Landgate

Location Knowledge

# An Overview of MODIS and SUOMI NPP VIIRS Satellite Data Processing in Western Australia

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# Landgate's Satellite Remote Sensing Services

- Landgate is a Western Australian State Government Department of approximately 800 staff primarily responsible for land ownership and land information

- Satellite Remote Sensing Services – 30 staff
  - customer focused
  - satellite-based land information across Australia and NZ
  - FireWatch Indonesia
  - Pasture Growth Rate for Fonterra NZ

- MODIS, SUOMI NPP, NOAA AVHRR, FY, METOP, Landsat, SPOT, Aerial Photography

- R&D staff of 1

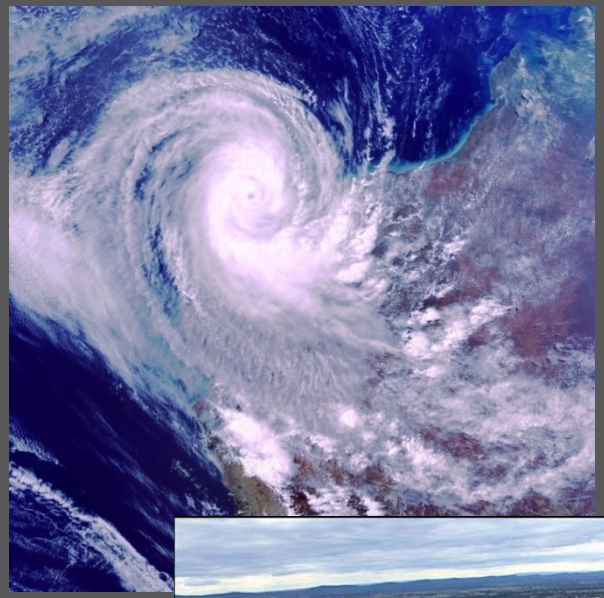
- We have strong links with the Remote Sensing and Satellite Research Group at Curtin University and Professor Merv Lynch (4 staff)

# The Role of Landgate's Satellite Remote Sensing Services

***From reception we provide remote sensing products and services for :***

- Emergency Management
- Natural Resource Management
- Agriculture
- Ocean Sciences
- Geological and Mineral Requirements

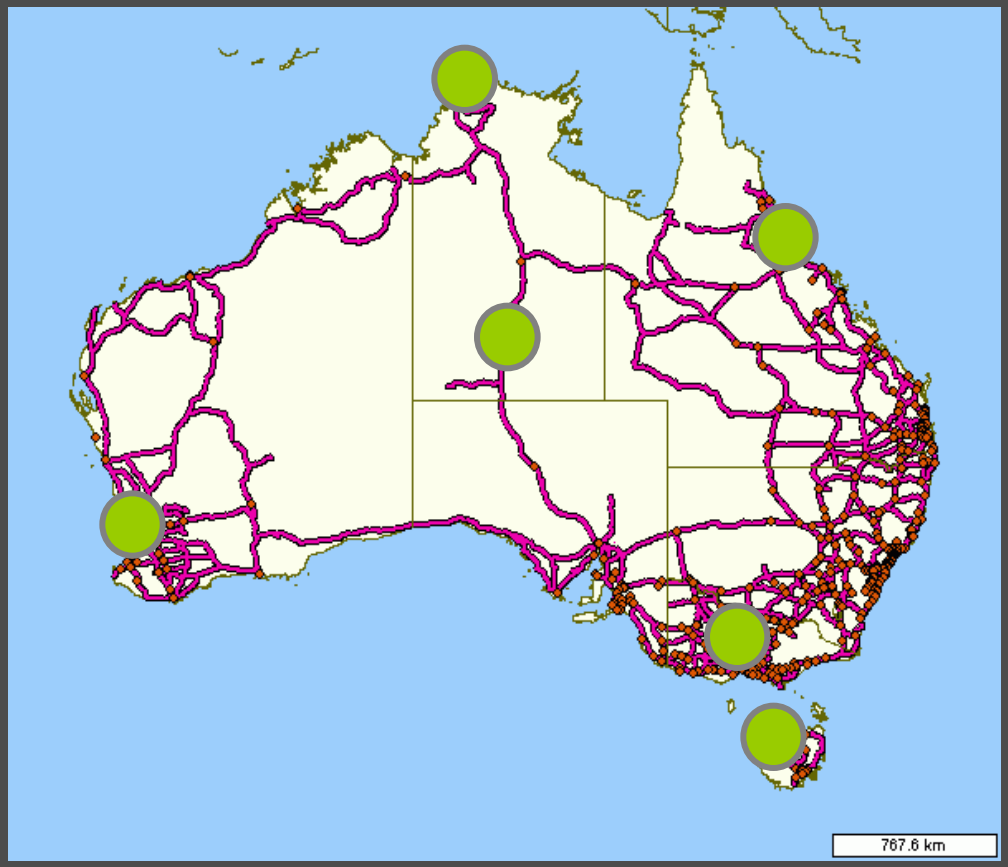
Firewatch | FloodMap | Pastures from Space | AgImage | CarbonWatch | Land Monitor | VegetationWatch | OceanWatch | Geology | Internet Delivery

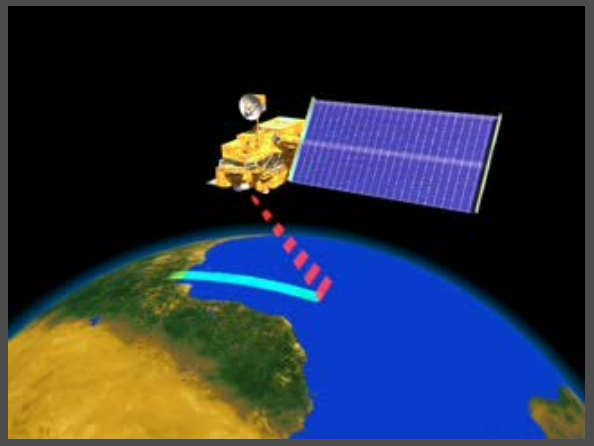


# Reception of Satellite Data in Western Australia

2.4m L/X band Seaspace Antenna

# Reception of Satellite Data Across Australia



Satellite Image Reception

## Processing of Satelite Data

**IMAPP and CSPP are fundamental to Landgate SRSS satellite products and services.**

**IMAPP** for MODIS Terra and Aqua processing
- Level 1B
- TOA reflectances and temperature
- MOD14
- MOD35
- MOD04
- SST and Chlorophyll-A
- MOD07

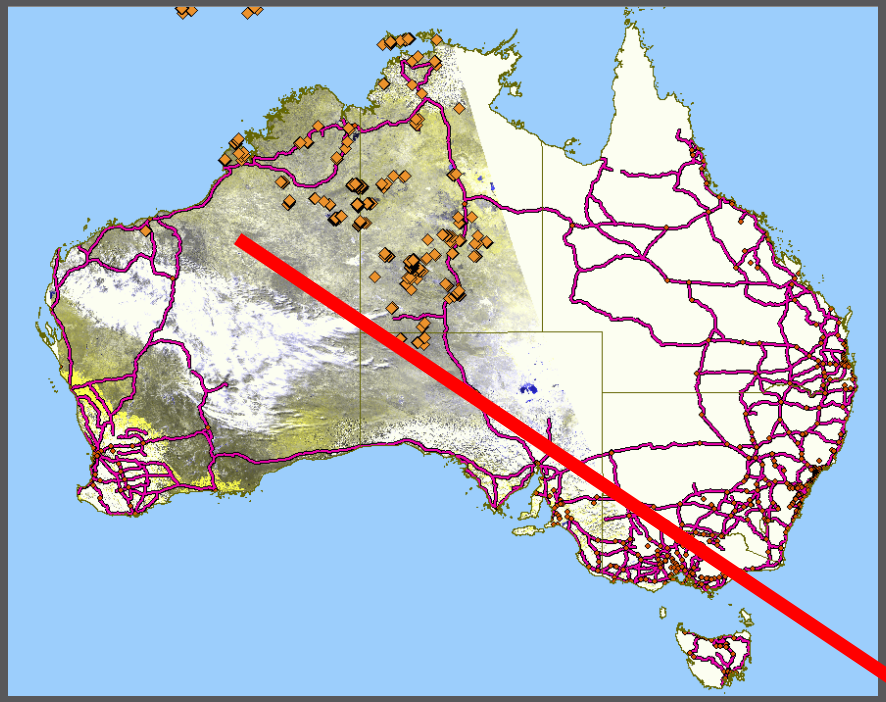
**CSPP** for SUOMI NPP
- TOA reflectances and temperatures
- SDR/EDR Fire Hotspots

At Landgate we operate a 24/7 internet delivery system for fire/flood/vegetation information

MODIS raw data from 6 MODIS receiving stations ~ 30 passes a day across Australia, NZ and Indonesia

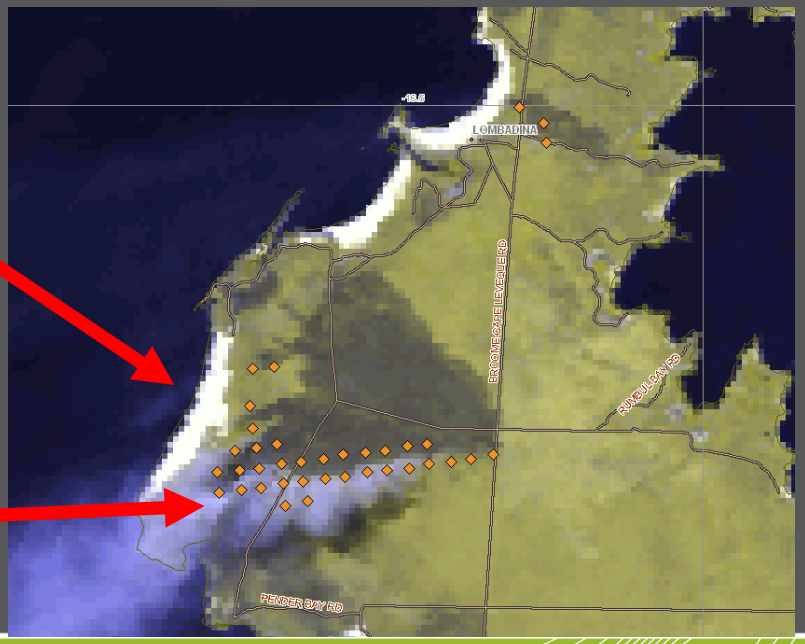
## FireWatch

MODIS and SUOMI NPP Fire hotspots and burnt area maps of Australia for Emergency Management



Fire hotspots can be seen over the latest satellite image

Image Date:
18 August 2011




The fire front can be seen from the hotspots and the area burnt over the previous week

