An aerial photograph of a large satellite dish antenna, partially obscured by a grid of technical data and a blue line graph. The data appears to be a table of values, possibly related to satellite specifications or simulation parameters.

# Concept for “end to end” simulation toolbox to support the model based design of satellite VIS – IR observational surveys

Agostino Fiorani  
Antonella Canestro  
Antonio Bartoloni  
Cesare Aragno

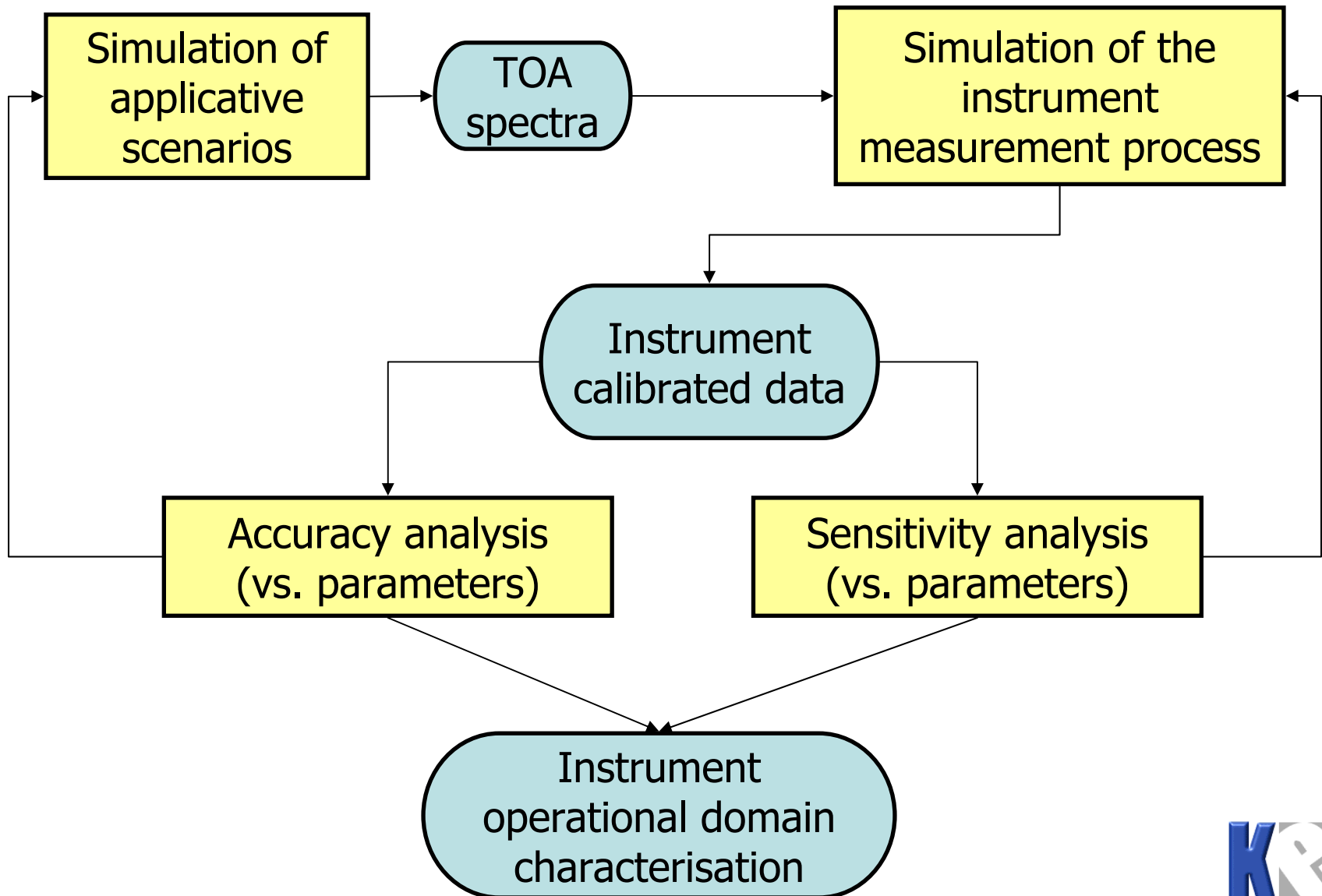


# Simulation toolbox characteristics

- **Toolbox design drivers:**
  - End user application driven simulations
  - Model based instrument design
  - Scalable simulation complexity
  - Integrated simulation environment
- **Toolbox applications:**
  - instrument performance assessment
  - instrument parameters tuning for the observation of a given phenomenon



