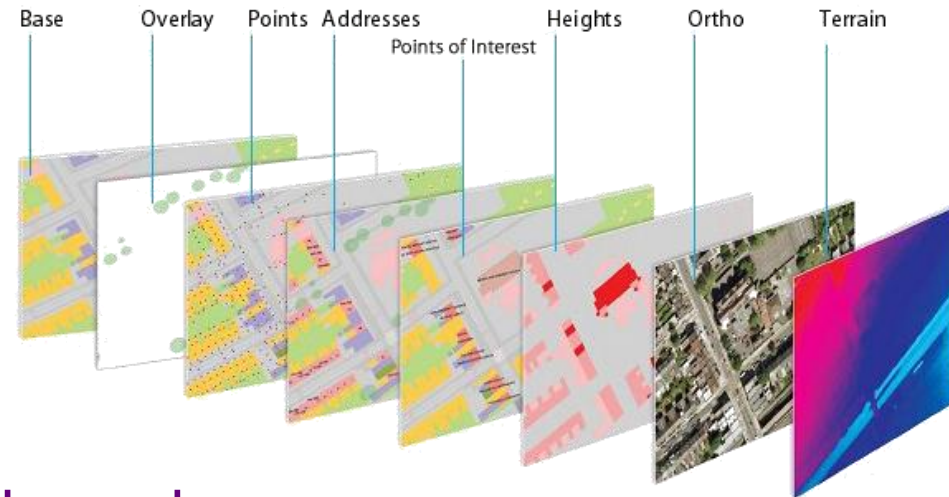


What is Spatial Data and How can I Access it for my Research?

Gail Millin-Chalabi
Geodata Research & Development Officer
Feb 9th 2012

Overview

- Introduction to spatial data
 - Data types
 - Data models
 - Data portrayal
- Historic context
 - Data access & analysis
- Accessing spatial data on the web
 - OGC standards
 - Landmap services (application examples)
 - Other spatial data services
- Further information



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WHAT IS SPATIAL DATA?

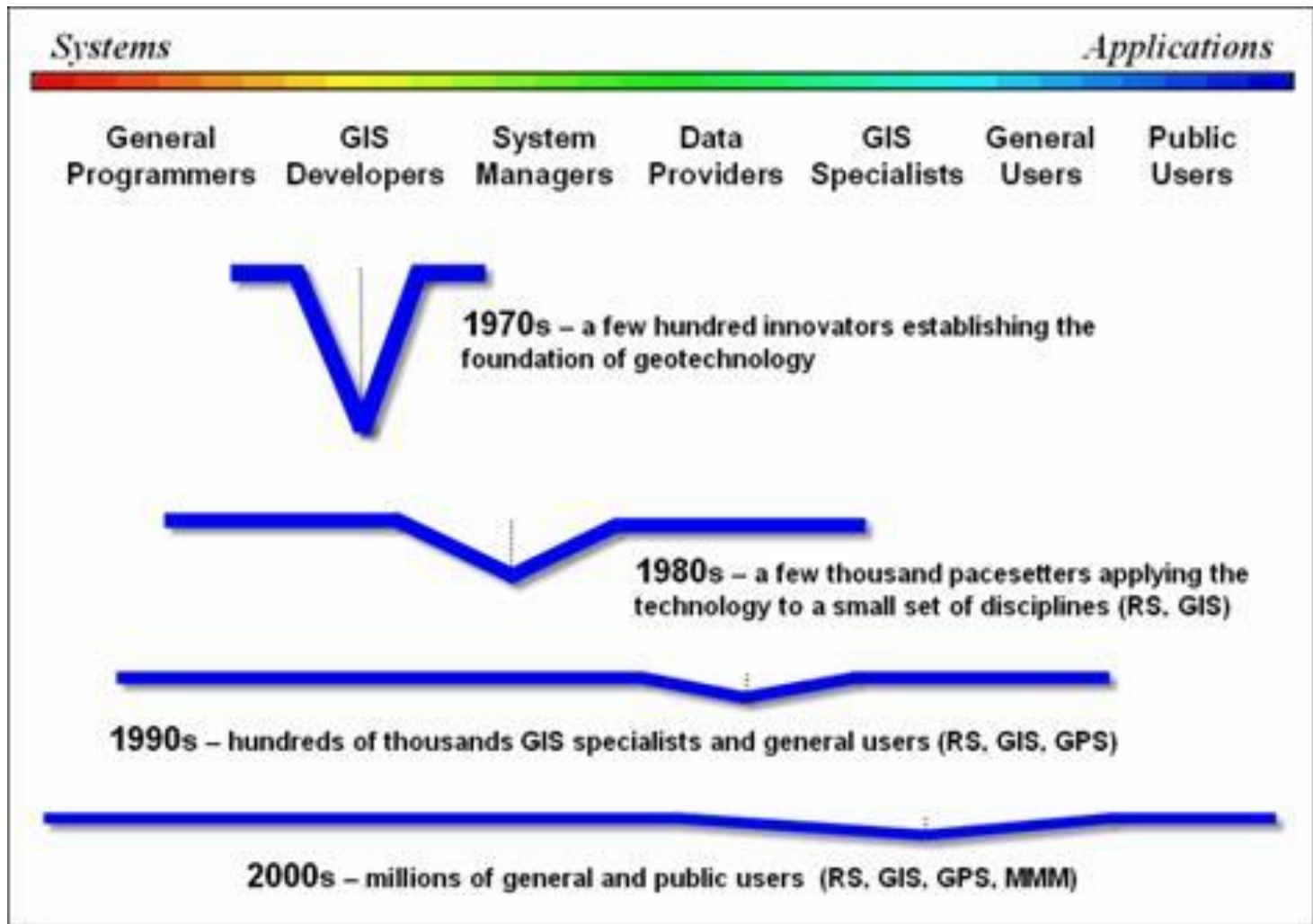


Defining Spatial

‘Spatial is special’ (Longley *et al.*, 2001, p.5)