## FireWatch

Near Real Time MODIS Satellite Images for Burnt Area, Smoke and Cloud

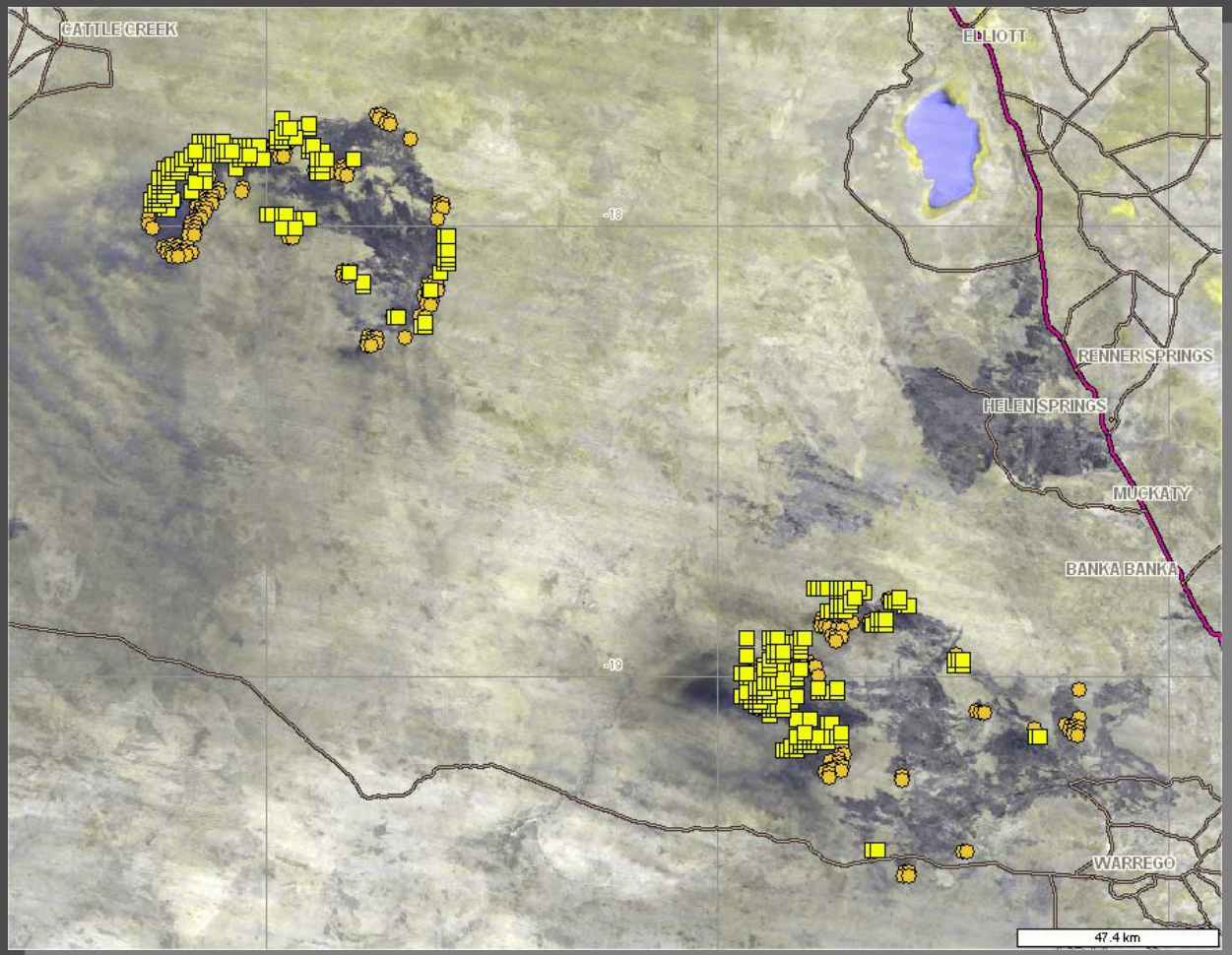
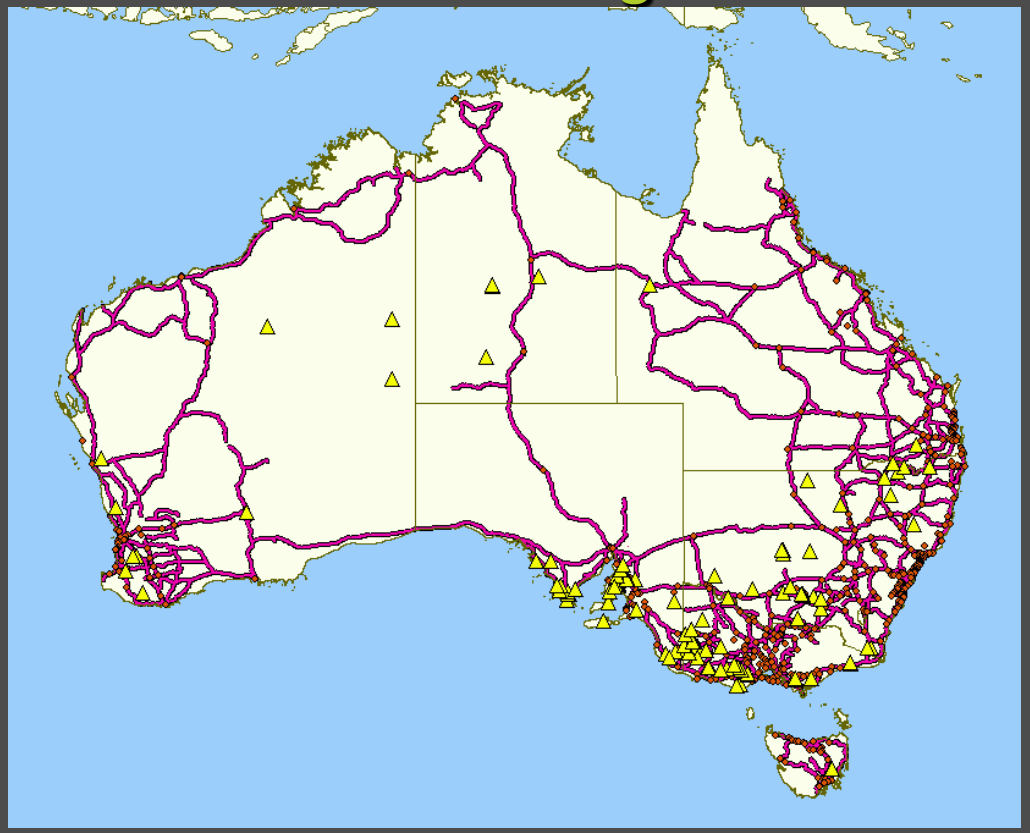
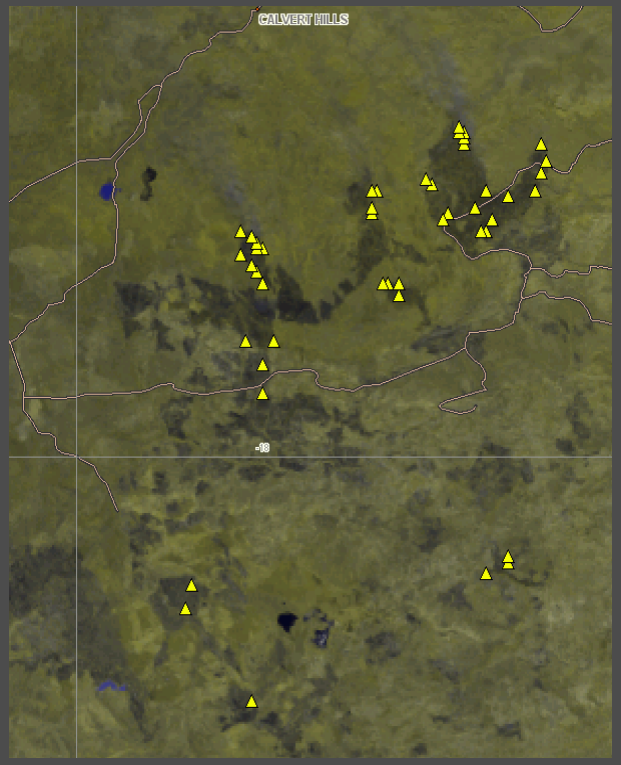



