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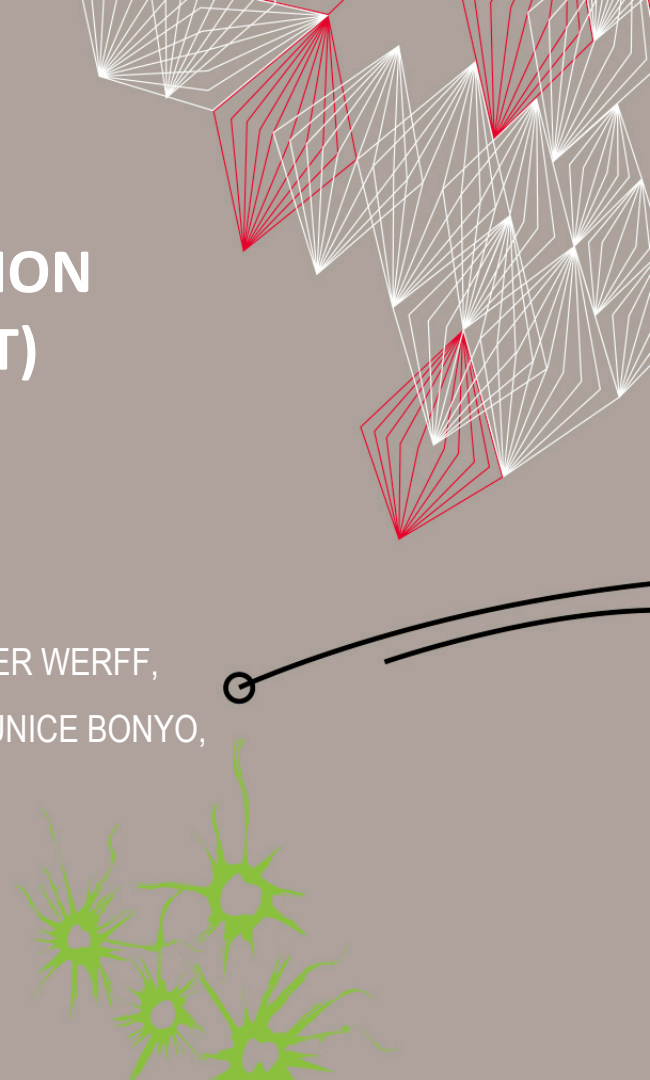
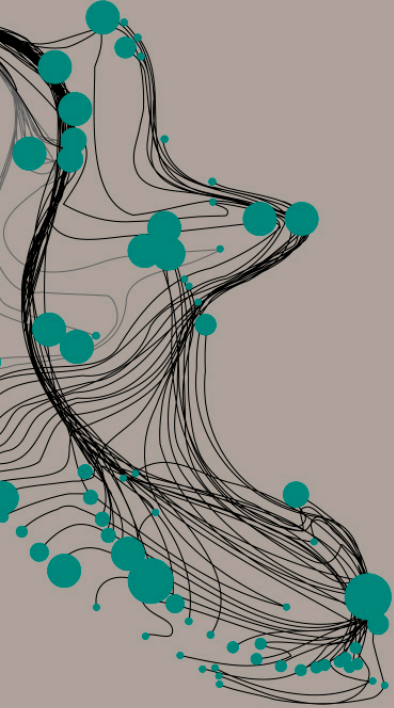
GEOHERMAL HOTSPOT DETECTION WITH ECOSTRESS DATA (GEOHOT)

“USING ECOSTRESS TO EMPOWER THE ENERGY TRANSITION”