- Almost all human activities and decisions involve a geographic component
- Spatial refers to any space
 - space on a different planet (outer space images e.g. Google Sky)
 - Space of the human body (medical images e.g. X-ray)
 - Geographic space to specifically define space on Earth (e.g. OS Explorer map)
- **Spatial data can be processed and analysed and displayed as a map:**
 - Geographical Information Systems (GIS) e.g. ArcGIS, GRASS, MapInfo and QGIS
 - Image Processing packages e.g. Erdas Imagine, ENVI, PCI, Idrisi Kilimanjaro and GRASS

Spatial Historic Context

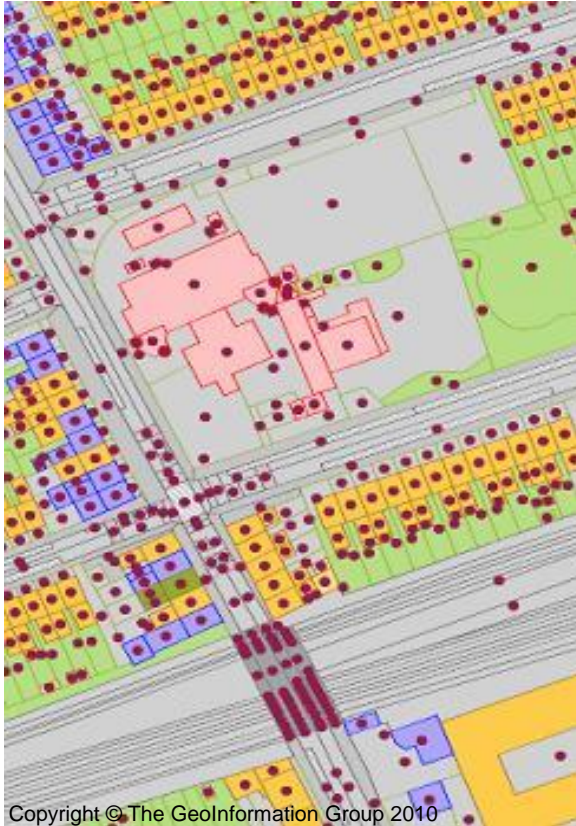


[A Multifaceted GIS Community \(GeoWorld January, 2007\)](http://www.innovativegis.com/basis/mapanalysis/Topic27/Topic27.htm)

<http://www.innovativegis.com/basis/mapanalysis/Topic27/Topic27.htm>

Data Models

Vector (Feature)



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- Points, lines and polygon layers
- Buildings, roads, tree canopies etc.
- Features have associated attributes

Raster (Coverage)

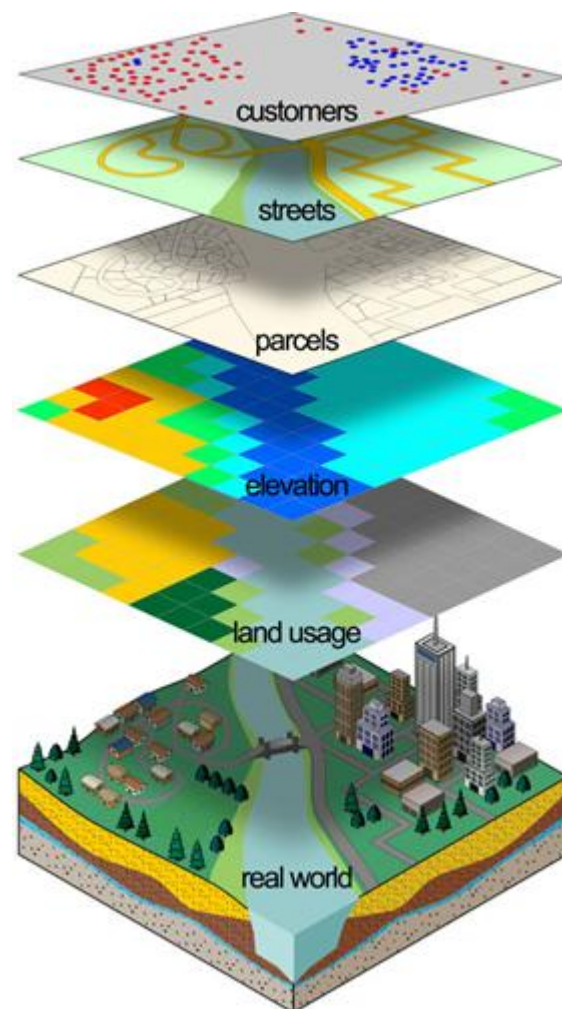


Copyright © The GeoInformation Group 2010

- Cells/pixels
- Satellite, airborne images, DTM, DSM etc.
- Continuous data or simple entities

Real World Representation

- Data Layers provide information about each element of the real world
 - Customers, streets, parcels (vector)
 - Elevation and land usage (raster)
- Each layer will have the same Spatial Referencing System (SRS) e.g. British National Grid
- Points to consider when comparing between layers
 - Spatial resolution of the data layers
 - Use of different data models



© Copyright 2011 Westfield State University.