# End user application driven simulations

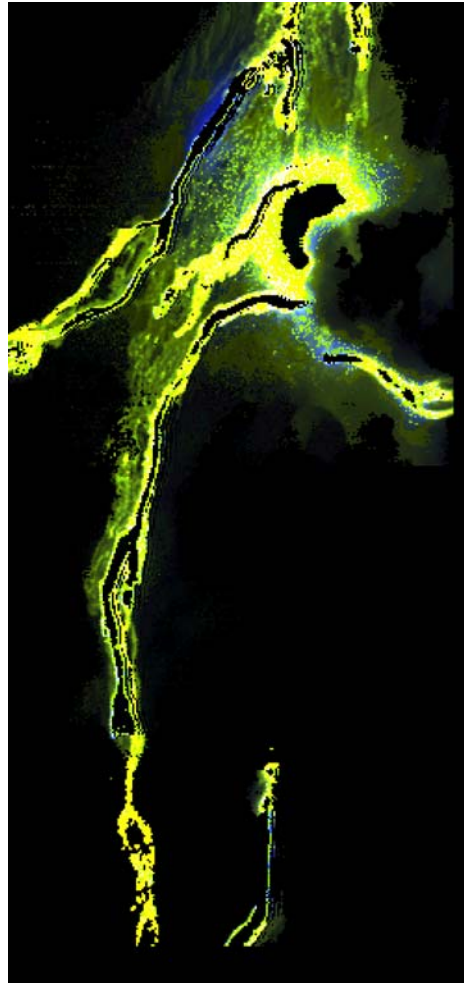


# Example: Etna lava flow

## Simulation

Pseudo-RGB  
obtained with  
the following  
bands:

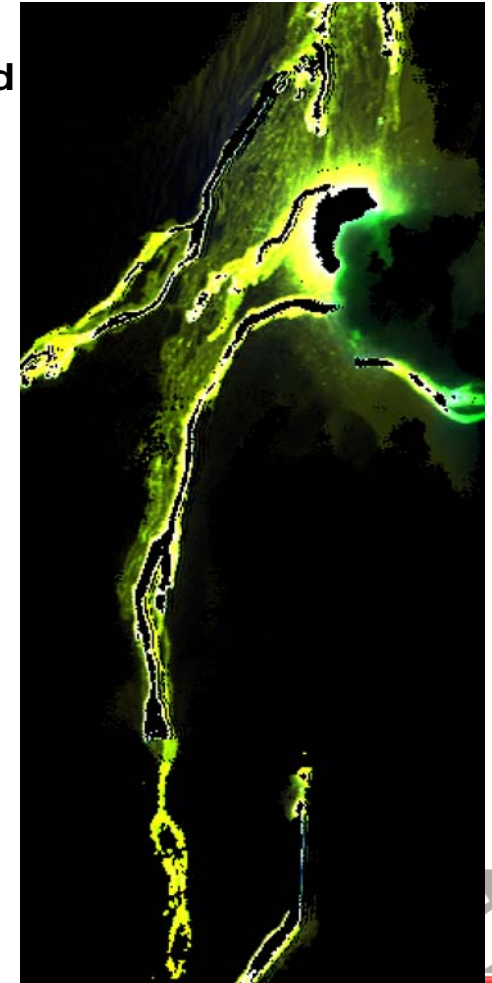
R  $\rightarrow$  10.93  $\mu\text{m}$   
G  $\rightarrow$  8.385  $\mu\text{m}$   
B  $\rightarrow$  2.3775  
 $\mu\text{m}$