CHRIS HECKER, AGNIESZKA SOSZYNSKA, HARALD VAN DER WERFF,
THOMAS GROEN, ROBERT HEWSON, ROBERT REEVES, EUNICE BONYO,



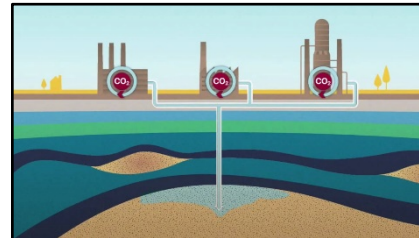
FACULTY OF GEO-INFORMATION SCIENCE AND EARTH OBSERVATION



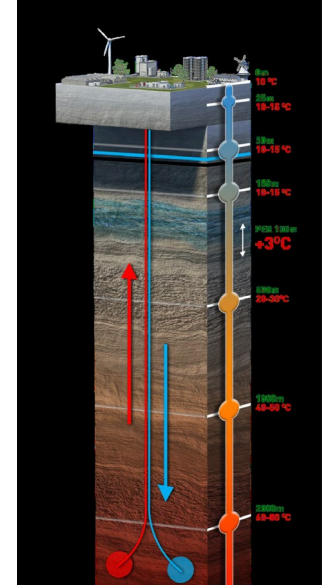
NEEDS FOR A SUSTAINABLE FUTURE: A GEOLOGIC PERSPECTIVE



Critical raw materials
(e.g. REE, Li)



Carbon Capture, Utilization and Storage

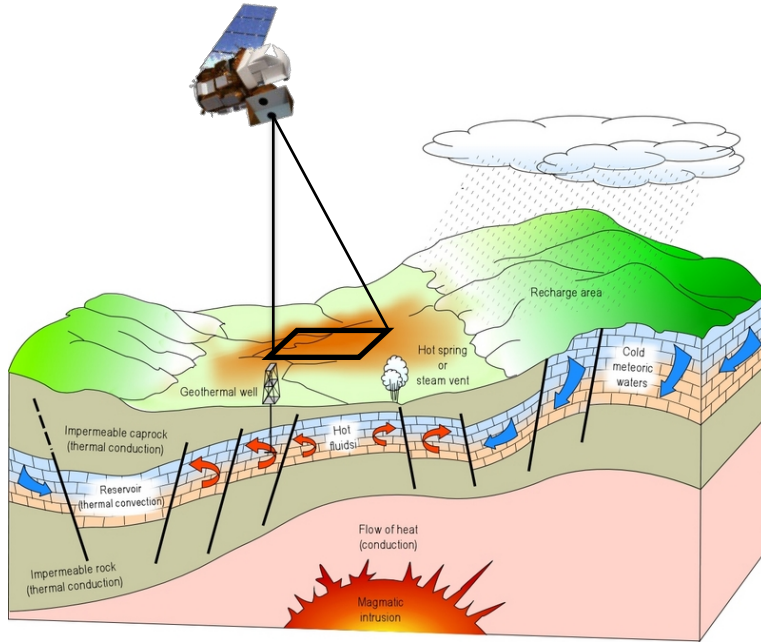


Geothermal energy
(heat and electricity)



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GEOHERMAL SURFACE MANIFESTATIONS



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

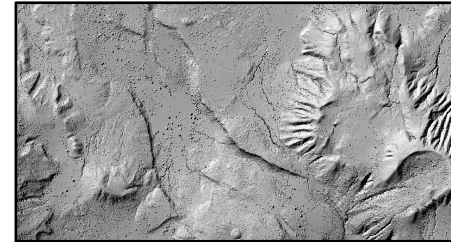
GT surface manifestations:

Clay alteration

Structures

Surface hotspots

=> Starting point for detailed exploration



ISSUES WITH STATE-OF-ART

- Spaceborne Remote Sensing:
 - Size of anomalies small compared to pixel
 - Wrong overpass time
 - Effect of thermal inertia not captured

⇒ Anomalies due to insolation
bigger than due to extra heat
flux

⇒ Even at sunrise effect still
measurable
(Coolbaugh et al., 2007)



ECOSTRESS TO THE RESCUE

- Experimental thermal sensor on ISS
- Designed for plant stress
- Ideal to test new approaches:
 - Precessing orbit (different acquisition times)
 - Diurnal time series
 - Suitable pixel size (<100m)





THE GEOHOT PROJECT

- Link with NASA ECOSTRESS Science Team
- 3 Year funding NWO-GO (Started: 2021)
- Objectives
 - O1: Quantify effect overpass time on detections
 - O2: Optimize detections through use of time series
- => near-global geothermal anomaly detection tool

STUDY AREAS

Three areas with ground information, airborne TIR surveys and ground-based fumarole monitoring.

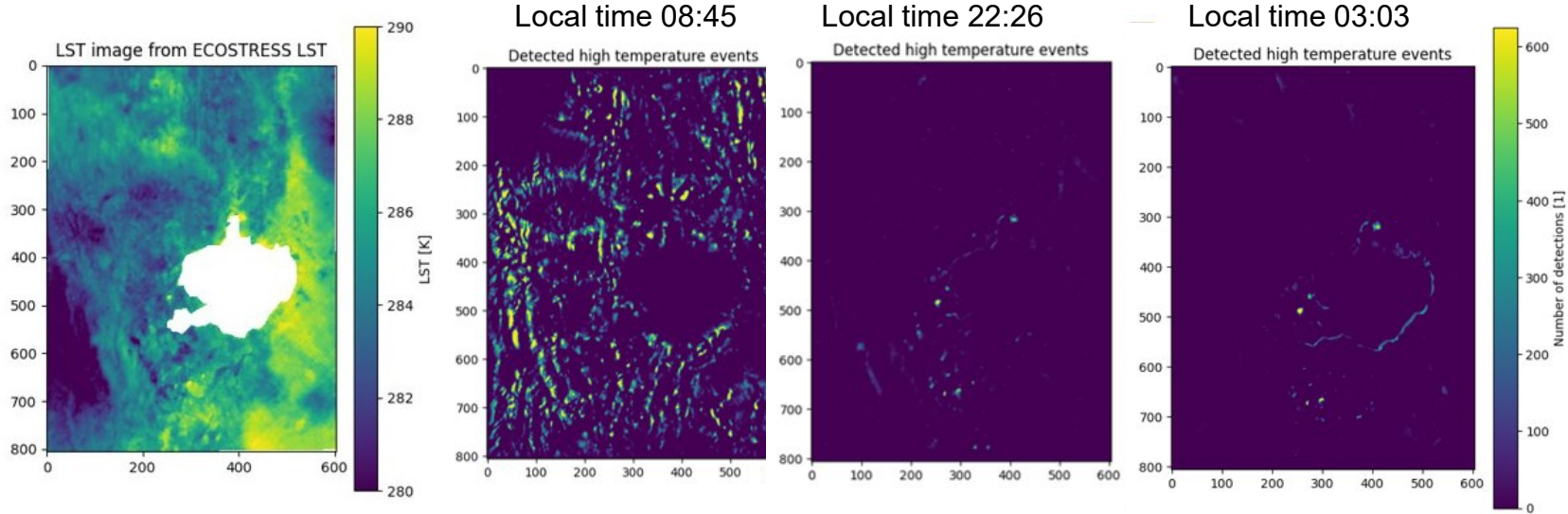
Olkaria, KE

Mataloko, ID

Waiotapu, NZ



(VERY) EARLY RESULTS (1)

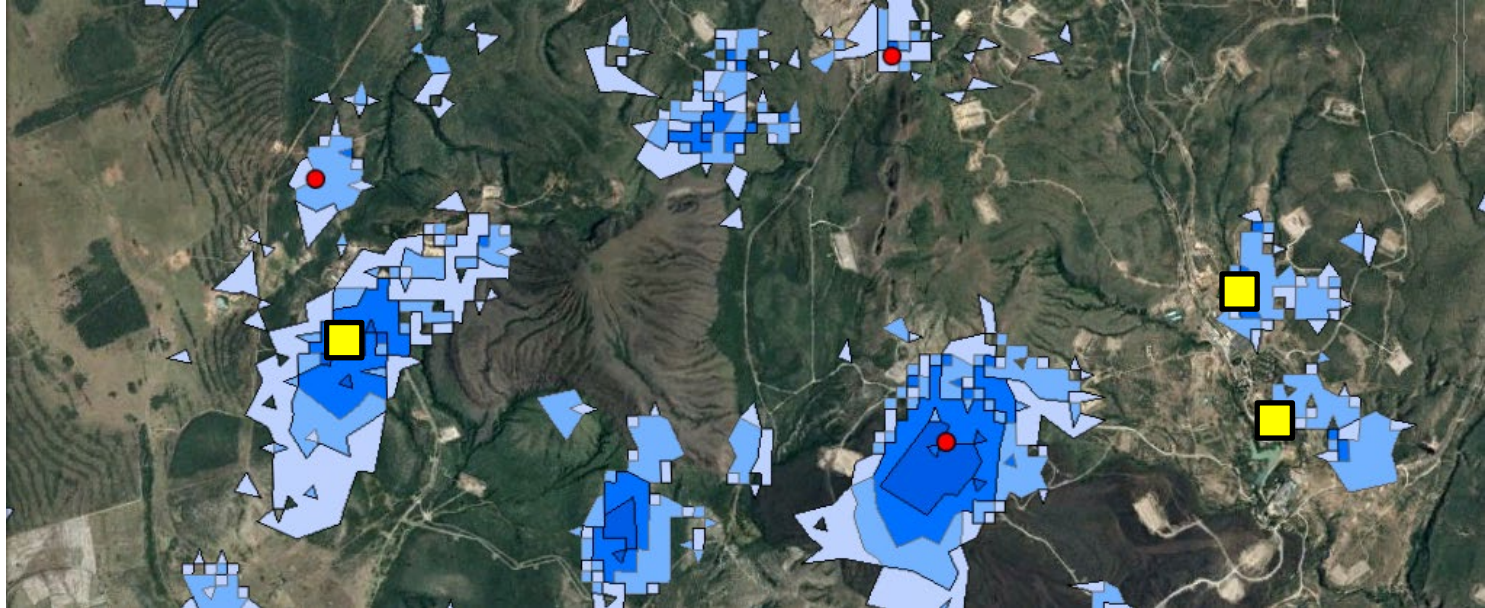


Example (geo)thermal anomaly detection in Naivasha, Kenya with ECOSTRESS data

- Daytime detections: strongly influenced by topography
- Early nighttime: some issues with heat capacity
- Late nighttime: best results (but issues with lake mask)

Source: Soszynska et al. (ongoing work)

(VERY) EARLY RESULTS (2)



ECOSTRESS thermal anomaly detection results (blue) on GE.

Red dots: known fumaroles; Yellow squares: power plants

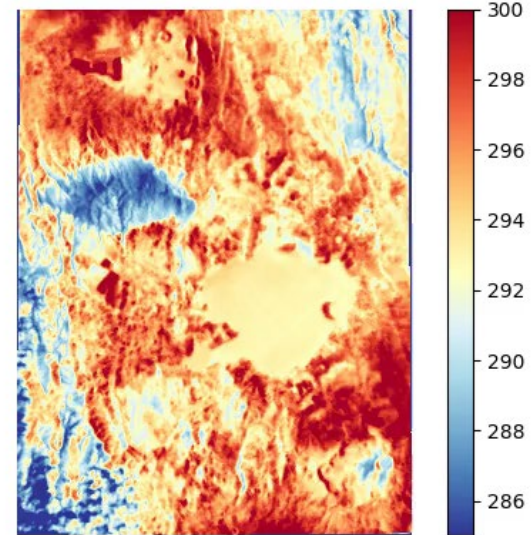
Several unknown hotspots

Source: Soszynska et al. (ongoing work)

(VERY) EARLY RESULTS (3)

- Video of multiple acquisitions
- Geolocation issues
- => need solving

ECOSTRESS LST image



Source: Soszynska et al. (ongoing work)



SUMMARY AND OUTLOOK

- Promising results
 - Next steps:
 - Geolocation fix
 - Look at time series
 - Quantify detection “success” with ground/airborne data
- => near-global geothermal anomaly detection tool

ACKNOWLEDGEMENTS

- NWO-GO grant ALWGO.2019.038



- NASA Science Team grant 18-ECOSTRES18-0014



- Partner organizations:



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