www.dmcii.com

dmc International Imaging

Introduction to DMCii

Laura Brindle

DMCii and SSTL Company Organisation

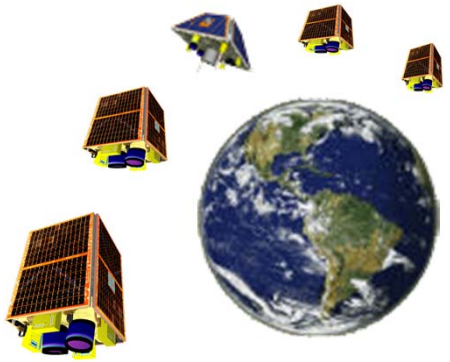
- **SSTL**
  - Established in 1985, now 450 staff
  - 37 satellites built & launched
  - Currently in production: 9 satellites
  - 14 payloads for GALILEO

- **DMCii**
  - Wholly owned subsidiary of SSTL
  - Established 2004, now 25 staff
  - DMC satellite operations, constellation coordination, Calibration
  - Data supply
  - Value-added services
  - International Disaster Charter activities

The DMC Concept

A Unique International Partnership Combining National Objectives, Humanitarian Aid and Commerce...

The Consortium



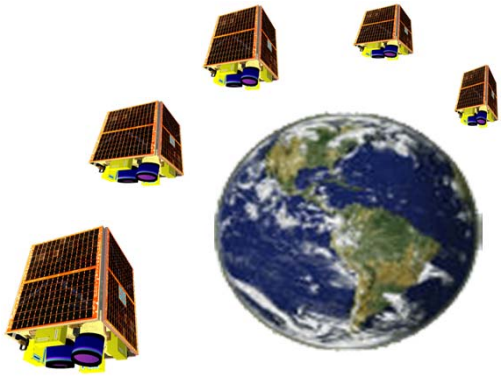
The Constellation

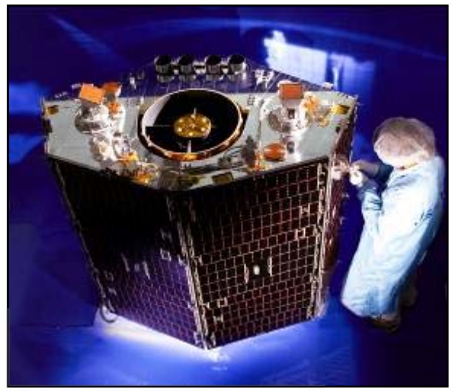
- ALSAT-1
- Beijing-1
- NigeriaSat-1
- BILSAT
- UK-DMC
- Deimos-1
- UK-DMC2
- NigeriaSat NX
- NigeriaSat-2

The Coordinator

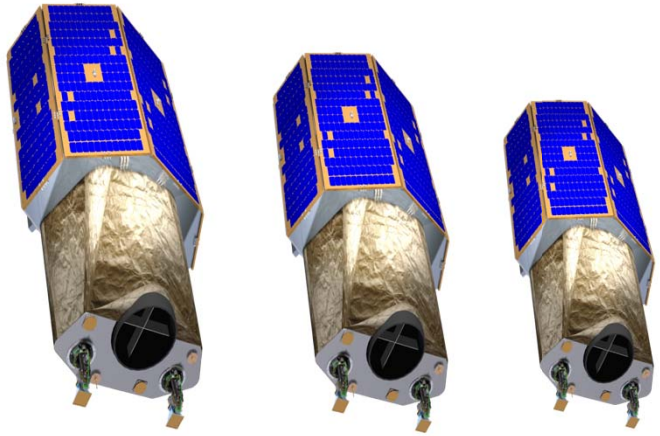
Current and Near Future Satellites

- UK-DMC2 (22m ms)
- Deimos-1 (22m ms)
- NigeriaSat-1 (32m ms)
- Beijing-1 (32m ms)
- UK-DMC (32m ms)





- NigeriaSat-2 (2.5m pan, 5m ms, 32m ms)
- NigeriaSat-X (22m ms)



Due for launch 2013:

- 1m Constellation (DMC-3)

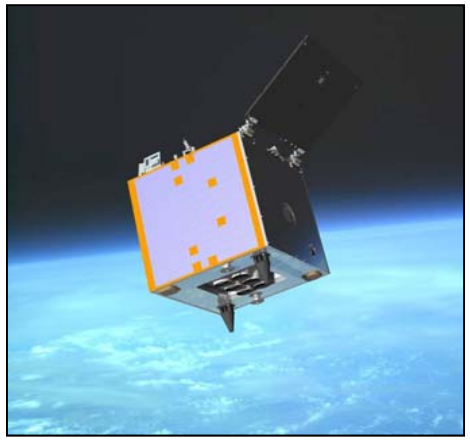
DMC 1st and 2nd Generations

1st Generation (Launched 2003-2005)

- International partnership of 5 Satellites
- Daily global coverage
- 650Km swath
- 32m Resolution
- Spectral bands same as Landsat ETM bands 2 (Green), 3 (Red) and 4 (NIR)

2nd Generation (Launched 2009)

- 22m Resolution
- Same 650km swath
- Same Bands (G,R,NIR)
- X-Band downlink (replaces S-band)
- New operational modes, NRT Direct Downlink Service
- Improved S:N, MTF, Stability, Geometry, Dynamic Range



Two new DMC satellites launched 17th of August 2011

NigeriaSat-2

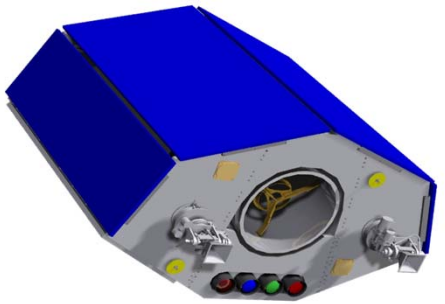
-2.5m PAN (20- 80km Swath)

-5m B,G,R,NIR (20-80km Swath)

-32m B,G,R,NIR (330km Swath)

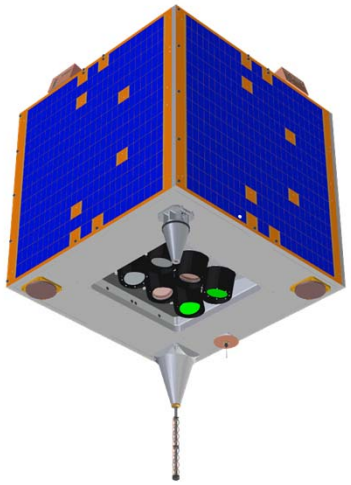
-Along-track stereo capability

-Multiple imaging modes incl. 4x4 mode (80x80km)



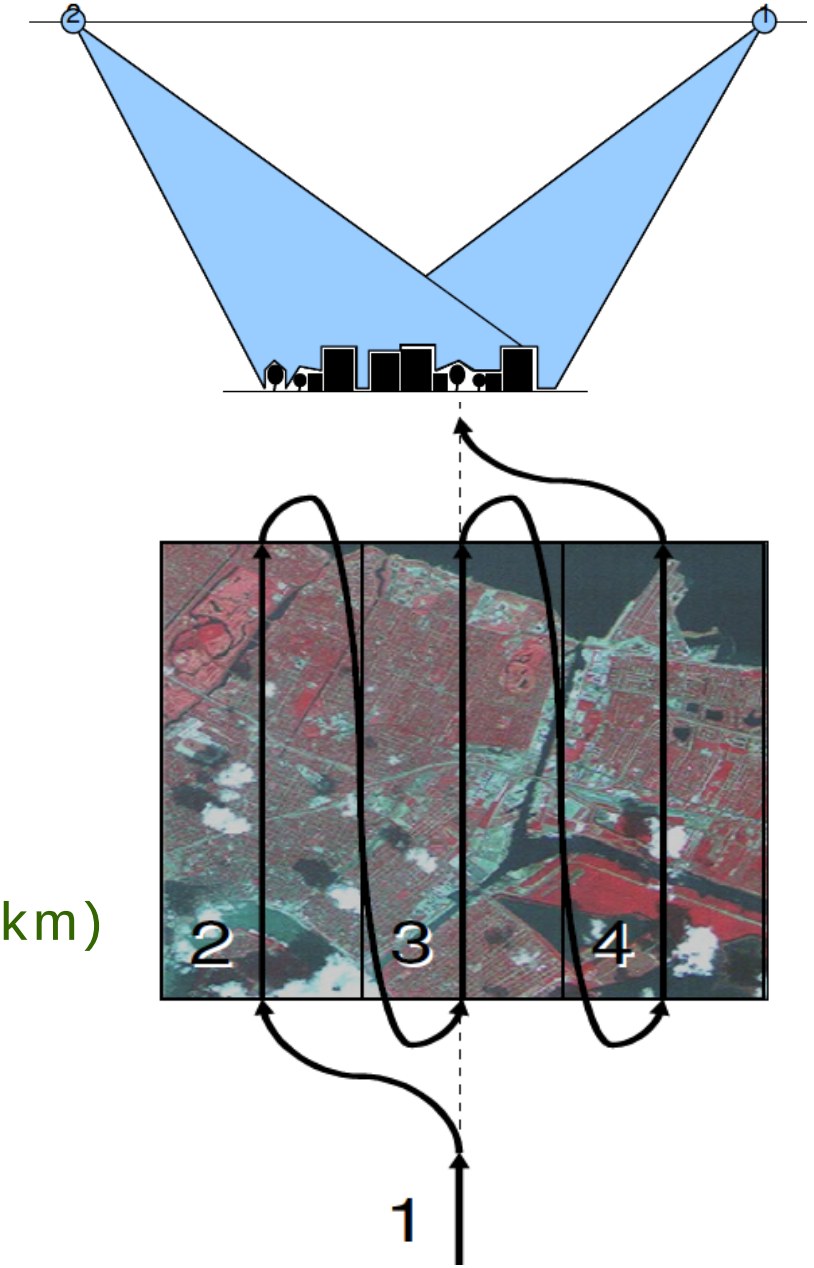
NigeriaSat-X

– 22m G,R,NIR (650km Swath)



NigeriaSat2

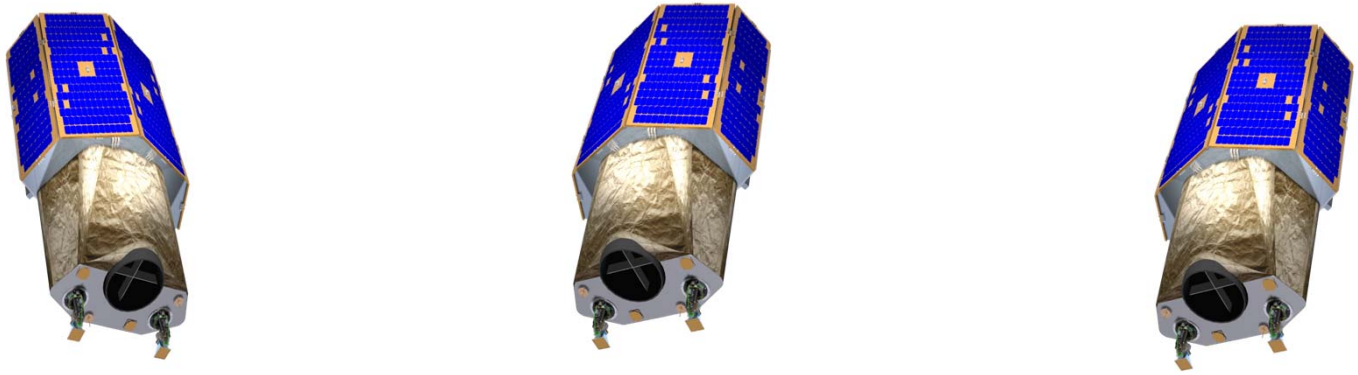
- 45º roll in 25 seconds
- High geolocation accuracy
- Along-track stereo capability
- Strip mode
- Spot mode (off-pointing)
- Area mode (4x4 scenes= 80x80km)