MIVIS  
simulated

## Observed

MIVIS  
observed

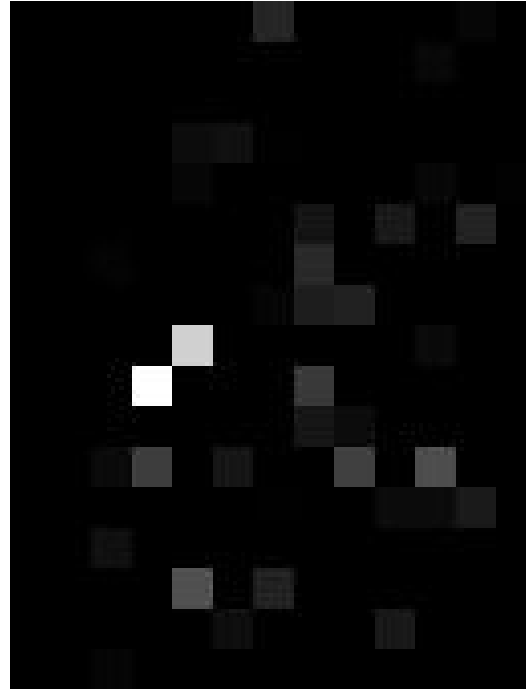


# Example 2: low thermal anomalies (Etna)

## Pixel size effect



Band 8.6 micron  
Spatial resolution 10m

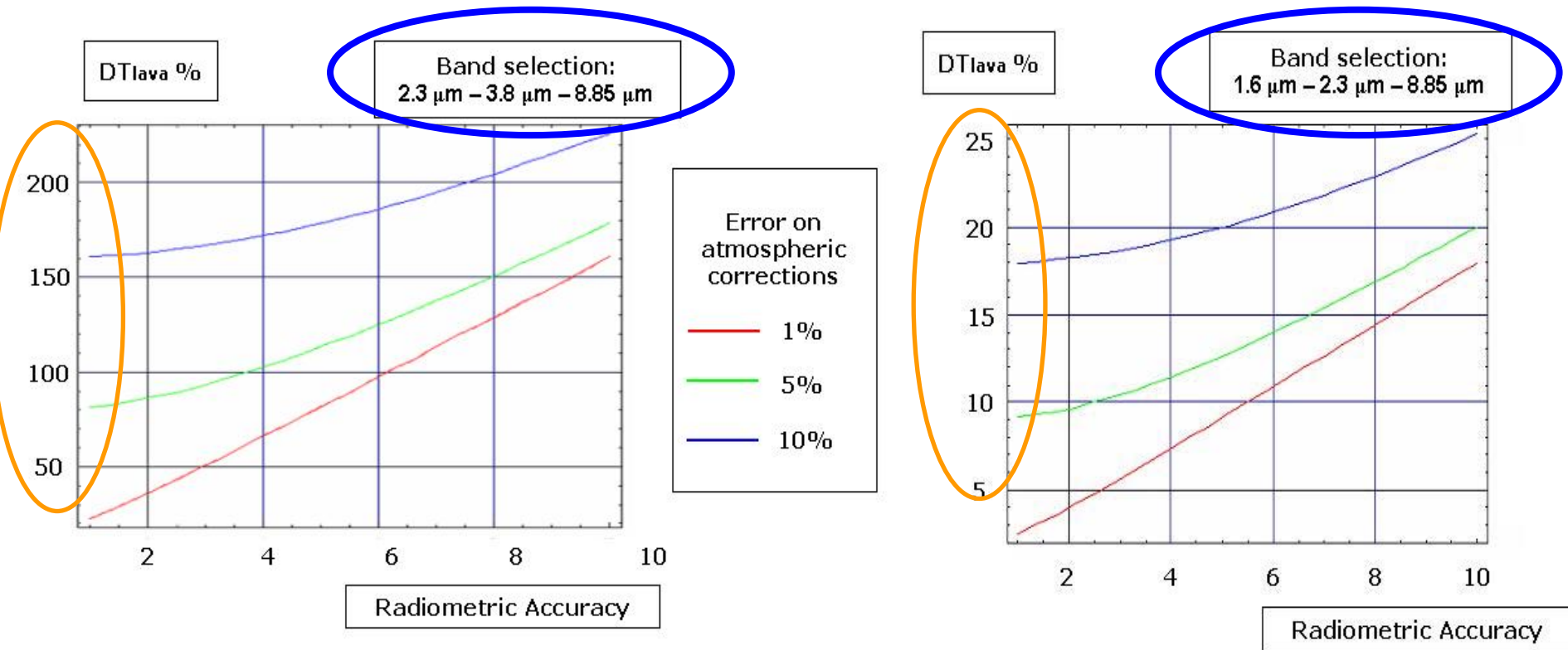


Band 8.6 micron  
Spatial resolution  
100m

The observation of the thermal anomaly is possible with an absolute radiometric accuracy of the IR payload of at least  $\Delta T \approx 2.75 \text{ K}$  (at 8.85 micron), hot spots are still detectable

# Example: error on lava temperature estimation

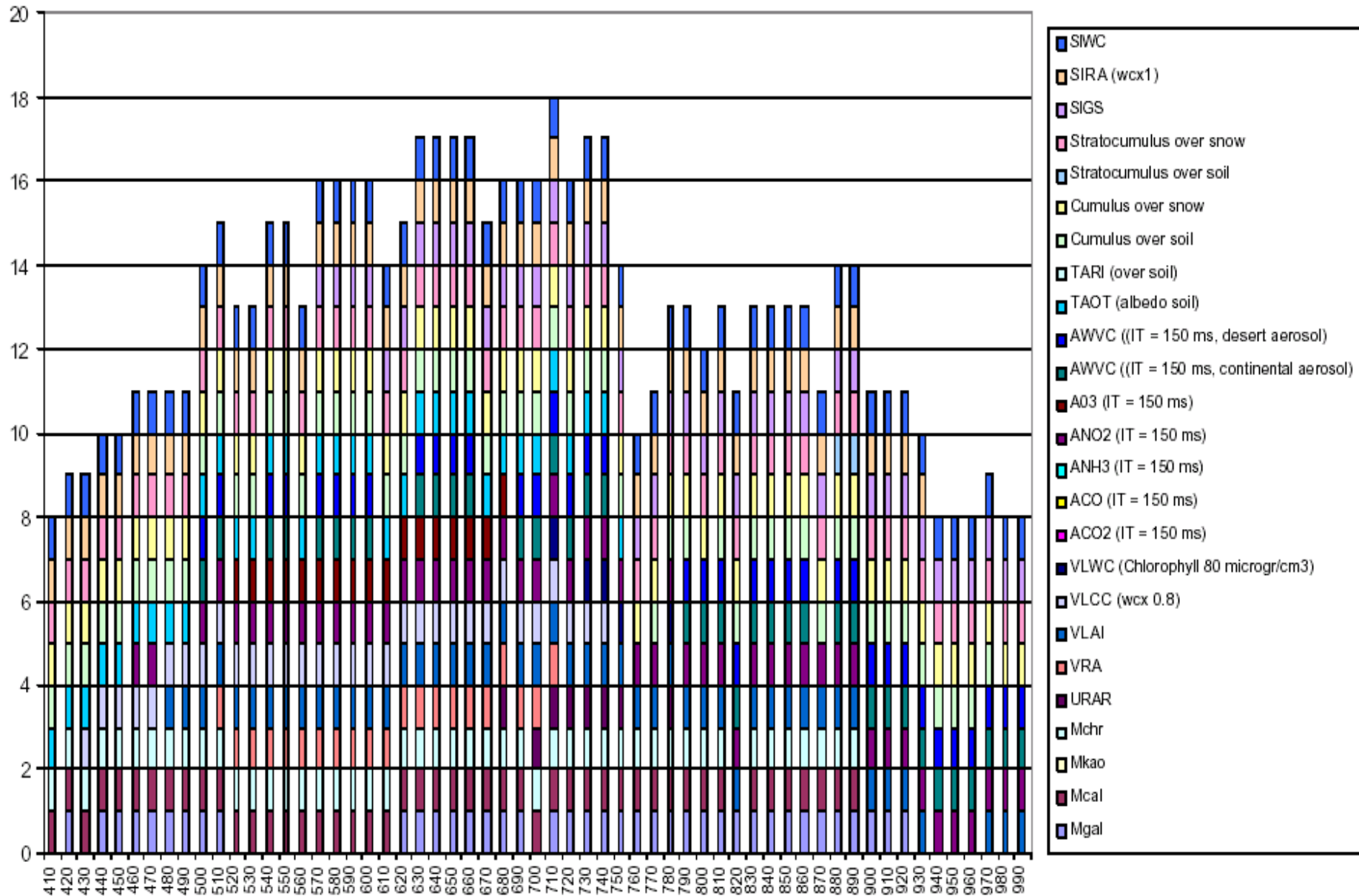
## Geophysical scenario: lava flow (Etna)



