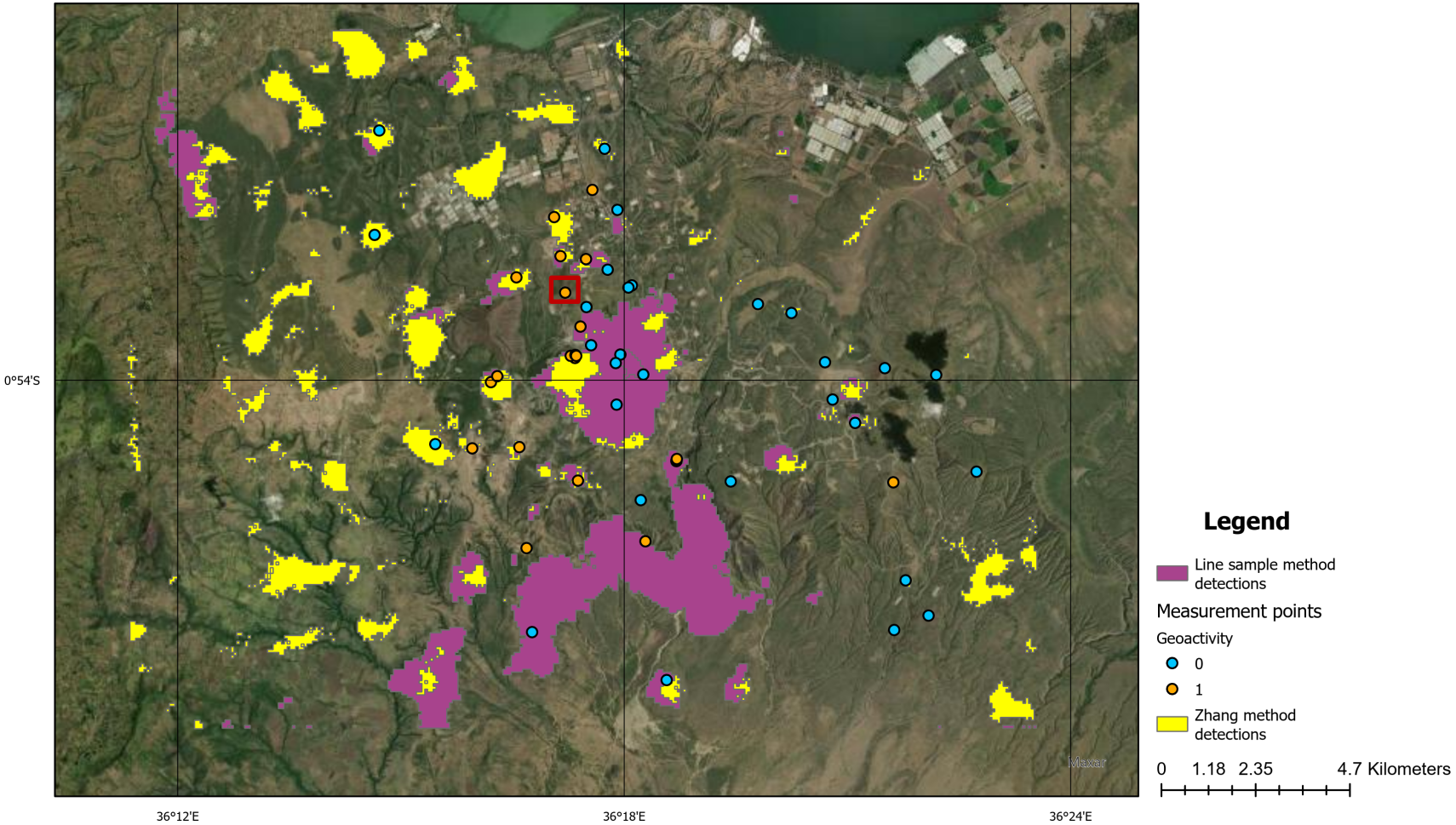
FIELD WORK – PRELIMINARY RESULTS



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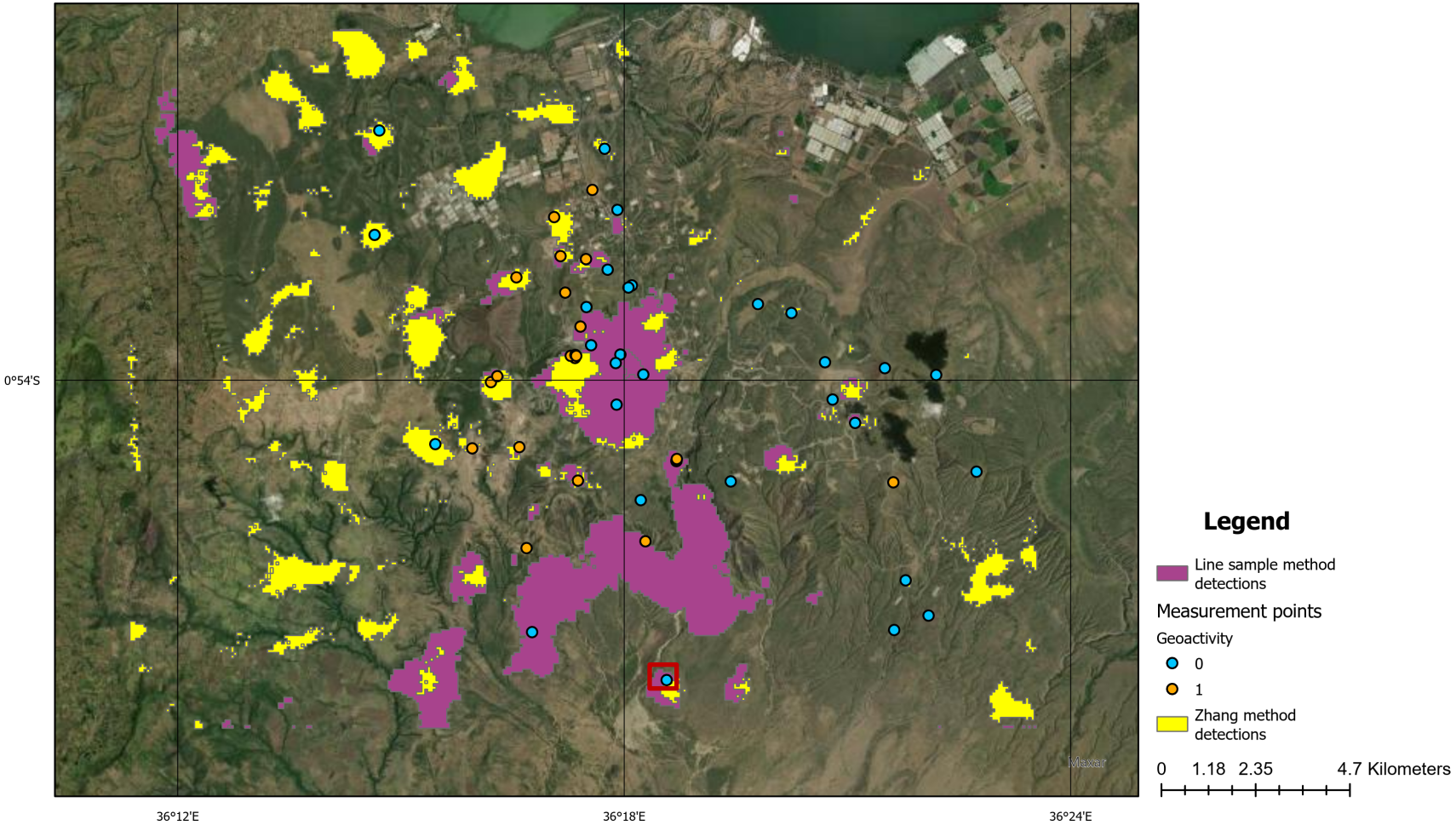
K24 – NOT DETECTED ANOMALY

FIELD WORK – PRELIMINARY RESULTS



K36 – FALSE POSITIVE DETECTION

PRELIMINARY VALIDATION - SUMMARY

Altogether: 22 „hot points”	Both methods	Zhang method	Line-sample method
Omissions	4 (18%)	6 (27%)	5 (23%)
False positives	2 (7%)	6 (21%)	8 (28%)
Correct detections	11 (50%)	16 (73%)	17 (77%)

NEXT STEPS

- Further analysis of the results
  - What are the influencing parameters on the detection errors?
    - Vegetation cover
    - Weather conditions
    - Slope direction
    - Rock formation properties
    - …
  - Can we optimise the methods?
- Wait for the main results: the temperature logger data
- Analyse the heat flux plates data

THANK YOU!