New High Resolution

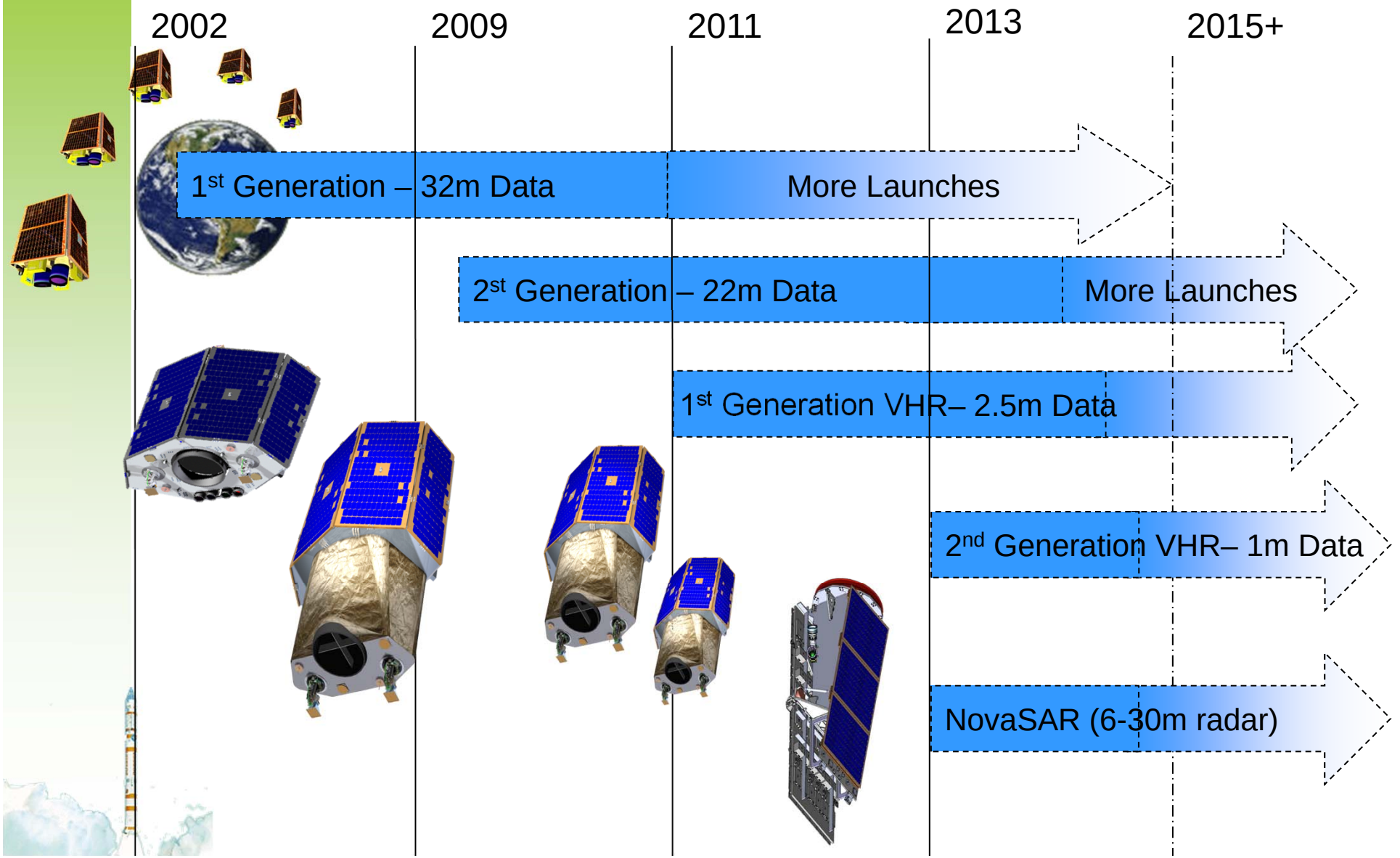
NigeriaSat-2 2.5m pan-sharpened image, Salt Lake City Airport, USA

DMC-3 VHR Constellation (2014)

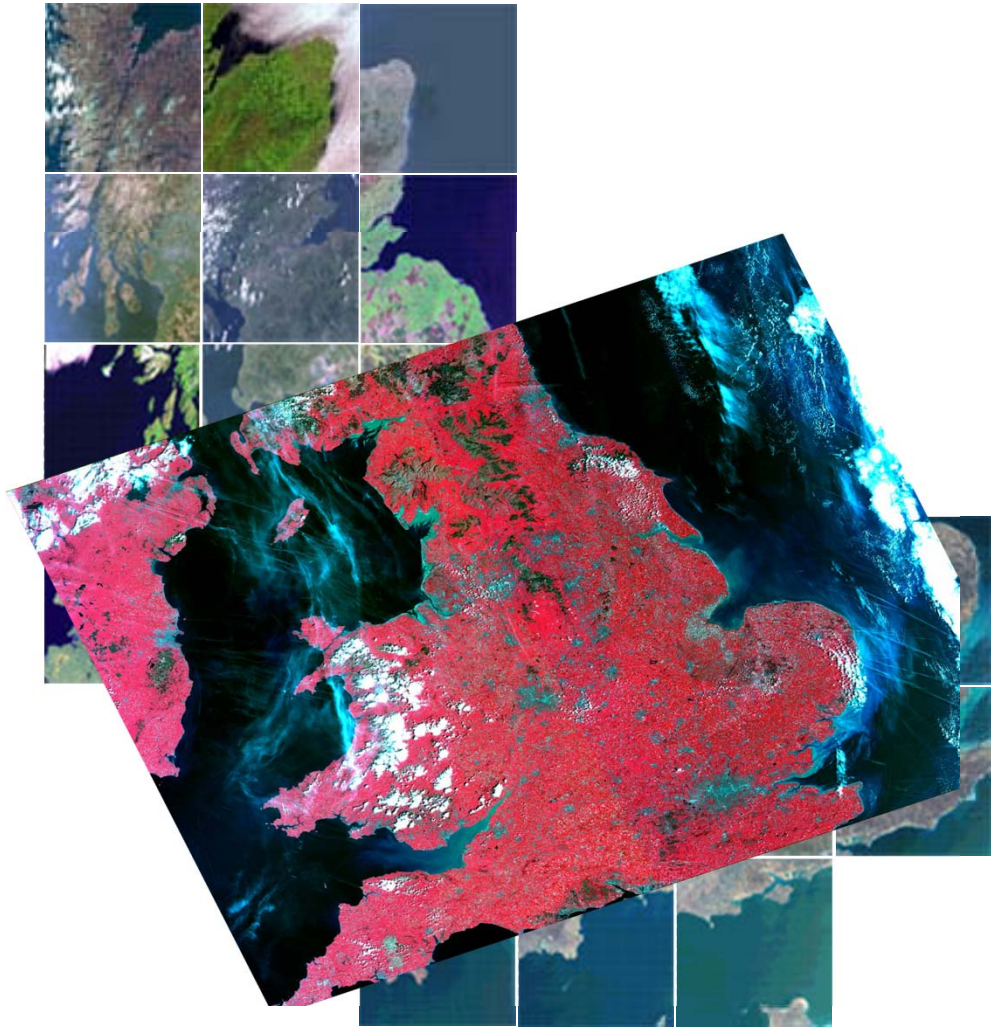


- 3 satellites to launch together >> Daily Revisit
- Bands: R,G,B, NIR, Pan
- Resolution: 1m Pan; 4m MS
- Swath 23km
- Single pass 3x3 mode (60x60km)

DMC Constellation Sustainability



Timeliness



DMC 640 x 750 km Image

– single image from UK-DMC

- Most of England captured within 1 minute

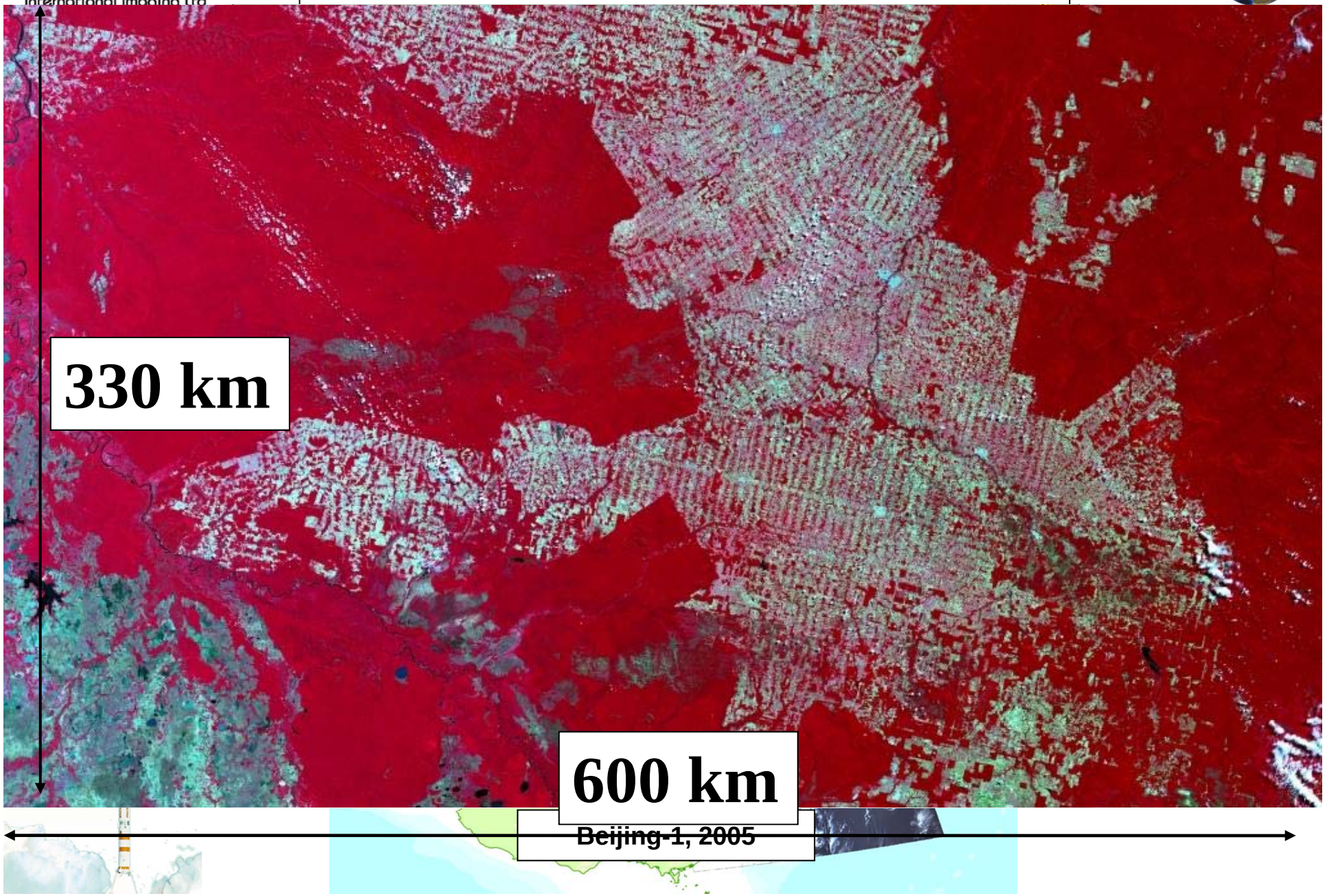
- Ideal for consistent classification approach