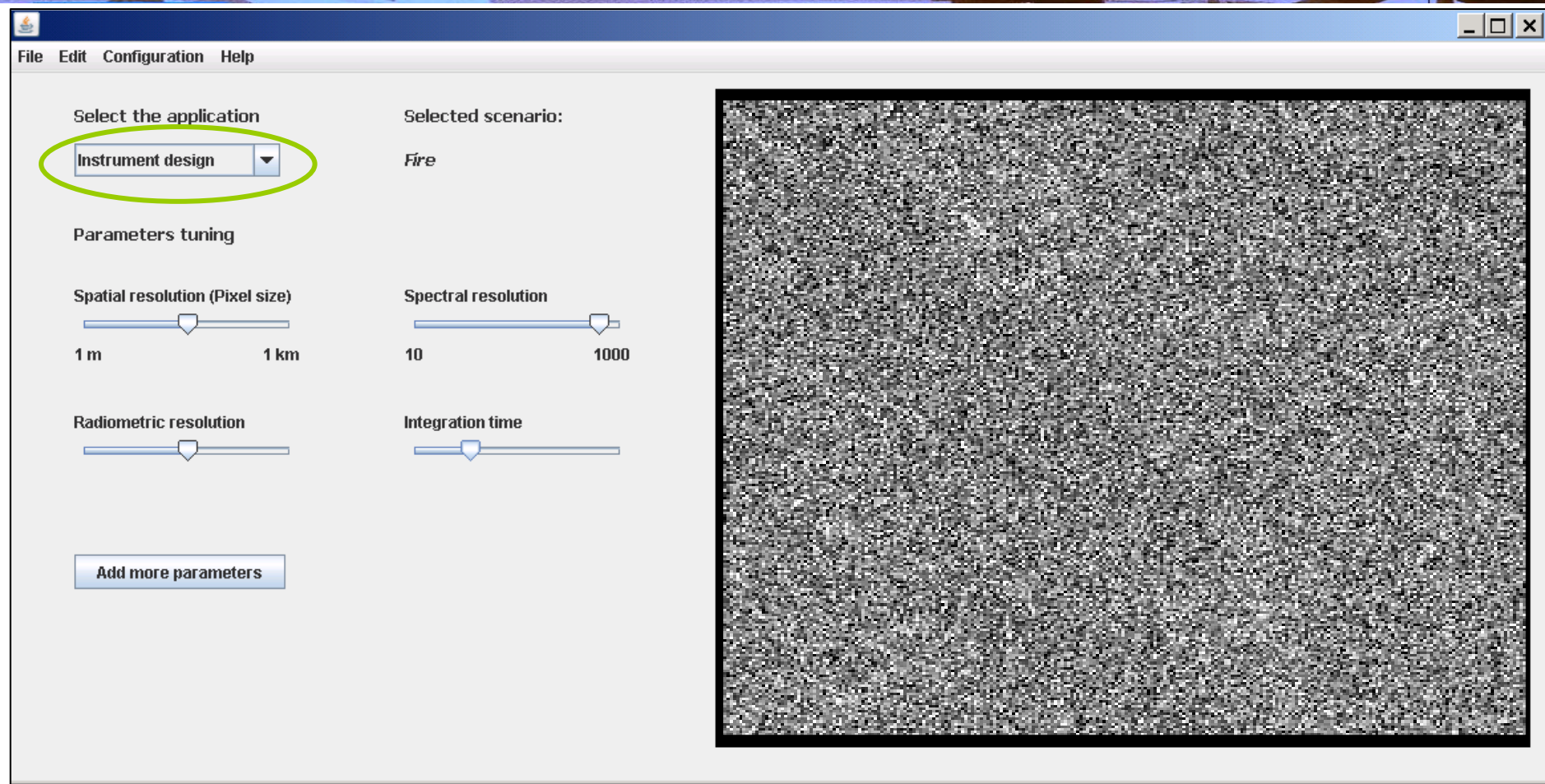
The selected bands have a large effect on temperature retrieval error