Image Date:
6th October 2004

# SUOMI NPP Fire Hotspots – CSPP VIIRS EDR Package

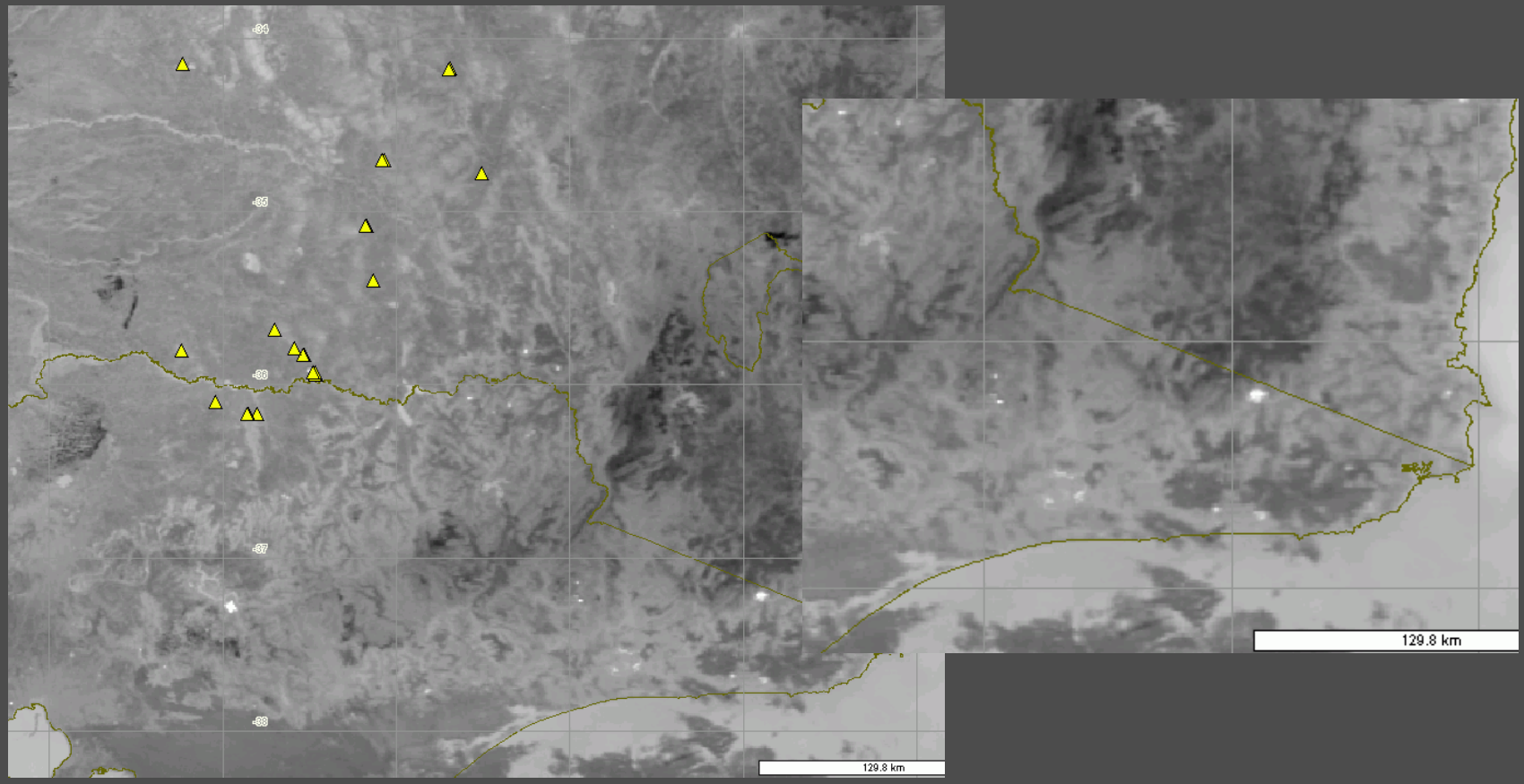


5-15th April 2013



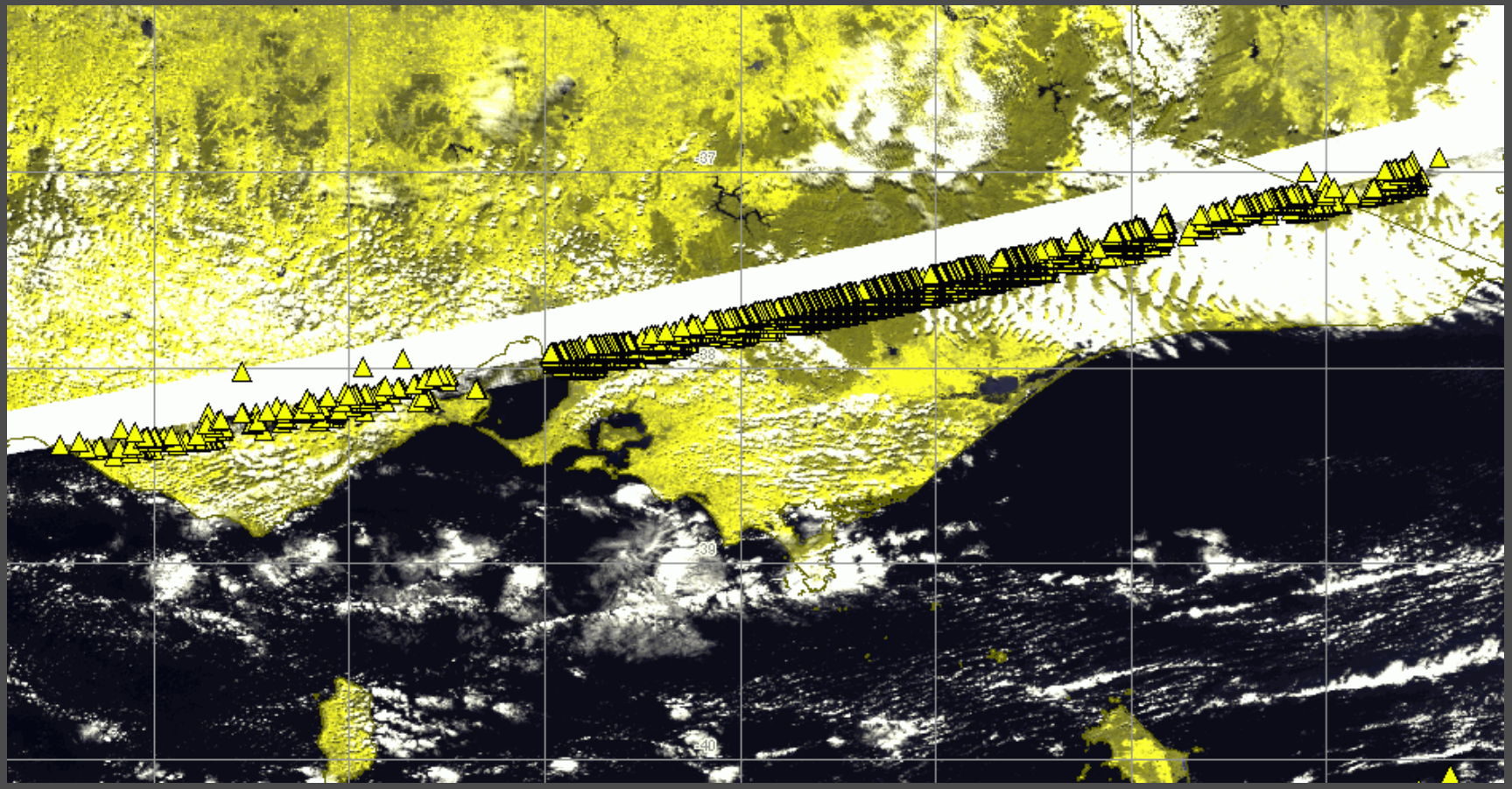

25th June 2012

# SUOMI NPP Fire Hotspots – CSPP
# Fires Not Detected




9th April 2013

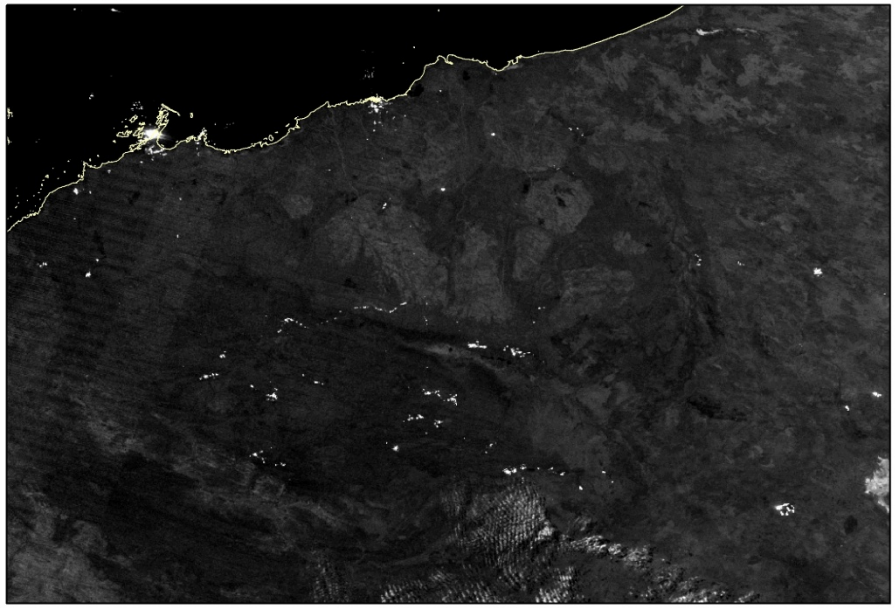
# SUOMI NPP Fire Hotspots – CSPP Noise



5th October 2012

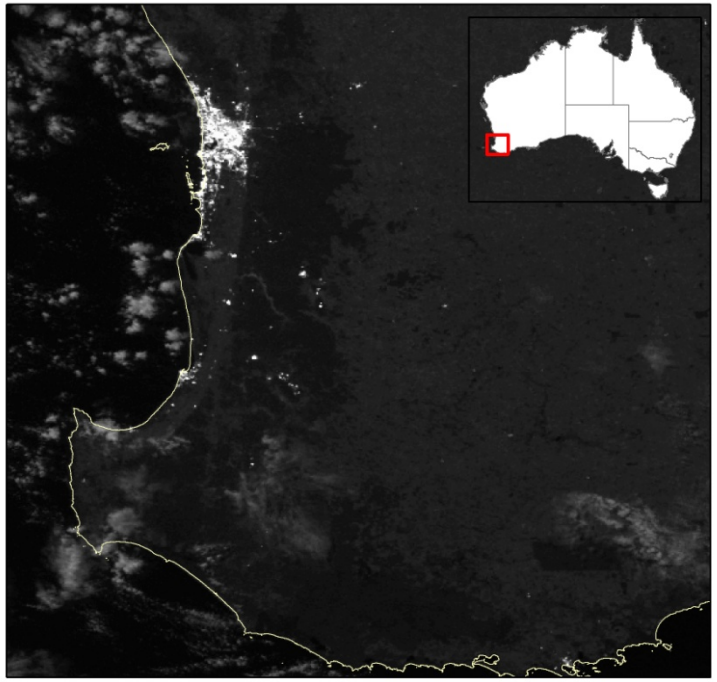
# SUOMI NPP – Day-Night Band

Pilbara Region - Western Australia

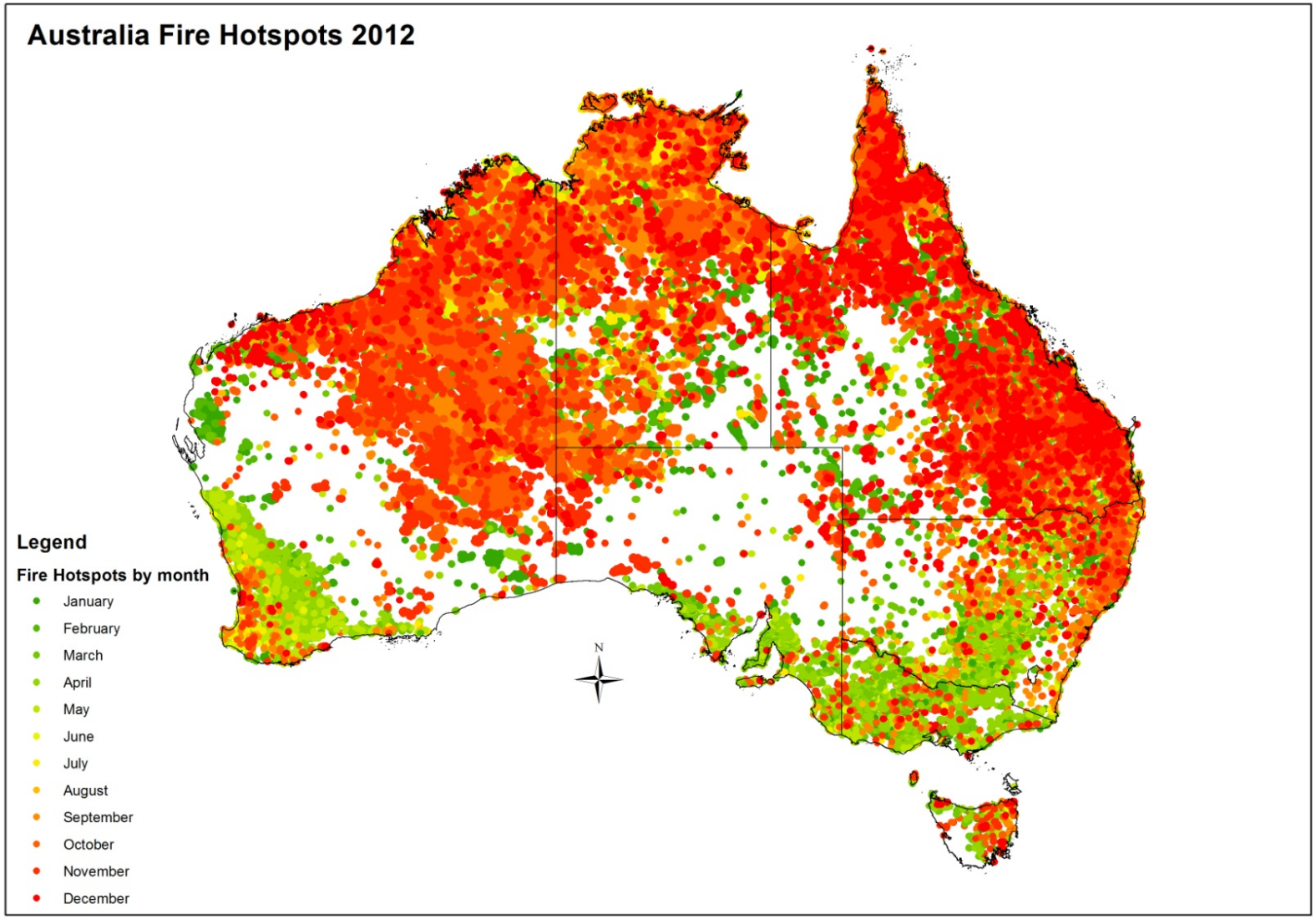


Suomi NPP - 20120901 dnb

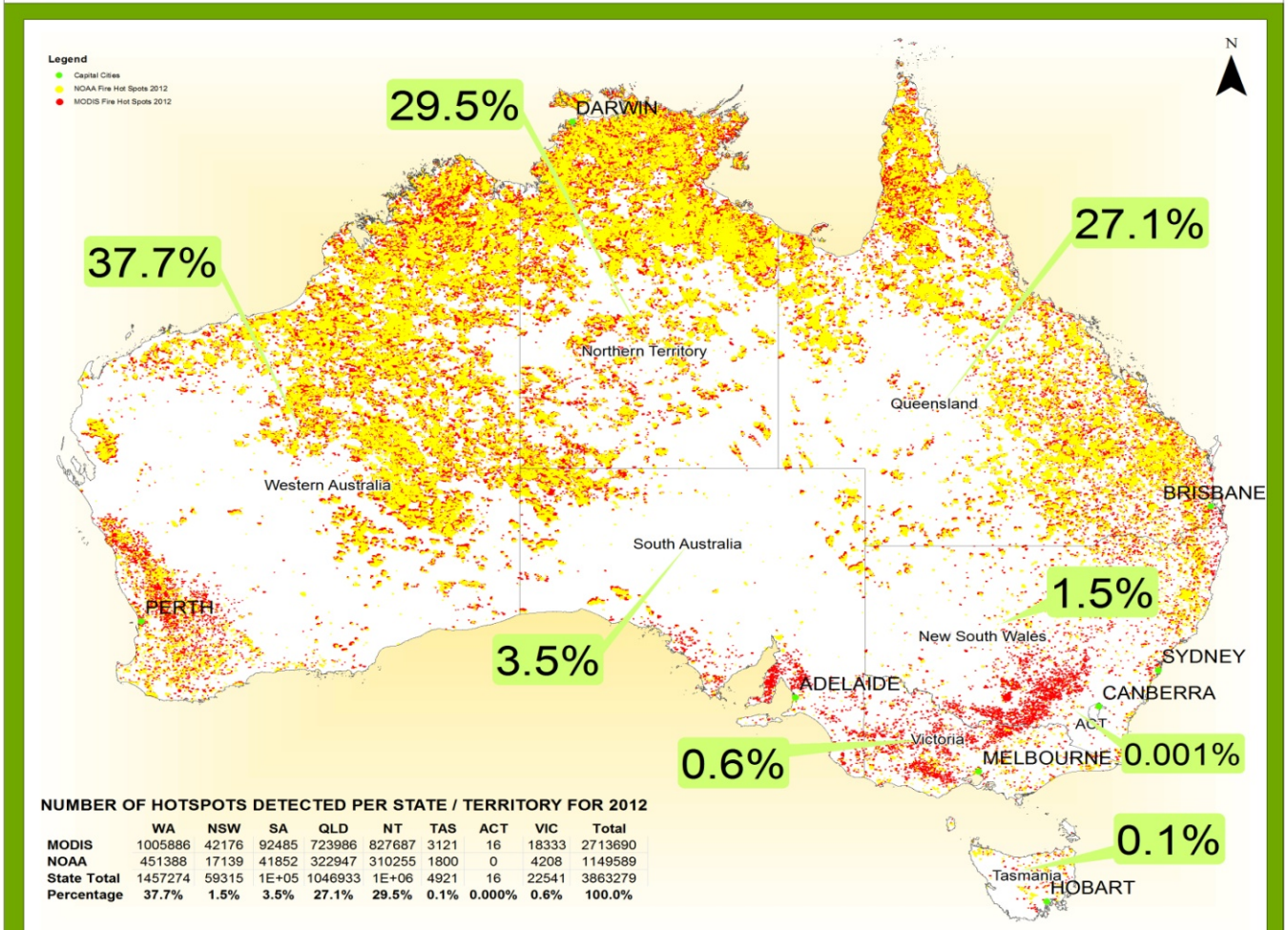
South West of Western Australia



Suomi NPP - 20120901 dnb


Australia Fire Hotspots 2012
Legend
Fire Hotspots by month
January
February
March
April
May
June
July
August
September
October
November
December
N

# FIRE HOTSPOTS DETECTED BY NOAA & MODIS SATELLITES 2012




**NUMBER OF HOTSPOTS DETECTED PER STATE / TERRITORY FOR 2012**

| | WA | NSW | SA | QLD | NT | TAS | ACT | VIC | Total |
|---|---|---|---|---|---|---|---|---|---|
| MODIS | 1005886 | 42176 | 92485 | 723986 | 827687 | 3121 | 16 | 18333 | 2713690 |
| NOAA | 451388 | 17139 | 41852 | 322947 | 310255 | 1800 | 0 | 4208 | 1149589 |
| State Total | 1457274 | 59315 | 1E+05 | 1046933 | 1E+06 | 4921 | 16 | 22541 | 3863279 |
| Percentage | 37.7% | 1.5% | 3.5% | 27.1% | 29.5% | 0.1% | 0.000% | 0.6% | 100.0% |

Landgate FIREWATCH

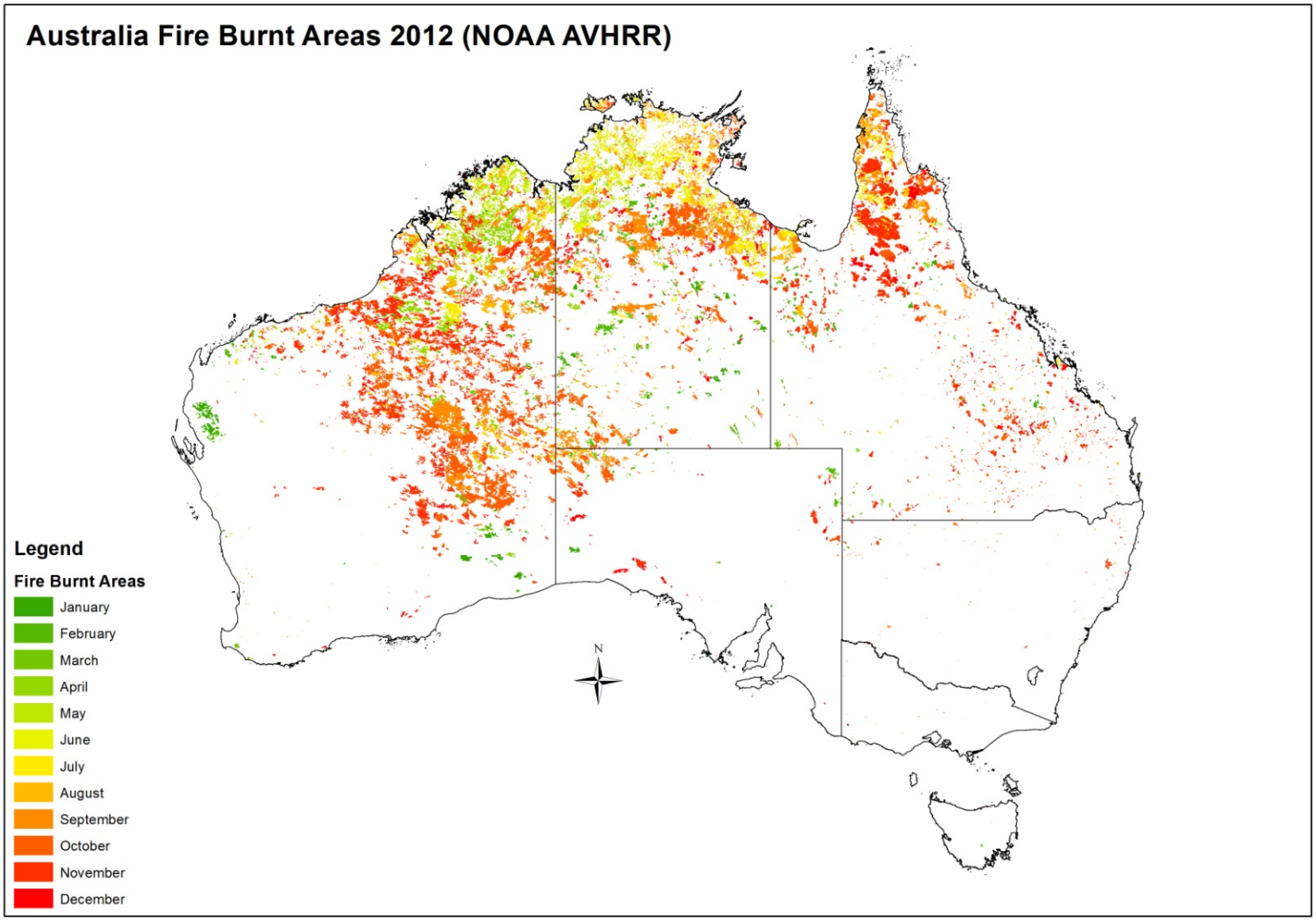
Landgate, Satellite Remote Sensing Services, 65 Brockway Road, Floreat, Western Australia, 6014
Ph. (08) 9387 0330
Fax. (08) 9383 7142