- Near real-time precision agriculture fully supported

- Reliable multi-temporal coverage per season

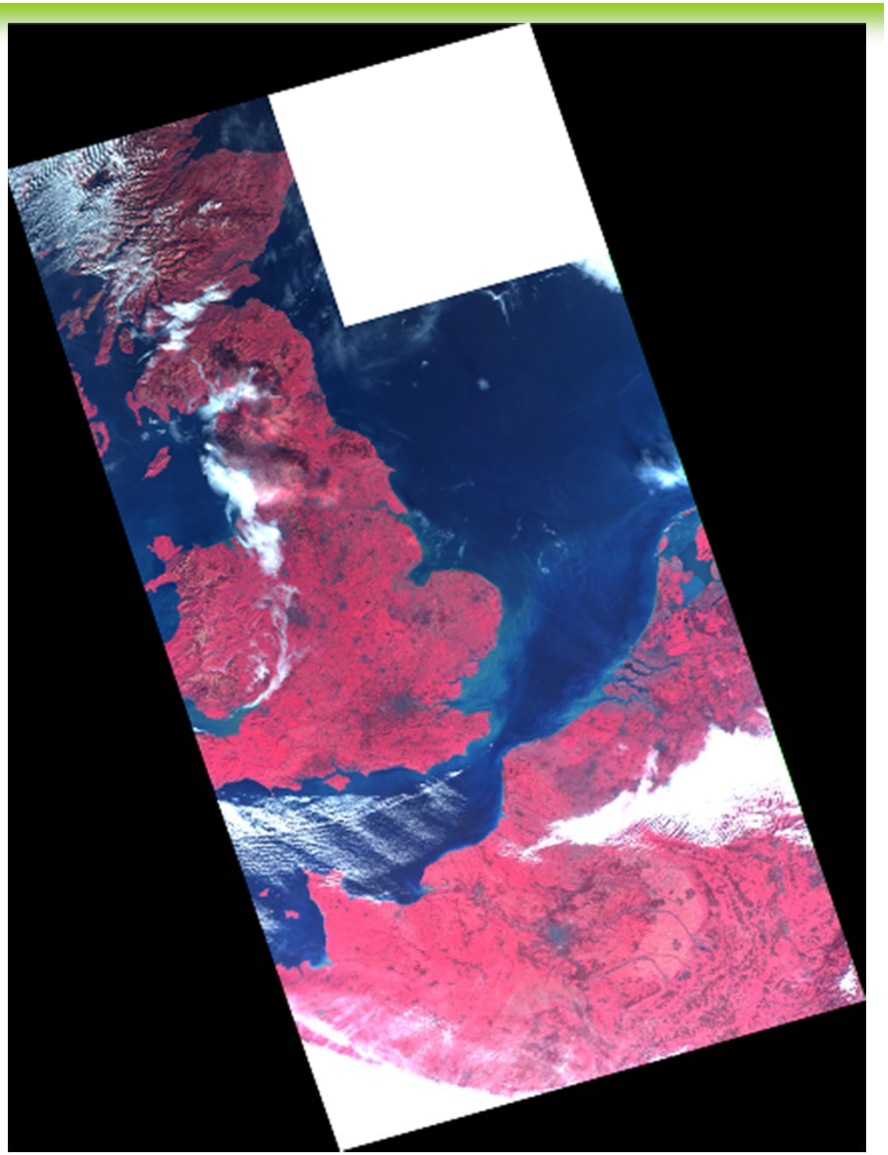
- Many fewer images to process than Landsat

Image size



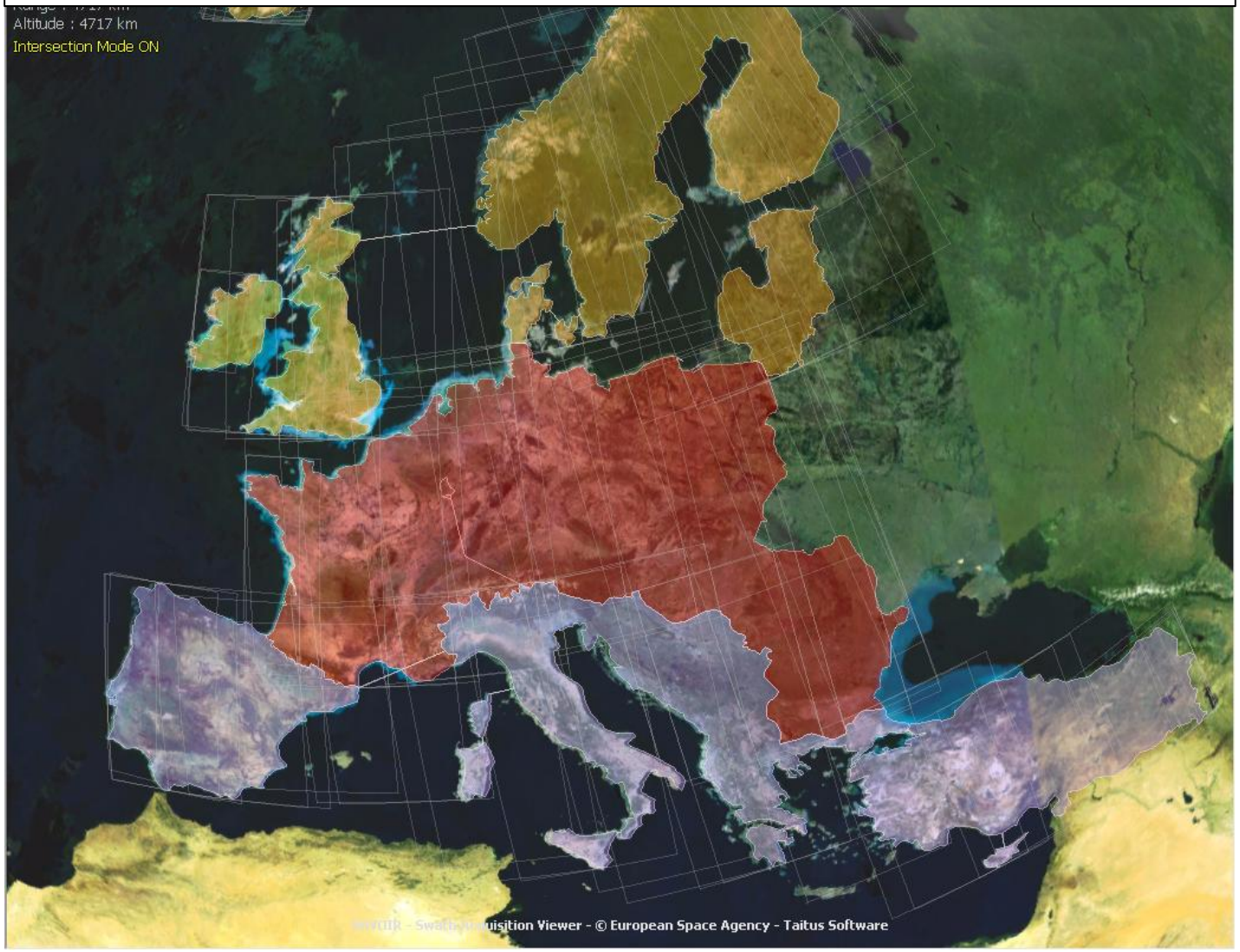
Constellation against Cloud - UK weather

Multiple MODIS images May 2006

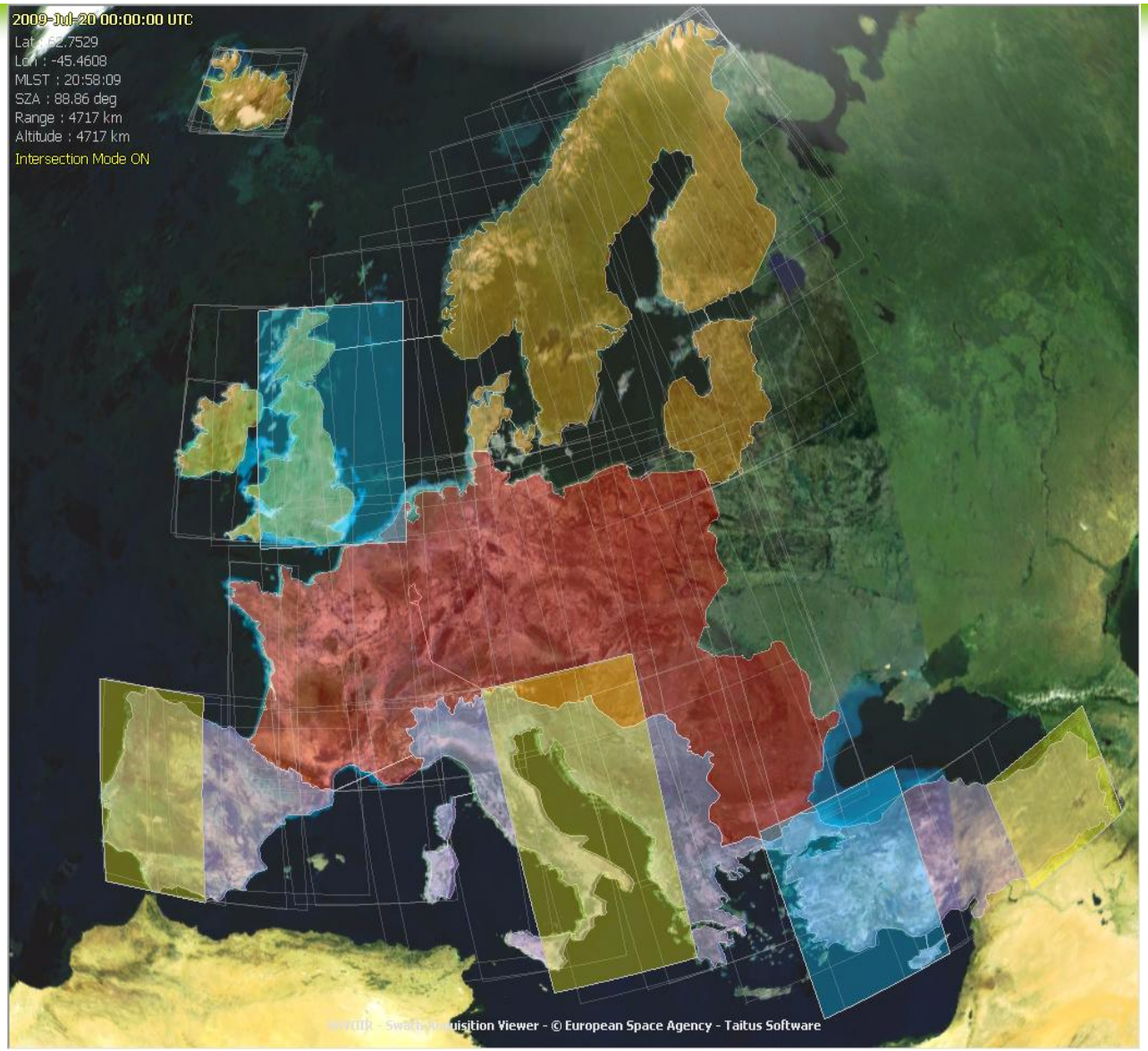


Single DMC image April 2007

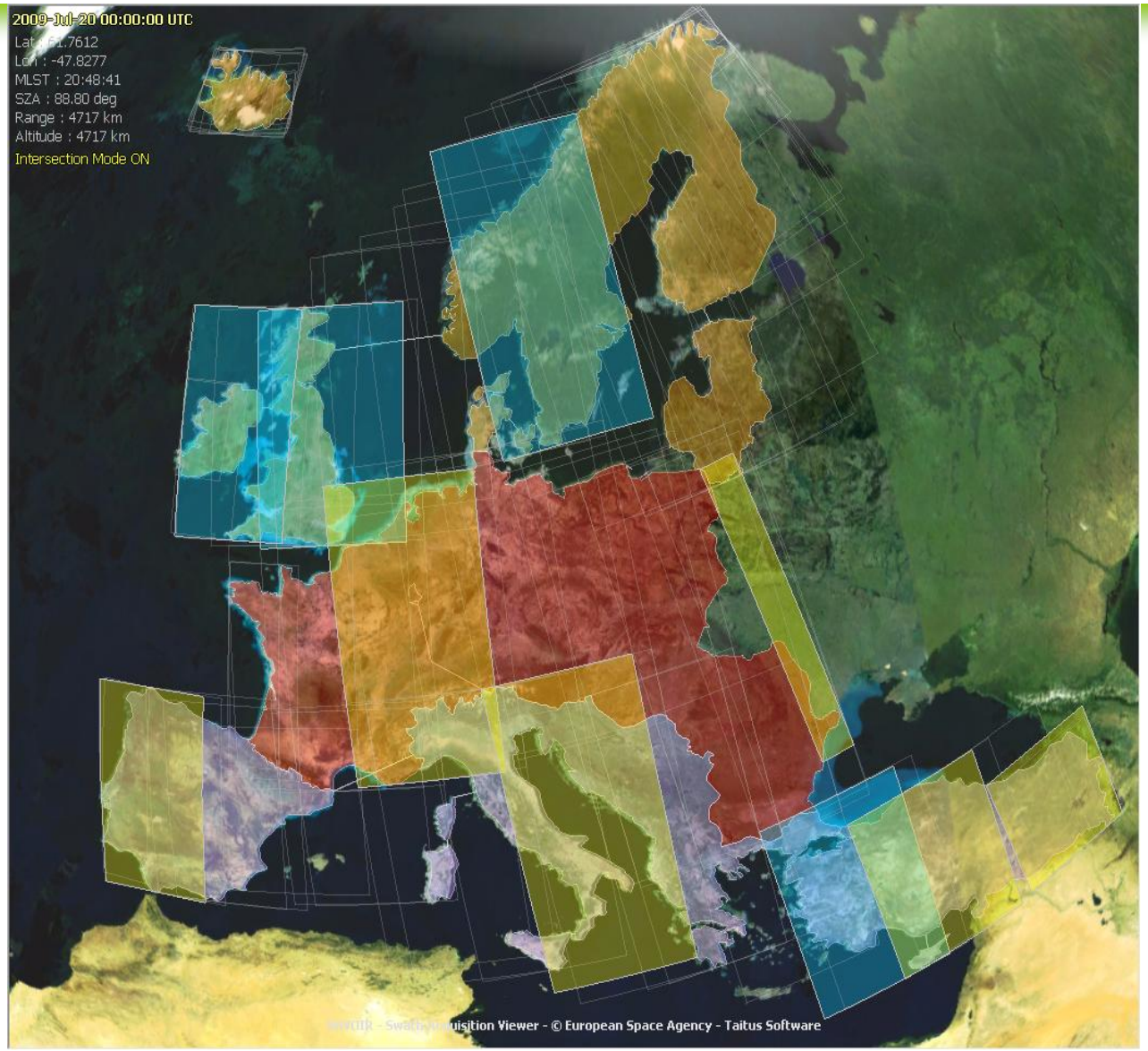
DMC Imaging Capacity:
5-day 22m European Coverage



Day 1


2009-Jul-20 00:00:00 UTC
Lat : 52.7529
Lon : -45.4608
MLST : 20:58:09
SZA : 88.86 deg
Range : 4717 km
Altitude : 4717 km
Intersection Mode ON
Swath Acquisition Viewer - © European Space Agency - Taitus Software

Day 2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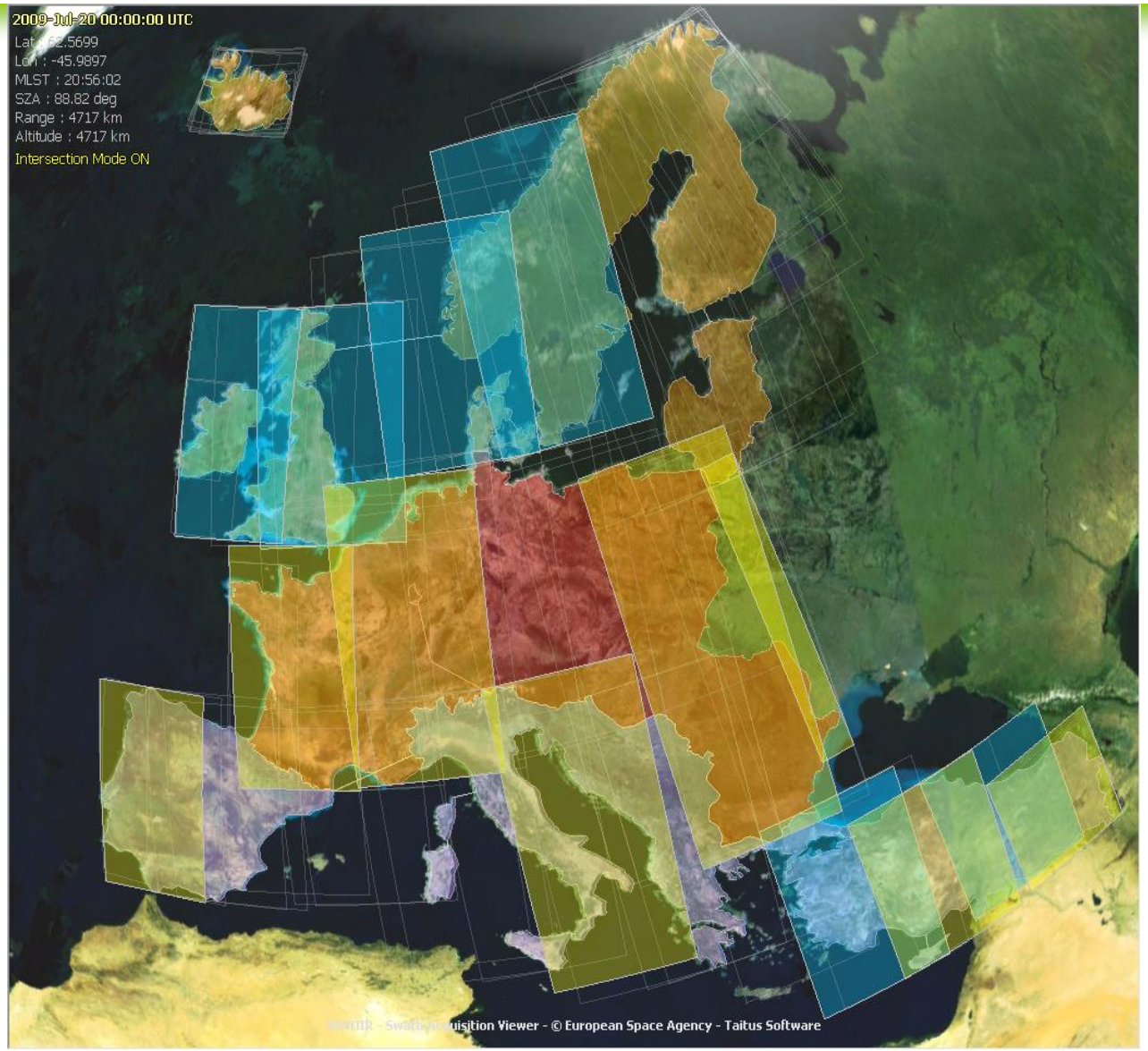
Lon : -47.8277
MLST : 20:48:41
SZA : 88.80 deg
Range : 4717 km
Altitude : 4717 km
Intersection Mode ON
Swath Acquisition Viewer - © European Space Agency - Taitus Software

Day 3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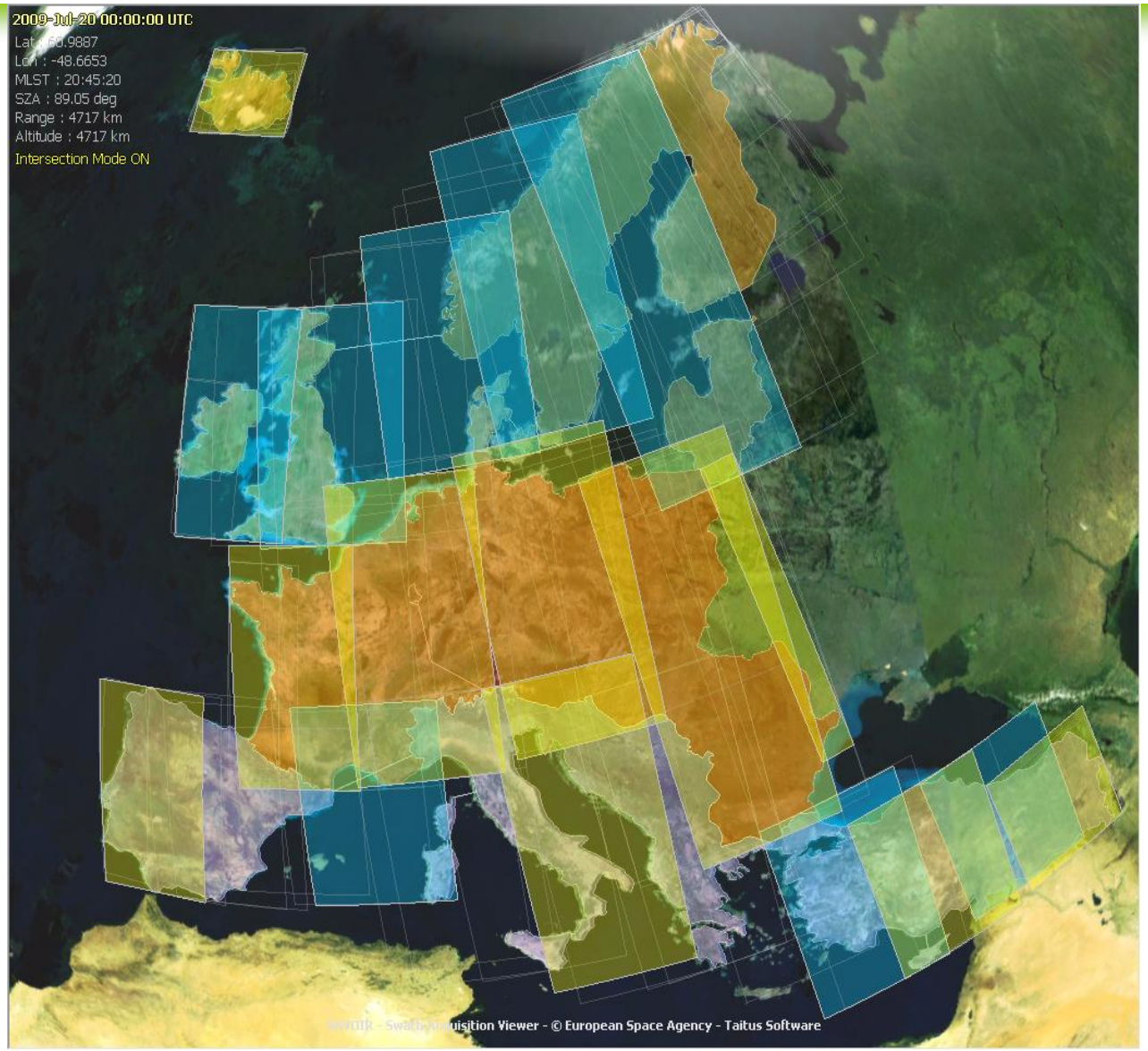
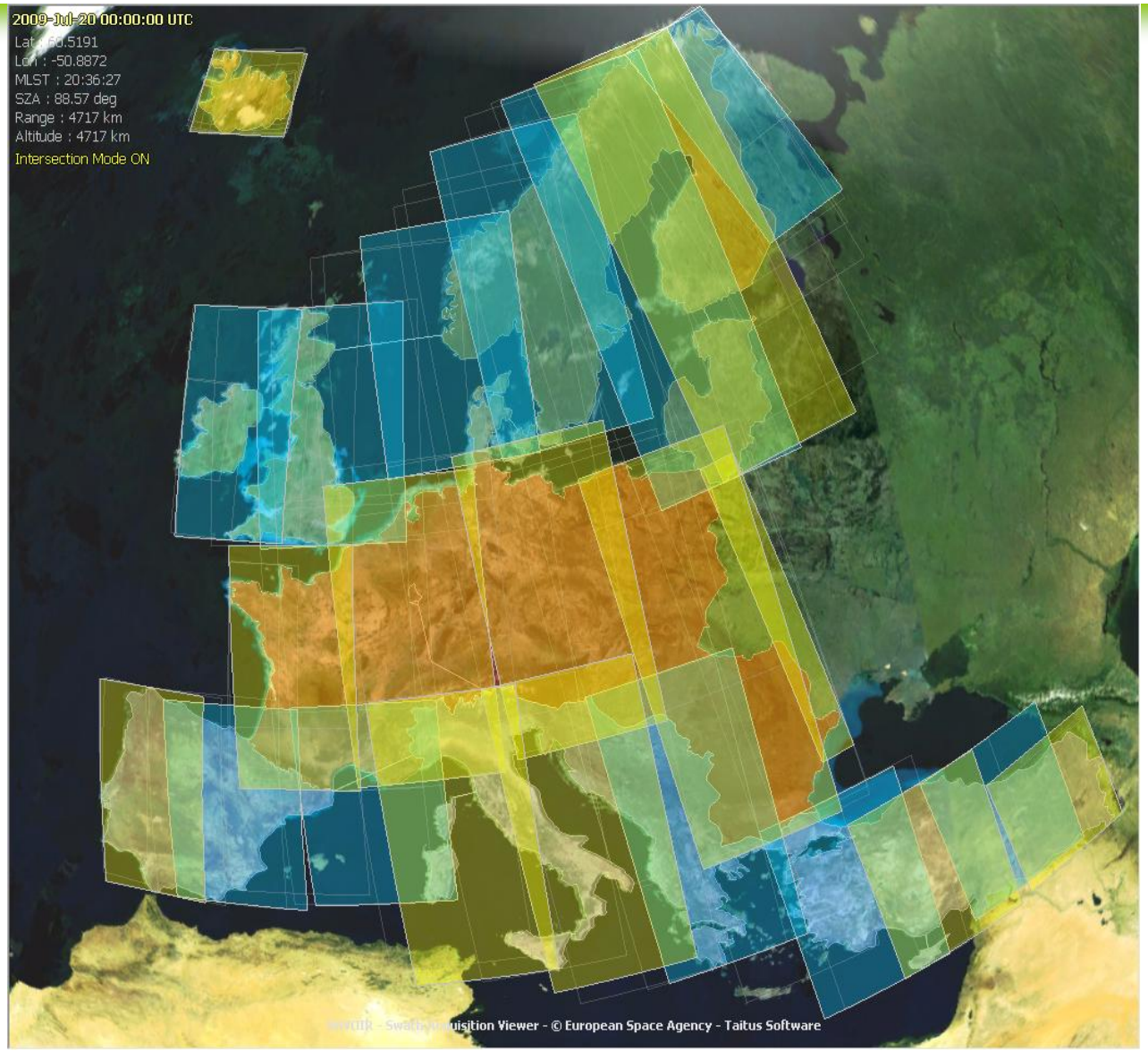
Lon : -45.9897
MLST : 20:56:02
SZA : 88.82 deg
Range : 4717 km
Altitude : 4717 km
Intersection Mode ON
Swath Acquisition Viewer - © European Space Agency - Taitus Software