# Sensitivity analysis



# Instrumental design







File Edit Configuration Help

Select the application  
Instrument design

Selected scenario:  
*Fire*

Parameters tuning

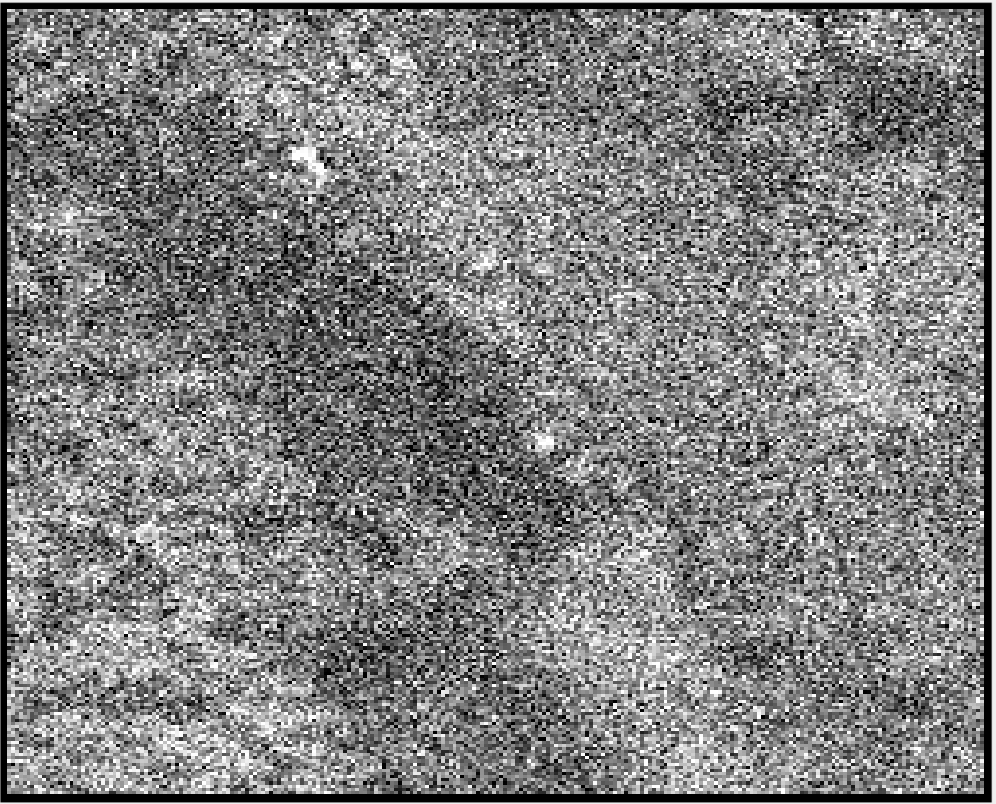
Spatial resolution (Pixel size)  
1 m 1 km

Spectral resolution  
10 1000

Radiometric resolution

Integration time

Add more parameters



# Sensitivity analysis

File Edit Configuration Help

Select the application  
Sensitivity analysis

Selected scenario:  
*Fire*

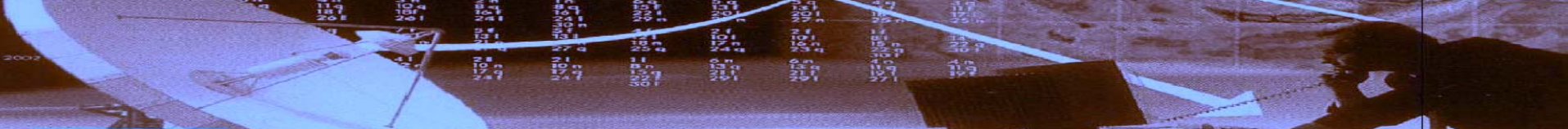
Phenomenon characteristics

Spatial dimension  
1 m 1 km

Spectral wideness  
1 nm 100 nm

Radiometric amplitude

Add more parameters



File Edit Configuration Help

Select the application  
Sensitivity analysis

Selected scenario:  
*Fire*

Phenomenon characteristics

Spatial dimension  
1 m 1 km

Spectral wideness  
1 nm 100 nm

Radiometric amplitude

Add more parameters

A grayscale satellite image of a landscape, possibly a coastal area, with two yellow circles highlighting specific points of interest. The interface includes a menu bar (File, Edit, Configuration, Help), a dropdown menu for 'Sensitivity analysis', a 'Selected scenario' field showing 'Fire', and three sliders for 'Spatial dimension' (1 m to 1 km), 'Spectral wideness' (1 nm to 100 nm), and 'Radiometric amplitude'. An 'Add more parameters' button is also present.