Fire Hotspots were derived from 1km resolution NOAA AVHRR and MODIS satellite sensors

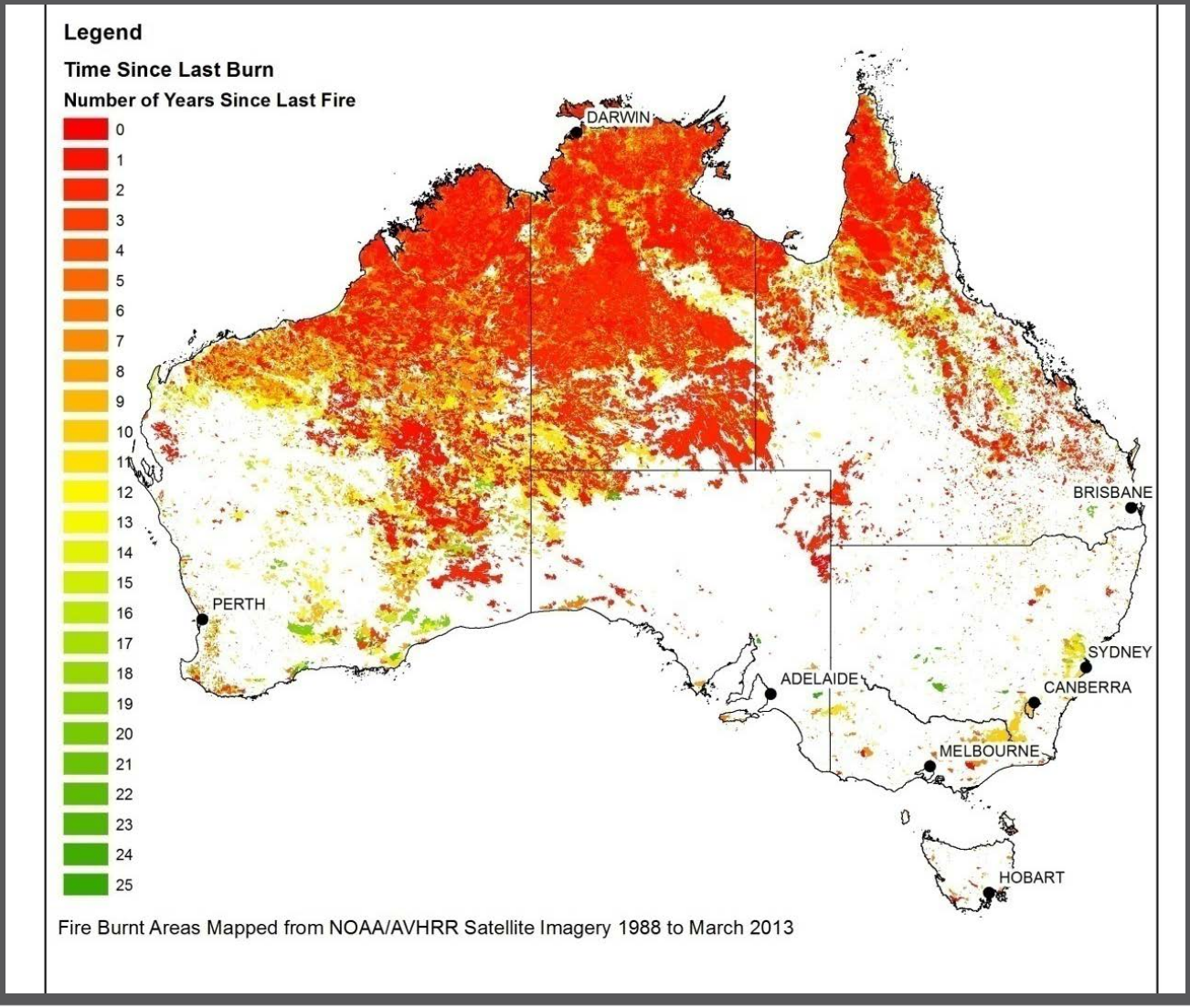
Map Produced on the 9th of May 2013

Firewatch | FloodMap | Pastures from Space | AgImage | CarbonWatch | Land Monitor | VegetationWatch | OceanWatch | Geology | Internet Delivery

# Mapping the cumulative burnt area across Australia



# FireWatch
## Time Since Last Burn

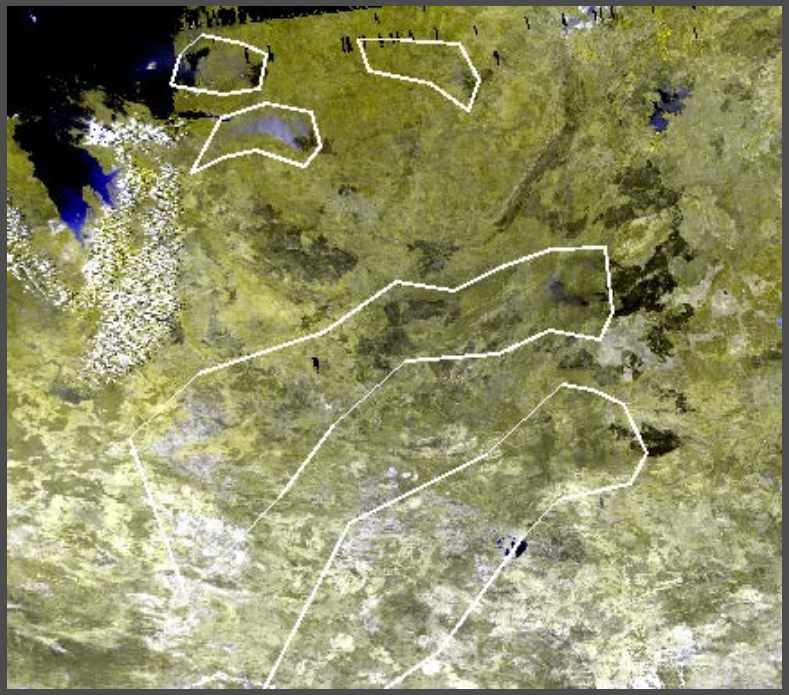


## FireWatch

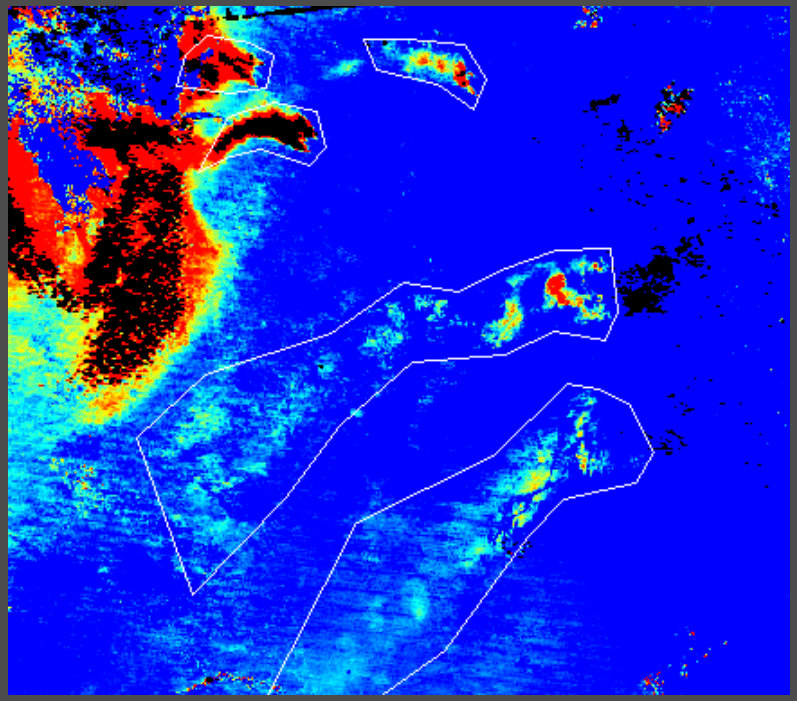
Smoke from fires can be tracked and mapped

# Reflectance Change Based AOD Methodology

Acquired on the 13th October, 2012 showing fires in the Kimberley region. In the above image however, the smoke is not visible.



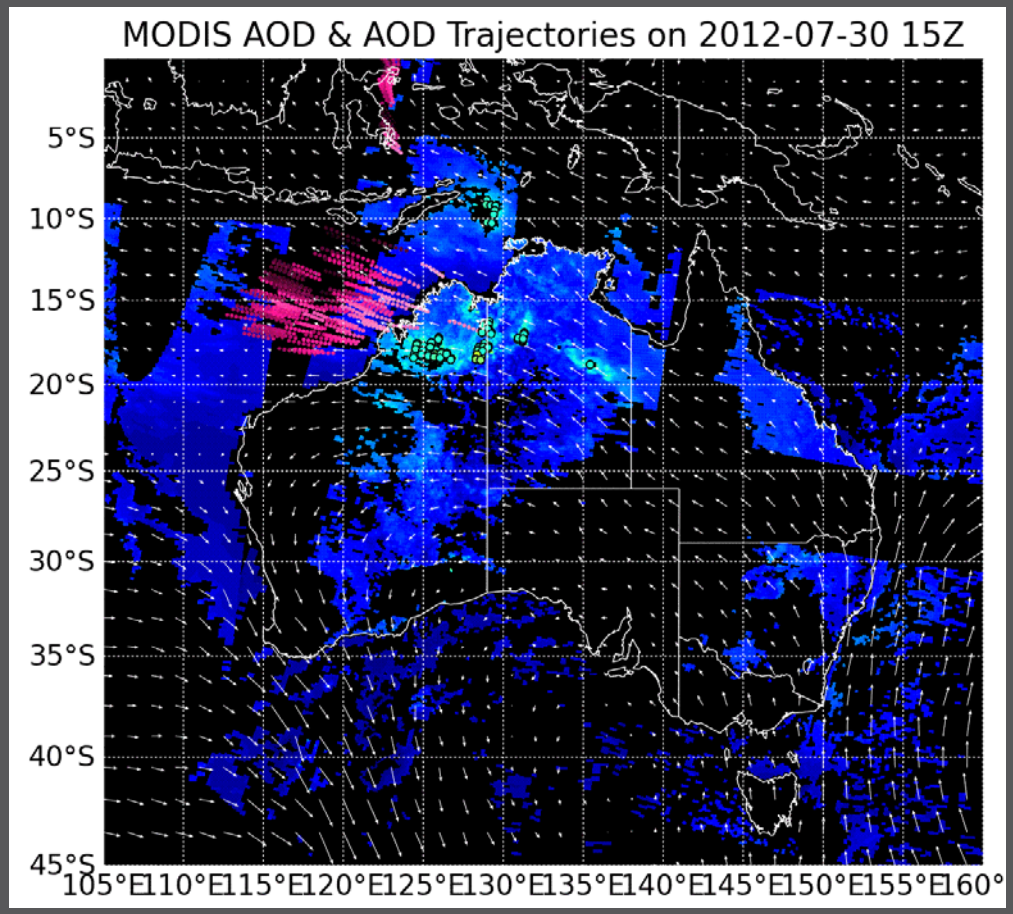
**MODIS Aqua bands 2, 2, 1 (RGB) image**

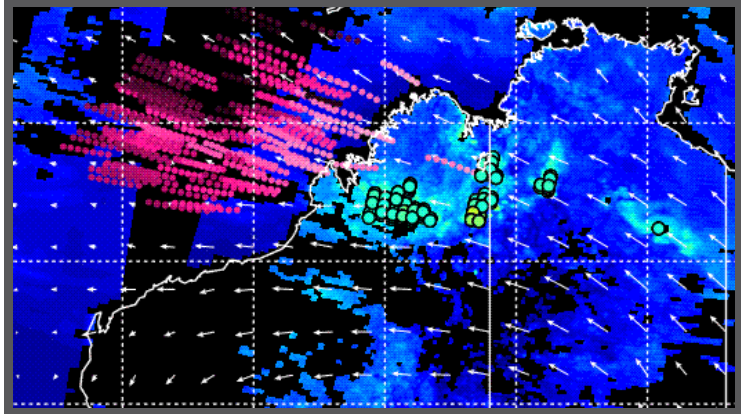


**MODIS Aqua Aerosol Radiance in Band 3**

Firewatch | FloodMap | Pastures from Space | AgImage | CarbonWatch | Land Monitor | VegetationWatch | OceanWatch | Geology | Internet Delivery

IDEA-I

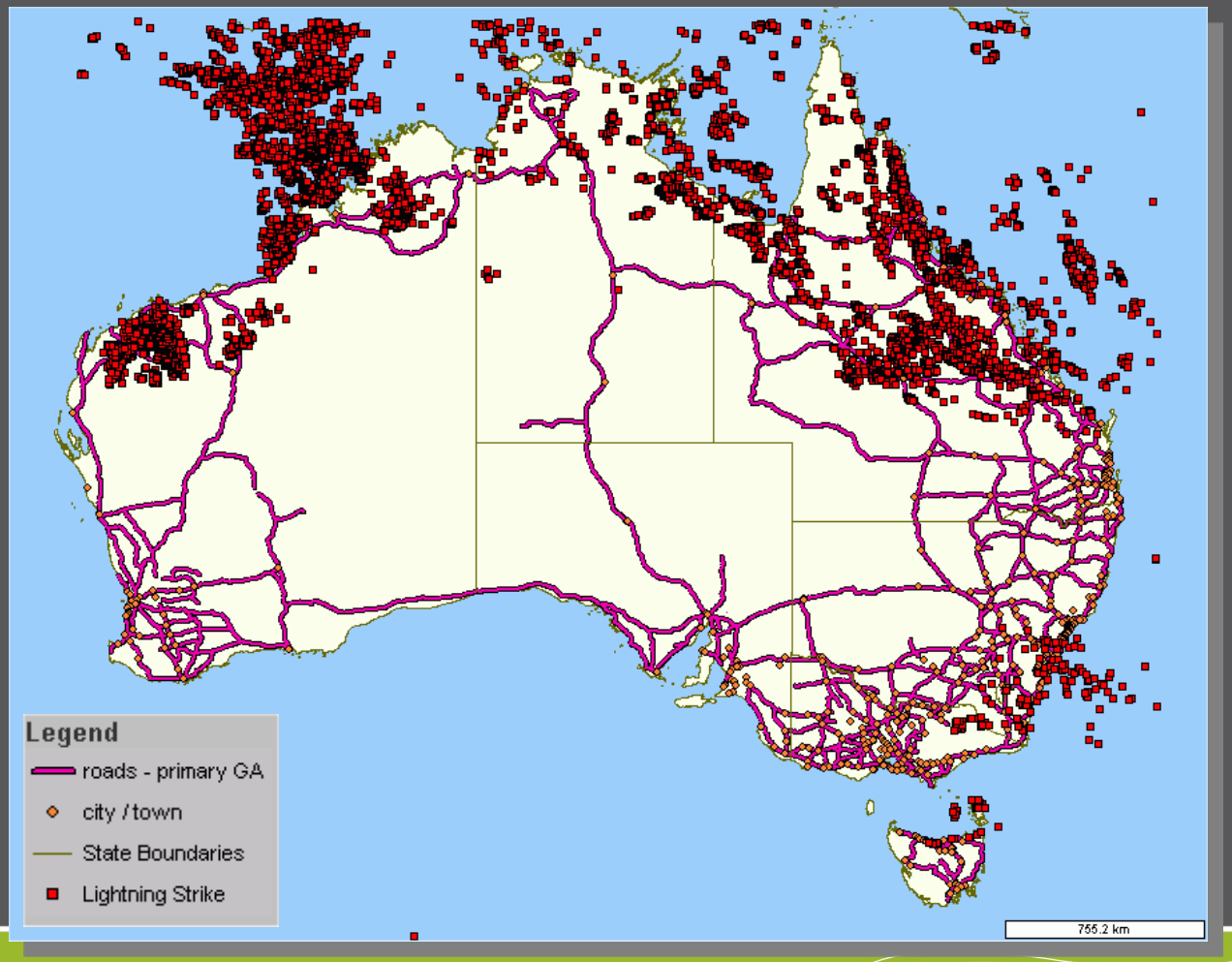


Firewatch | FloodMap | Pastures from Space | AgImage | CarbonWatch | Land Monitor | VegetationWatch | OceanWatch | Geology | Internet Delivery

## FireWatch

Lightning Strike Information, updated every 10 minutes aids fire managers

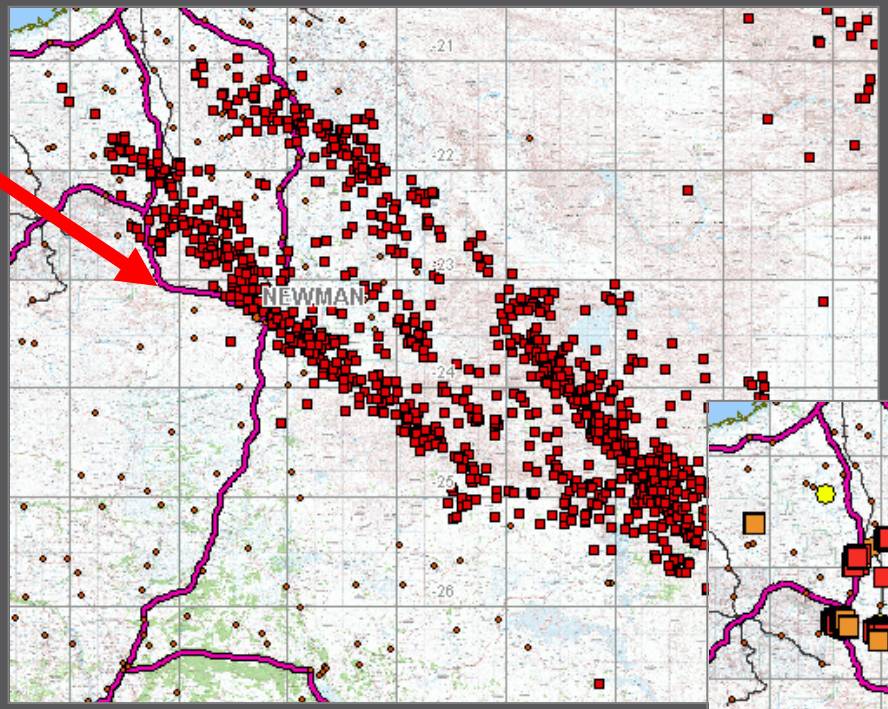



2 Feb 2004

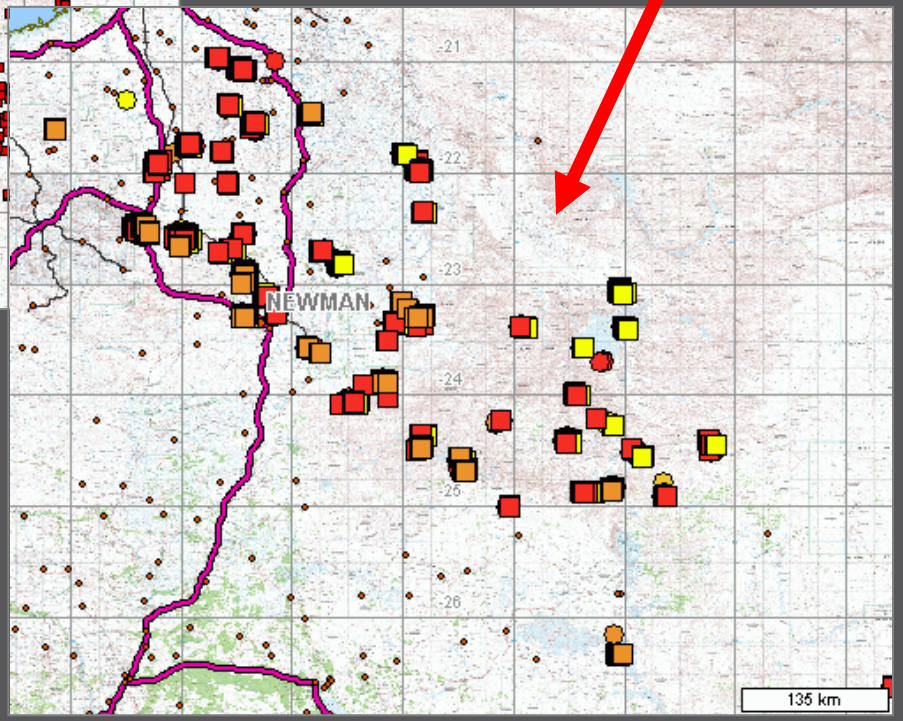
## FireWatch

Lightning Strike Information, updated every 10 minutes aids fire managers

Lightning Strikes: 1 November 2005




Fire Hotspots mapped over the following 2 days



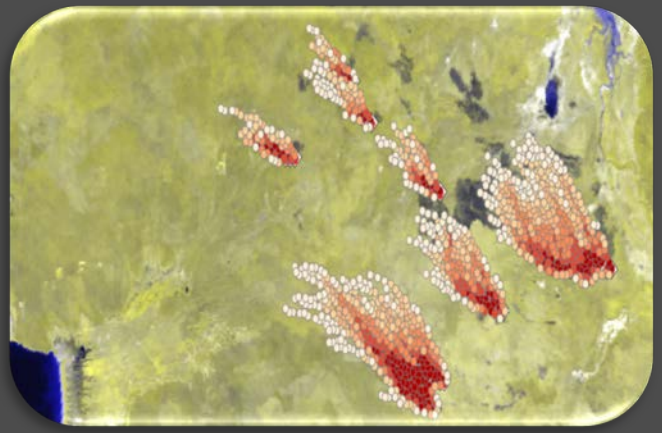
# Aurora Overview

Aurora combines technological developments by the **University of Western Australia** (Australis simulator) and **Landgate** (FireWatch system) to simulate the direction, intensity, and rate of bushfire spread in near real-time, to provide **Department of Fire and Emergency Services** an improved capability in planning and responding to bushfires.

# Fire Spread Simulation Options

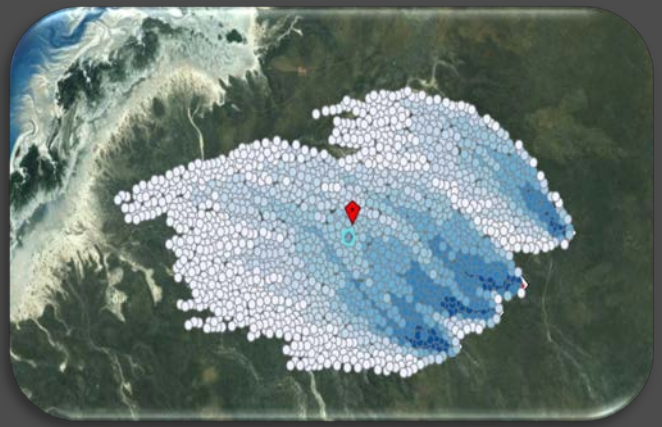
## Automatic Fire Spread Simulations

- Run automatically from MODIS mapped fire hotspots.
- Results available 45mins after the satellite overpass.



## Custom Fire Spread Simulations

- Run a series of your own fire spread scenarios quickly, to optimise fire suppression outcomes and / or assess the risk to nearby communities.
- Run ‘what if’ simulations with alternative weather conditions.
- Run training scenarios for incident controllers.

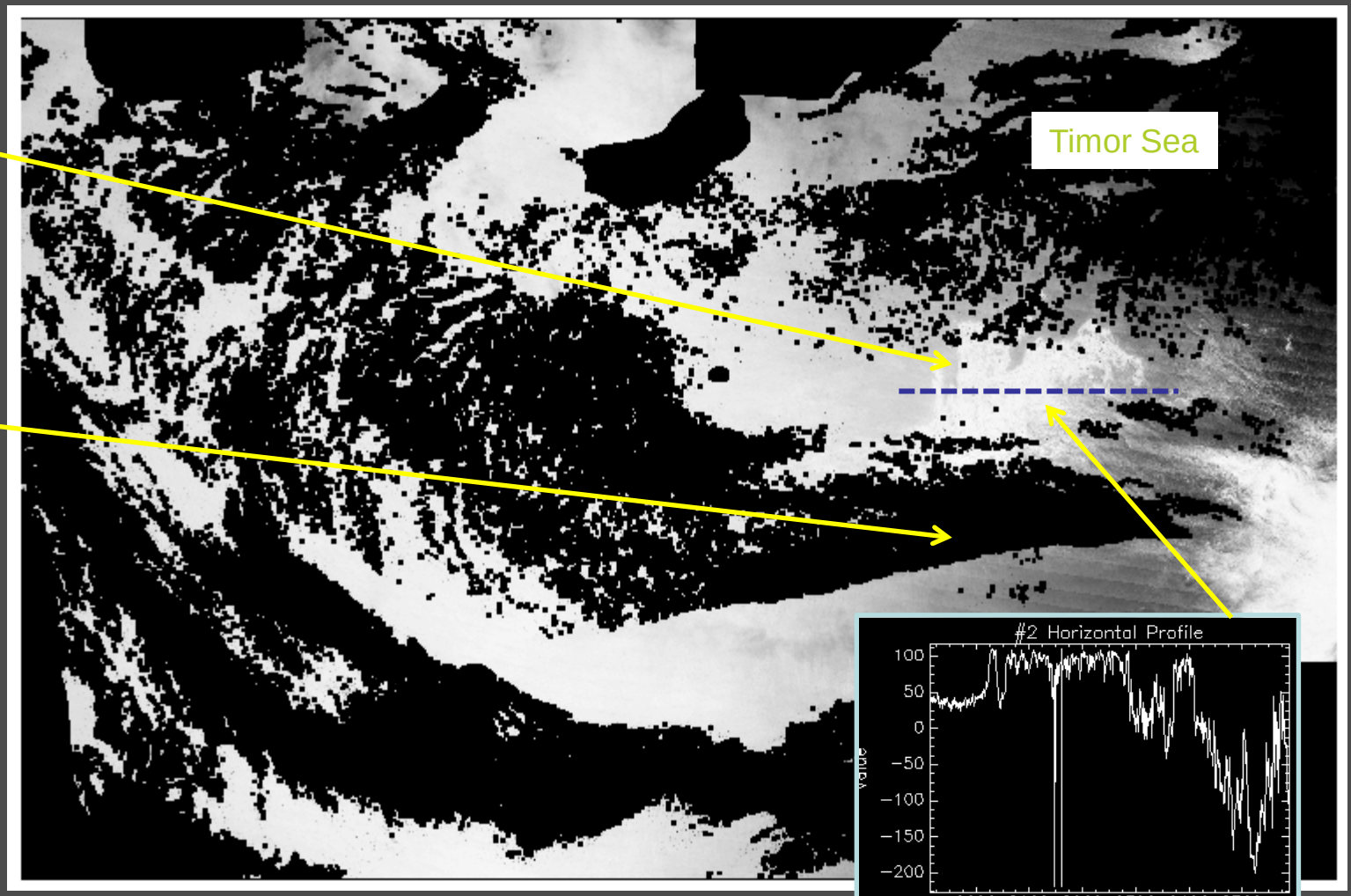


# Detection of Possible Oil Spills on Ocean Waters using MODIS and PCA Analysis

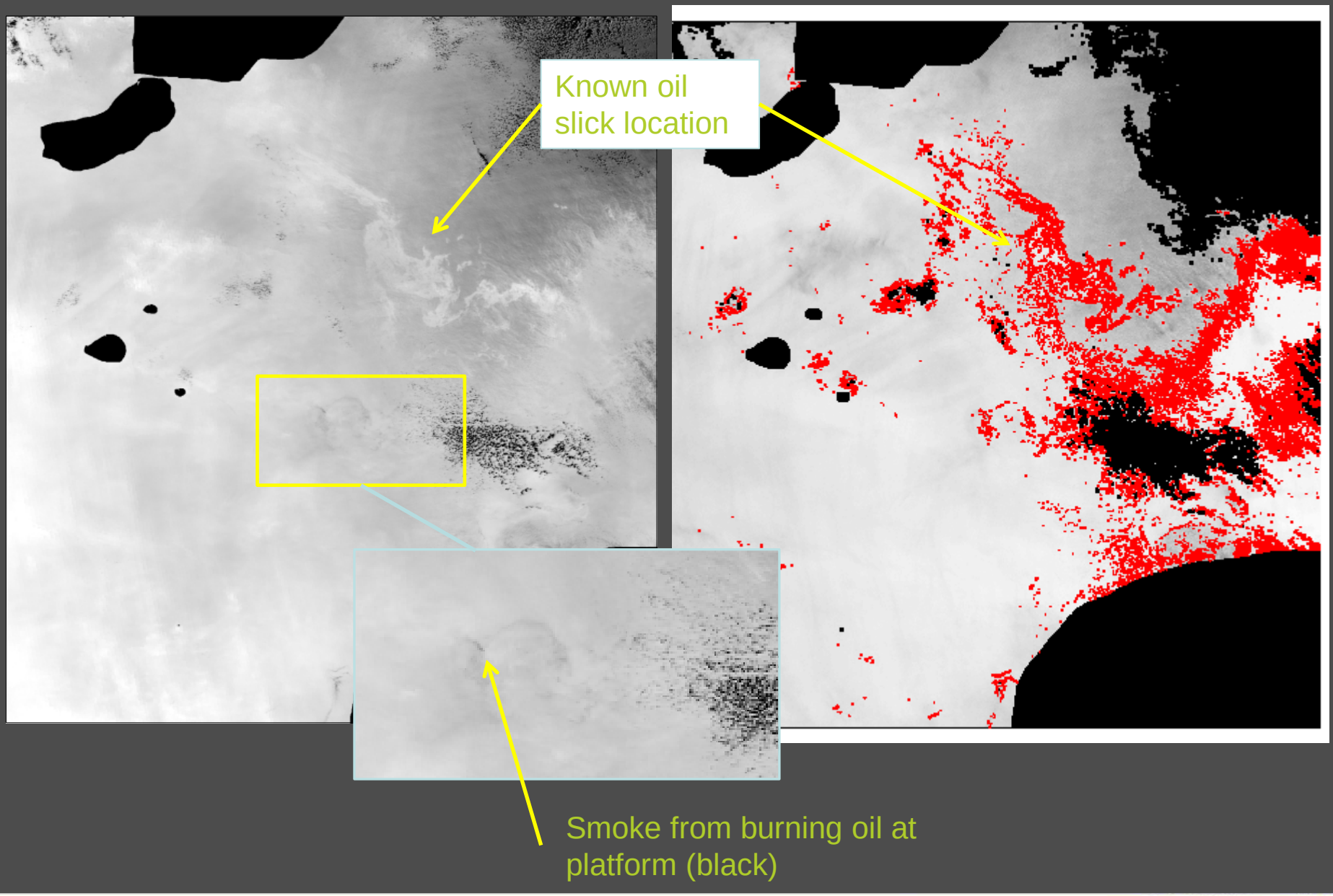
- Aim is to develop a possible oil spill flagging tool which uses MODIS data. Area of interest is in the Timor Sea and region and Indian Ocean north of Western Australia.
- However, when sun glint is present, the oil spill can be seen in visible bands. Therefore, statistical methods were investigated to see if a “likely” oil spill could be automatically flagged.
- Principal component analysis (PCA) of multiband remote sensing data was used to determine change points in images, with the aim of quantifying the change for further analysis.
- The PCA alone cannot tell if the observed change is caused by oil. However, further classification techniques were applied to determine regions where the oil may be present.
- Method tested on known oil slick locations – West Atlas A oil spill in 2009.

# Example. 3rd of September 2009. Spill started on the 21st of August.

PCA result. In sun glint, values in oil area are significantly different to surrounding waters.
Cloud and land masked from analysis. Masking of cloud edges important.

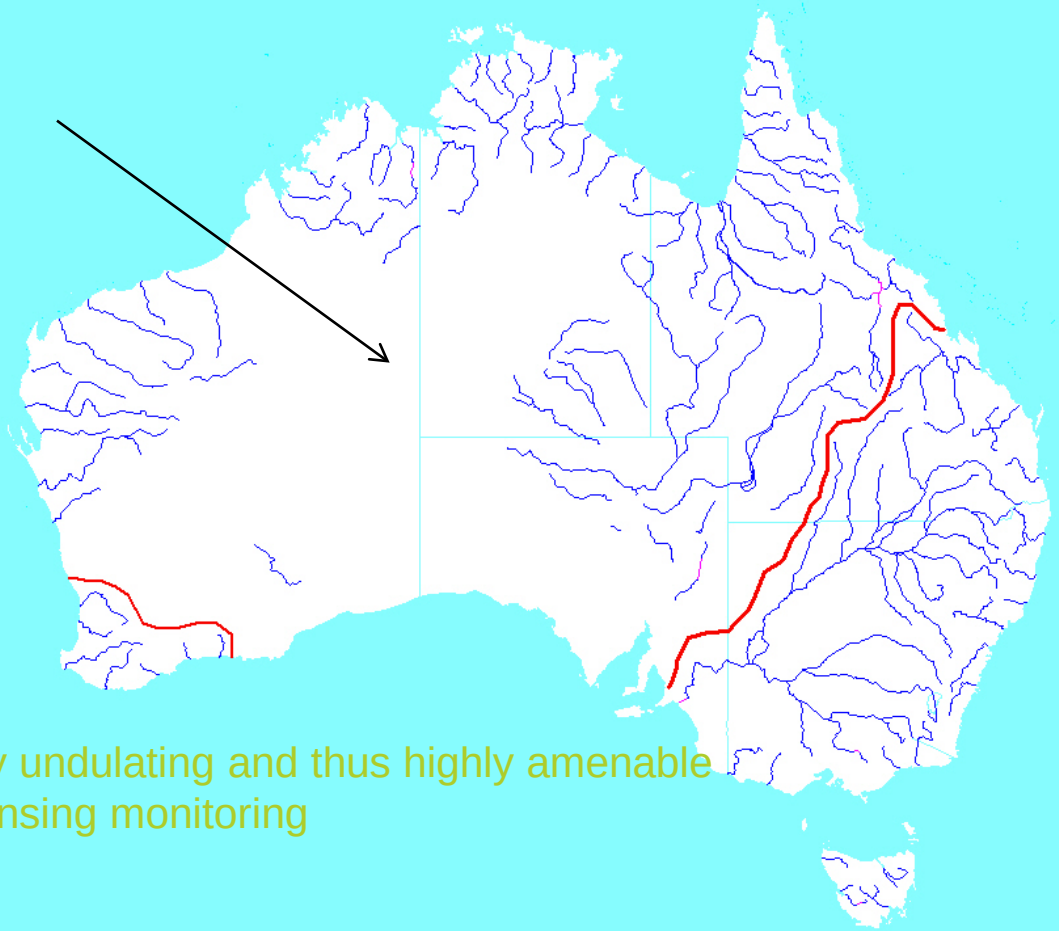


Test is repeatable. Example, 10th of September 2009.



# FloodMap – why use satellite methods – Andrew Buchanan

Australia's interior is relatively sparsely gauged – lack of information



Mostly gently undulating and thus highly amenable to remote sensing monitoring

# Example – Impact on the mining industry

# Operational modes – Part cloud (MODIS) Full cloud (Radar)

## 1) Sparse cloud cover

MODIS- visible bands
Morning and afternoon pass

Extract water using red and infrared wavelengths

250 spatial resolution

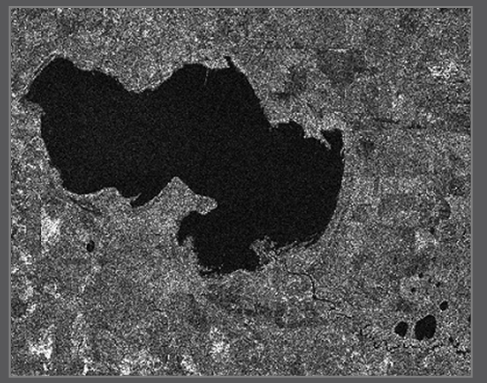
2300km swath

## 2) Where Cloud Cover is Extensive

Radar – COSMO SkyMed, Radarsat
Radar penetrates cloud cover. TerraSAR now available.

1-50m spatial resolution

20- 300 km swath



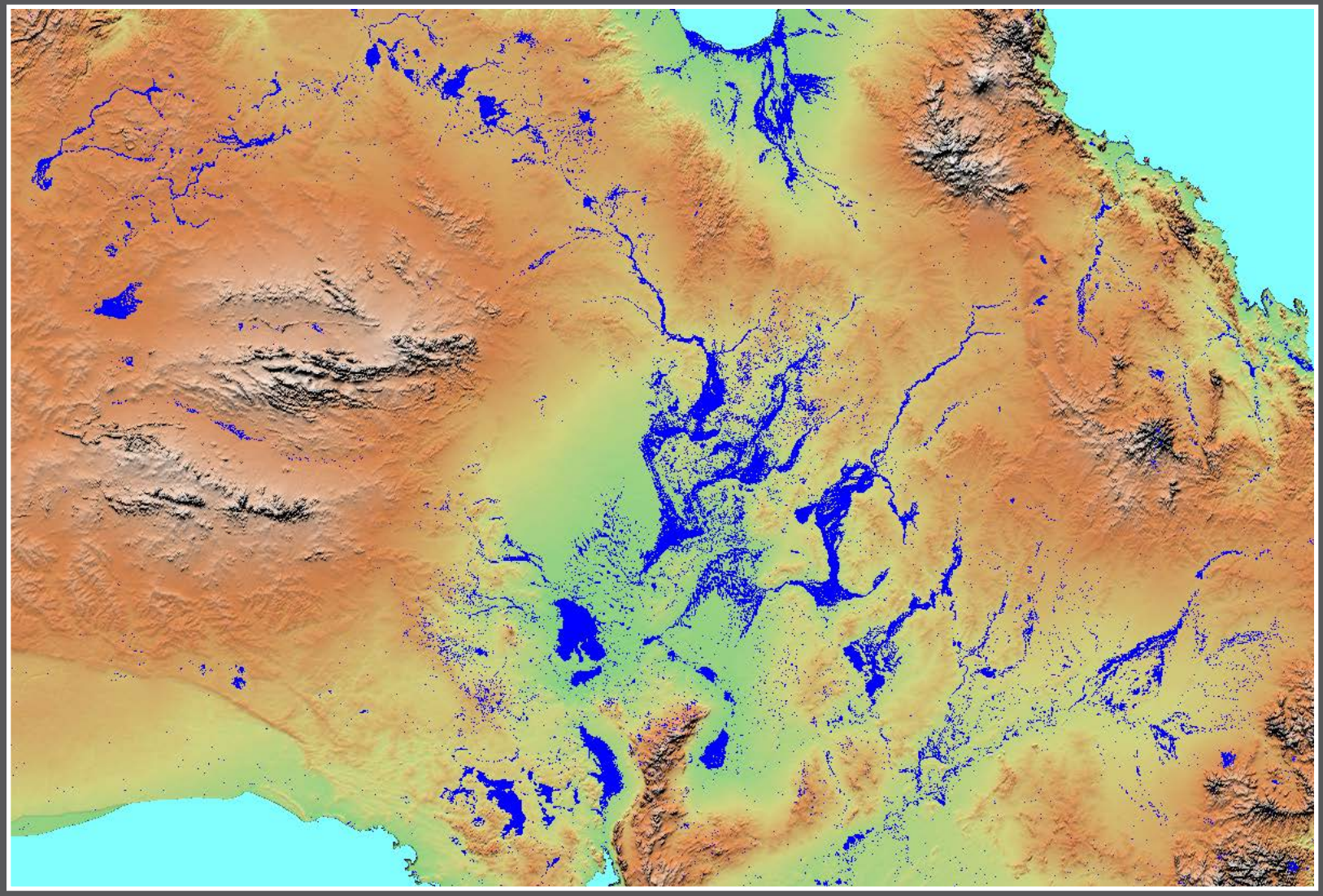
## 3) Where Detail is Required

Commercial operators eg Worldview

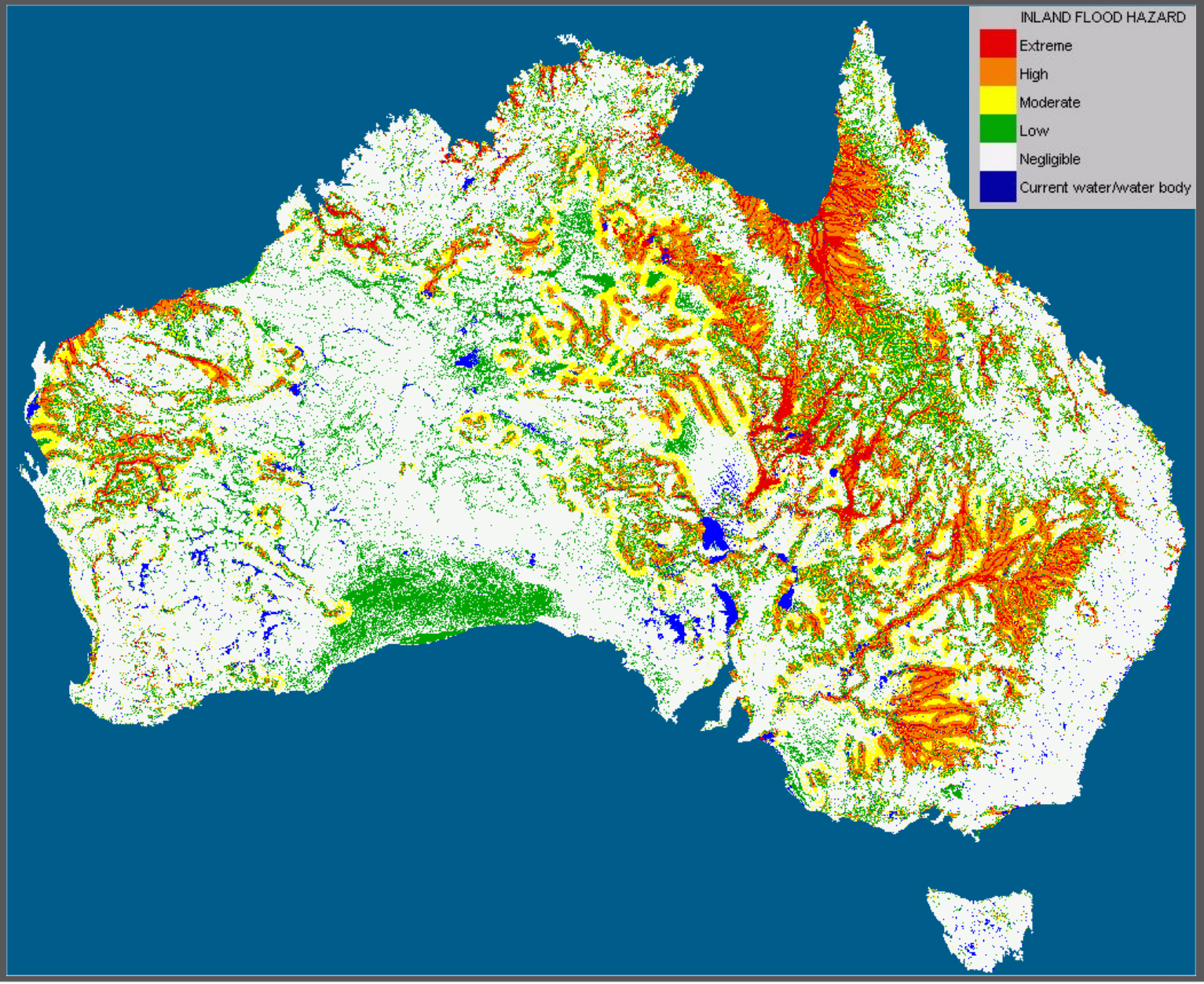
30-1m spatial resolution

180-11km swath

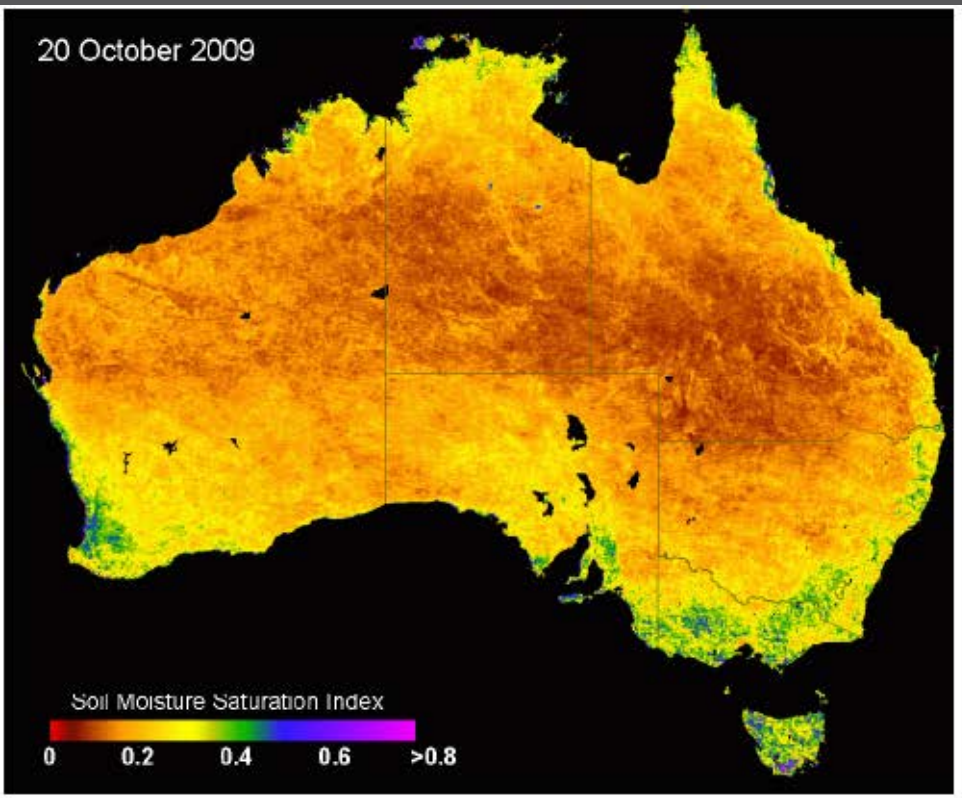
**Standard products example** - Archived surface water polygons: years 2006-11

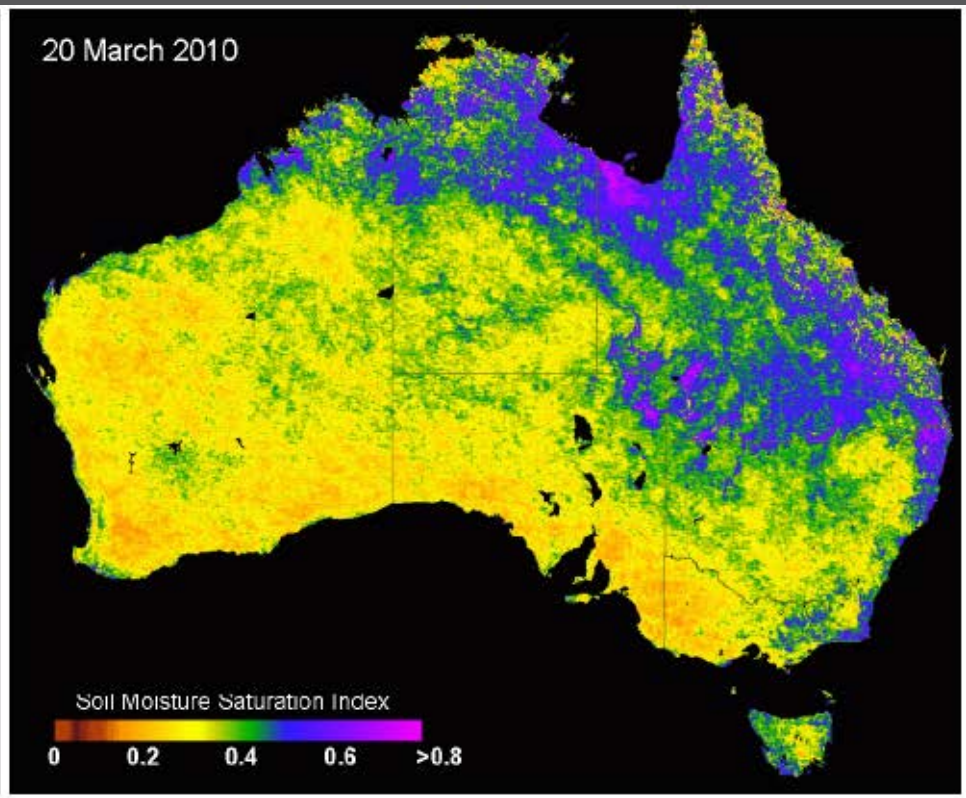


# A national flood hazard model derived using archived flood polygons



# Standard products example – daily soil moisture at 4km (relative measure) using MTSAT




**Yellow/brown – low relative soil moisture**

**Green/blue – high relative soil moisture**

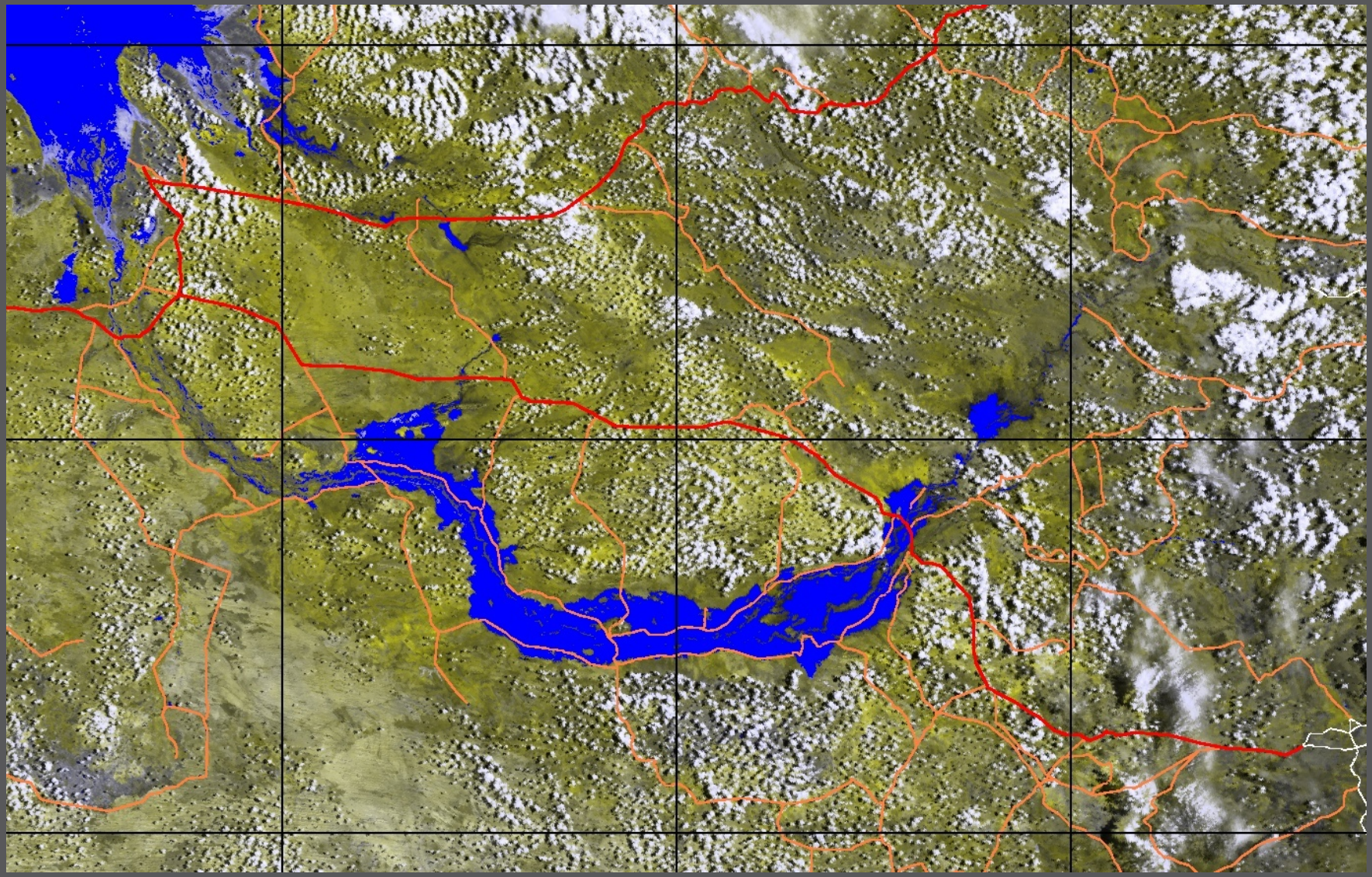
TC Clare

Yarraloola Station, N.W. Coastal H.Way

TC Clare – Town of Lake Grace isolated by road.

# Mapping and monitoring flood with cloud cover

27th February 2002



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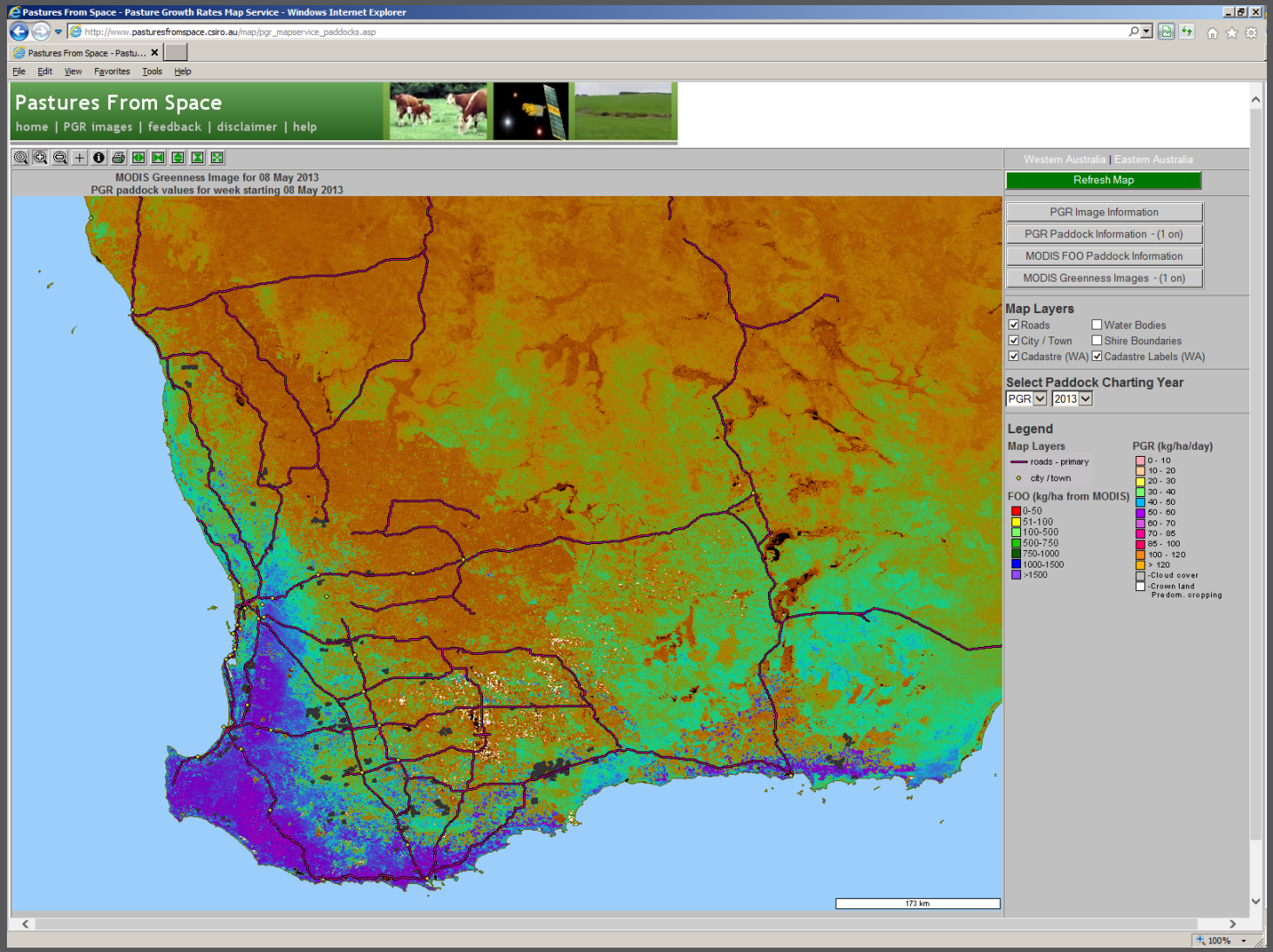
# Final image showing flood waters reaching ocean

4rd March 2002

Firewatch | FloodMap | Pastures from Space | AgImage | CarbonWatch | Land Monitor | VegetationWatch | Geology | Internet Delivery



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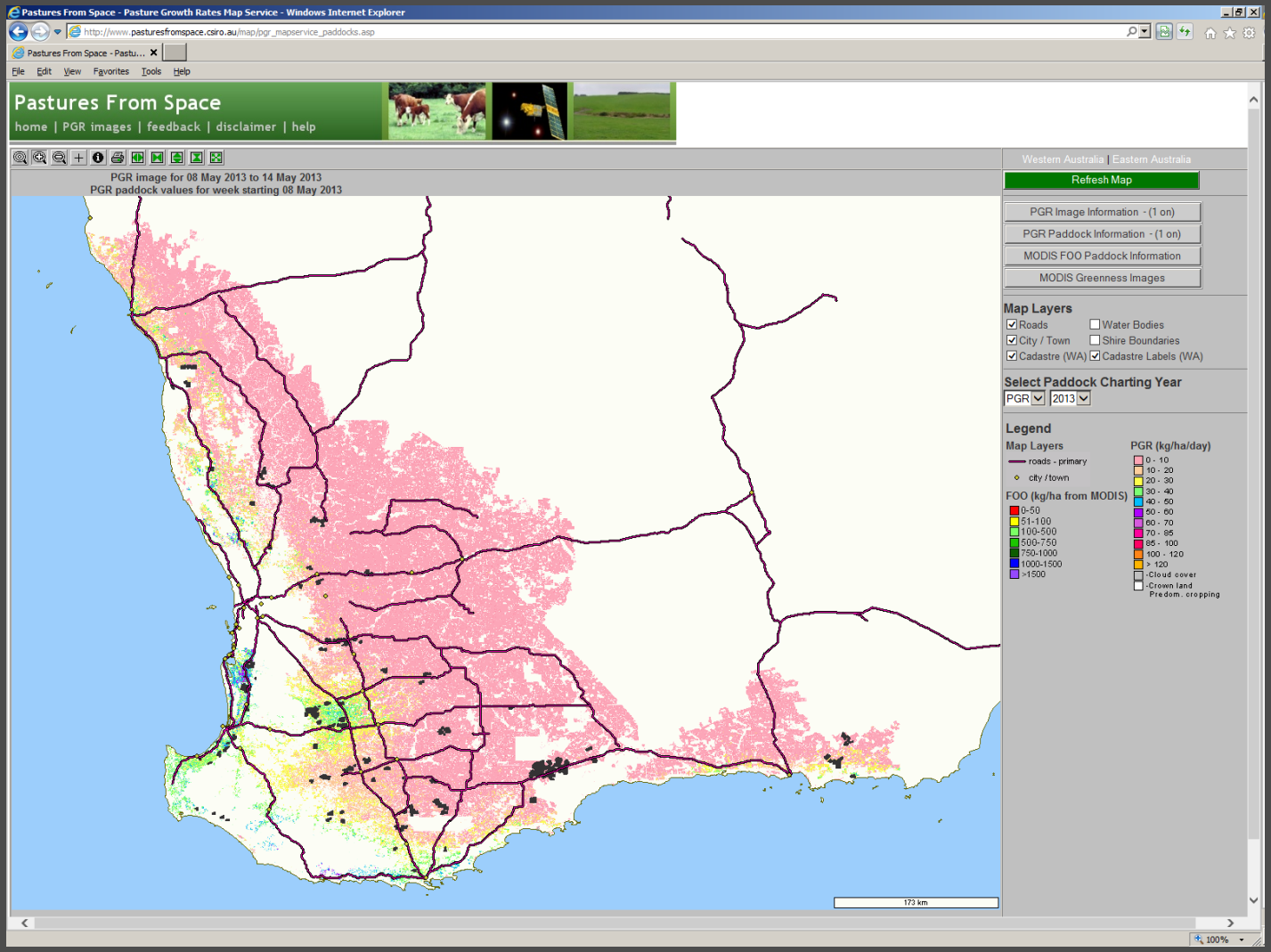

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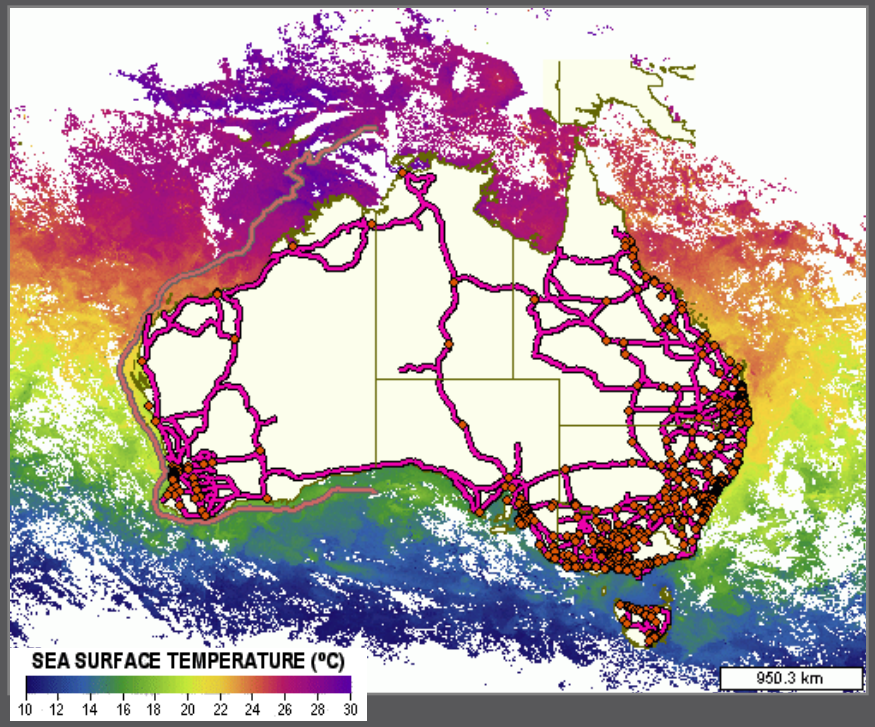
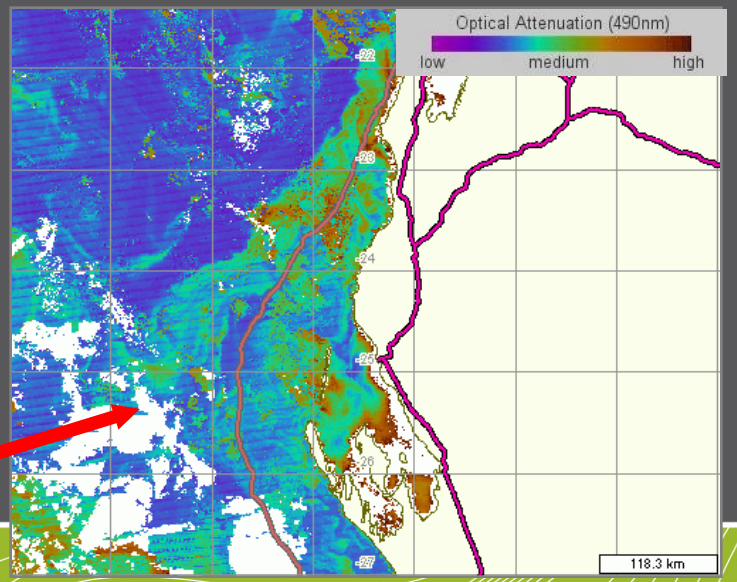
## OceanWatch

Sea Surface Temperature



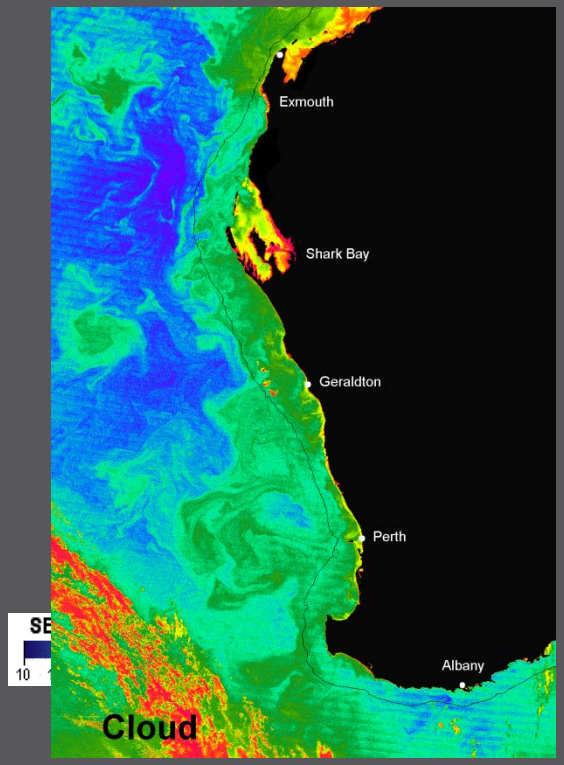



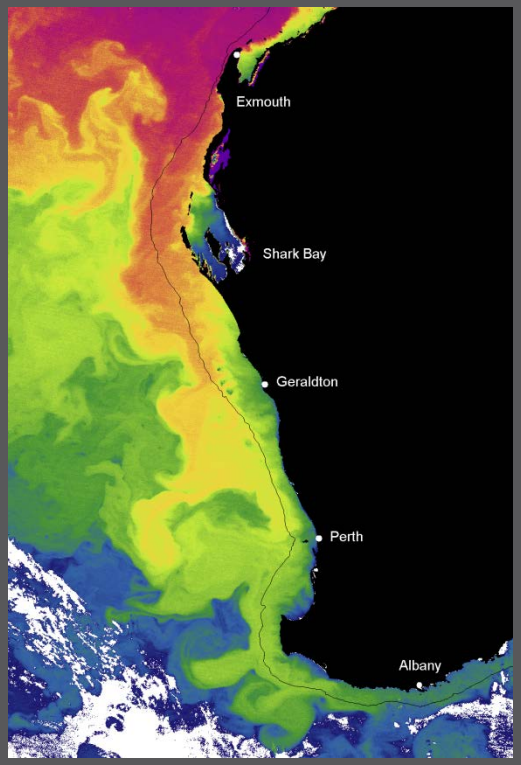

Optical Attenuation data for water clarity

Firewatch | FloodMap | Pastures from Space | AgImage | CarbonWatch | Land Monitor | VegetationWatch | OceanWatch | Geology | Internet Delivery

## OceanWatch

Sea Surface Temperature



Firewatch | FloodMap | Pastures from Space | AgImage | CarbonWatch | Land Monitor | VegetationWatch | Geology | Internet Delivery

## Things to Do

A third antenna to avoid orbital conflicts

Aerosol Optical Depth from MODIS and SUOMI NPP

Day-Night Band?

METOP and FY processing

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**Thank you very much.**

www.firewatch.landgate.wa.gov.au

www.floodmap.landgate.wa.gov.au