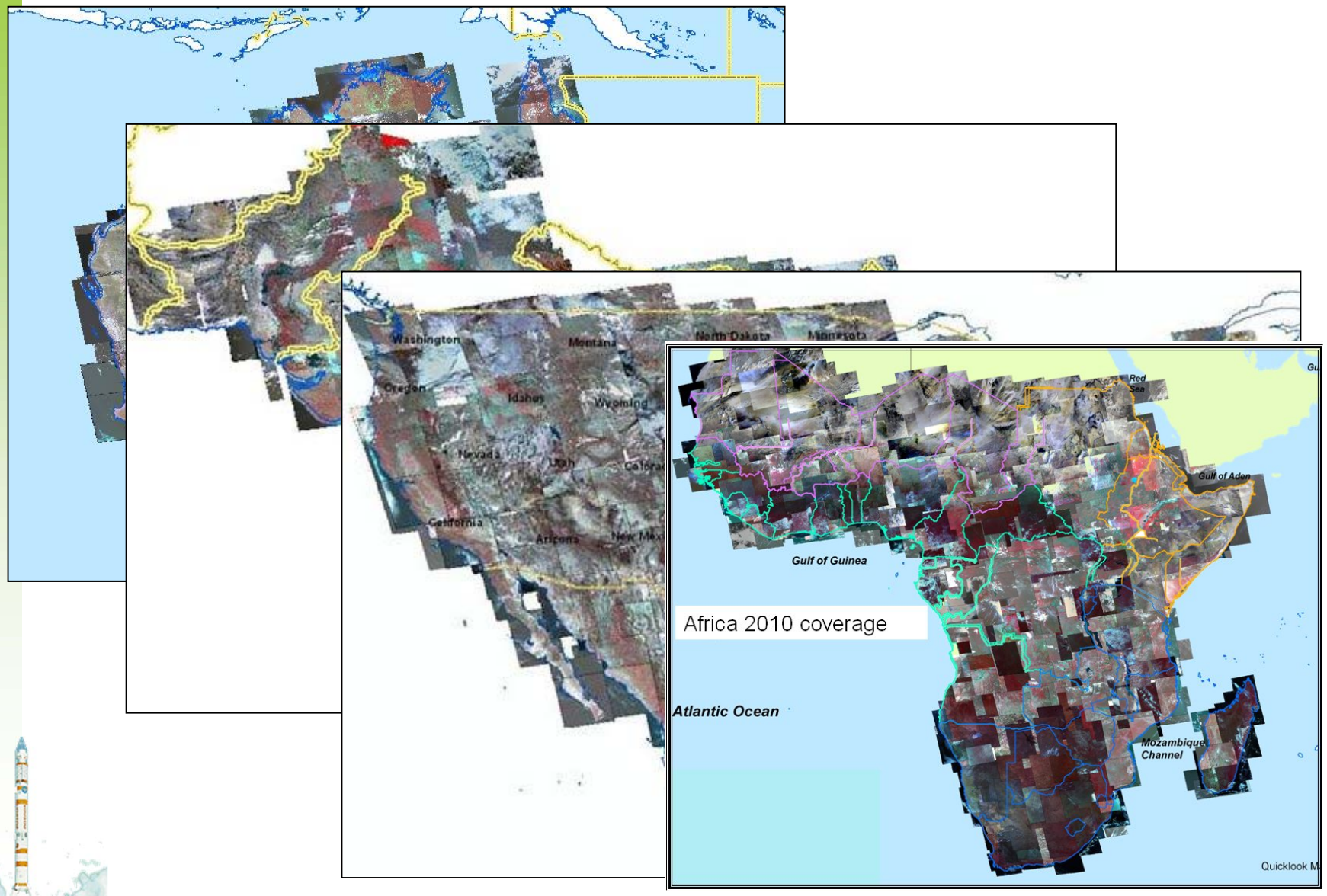
Day 4


2009-Jul-20 00:00:00 UTC
Lat : 50.9887
Lon : -48.6653
MLST : 20:45:20
SZA : 89.05 deg
Range : 4717 km
Altitude : 4717 km
Intersection Mode ON
Swath Acquisition Viewer - © European Space Agency - Taitus Software

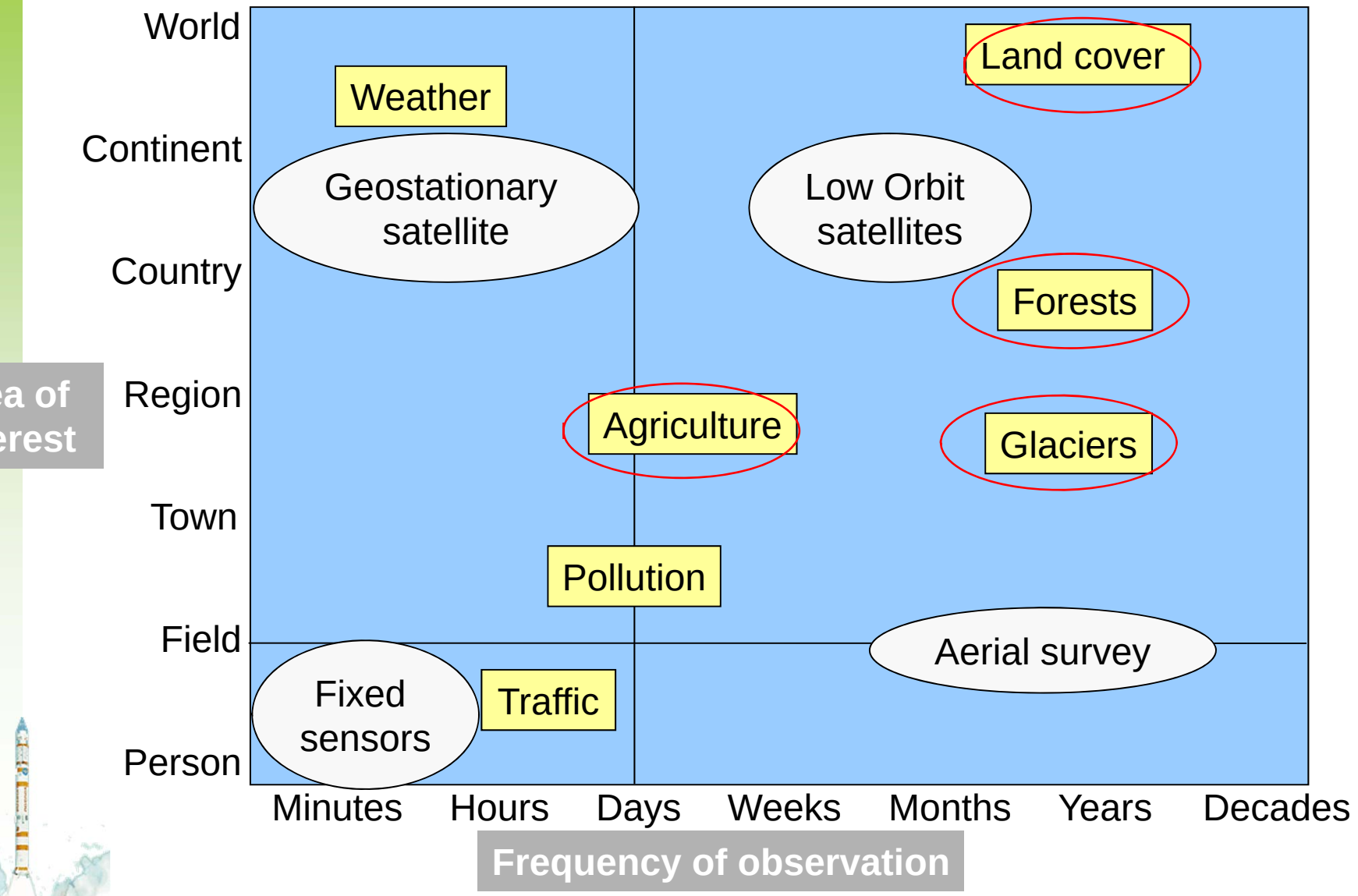
Day 5


2009-Jul-20 00:00:00 UTC
Lat : 50.5191
Lon : -50.8872
MLST : 20:36:27
SZA : 88.57 deg
Range : 4717 km
Altitude : 4717 km
Intersection Mode ON
Swath Acquisition Viewer - © European Space Agency - Taitus Software

Rapid Coverage of Large Areas



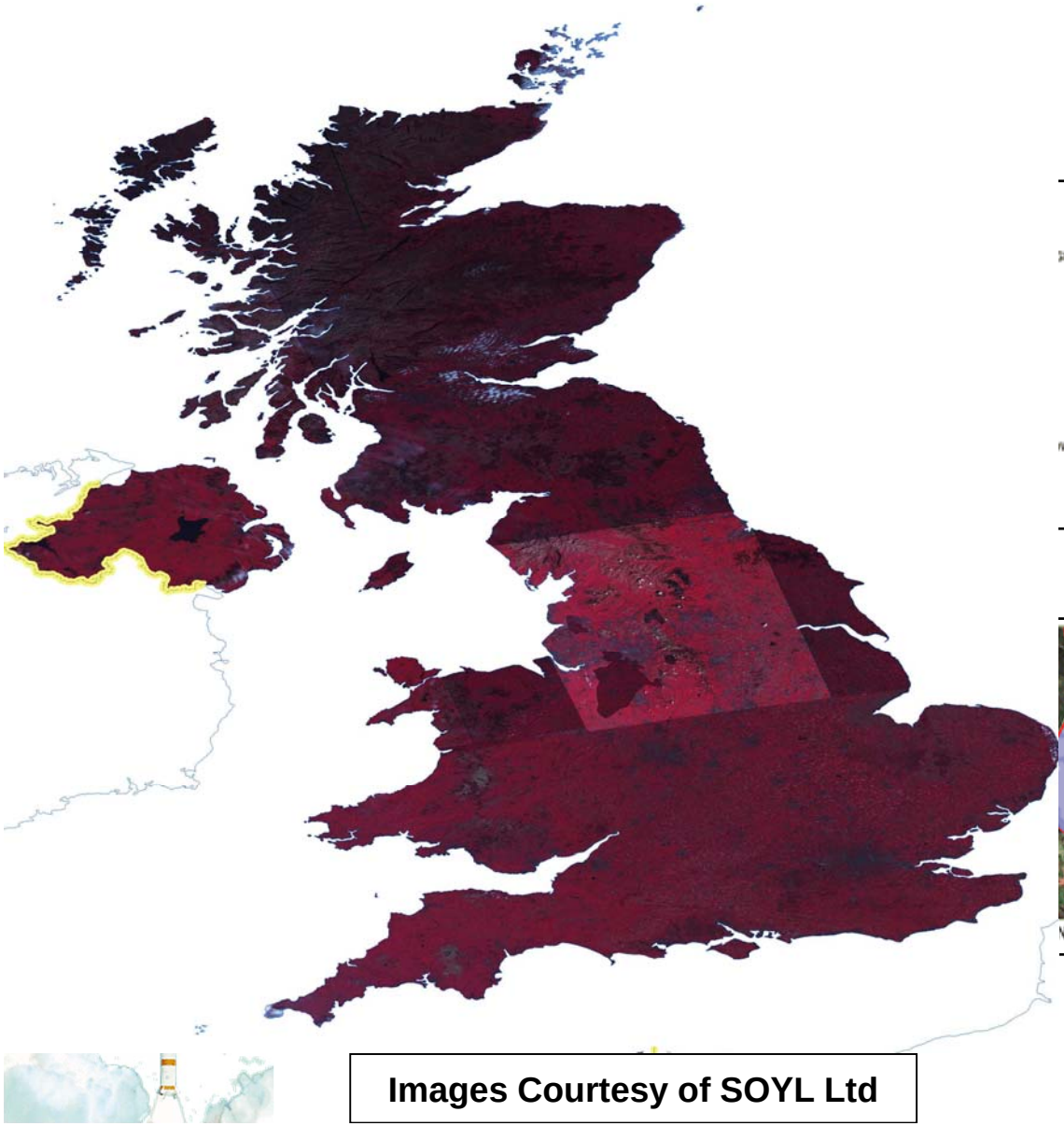
Information frequency and scale

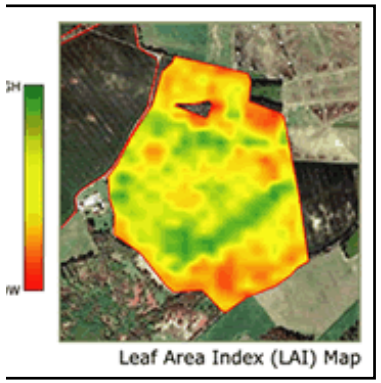


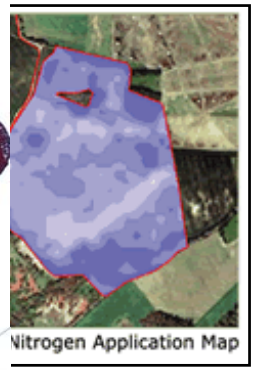
DMC data supply for Precision Agriculture

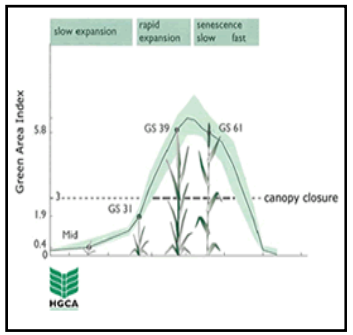
- Active in: UK, France, Belgium, Netherlands, Germany, Bulgaria, Canada, USA, Russia, Argentina, Japan
- Highly demanding EO application – timeliness is vital
- Requires intensive and reactive imaging services and rapid delivery
- Diverse customer requirements. Typical scenarios:
  - Standard programming, e.g. 4-5 discrete windows per season, each 2-3 weeks in duration
  - Intensive tasking service with daily customer involvement in satellite tasking decisions
  - Subscription service (e.g. full country coverage every 4 days for 6 months of the year)

“SOYLsense” (UK)







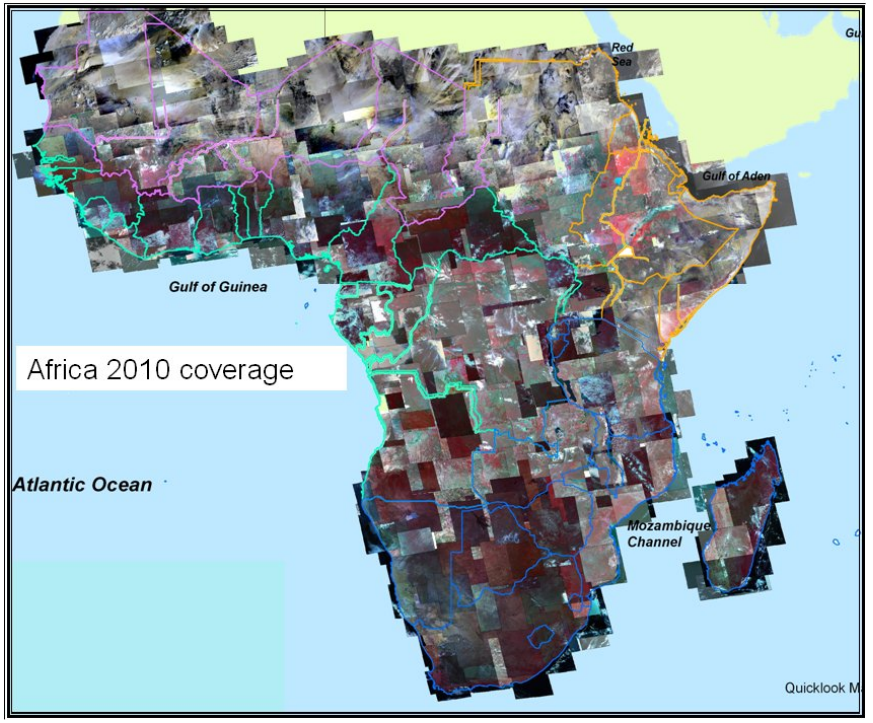


Images Courtesy of SOYL Ltd

Land Cover mapping

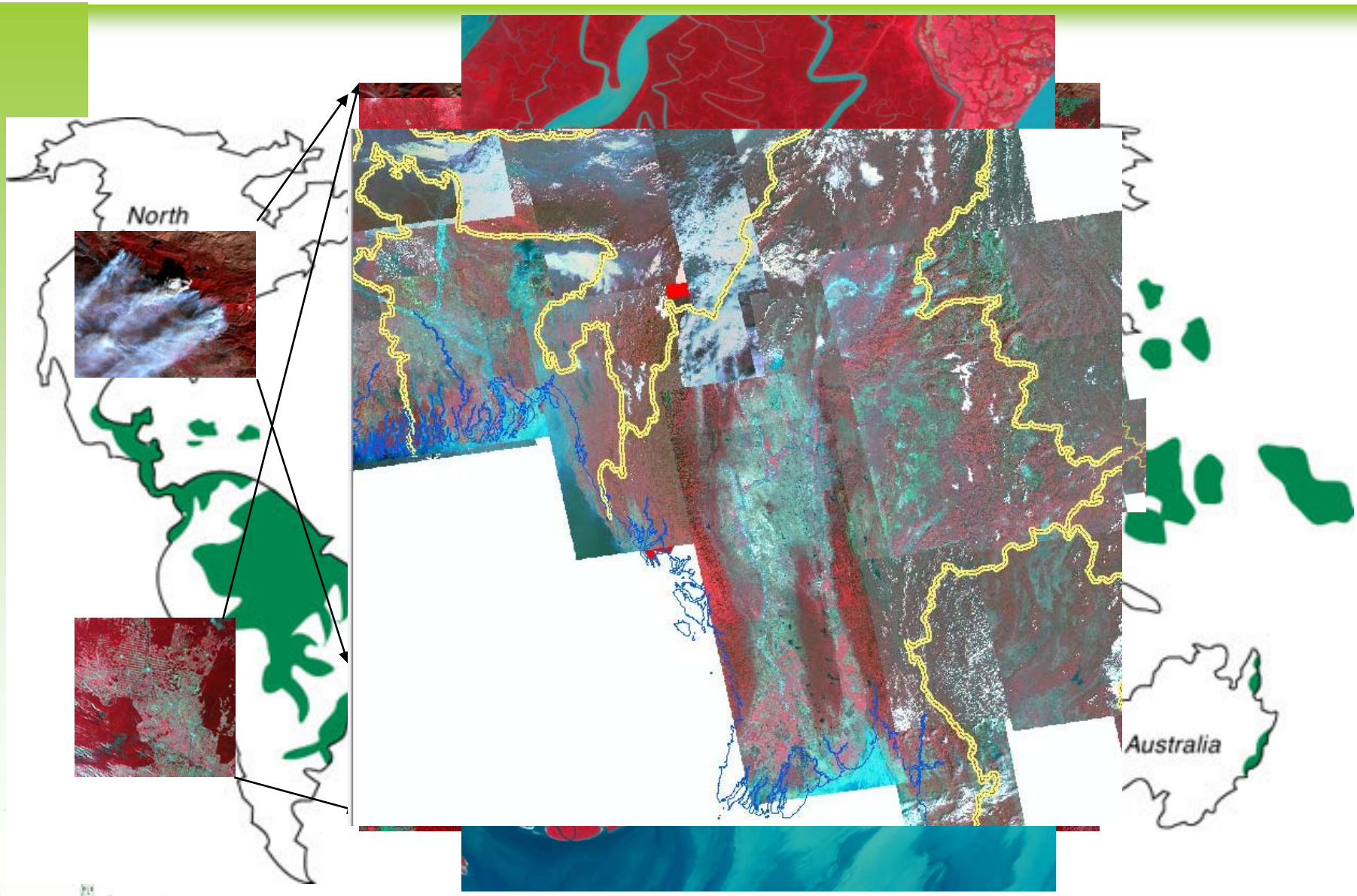
- All of Sub-Saharan Africa in 1 year
- For European GMES Program
- Supports multiple projects/applications incl. land cover, forestry, emergency preparedness

- 58 Countries
- Total area >24,000,000 km^2
- >2,000 confluence points to be acquired cloud-free



Tropical forest monitoring- deforestation

Tropical forests



Amazon monitoring 2005

2005

2006

2007

2008

2009

2010

2011

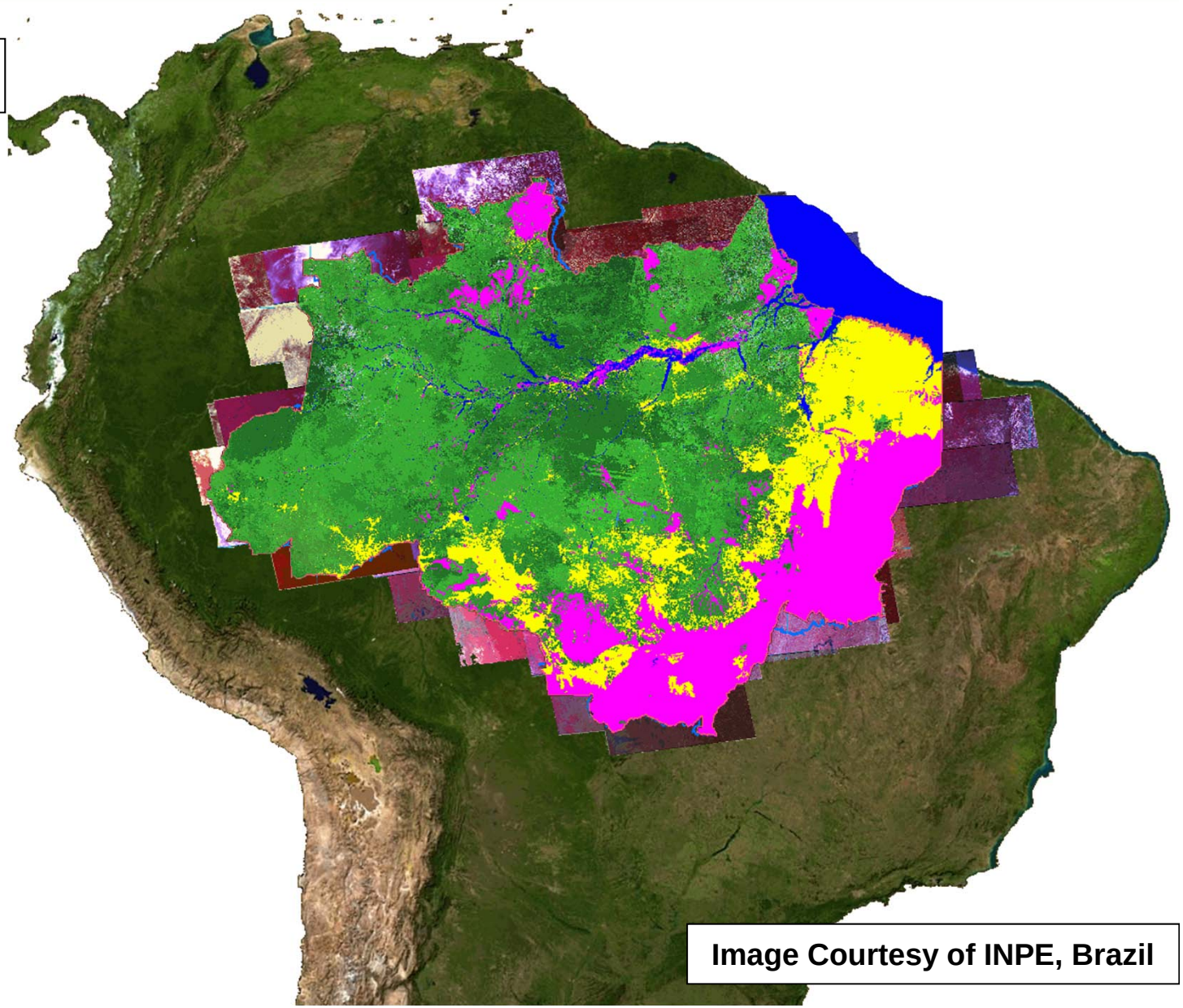


Image Courtesy of INPE, Brazil

Amazon monitoring 2011

2005

2006

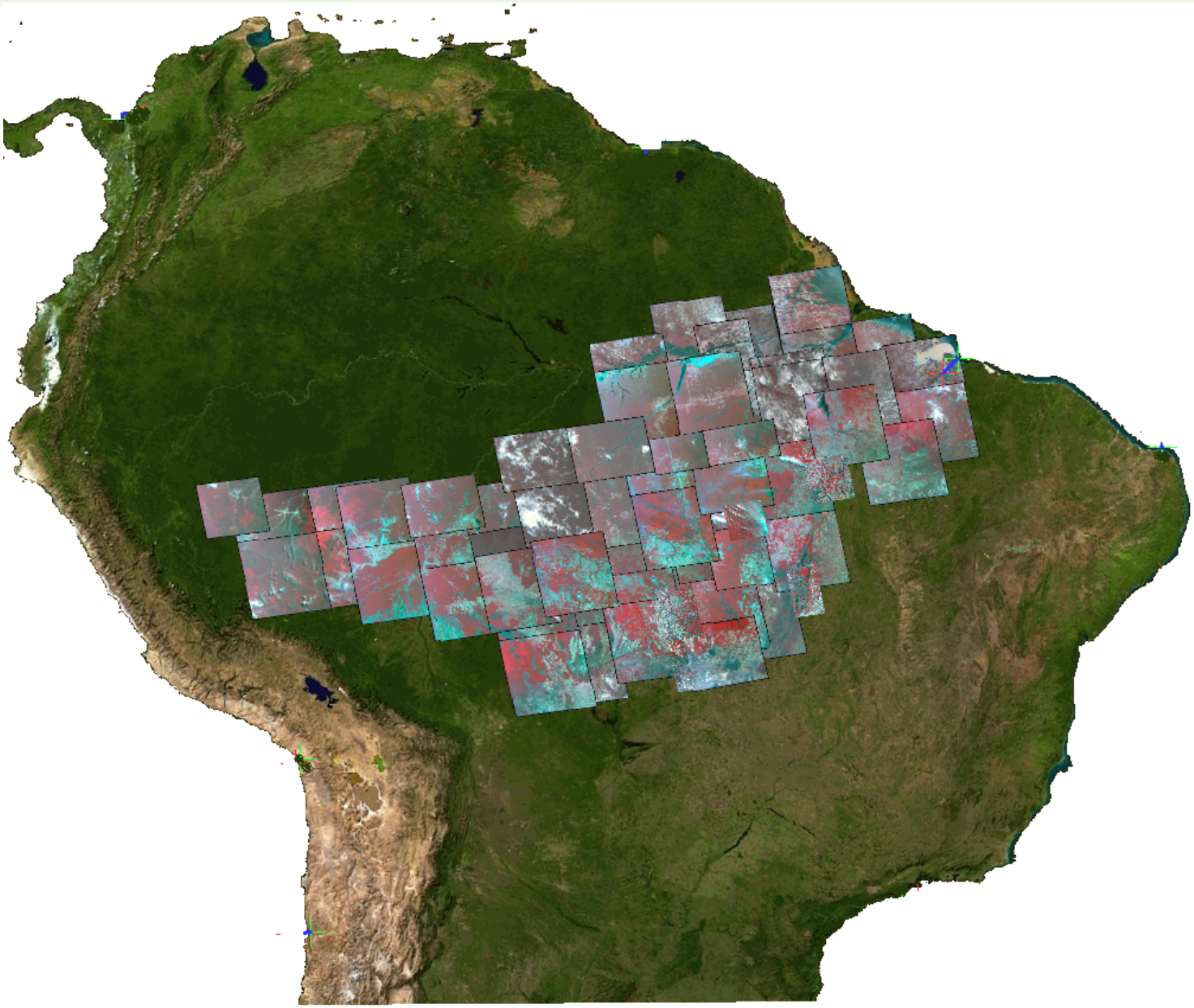
2007

2008

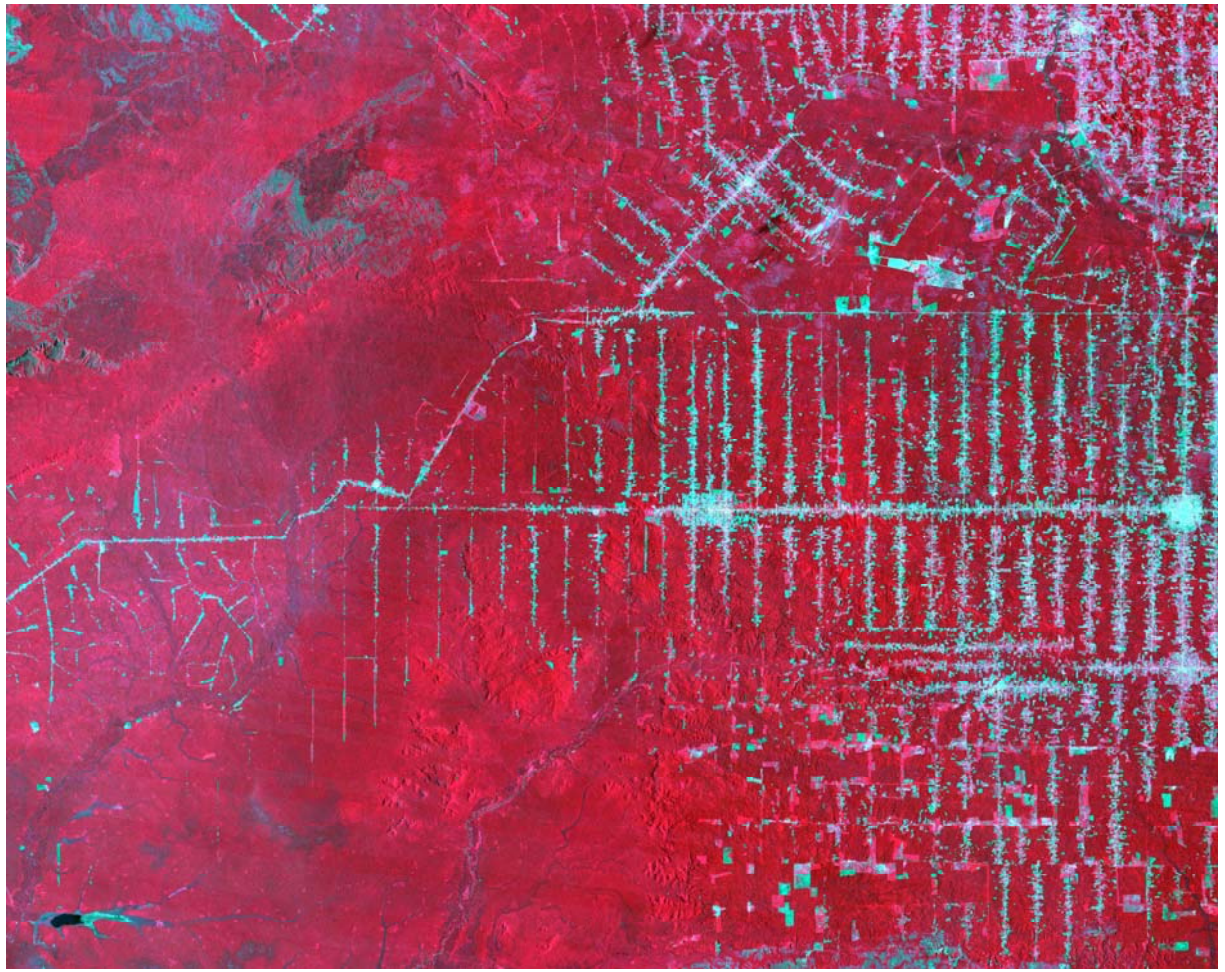
2009

2010

2011

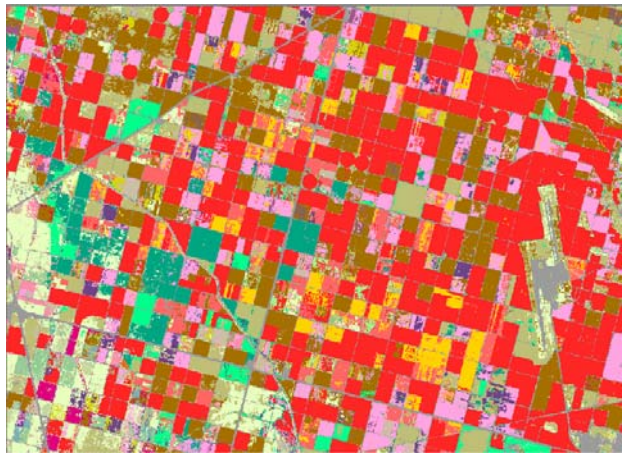


UK-DMC2 Image, 2010 Landsat 1986



California

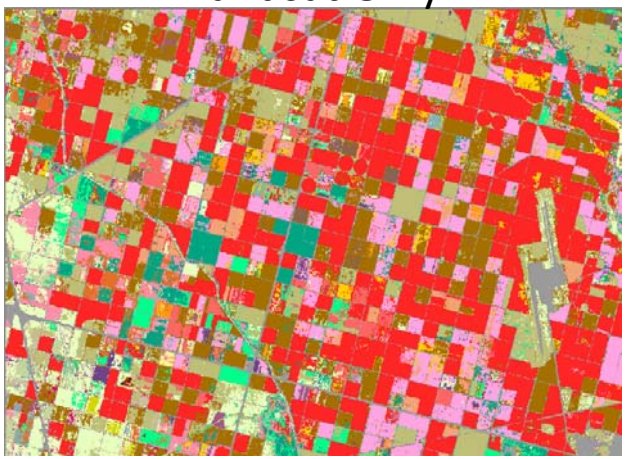
Landsat & DMC



	Producer	User
ALL CROPS	85.1%	
Corn	91.4%	90.1%
Rice	99.1%	99.7%
Cotton	97.4%	94.9%
W. Wheat	84.9%	88.0%
Alfalfa	92.7%	90.4%
Fallow/Idle	79.2%	73.1%

211 bands – North
215 bands – South

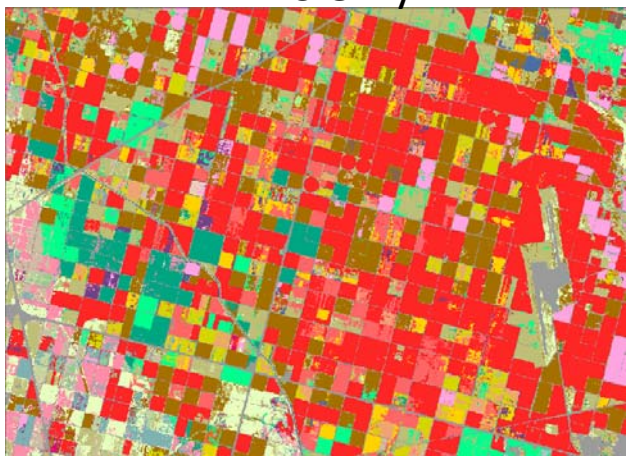
Landsat Only



	Producer	User
ALL CROPS	82.5%	
Corn	88.5%	89.0%
Rice	99.0%	99.8%
Cotton	95.8%	90.8%
W. Wheat	82.8%	85.5%
Alfalfa	91.7%	88.5%
Fallow/Idle	76.3%	67.6%

151 bands – North
135 bands – South

DMC Only

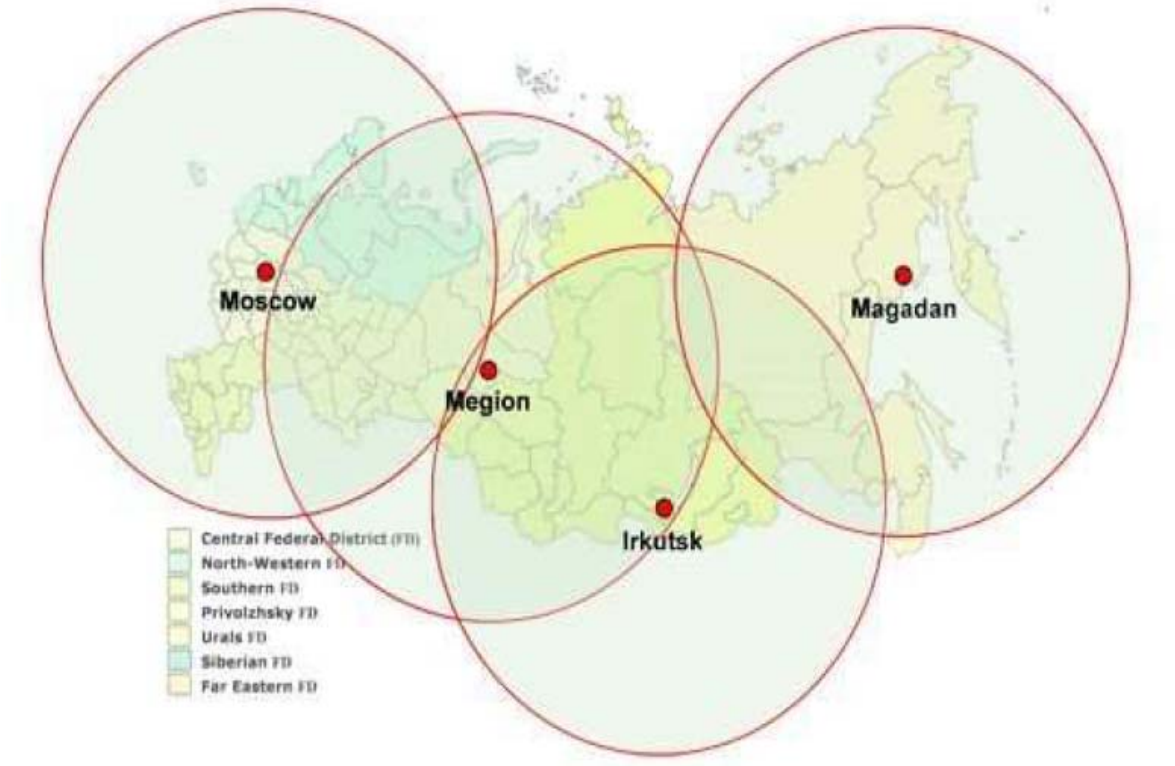


	Producer	User
ALL CROPS	76.4%	
Corn	90.6%	89.9%
Rice	98.9%	99.1%
Cotton	97.3%	94.5%
W. Wheat	83.6%	79.5%
Alfalfa	92.8%	82.4%
Fallow/Idle	79.0%	45.4%

99 bands – North
93 bands – South

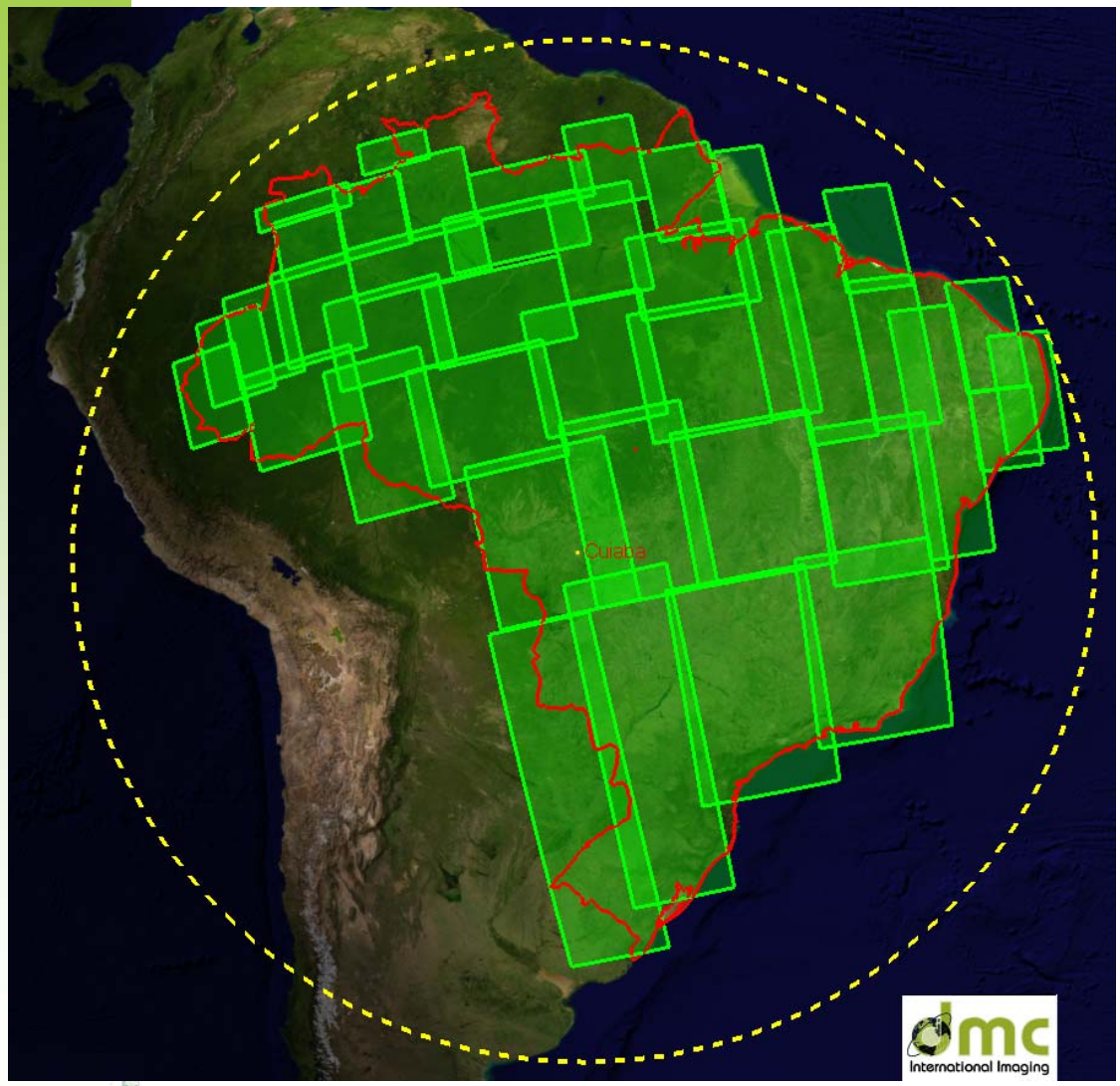
Direct download already operational

- 3-year agreement with Russia's ScanEx Research and Development Center
- Network of four ground stations strategically placed throughout the vast Russia and CIS territory to downlink data directly
- Rapid delivery system is particularly suited to agricultural planning and monitoring forest fires



Direct download from UK-DMC2 to the Cuiaba ground station

Scenario between 100-200min per month

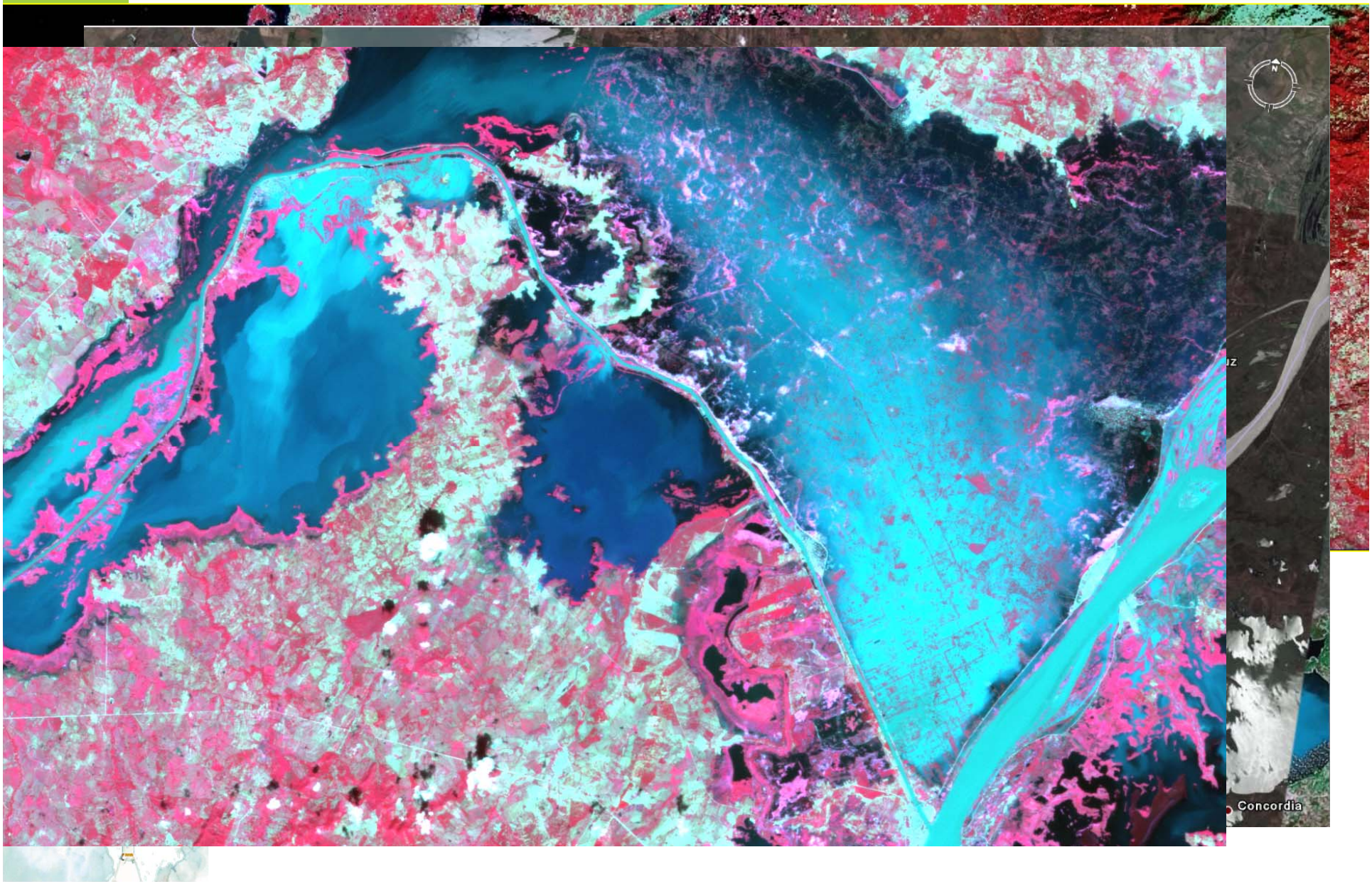


- 39 passes used (out of 58 available)
- One month coverage of the country
- 11M km^2 covered
- 150 min of download time used

Disaster response

Flood Colombia 2010

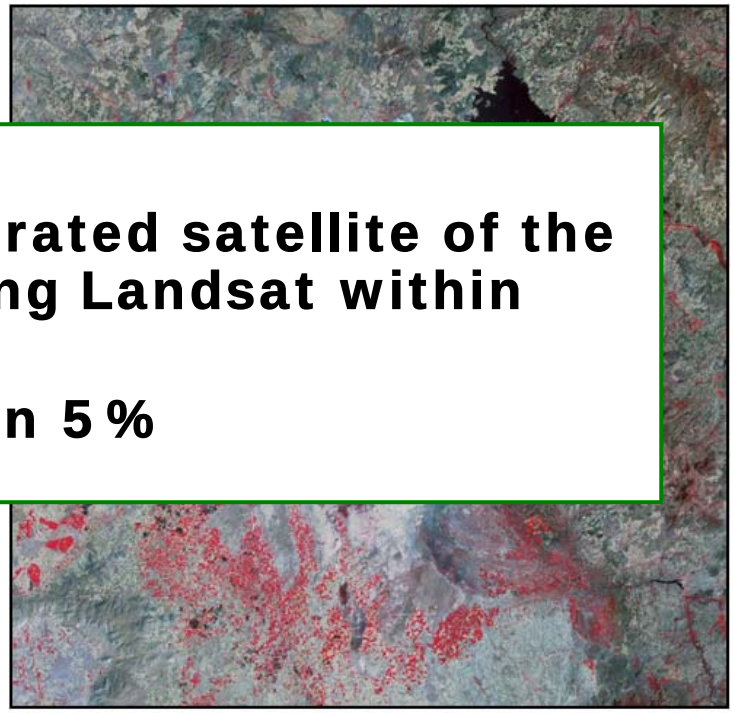
Campo de la Cruz, Santa Lucia



Satellite Calibration

Three elements:

1. Cross-Calibration over Desert Invariant Sites with Landsat 7 ETM
2. Cross-Calibration over the Dome-C site with Landsat 7 ETM
3. Vicarious Calibration (Absolute) over the Tuz Golu site, Turkey.



Result:

- **UK-DMC2 is the best calibrated satellite of the DMC Constellation, tracking Landsat within 1%**
- **Absolute calibration within 5%**

Satellite Calibration

- Increased satellite numbers
- Increased data capacity
- Need to better understand calibration sites with modelling
- Requirement for automated system
- Procedures established leading to “self-calibrating” systems

Thank you

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