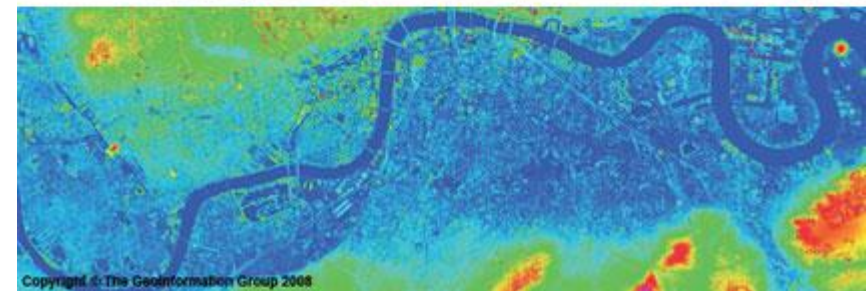
Spatial Data Analysis Tools

- **GIS**
 - ArcGIS (proprietary)
 - MapInfo (proprietary)
 - QGIS (open source)
 - GRASS (open source)
- **Image Processing**
 - Erdas Imagine, ENVI, Idrisi Kilimanjaro, PCI & Definiens (proprietary)
 - GRASS & OpenEV(open source)
- **Computer Aided Design (CAD)**
 - MicroCAD (proprietary)
 - Google SketchUp (free to download)
- **3D Visualisation packages**
 - Google Earth, Erdas Titan & ArcGIS Explorer
 - Global Mapper (proprietary)

Spatial Analysis

Obtaining new meaningful information from spatial datasets

- **Location Analysis**
 - Buffer, Corridor, Overlay
- **Terrain Analysis**
 - Slope, Aspect, Catchment, Drainage networks, viewshed
- **Measurements**
 - Distance between two entities, length of a road/channel
- **Neighbourhood Analysis**
 - Nearest neighbour, proximity, Public Participation GIS
- **Pattern/Class Analysis**
 - Multivariate, cluster, classification



SPATIAL DATA ACCESS



Spatial Information Science

Open

Where

Points of Interest

Interoperability

Open Data

Sensor Web

Shared Understanding

Information Integration

Geosynchronization

Time

Planning

SDI

GPS

Data Quality

Alerts

Situational Awareness

Real Time

Weather

Visualization

Earth Observation

Analysis

Navigation

CAD

BIM

Proximity

Global

Place

Linked Data

Geoweb

Geosemantics

Monitoring

Location

Map

Share

Monitoring

Location

Map

Share

Monitoring

Location

Map

Share

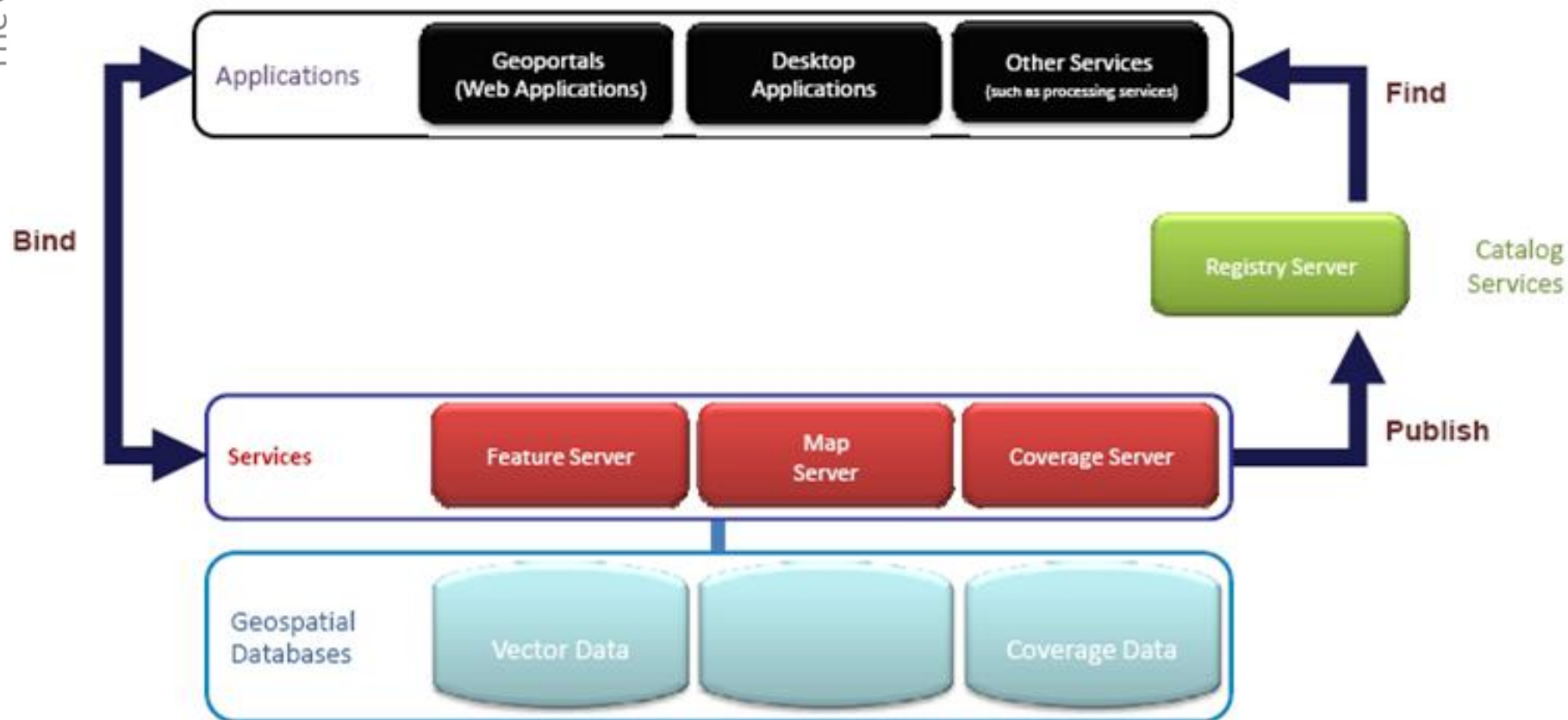
OGC/ISO Standards

- Visualise Spatial Data
 - Web Map Services (WMS)
 - Style Layer Descriptor (SLD)
 - Web Map Tile Service (WMTS)
- Access and Deliver Spatial Data
 - Web Feature Service (WFS)
 - Geographic Mark-up Language (GML)
 - Web Coverage Service (WCS)
- Describe spatial data
 - ISO 19115
- Deliver metadata 'data about data'
 - Catalog Service for the Web (CS-W)



Interoperability: Which Standard do you Use? by [gruntzooki](#) Flickr

SDI



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LANDMAP SERVICE



About

Datasets

Download

Learning Zone

Support

Projects

New 2m DSM & 5m DTM for Scotland

Holyrood Park - Edinburgh

© GetMapping 2010

Free to Download from Landmap Kaia

[Discover DSM and DTM data from GetMapping](#)

Landmap provides web-based access to **spatial data** and **learning materials** for UK HE and FE.

Landmap's **Optical & Thermal, Radar, Elevation and Feature** Collections give a combination of remotely sensed imagery and spatial data information unique in UK academia.

Register ▶

Already registered?

Download data ▶

Free and Accessible

Landmap buys datasets from **leading data providers** and supplies them **free-of-charge** to the UK academic community via Open Geospatial Consortium (OGC) standards for maximum interoperability.

Obtain GeoKnowledge

Empowering users through the [Learning Zone](#) to access and apply Landmap data in an efficient and effective way so powering **high quality research, teaching and learning**.

[Use Case: MSc. Thesis in Pluvial Flood Modelling](#)

Build 3D Models

High quality LiDAR & 5m DTM's make 3D model creation possible, essential for flood modelling, terrain analysis and city planning.

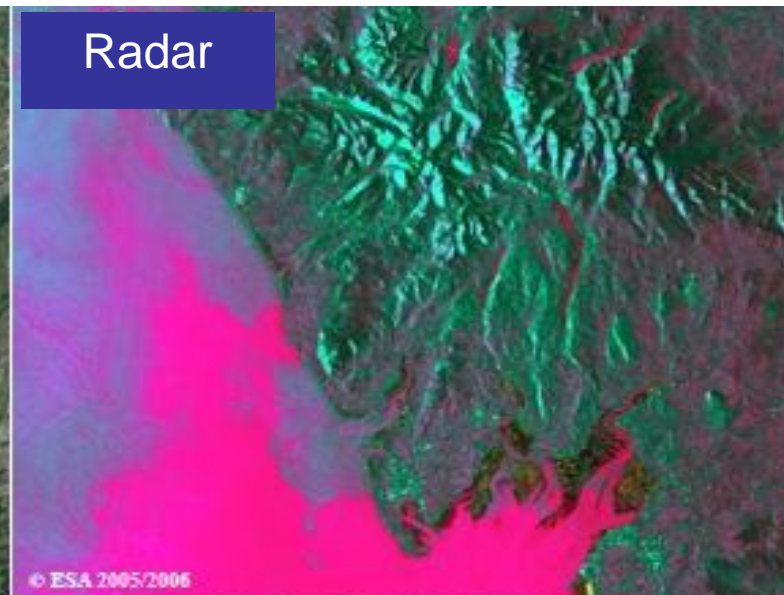
[Use Case: Jurassic Coast Project, Ravensbourne College of Design and Communication](#)

Website: landmap.mimas.ac.uk
Helpdesk: spatial@mimas.ac.uk
Twitter: @Landmap

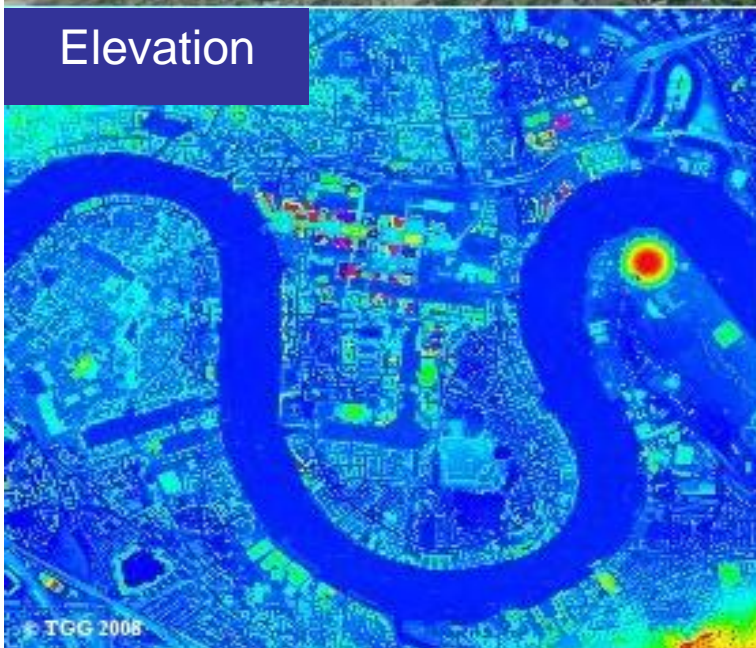
Optical &
Thermal



Radar



Elevation



Feature



Newbie?

- 1) Check your institution is licensed
- 2) Individual Registration
- 3) Familiarise yourself with Landmap license
- 4) Citation guidelines
- 5) Institution username and password:
 - Download data
 - Access e-learning content



Optical & Thermal Collection

Optical /Thermal collection	Format	Temporal scale	Coverage
Landsat 4/5 (Ortho)	Erdas Imagine	1988 – 1992	UK
Landsat 7	Erdas Imagine	1999 - 2001	UK
Mediterranean Landsat	Erdas Imagine/GeoTiff	1990, 1992, 2000	Cyprus & Spain (E&W)
Spot	GeoTiff	1986 - 1995	British Isles
TopSat	GeoTiff	2007 - 2009	Global coverage
Colour Infrared	GeoTiff	2004 - 2011	England, Wales & Scotland (not complete coverage)
Historic AP	MrSID	Late 1940s	RAF and USAF some Luftwaffe Coverage during war (some parts of London and Liverpool)
Modern AP	MrSID	1970 – 2009	Main conurbations in UK
Meris	GeoTiff	March 2011	Order on request
Thermal	Erdas Imagine & JPG	2009 - 2010	Main conurbations in UK

Change Detection Analysis

Manchester Ship Canal

Salford Quays



Radar Collection

Radar collection	Format	Temporal scale	Coverage
Envisat ASAR - Image Mode - Alternating Polarisation - Wide Swath	Ortho GeoTiff	2004 plus	Entire UK
ERS - ERS 1 - ERS 2 - ERS Coherence	Ortho GeoTiff	1995 - 1999	British Isles

Use radar for regular imagery to monitor an area without the worry of cloud cover

Fire Scar Detection in the Peak District

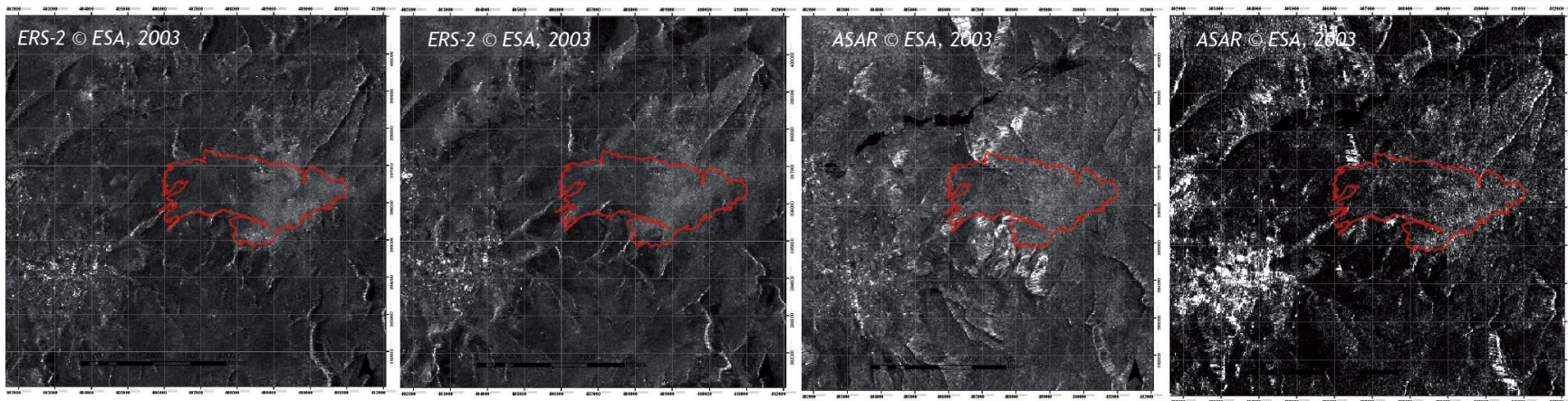
How well can the C-band SAR intensity and coherence signal detect a fire scar within a degraded UK moorland environment?

Objectives

- Determine the ability of SAR intensity and InSAR coherence to detect the fire scar over time in a moorland environment
- Analyse qualitatively how scene variables such as precipitation and CORINE land cover classes affect the SAR intensity and coherence signal, both inside and outside the fire scar

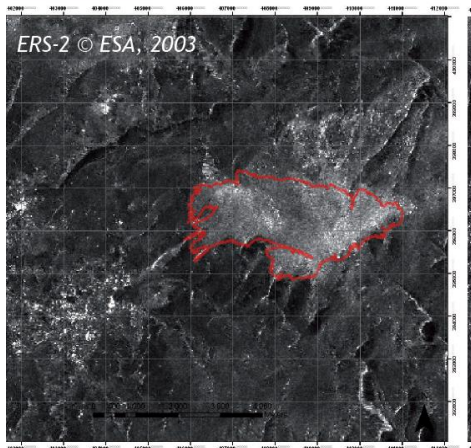


Bleaklow Fire Scar Detection

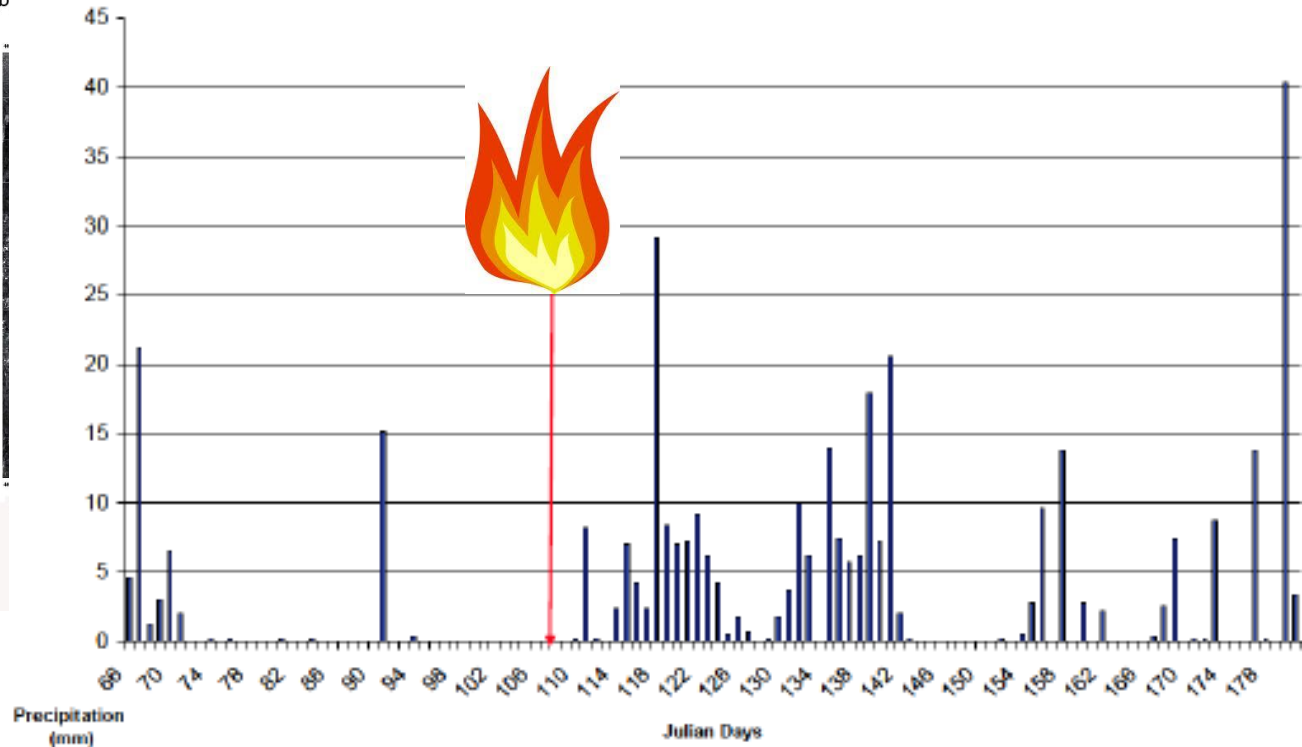


(a) ERS-2 08/02/2003 (39 JD)

(b)



(e) ERS-2 24/05/2003 (144 JD)



Elevation Collection

Elevation collection	Format	Temporal scale	Coverage
75m SRTM	Erdas Imagine	2000	British Isles
25m Landmap DTM	Erdas Imagine	2000	
KGPS Survey	Shapefile/KML/ GML	2000	6,400 km of roads (British Isles)
5m Bluesky DTM	Erdas Imagine	2009	England and Wales
0.25 - 1m LiDAR	Erdas Imagine	2005 - 2007	Metropolitan areas

Use elevation data to create 3D models

3D Modelling of the Jurassic Coast

Ravensbourne College of Design and Communication



Images Courtesy of Prof Jeremy Gardiner

Computer Numerically
Controlled (CNC) milling
Machine used.

CNC routing is a way of
machining an object directly
from CAD data with a sharp,
fast moving tool bit. Spatial
Data translated into .stl files
to create complex geometries
for milling.

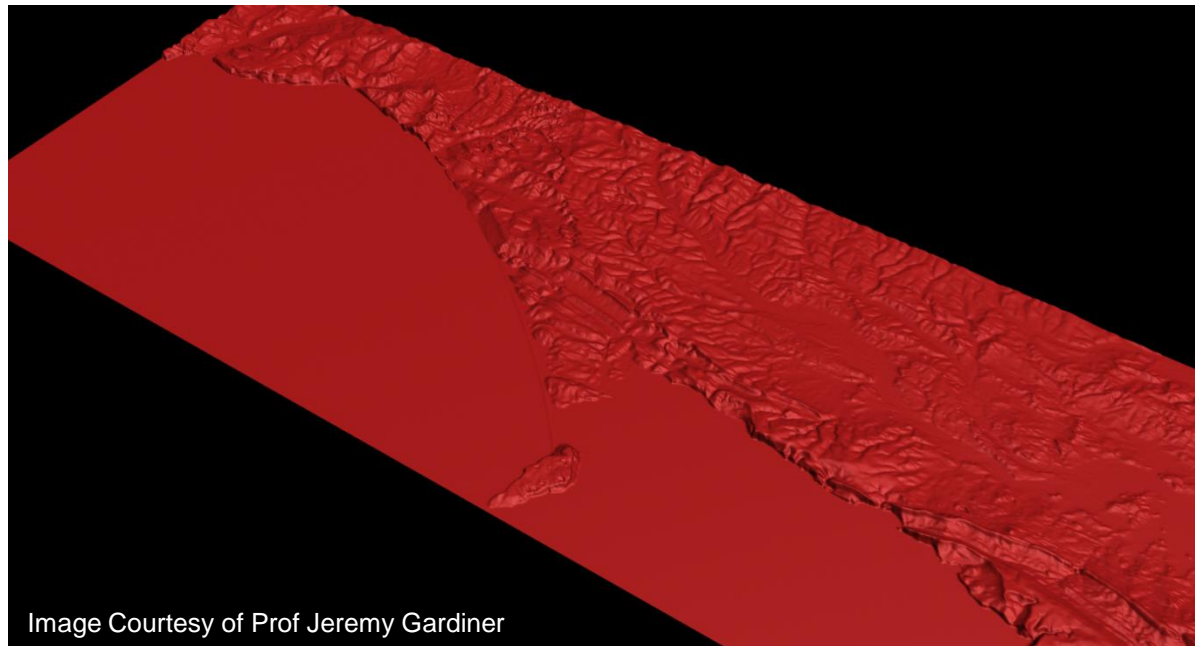


Image Courtesy of Prof Jeremy Gardiner

3D Modelling of the Jurassic Coast cont.



Images Courtesy of Prof Jeremy Gardiner

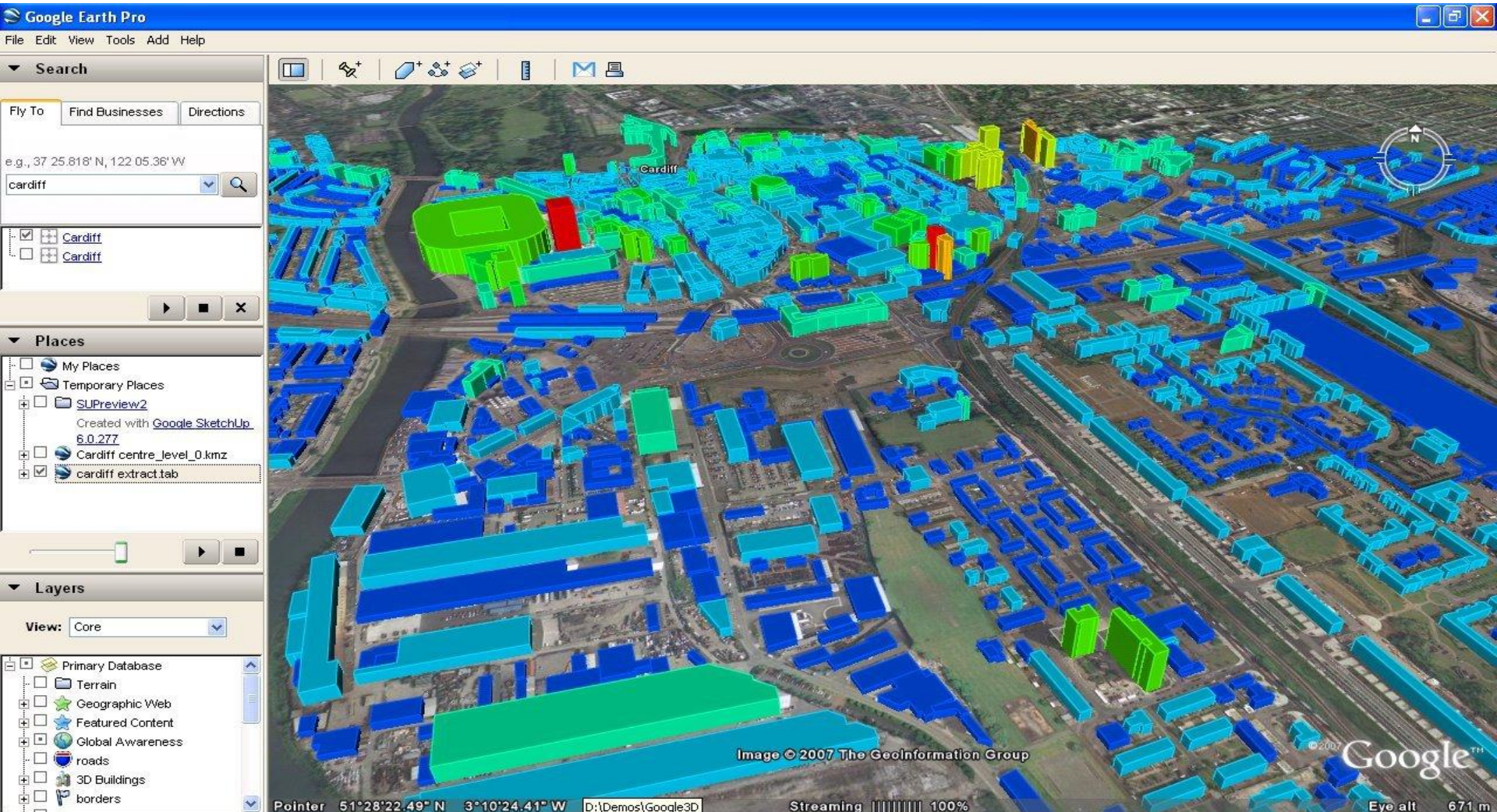
- **Subtractive Rapid Prototyping (SRP) solution**
 - Several advantages over 3D printers and other rapid prototyping systems which are more expensive, fragile and time consuming.
 - Tree axis machine, the Roland MDX 20 CNC 3 Axis mill benchtop milling machine which delivered a smooth surface finish without post finishing and gave tight tolerances up to $\pm 0.001\text{mm}$.
 - Having three axis means the cutter can be moved in the x, y and z axis simultaneously, whilst remaining perpendicular to the bed of the machine

Feature Collection

Feature collection	Format
Building Heights	Shapefile format
Building Class	Shapefile format

Provides Building Heights and Building Class data - main conurbations of the UK
Data in shapefile format & can be integrated into a GIS or Image Processing package

Mash-ups in Google Earth





Learning Zone

Quality courses developed by commercial companies and members of the academic community. Developed to **enhance knowledge** of spatial data, **facilitating applications** for research and to **support teaching and learning**.

The *courses* are broken down into discrete *units*, with units being constructed by several *topics*. Units contain exercises and reflective questions to test ability and understanding.

How to Access Learning Materials

The Learning Zone can be accessed from the perspective of a *Student/Researcher* through the **Course Selector** or from the perspective of a *Teacher/Lecturer* through the **Course Planner**. These two areas of the Learning Zone website provide further supportive information specifically for our two main audiences.

Course Selector

Benefits for Students/Researchers



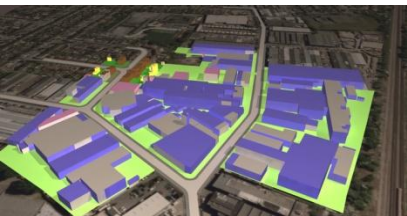
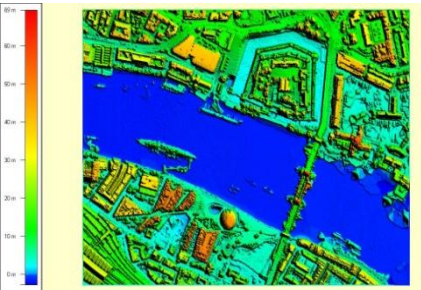
- Learn how to use spatial data by taking courses in Radar Imaging and Airborne Imaging
- Stuck on how to use some of the leading image processing softwares? Visit our courses using ENVI, Erdas, PCI, Definiens, Global Mapper and Idrisi
- Test your abilities with our exercises, quizzes and challenges

Course Planner

Benefits for Teachers/Lecturers



- Classroom guidance pages to aid using the online courses and units in a classroom environment
- Accompanying powerpoint presentations with new courses to introduce students to the subject
- Unit maps to assist in integrating online materials with your lesson plan.



• Airborne Imaging

- Modern Aerial Photography for ArcGIS
- Modern Aerial Photography for CR Viewer
- Historical Aerial Photography

• Applying Heights

- 3D Modelling with Google Sketch-Up
- LiDAR Imaging

• UKMap & Landuse

- Landuse Mapping
- Introduction to UKMap

• Image Processing

- ENVI, Idrisi Kilimanjaro, ERDAS v.9 & 2010 and PCI Geomatica

• Radar Imaging

- Introduction to Radar

• Classification Methods & Scripting

- Object Oriented Classification
- Python for ArcGIS

Level & Applications

- Airborne Imaging – Basic

- Urban sociologist looking at the change in the urban landscape with time using historic aerial photography

- Applying Heights – Basic/Intermediate

- Planning and landscape student wanting to create a basic 3D model of an urban area in Google Sketch-Up or Global Mapper
- Archaeologist wanting to understand how to use LiDAR for getting height values of an archaeological site

- UKMap & Landuse – Basic/Intermediate

- Geography student wanting to gain the skills to assess land use change for an undergraduate dissertation

- