

# Feasibility of DESIS Imaging Spectrometer for the Detection of Burned Areas: The Case Study of Arakapas Fire in Cyprus 2021

Daniele Cerra

Thomas Krauss

*Remote Sensing Technology Institute  
German Aerospace Center (DLR)  
Oberpfaffenhofen, Germany*

Maria Prodromou Kyriacos Themistocleous

*Cyprus University of Technology (CUT)  
Erathostenes Center of Excellence  
Limassol, Cyprus*

*Daniele.cerra@dlr.de*



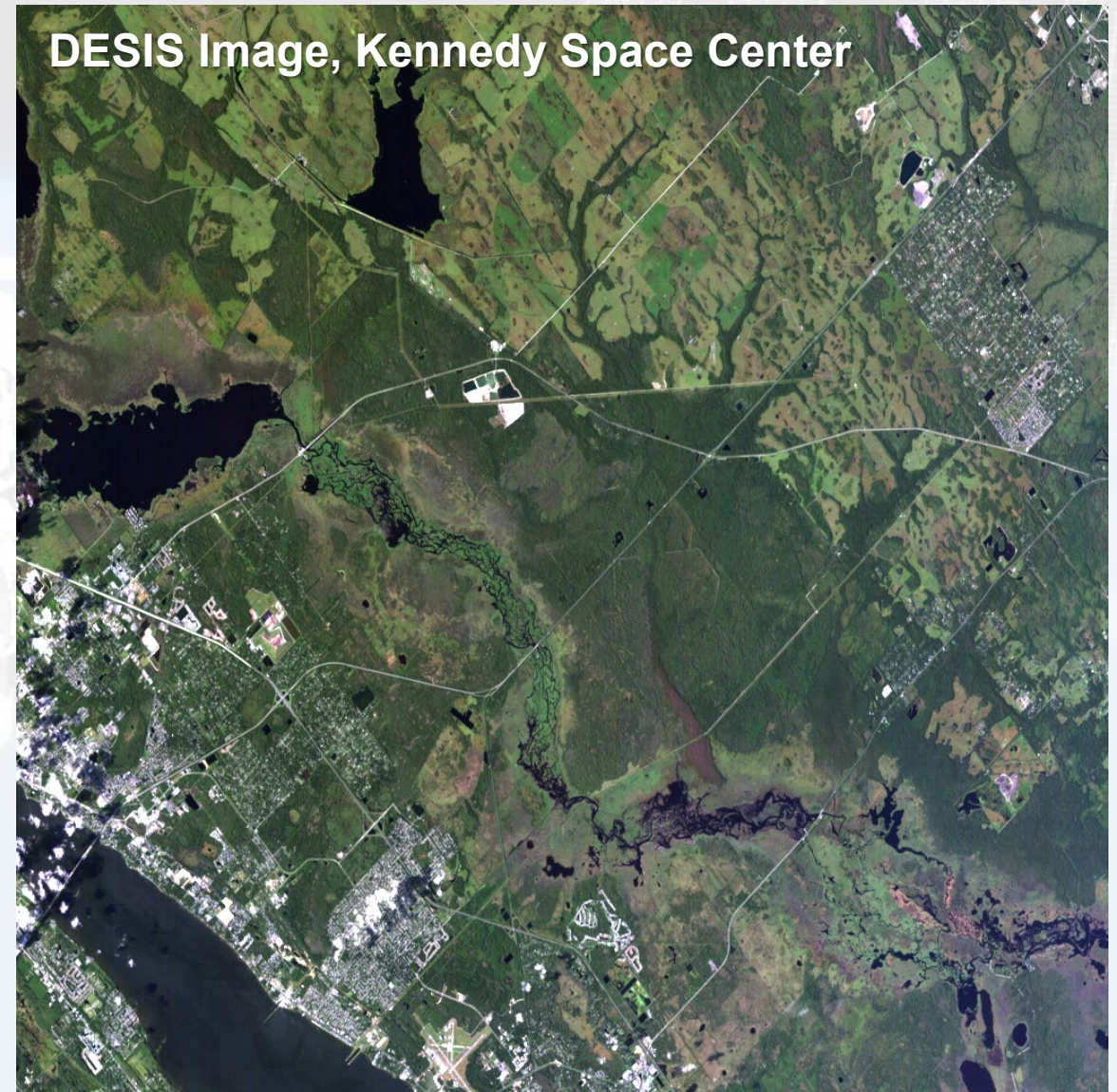
# DEISIS (DLR Earth Sensing Imaging Spectrometer)

2

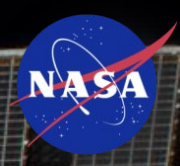
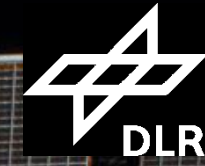
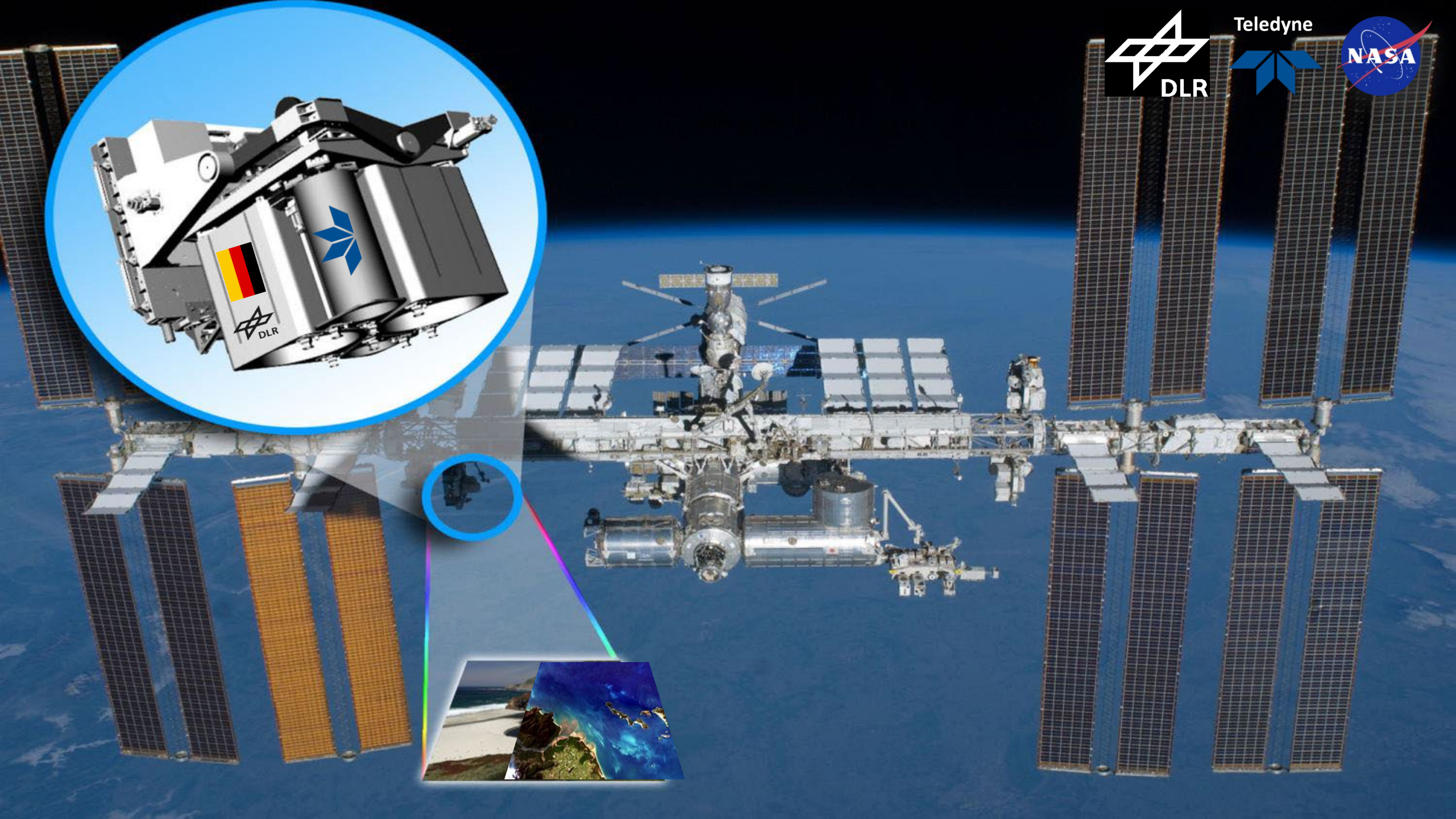
- Imaging Spectrometer
- 06.2018 Launched from Kennedy Space Center, US
- 08.2018 Mounted on the ISS (International Space Station)
- Developed by DLR
- Space Segment & data distribution by Teledyne, US

## Sensor Characteristics

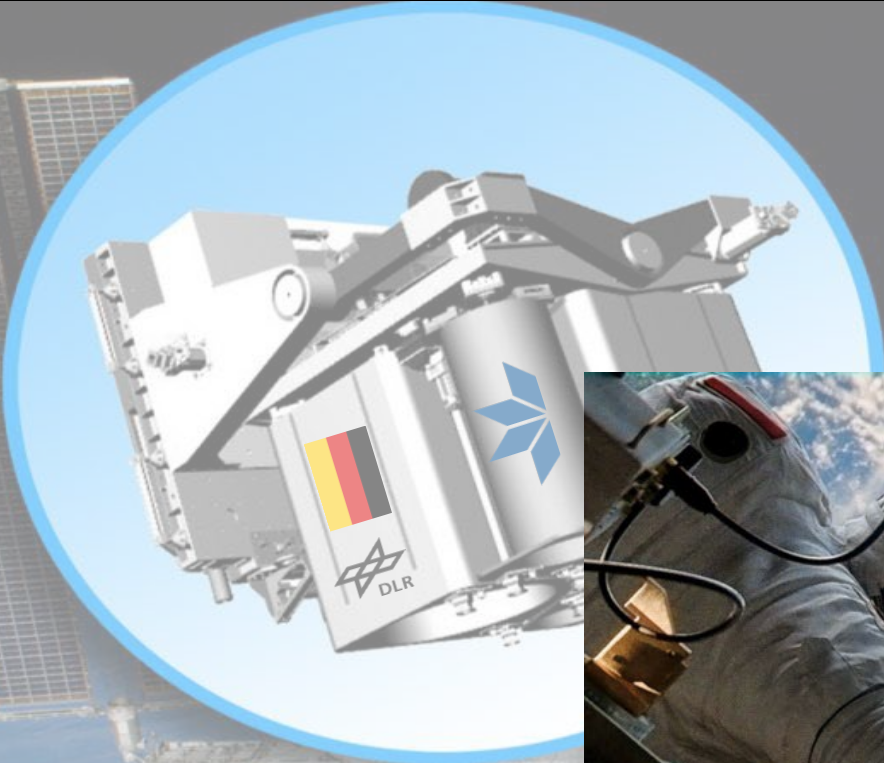
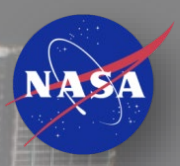
- Spectral Range: 400 to 1000 nanometres
  - Visible (mid-blue) to Near Infrared
  - 235 bands
- Spatial resolution around 30m





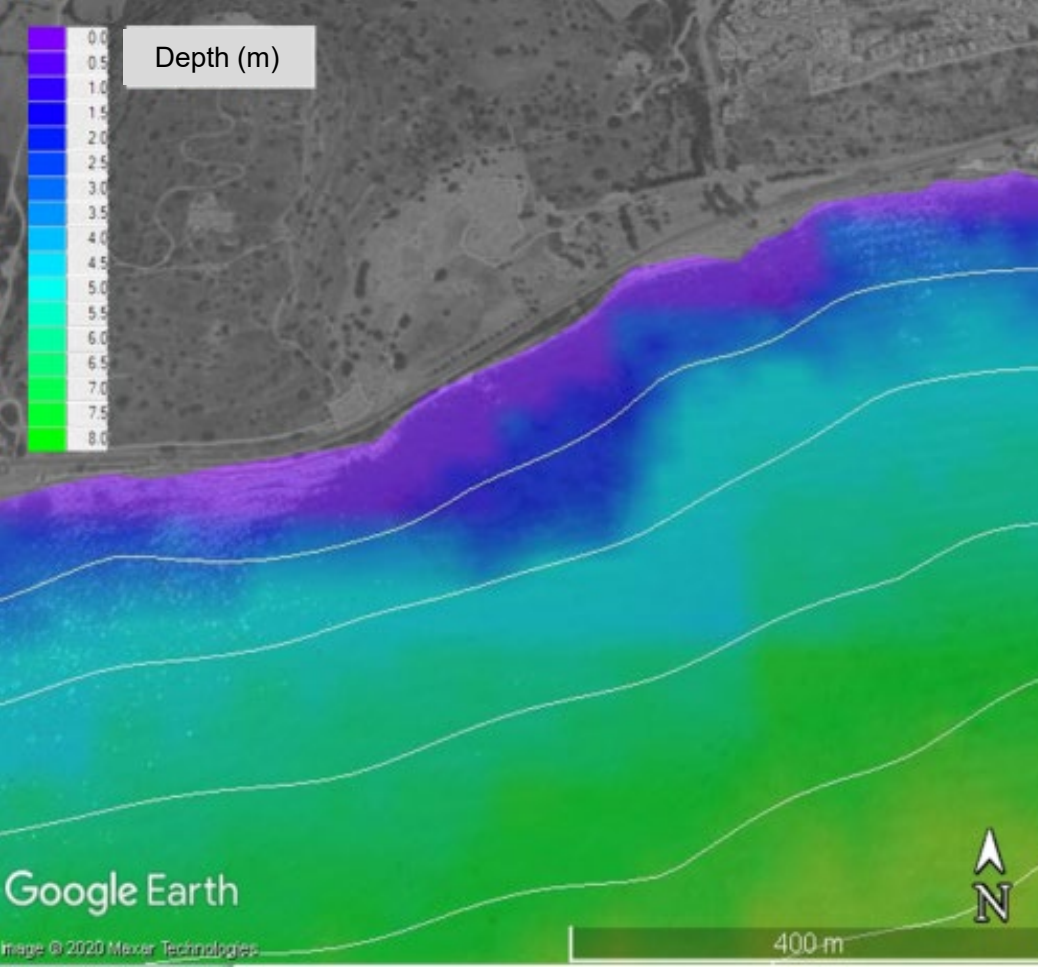
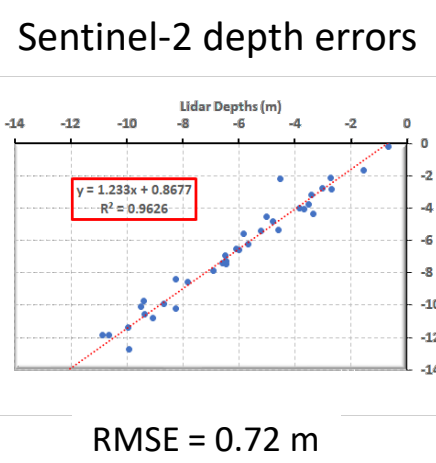
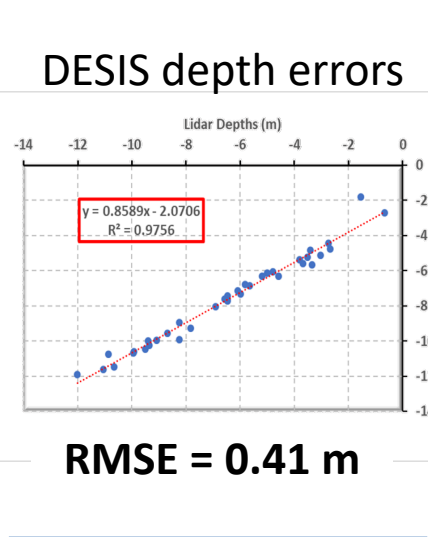
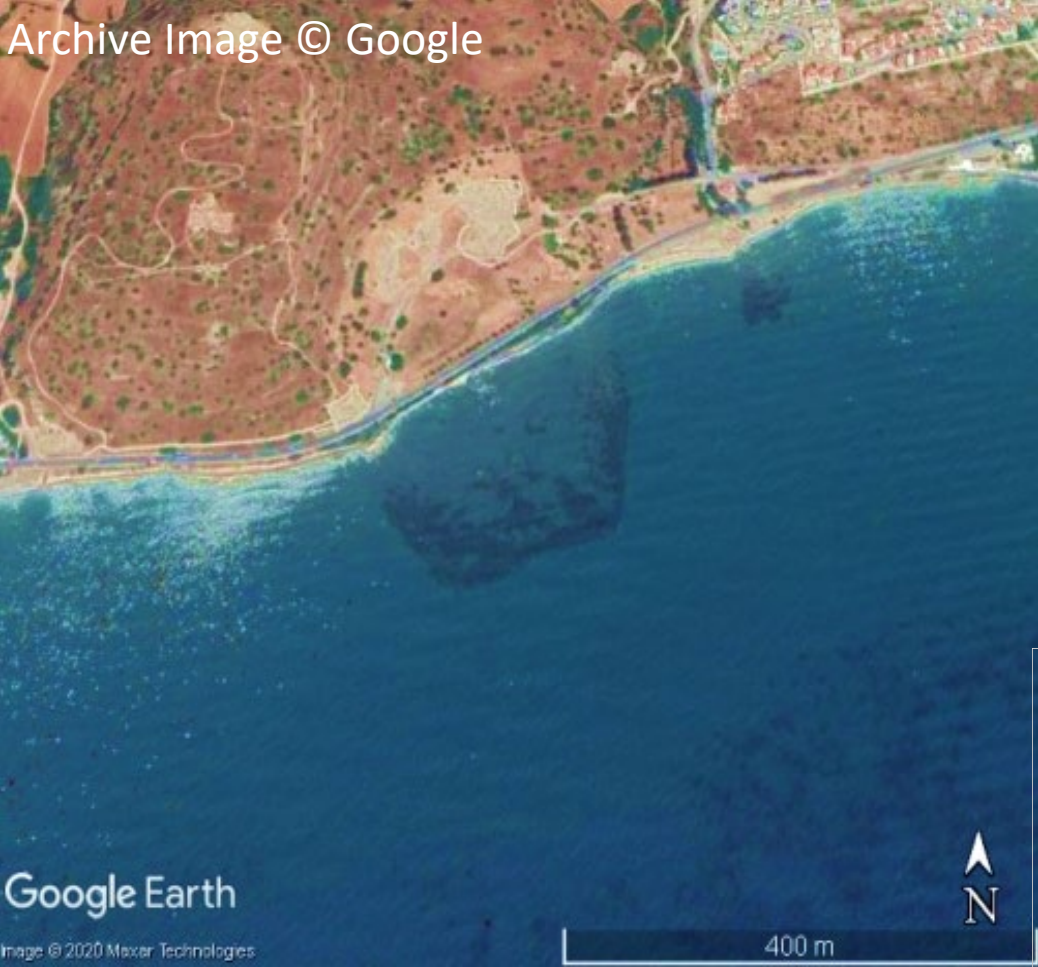








## Bathymetry: the submerged harbour of Amathus (I century BC), Cyprus



Cerra, Daniele und Gege, Peter und Evagorou, Evagoras und Agapiou, Athos und de los Reyes, Raquel (2020) *Monitoring Marine Areas from the International Space Station: the Case of the Submerged Harbor of Amathus*. In: Digital Heritage - Euromed 2020, Seiten 1-11. Springer. EUROMED 2020



# Case of study – the Arapakas Fire, Cyprus

6

- The fire event started on Saturday, the 3rd of July in the Limassol district near the village of Arakapas
- It was controlled after 24 hours
- The total burnt area estimated (local authorities) is ~45 Km<sup>2</sup>
- 10 Evacuated villages
- 13 Endangered CH sites
- 4 dead



TRTworld.com





Agios Georgios



Profitis Elias



Agia Marina

Profitis Elias

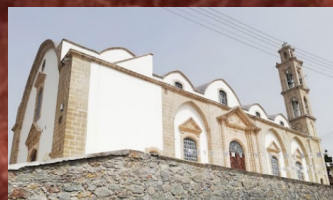


Agie Anargiri

According to the Department of Antiquities, 13 cultural heritage sites in the extended region of the fire



Panayia Chryseleoussa



Agia Marina



Timiou Stavrou



Monasteri of Panayias Iamatikis



Agios Georgios



Agia Marina

Agios Fotios & Anikitos



Akapnou Bridge

Panayis tis Agapis

Panayia Iamatikis

Panayia tou Kampou

Kimiseos tis Theodokou

Dierona water mill

Dieronas Ancient Bridge

Church of Archangelou Michael

Agios Georgios



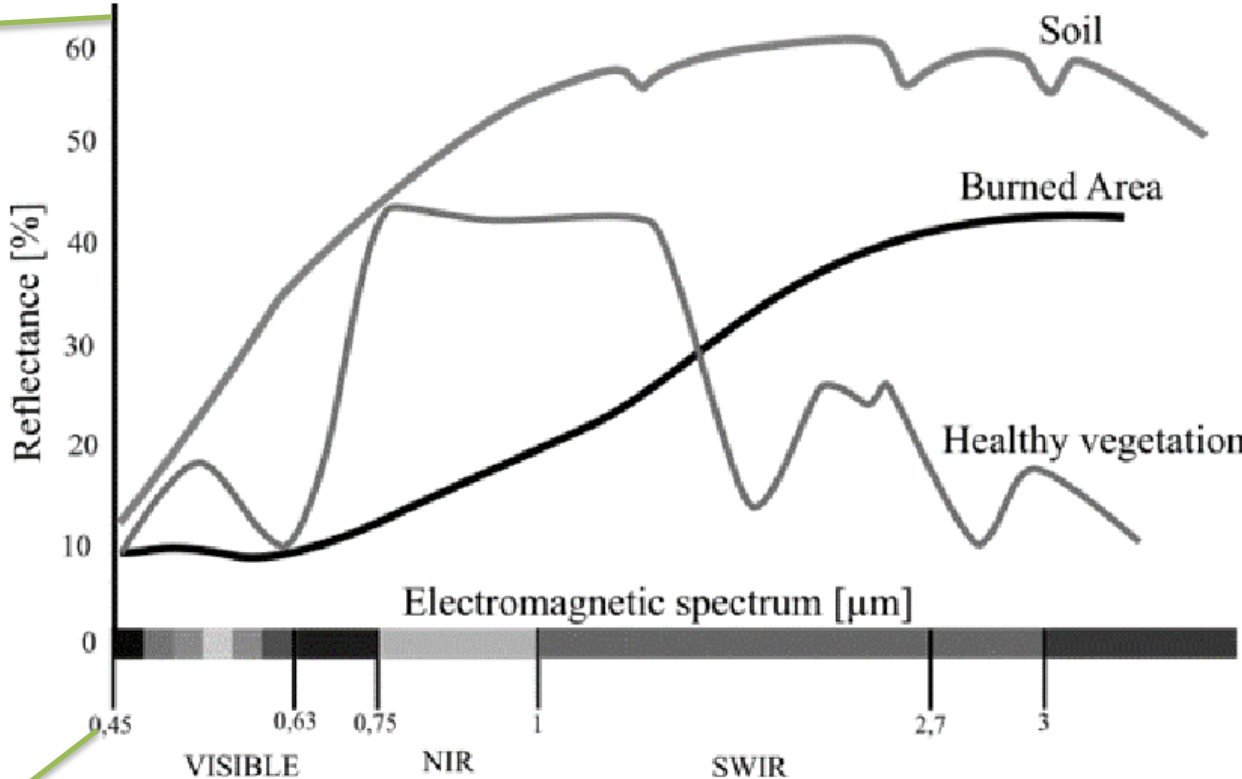
Agios Nicolaos



Panagia Parsata

Panayia Eleoussa





Adapted from Anna Szajewska & Miguel Castillo S





# Burned Areas Spectral Features: DESIS (True color combinations)



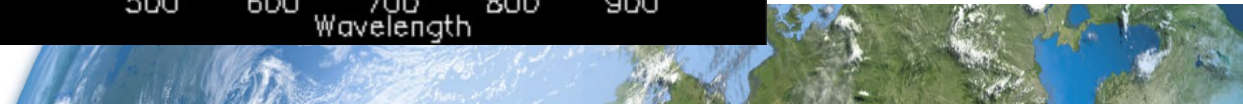
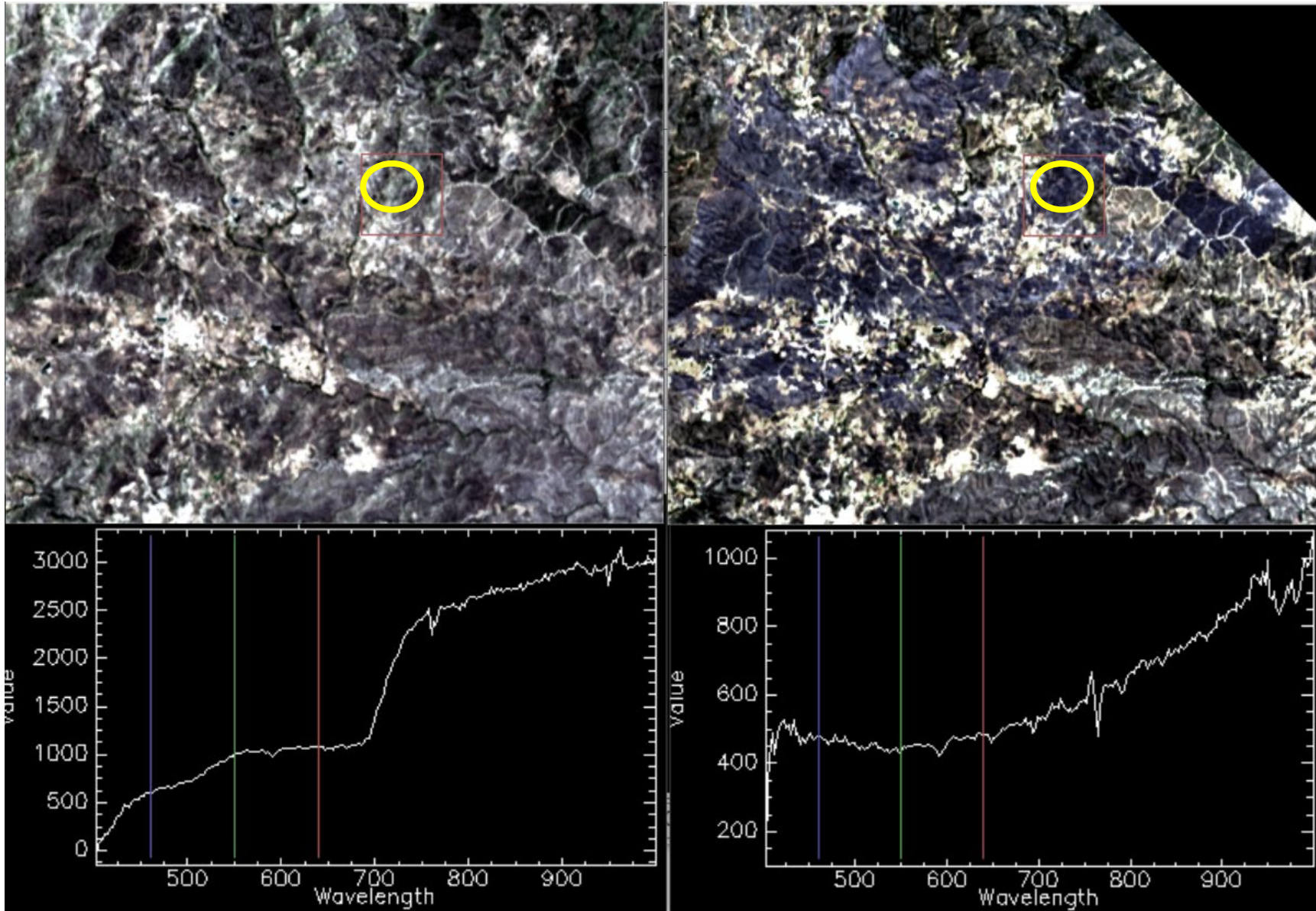
10.06.2021



31.07.2021









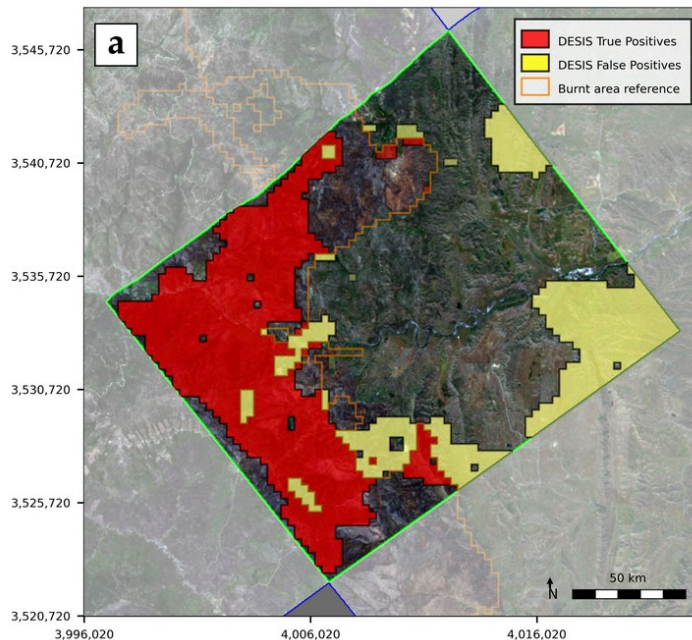
## Utilization of Hyperspectral Remote Sensing Imagery for Improving Burnt Area Mapping Accuracy

by  Michael Nolde \* ,  Simon Plank  and  Torsten Riedlinger 

German Aerospace Center (DLR), German Remote Sensing Data Center (DFD), Department for Geo-Risks and Civil Security, Oberpfaffenhofen, 82234 Wessling, Germany

\* Author to whom correspondence should be addressed.

Academic Editor: Luke Wallace



### Main Findings

#### NDVI to detect burned areas

- Optimal wavelengths:
  - 660–670 nm (red)
  - 810–835 nm (NIR)

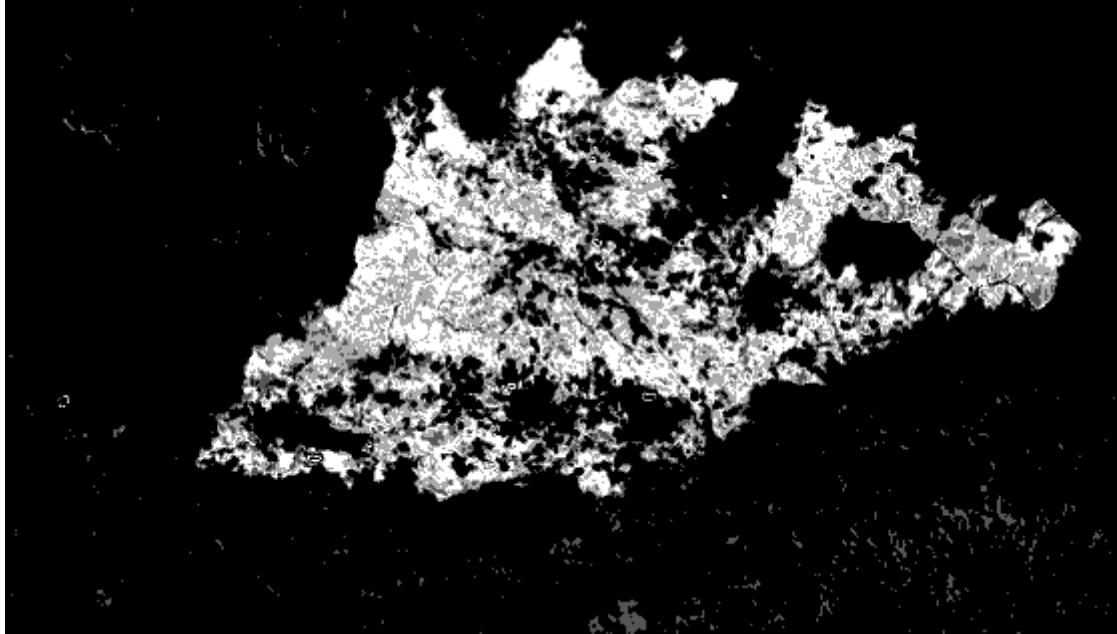
#### What if we use specific indices?

- Burned Area Index (BAI)
- Are these bands also optimal?
- What about comparison with broadband multispectral sensors?

$$BAI = \frac{1}{(0.1 - RED)^2 + (0.06 - NIR)^2}$$







**BAI index**

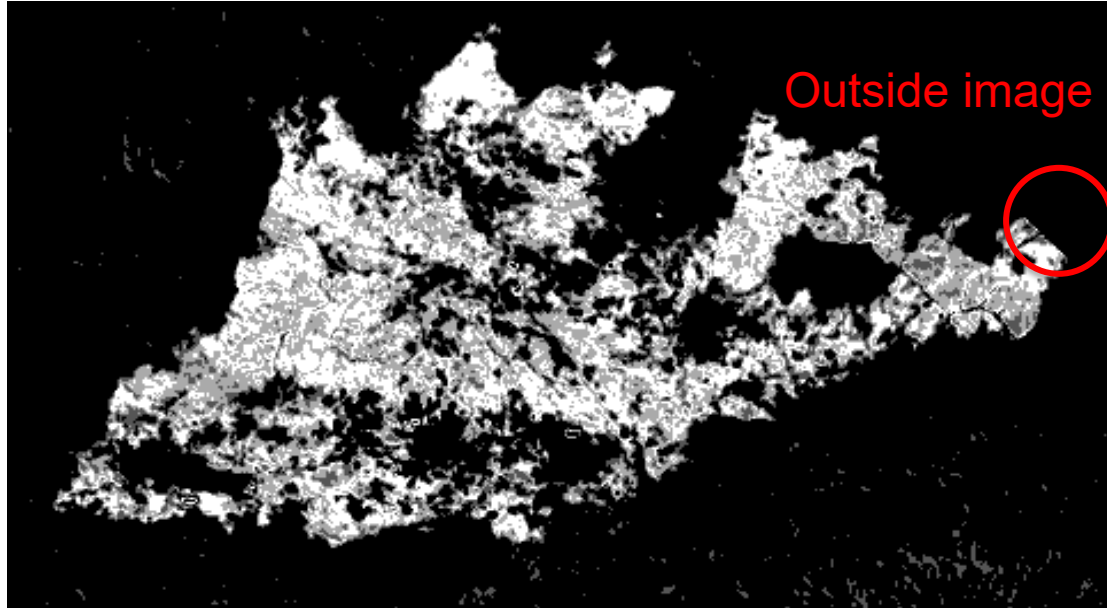


**Thresholded**

**Vectors: Fire Extent**

- Sentinel-2
- Information from local authorities





**DESIS  
BAI index**

5 days difference



**Sentinel-2  
BAI index**







**DESIS  
BAI index  
10.06.21**

2 days difference  
Same stretch

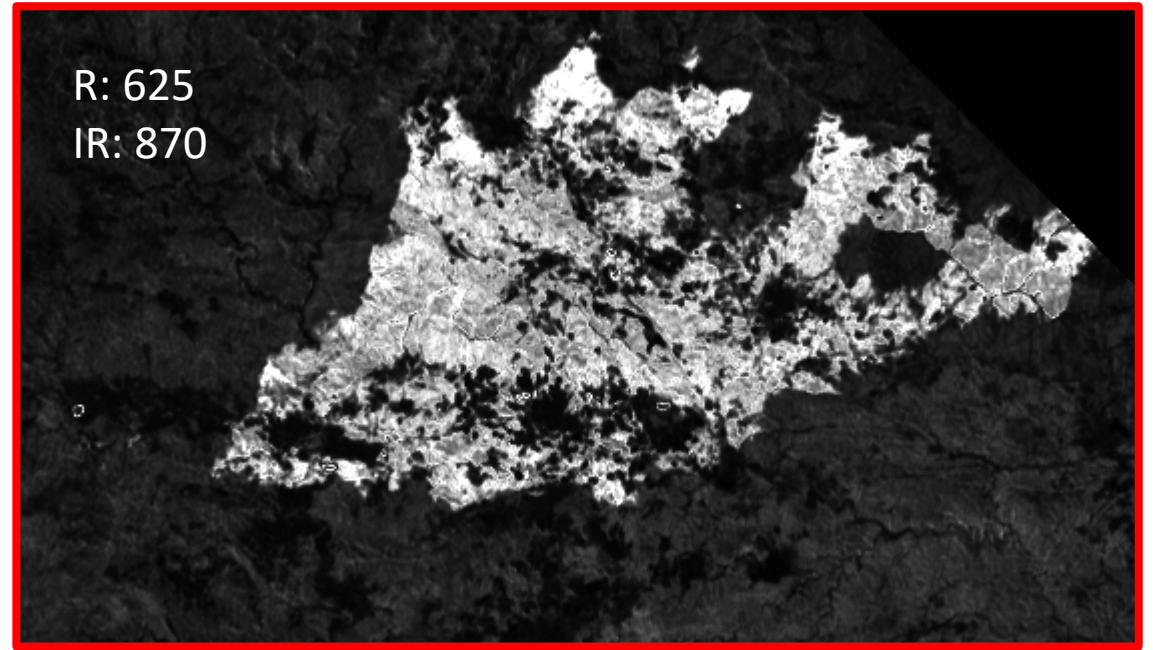
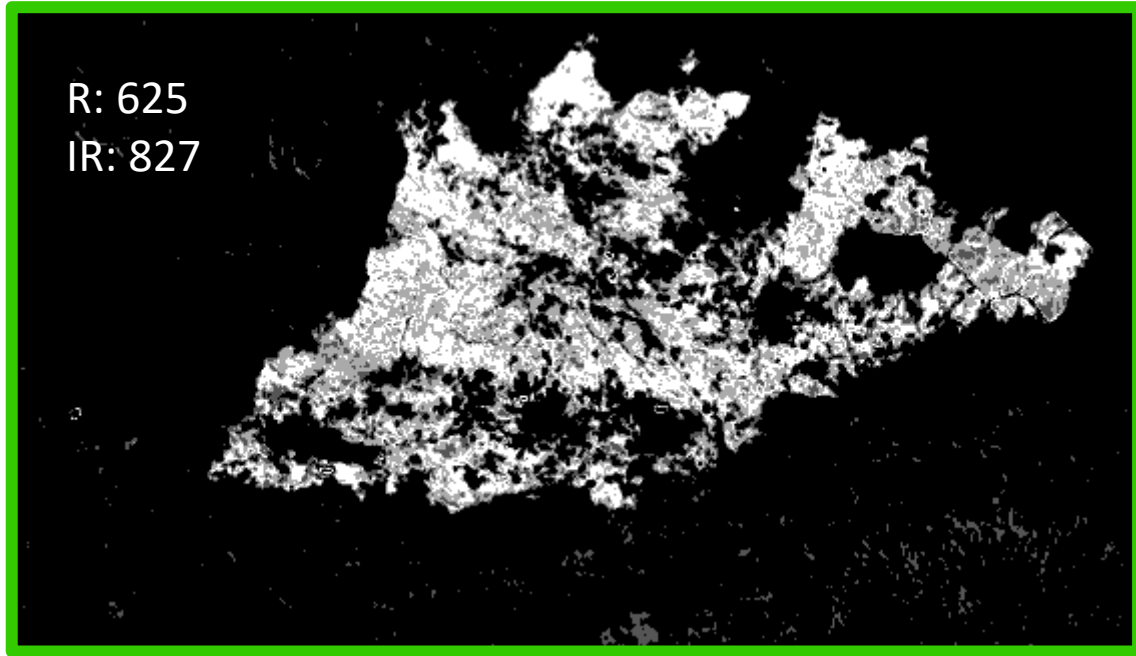


**Sentinel-2  
BAI index**

**DESIS values are generally closer to 0!**



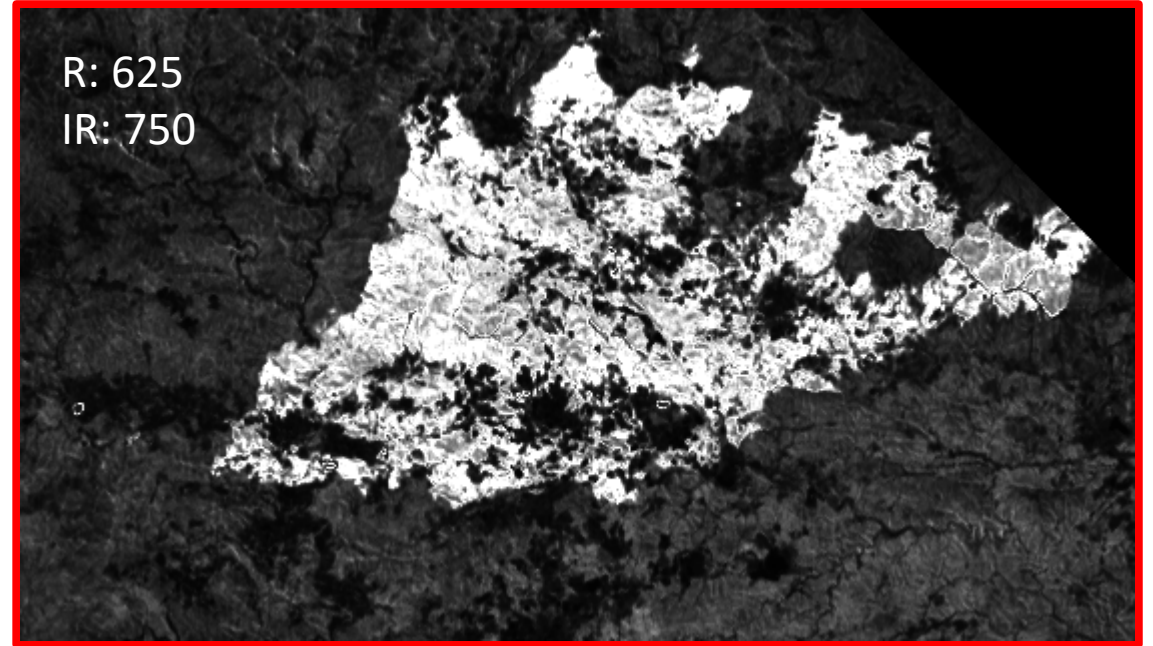
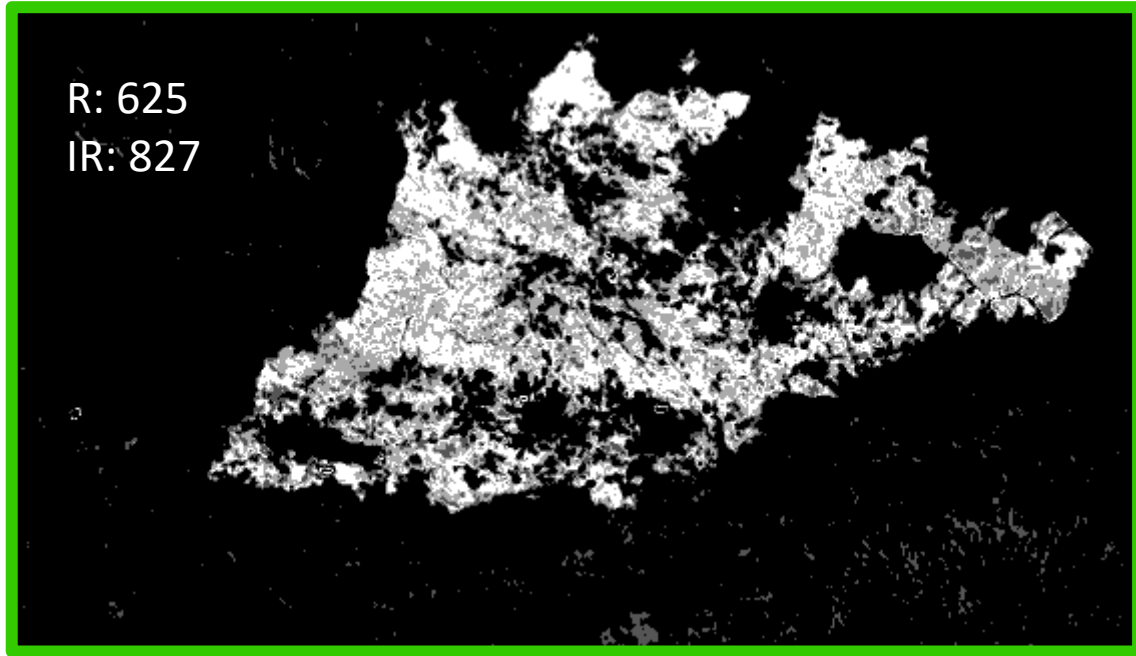




Towards longer wavelengths....



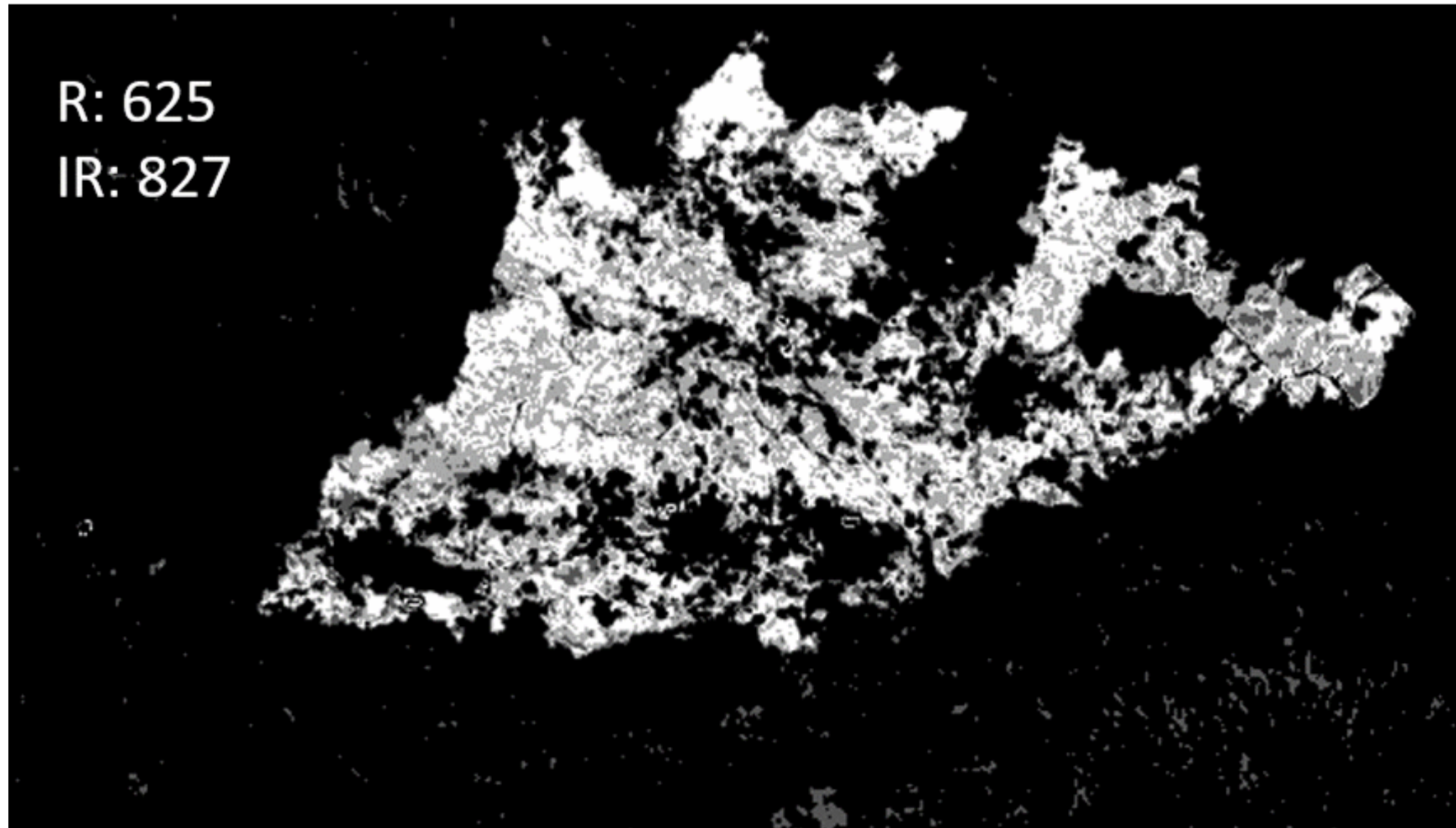




Towards shorter wavelengths....







Comparison





- **DESIS is effective at detecting burned areas after fires**
- **With respect to broadband sensors (Sentinel-2):**
  - Lower spatial resolution / level of detail
  - In some cases results seem more robust towards false alarms
  - Only visual analysis
- **With respect to shift in central frequency of bands used for spectral indices**
  - Burned Area Index (BAI)
  - The suggestion of using 660–670 nm (red) and 810–835 nm (NIR) seem accurate
  - When shifting the red or IR band towards shorter or longer wavelengths, the resulting spectral index seems less robust
- Further analysis and quantitative evaluation needed!





# Feasibility of DESIS Imaging Spectrometer for the Detection of Burned Areas: The Case Study of Arakapas Fire in Cyprus 2021

Daniele Cerra

Thomas Krauss

Maria Prodromou Kyriacos Themistocleous

*Remote Sensing Technology Institute  
German Aerospace Center (DLR)  
Oberpfaffenhofen, Germany*

*Cyprus University of Technology (CUT)  
Limassol, Cyprus*

*Daniele.cerra@dlr.de*



Knowledge for Tomorrow