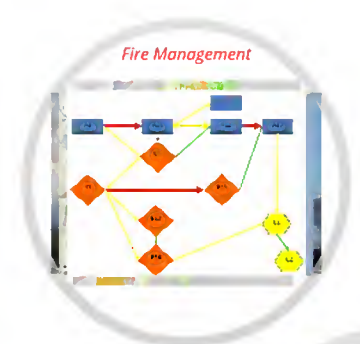
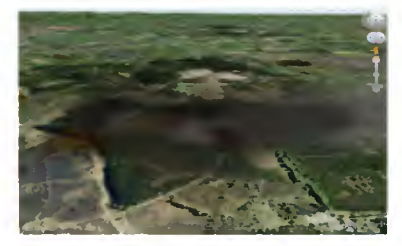
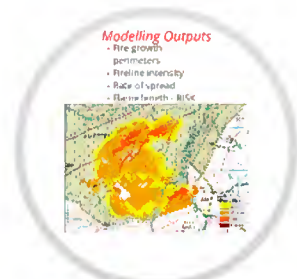
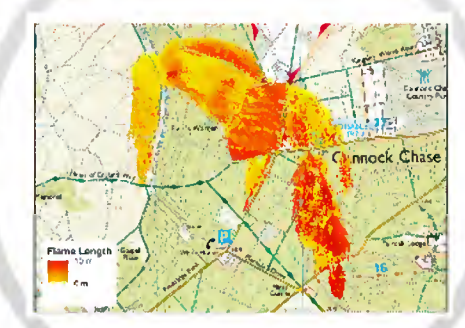


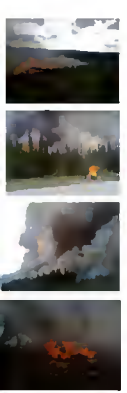
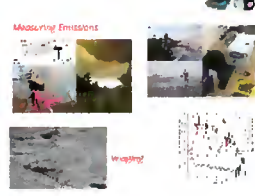
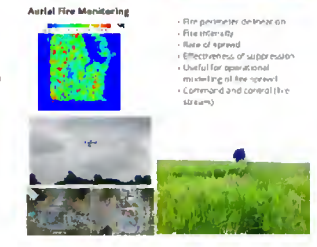
- During Fire**
- Wind speed
  - Wind direction
  - Relative Humidity
  - Temperature
  - Precipitation
- Soil/Moisture**
- Soil Moisture
  - Relative Humidity
  - Temperature
- Solar Driving**
- Aspect
  - Slope
- Topographic winds**
- Wind speed
  - Wind direction



### Sherbrook Case Study



so how can we ENHANCE understanding of wildfire behaviour?



NERC Knowledge Transfer Grant  
 Airborne, Ground and Satellite  
 Fire Growth Modelling  
 1st April 2010  
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- Fire Growth Modelling**
- Fire perimeter delineation
  - Fire intensity
  - Rate of spread
  - Effectiveness of suppression
  - Useful for operational modelling of fire network
  - Command and control (live streams)

Wildfire 2013: 23 October 2013

**KING'S**  
*College*  
**LONDON**

**Enhancing Understanding of Wildfire  
Behaviour and Suppression using Remote  
Sensing and Computer Simulation Modelling**

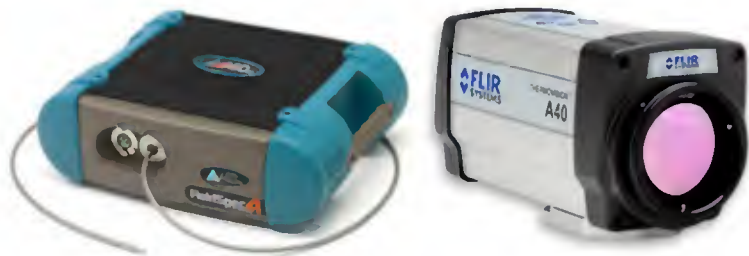
*Thomas Smith*

Environmental Monitoring and Modelling Research Group,  
Department of Geography, King's College London



**KCL Wildfire Research**

Field



**KCL Wildfire Research**

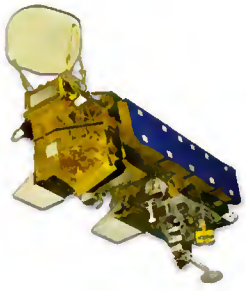
# Airborne



# Field



**KCL Wildfire Research**

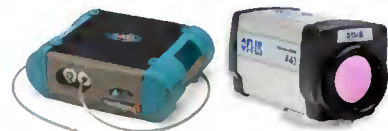


Spaceborne

Airborne

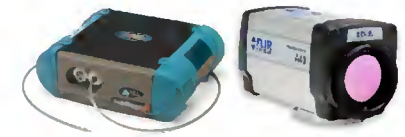


Field

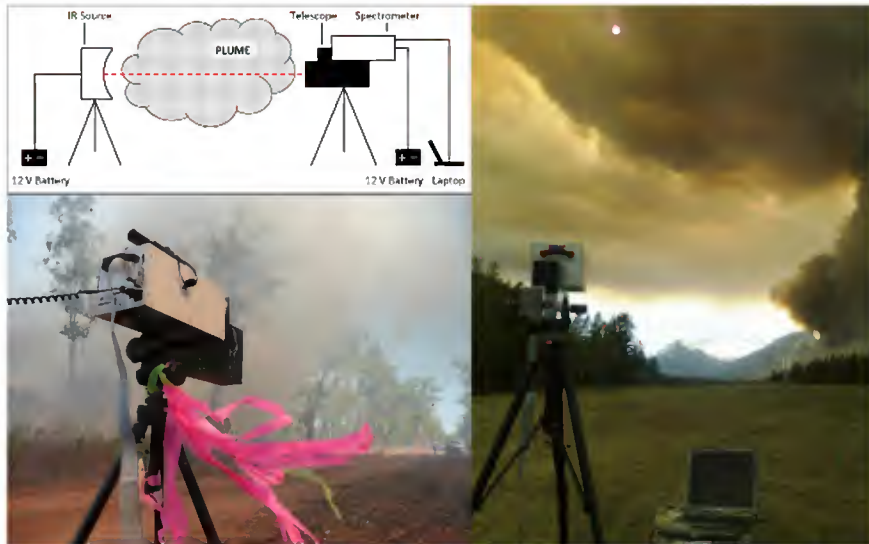


KCL Wildfire Research

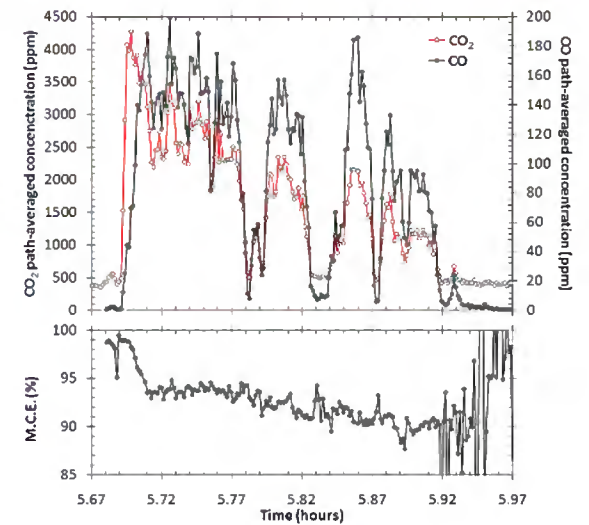
# Field



## Measuring Emissions



## Imaging





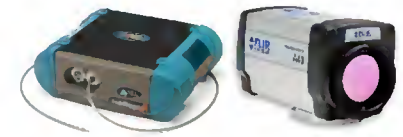








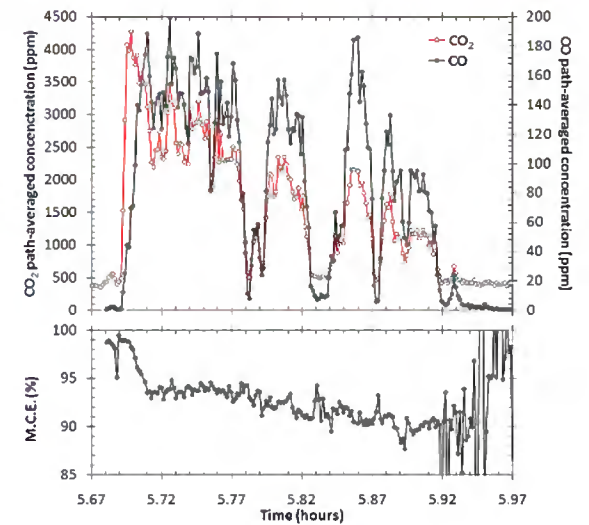
# Field

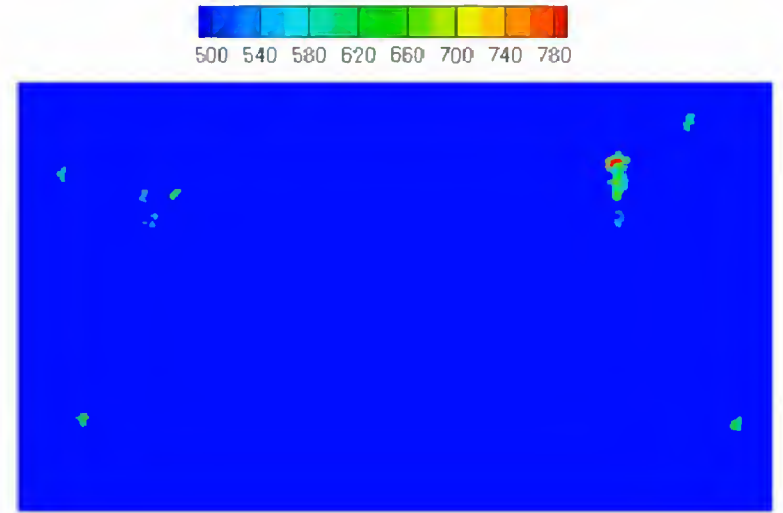
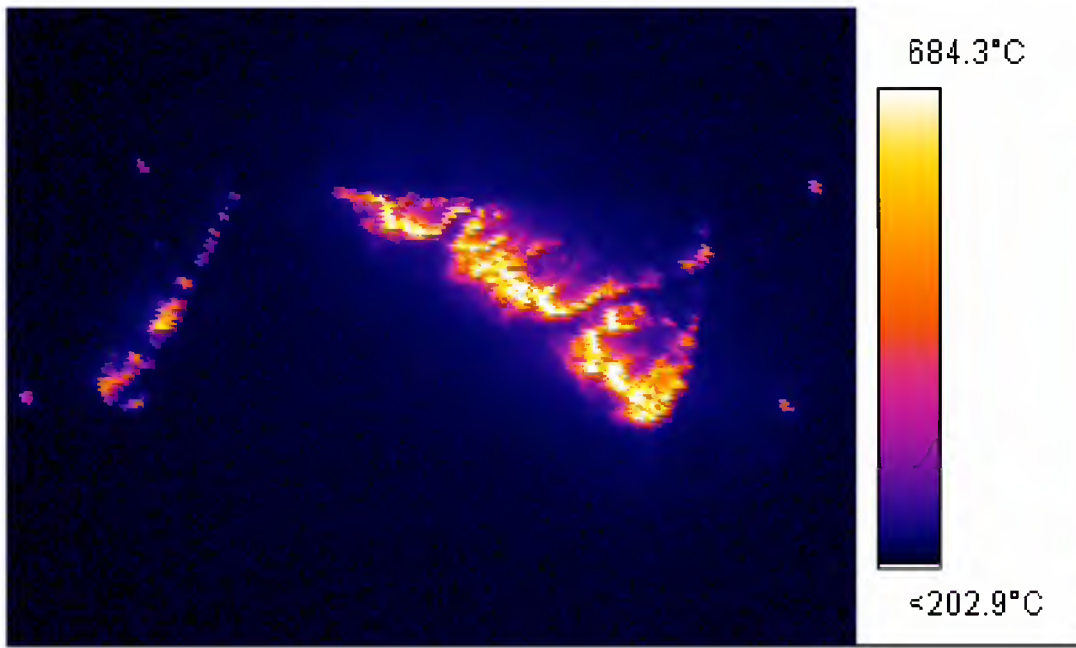


## Measuring Emissions



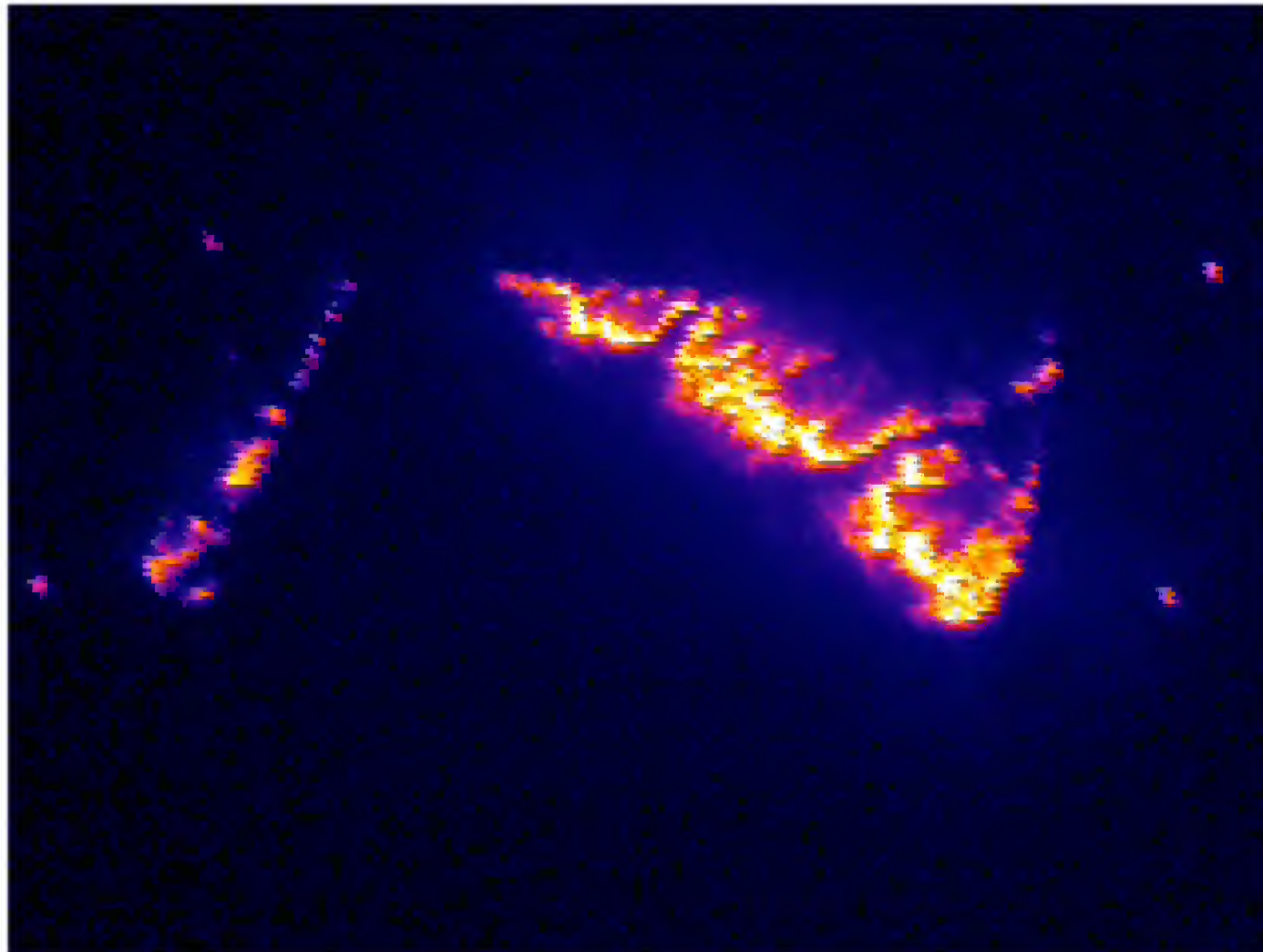
## Imaging





Airborne





684.3°C



<202.9°C

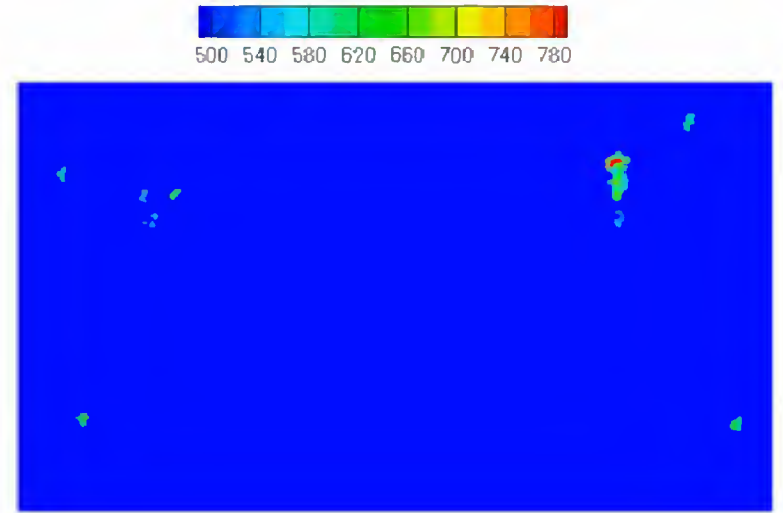
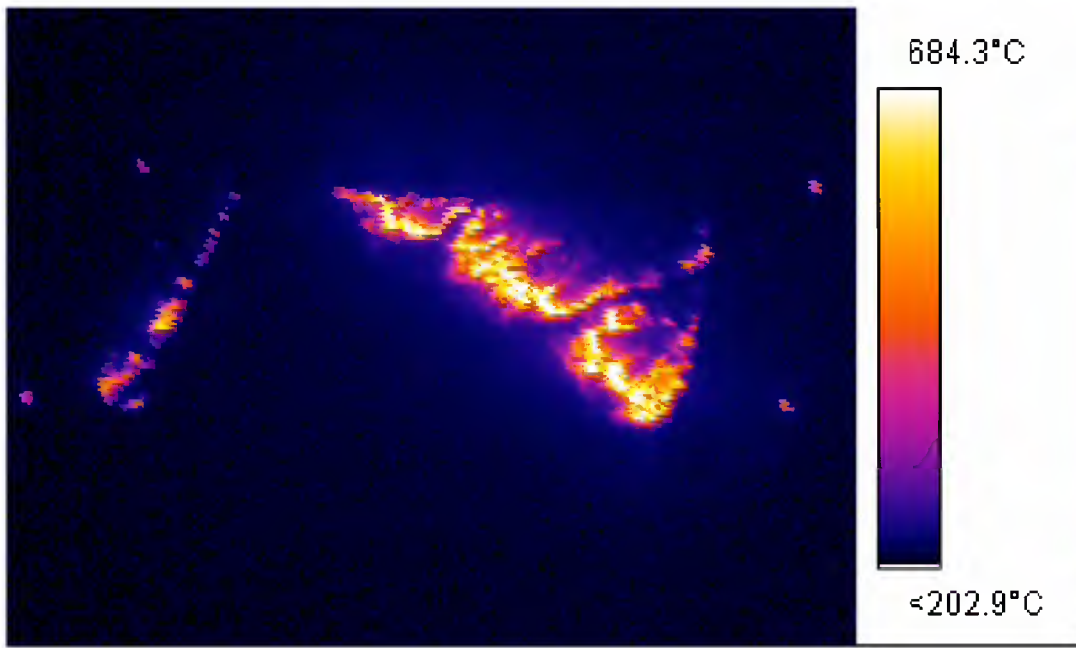


3°C



.9°C

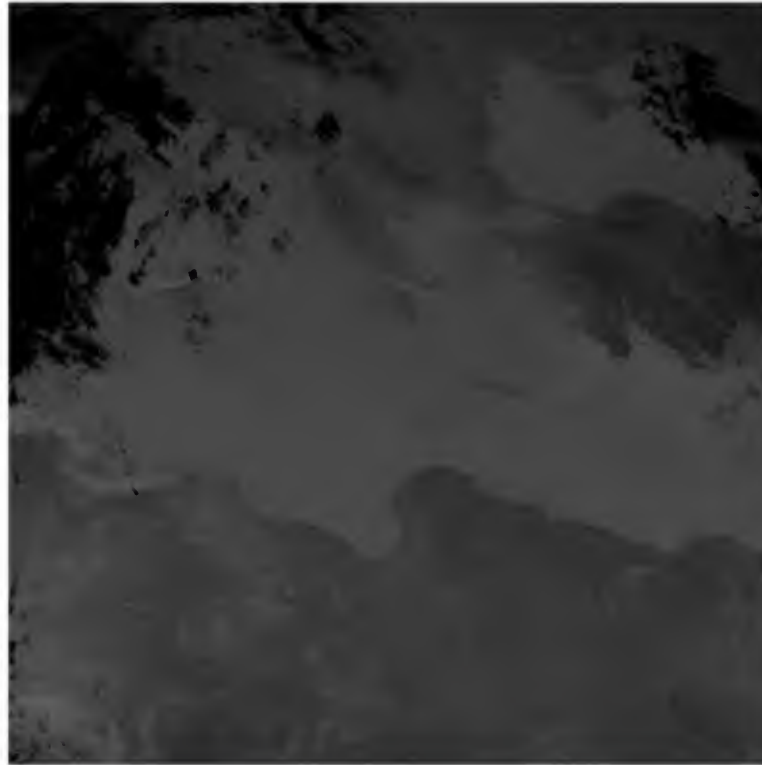
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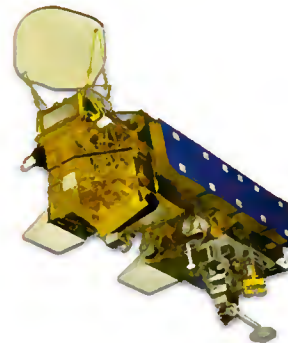
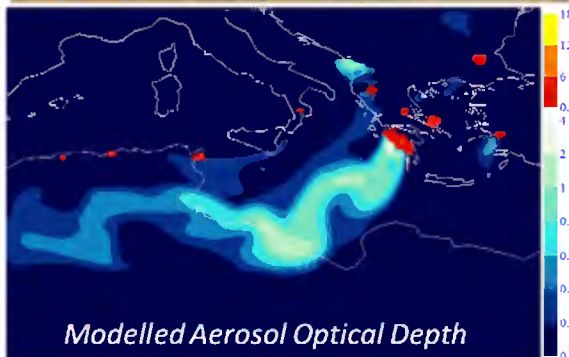
Airborne



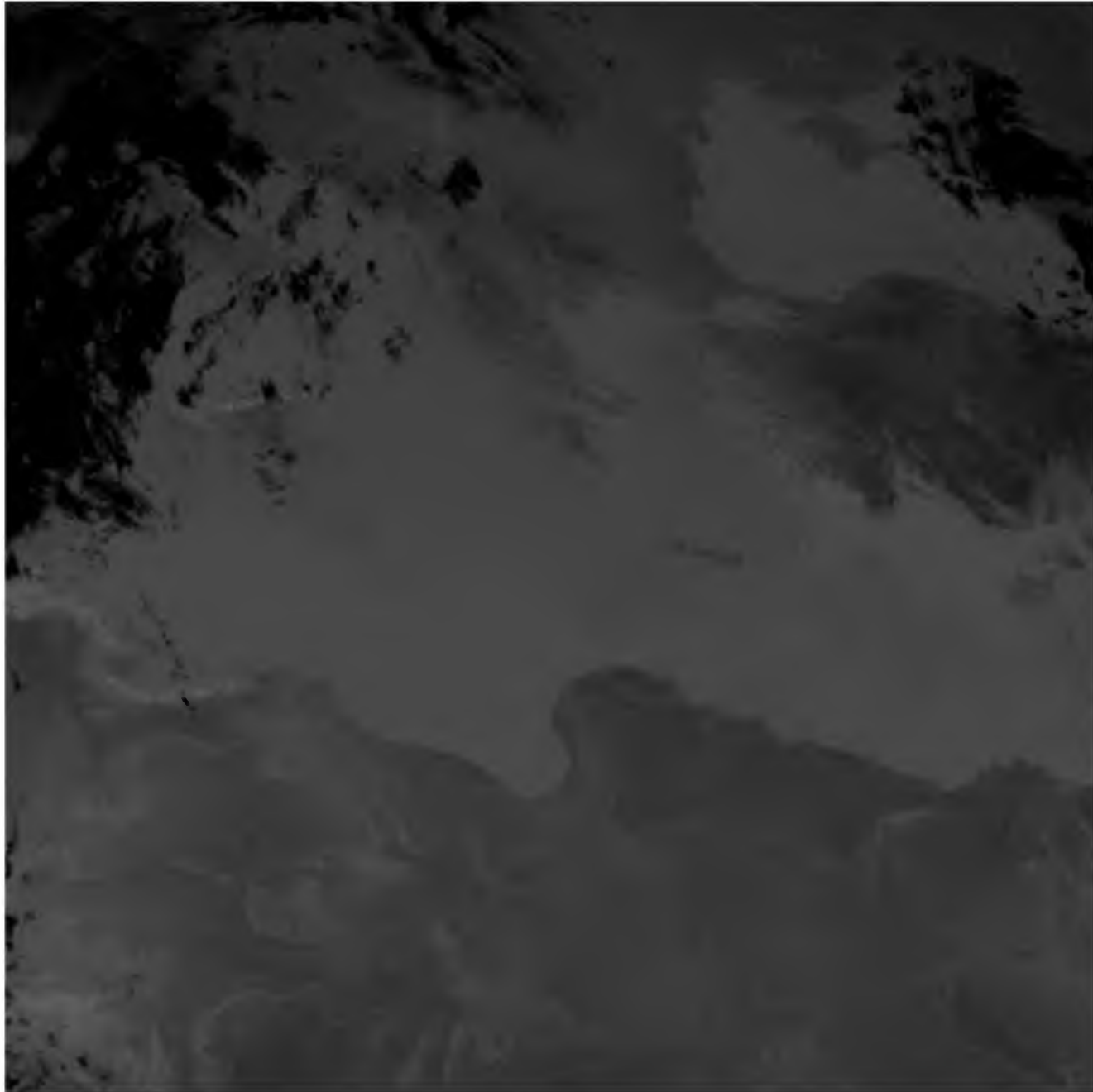




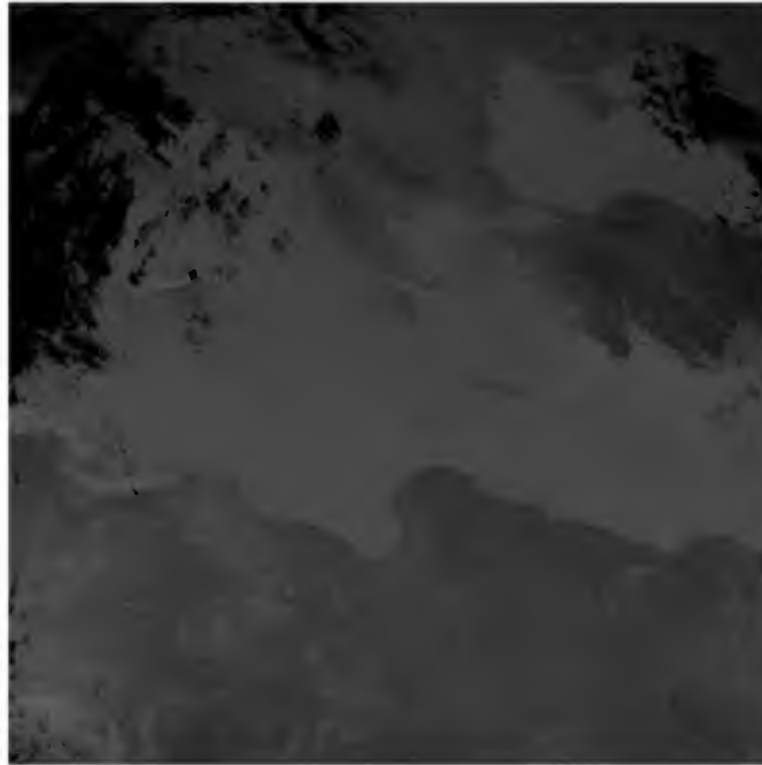
## *Fire Radiative Power Plume Modelling*



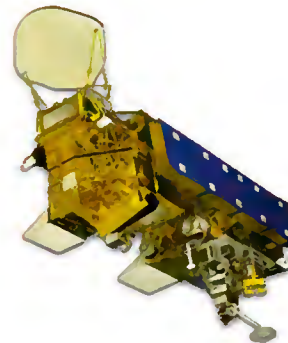
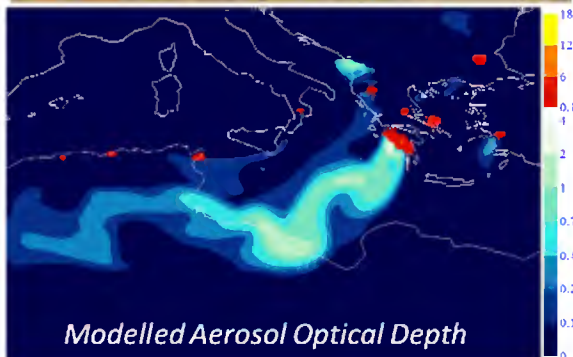
Spaceborne



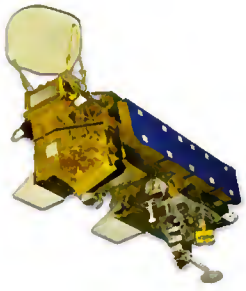
*Fire Radiative Down*



## *Fire Radiative Power Plume Modelling*



Spaceborne

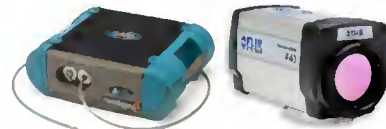


Spaceborne

Airborne



Field



KCL Wildfire Research

*...so how can we  
ENHANCE understanding  
of wildfire behaviour?*



## Fire Growth Modelling

## Aerial Fire Monitoring

NERC Knowledge Exchange Grant

Partners: Steve Gibson & NFRS

Support from:

SWFRS, CFRS

EWWF

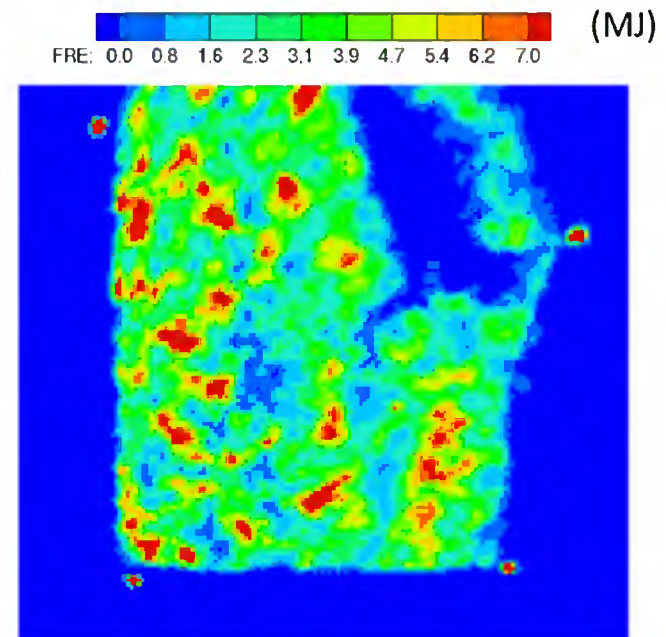
NERC UAV Cluster

Original meeting in York: 27 April 2011

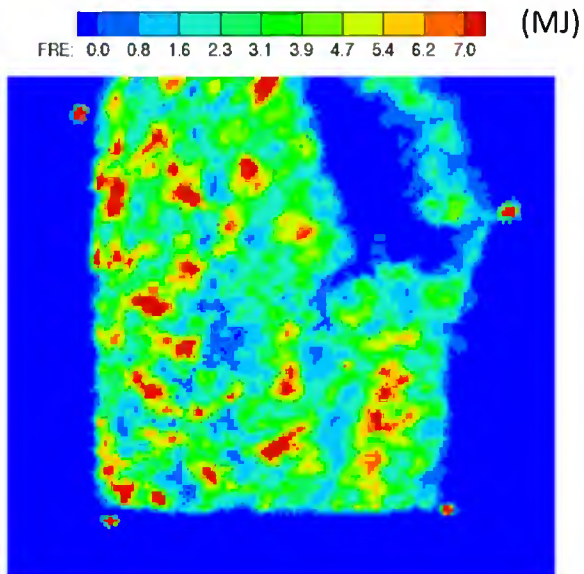
Grant awarded: 17 August 2011

Work began: February 2012

Scope: until Summer 2014



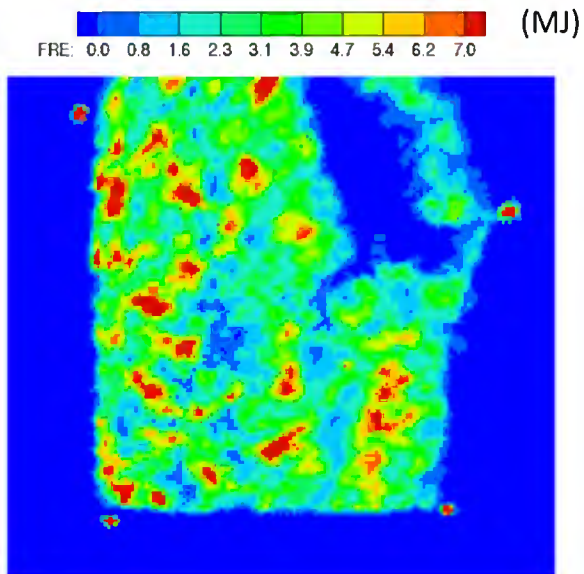
# Aerial Fire Monitoring



- Fire perimeter delineation
- Fire intensity
- Rate of spread
- Effectiveness of suppression
- Useful for operational modelling of fire spread
- Command and control (live stream)



# Aerial Fire Monitoring

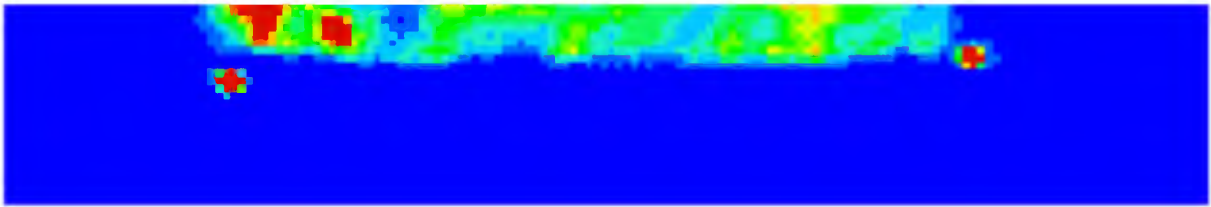


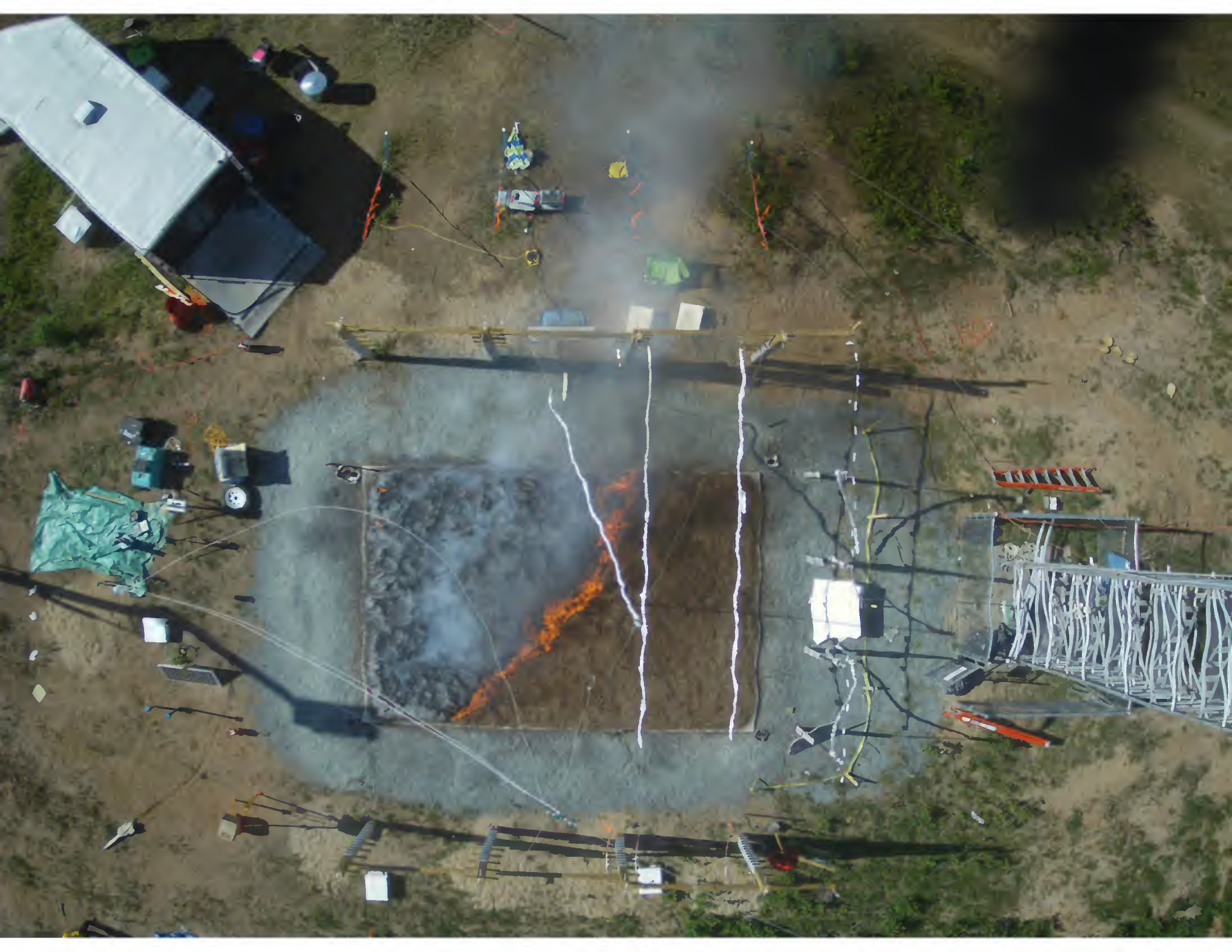
- Fire perimeter delineation
- Fire intensity
- Rate of spread
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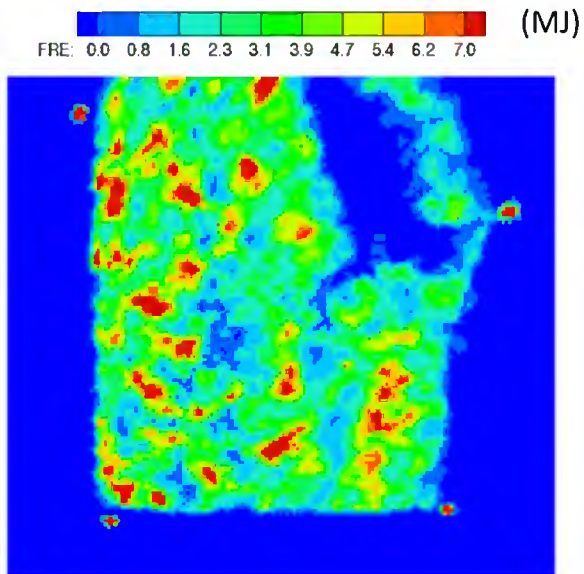








# Aerial Fire Monitoring



- Fire perimeter delineation
- Fire intensity
- Rate of spread
- Effectiveness of suppression
- Useful for operational modelling of fire spread
- Command and control (live stream)



Species  
Age class  
Dead wood  
Breaks  
Continuum to canopy

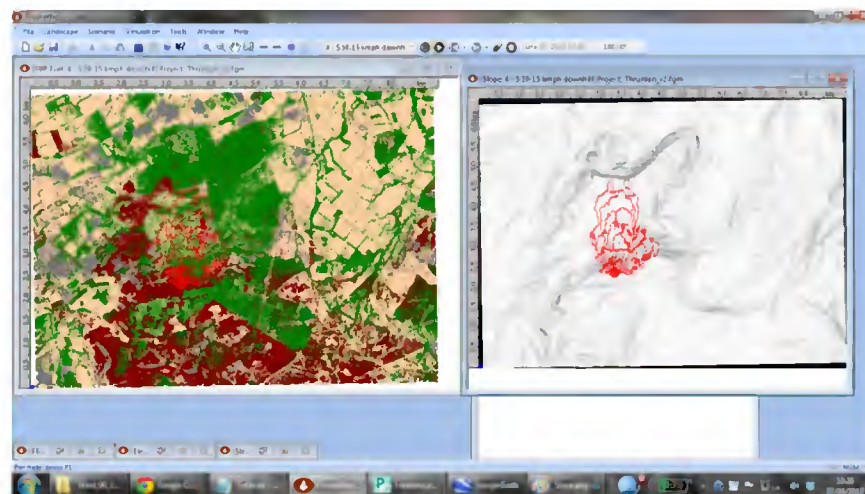
# Modelling Inputs



**Fire Growth Modelling**

Prometheus and FARSITE:

- In the process of adapting for UK fuels
- Consideration of 'patchy' UK landscape



# Meteorology

## Fuel



- Species
- Age class
- Dead wood
- Breaks
- Continuum to canopy

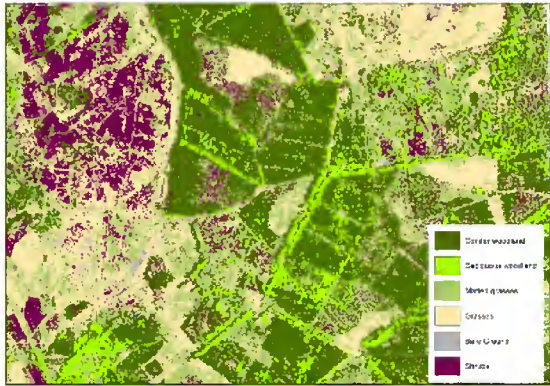
map

## Topography



Topograph

*Modelling Inputs*



**Fuel**

**Topo**

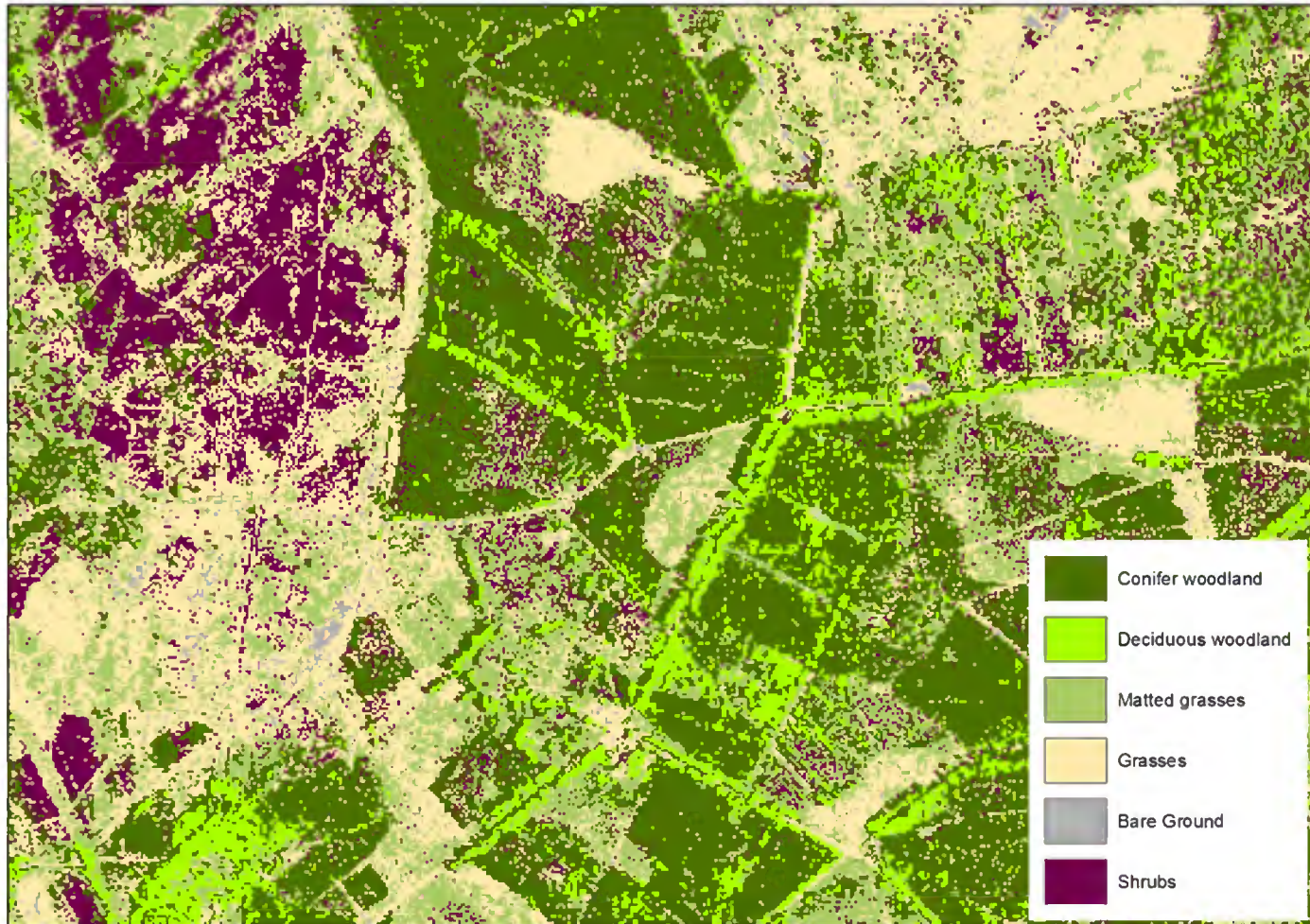


High resolution fuel map

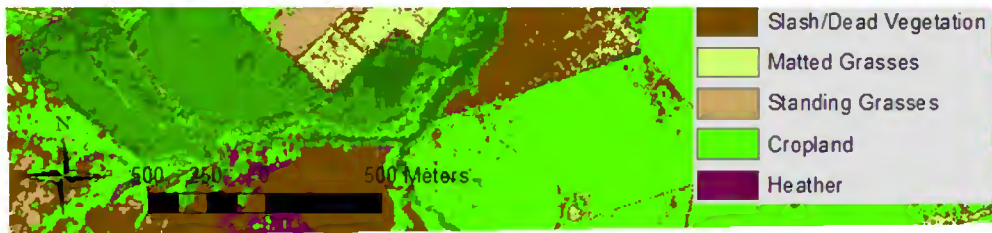
- Species
- Age class
- Dead wood
- Breaks
- Continuum to canopy

*Modelling Inputs*





# Fuel



High resolution fuel map

- Species
- Age class
- Dead wood
- Breaks
- Continuum to canopy



### During Fire:

- Wind speed
- Wind direction
- Relative Humidity
- Temperature
- Precipitation

### Soil/Veg moisture:

- Rainfall
- Relative Humidity
- Temperature

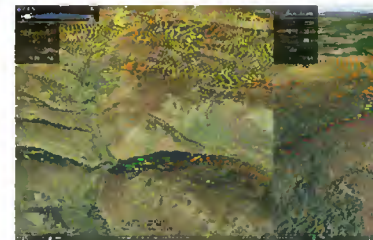
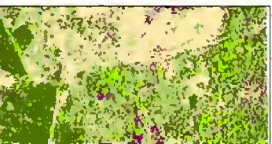
### Solar drying:

- Aspect
- Slope

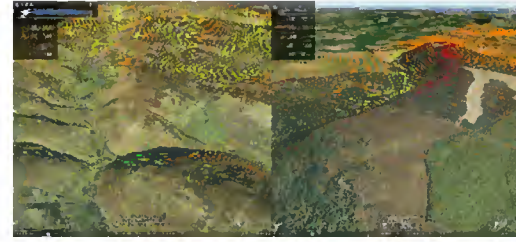
### Topographic winds:

- Wind speed
- Wind direction

# Meteorology

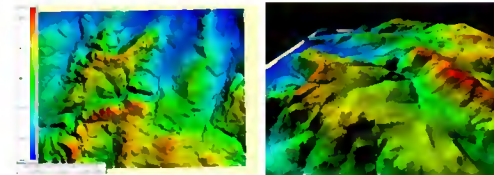


Topographic Winds

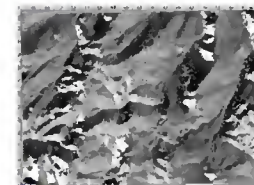


Topographic Winds

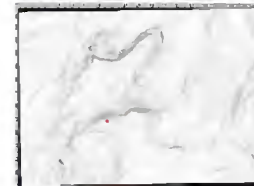
# Topography



Digital Terrain Model - 5 m

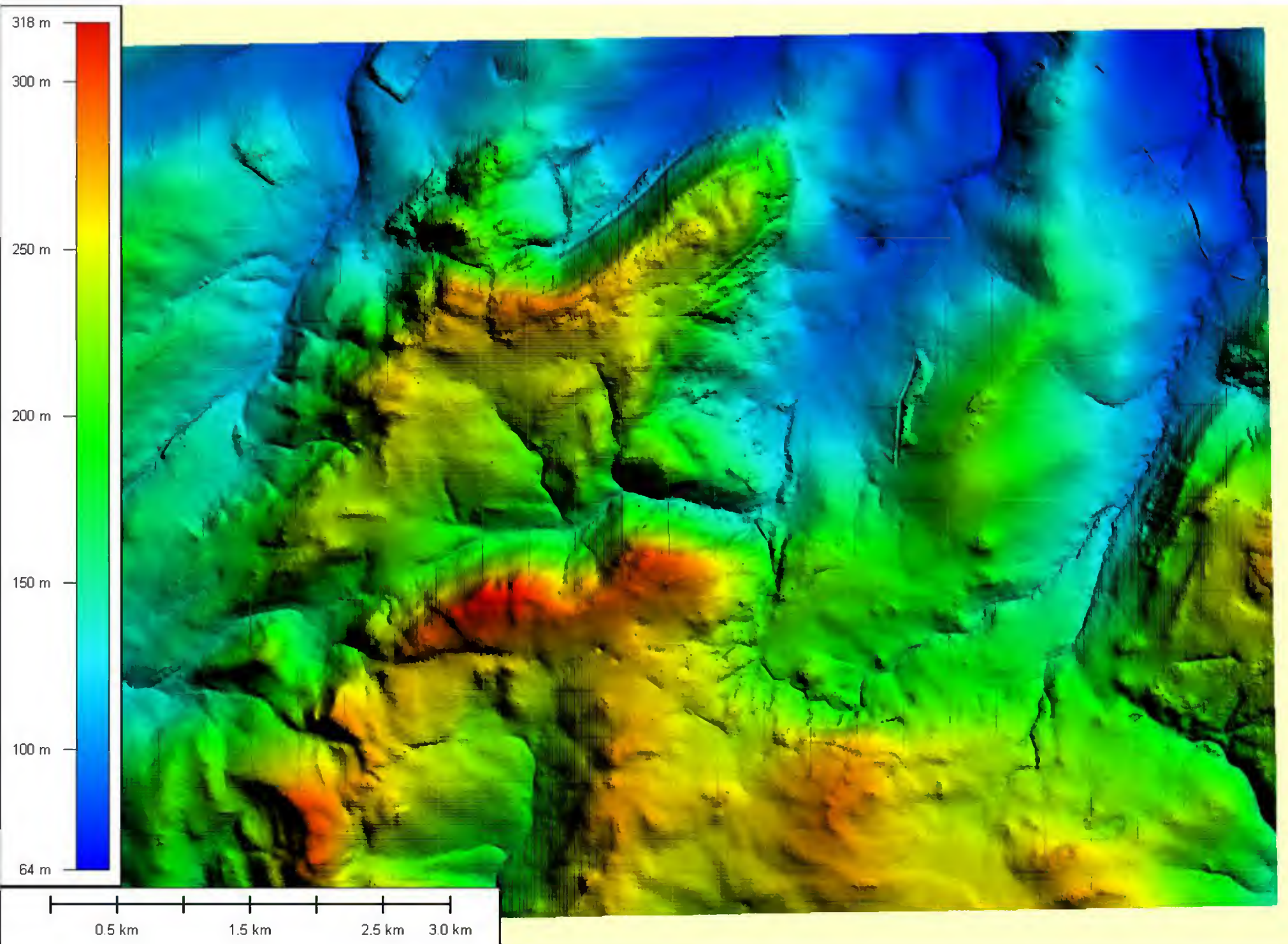


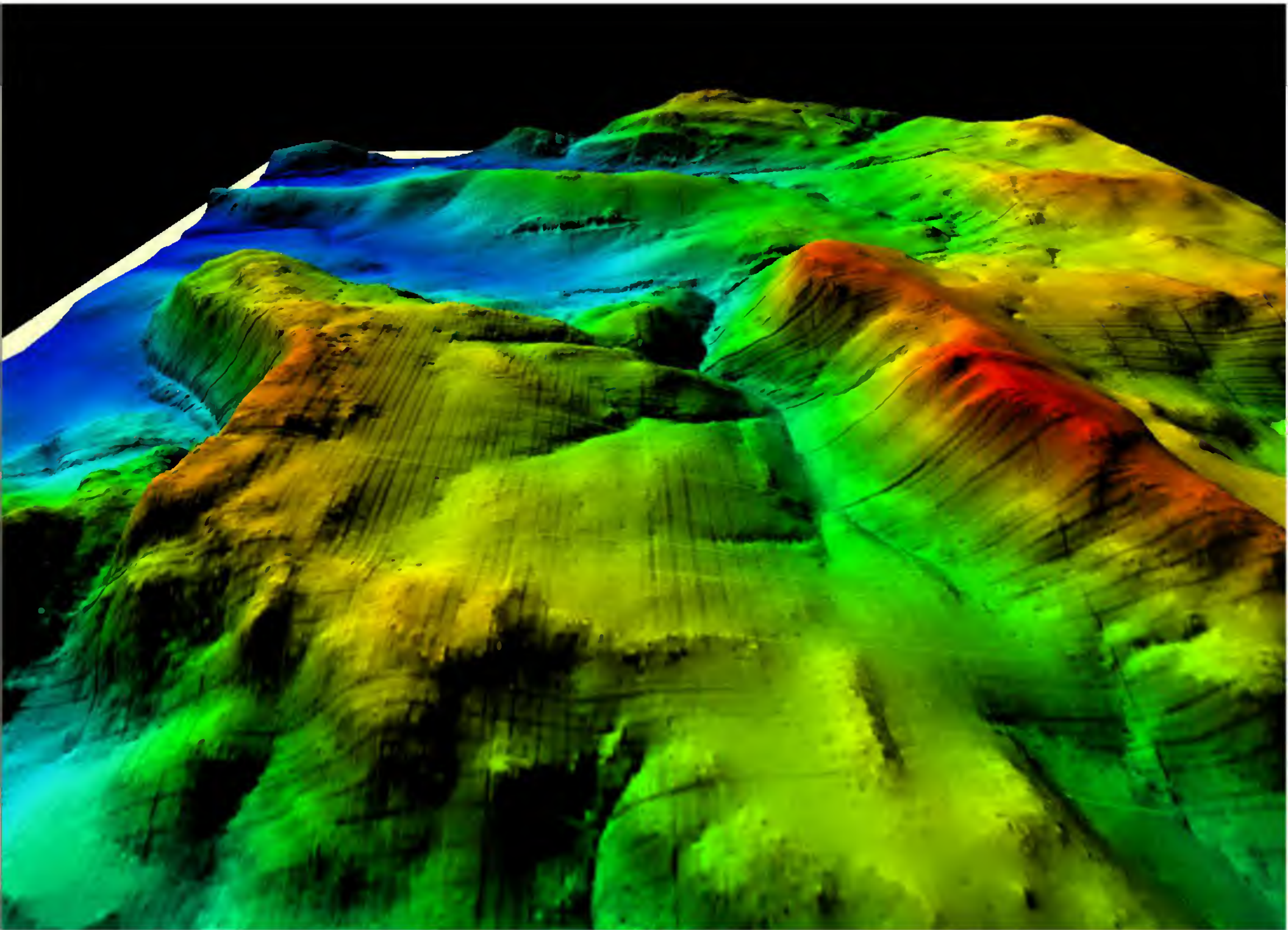
Aspect

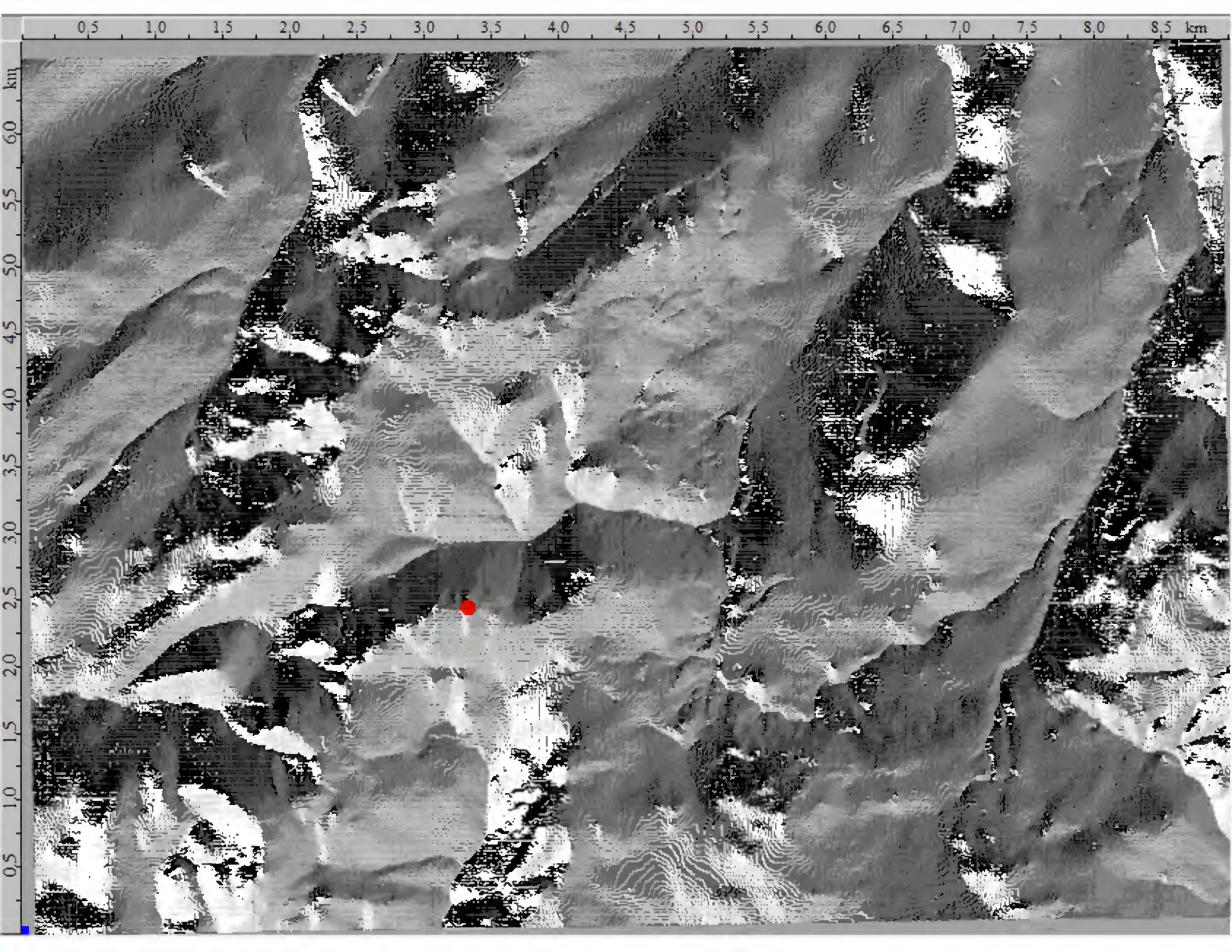


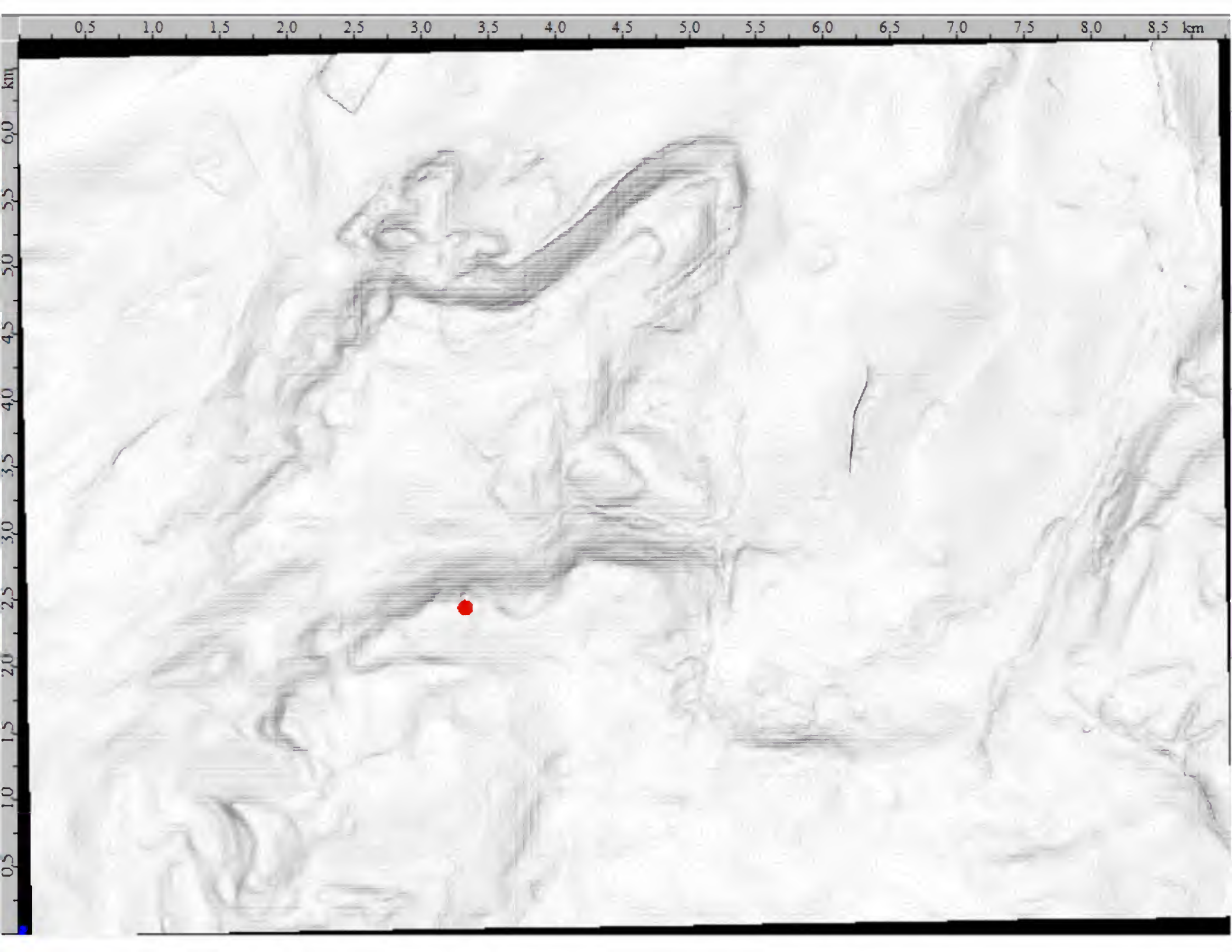
Slope

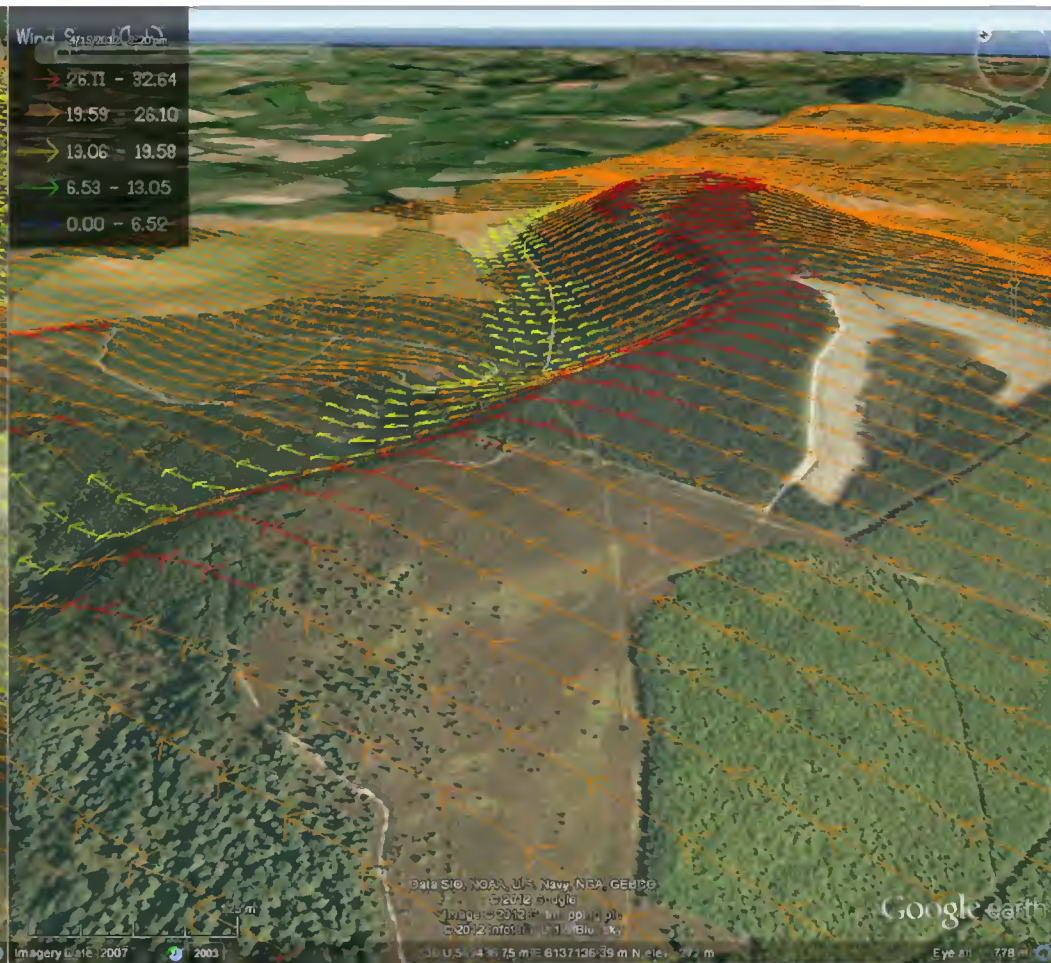
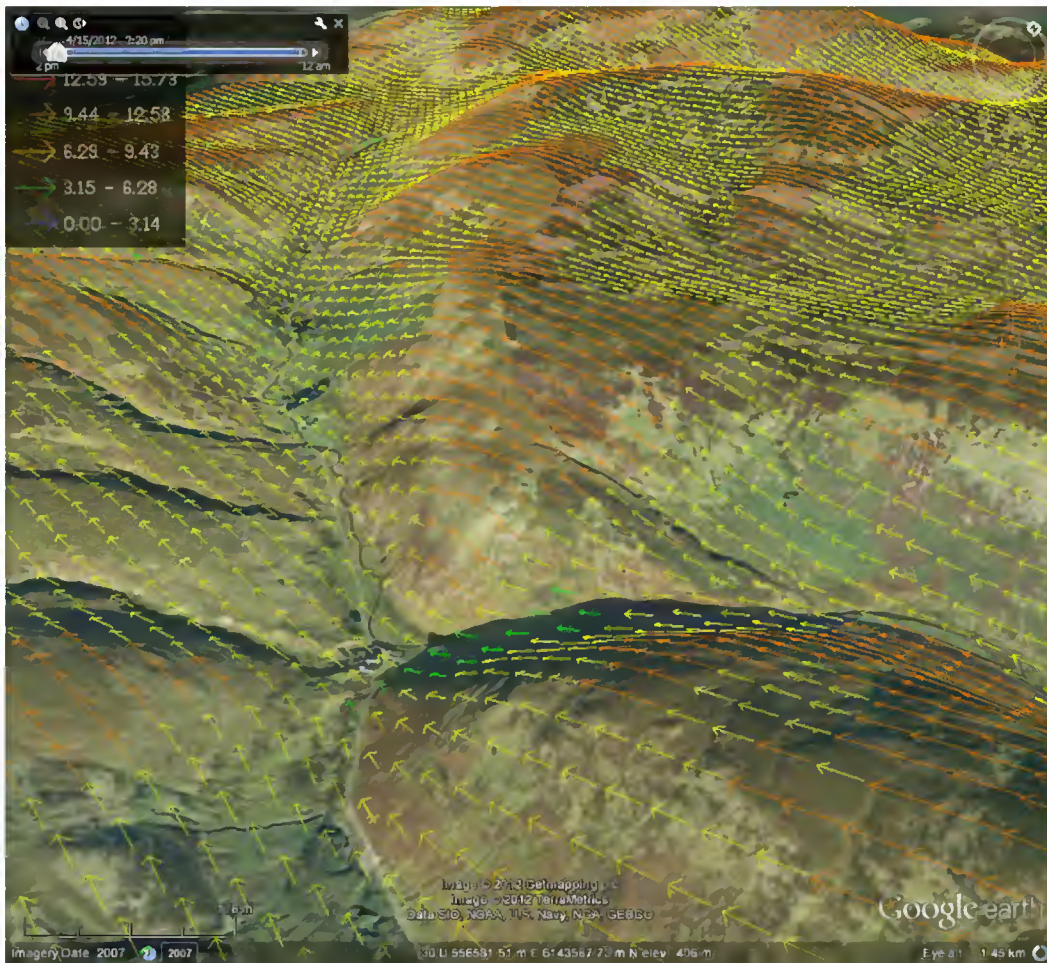
*Modelling Inputs*



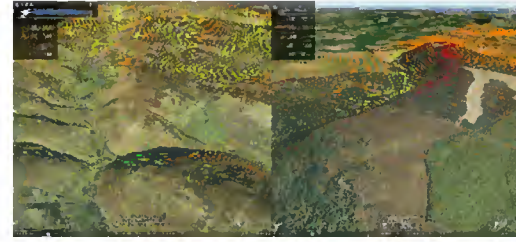






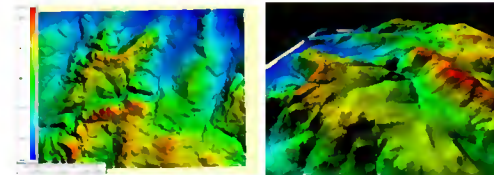


# Topographic Winds



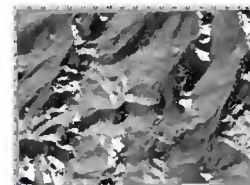
Topographic Winds

# Topography

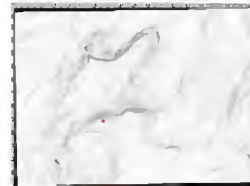


Digital Terrain Model - 5 m

*Modelling Inputs*



Aspect



Slope



# Meteorology

## Fuel



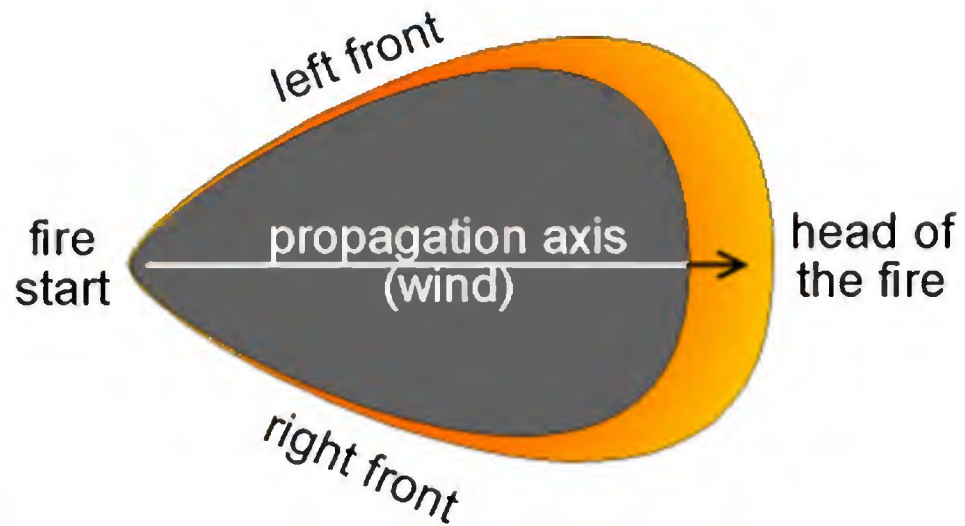
- Species
- Age class
- Dead wood
- Breaks
- Continuum to canopy



Topography

## Topography

*Modelling Inputs*

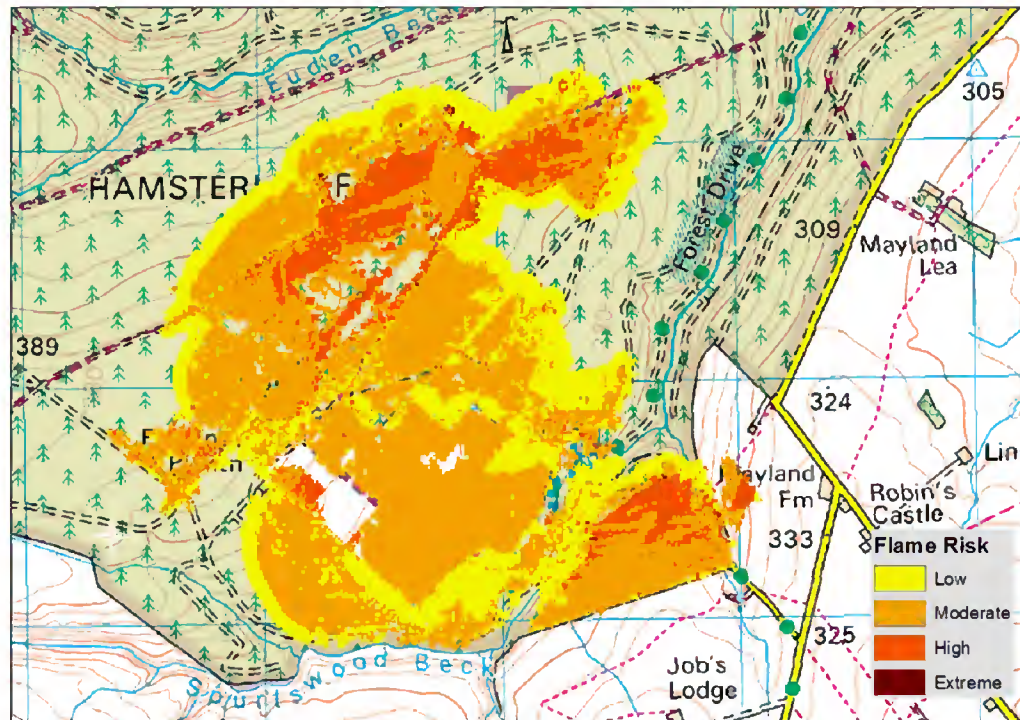


point/line/area ignition

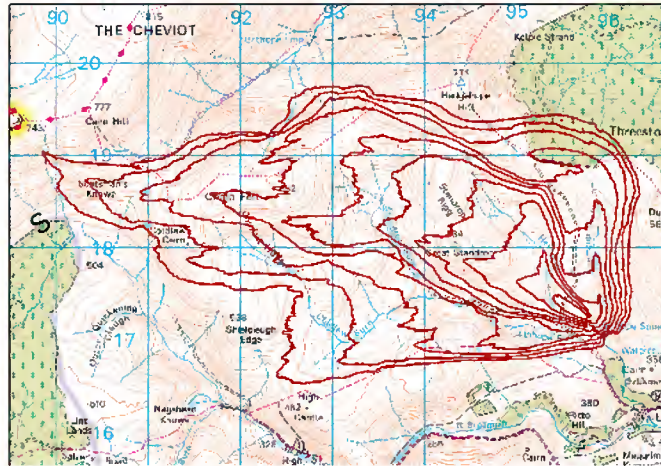
**FIRE**

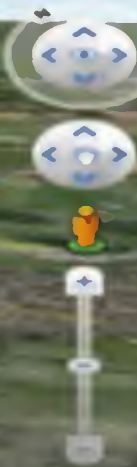
## *Modelling Outputs*

- Fire growth  
perimeters
- Fireline intensity
- Rate of spread
- Flame length - RISK



# Linhope Exercise

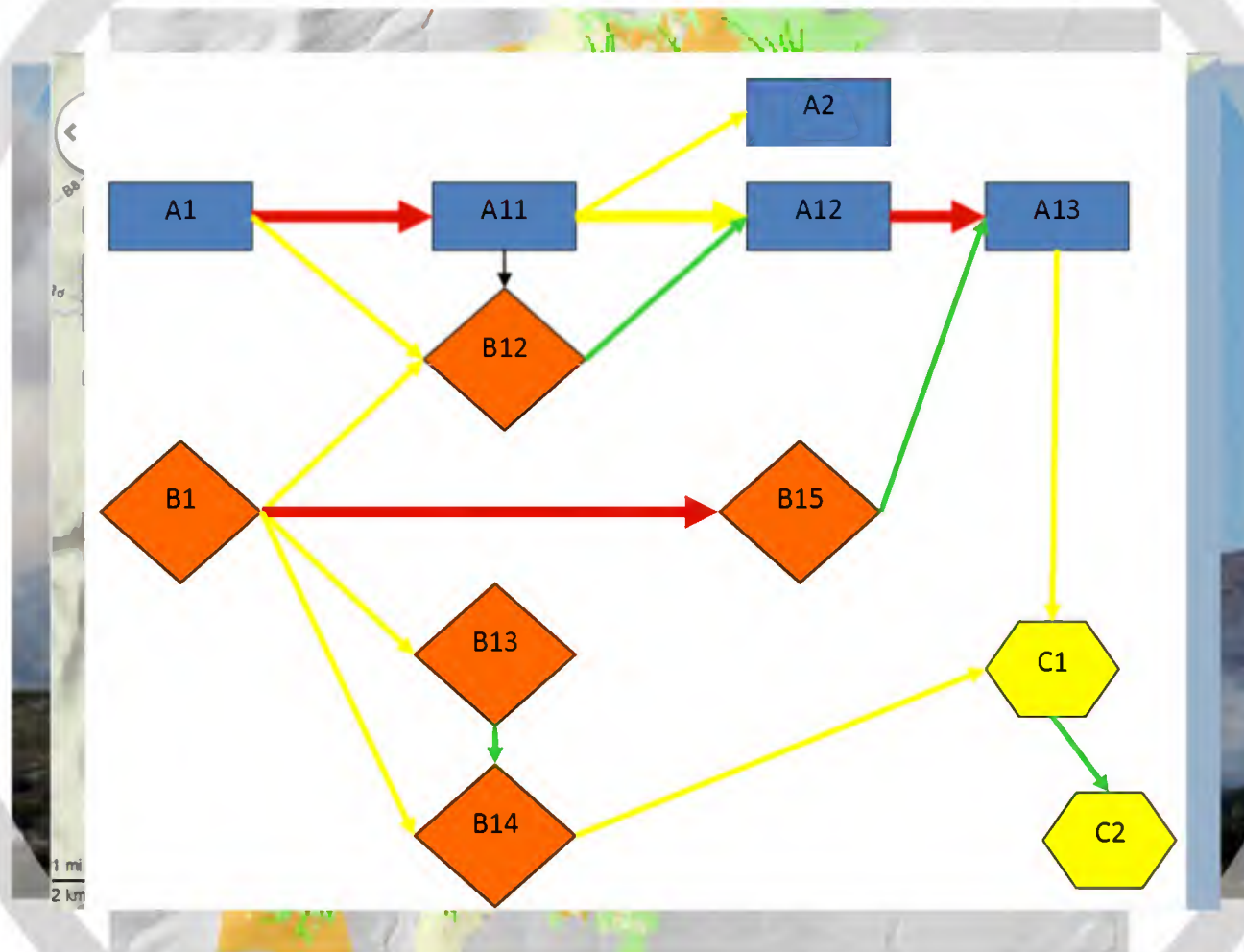


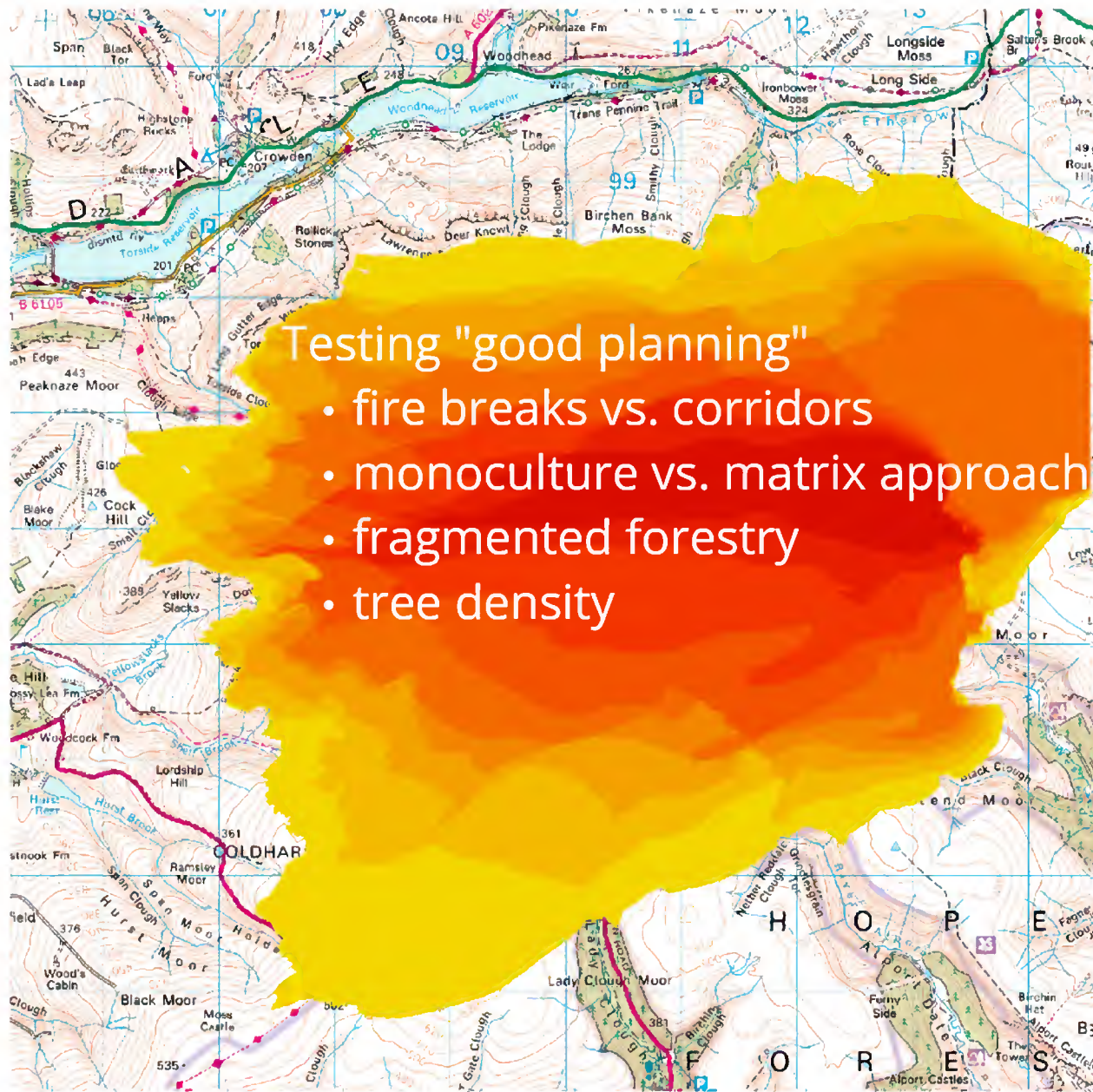


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Google Earth

# Fire Management





## Testing "good planning"

- fire breaks vs. corridors
- monoculture vs. matrix approach
- fragmented forestry
- tree density

# Questions?

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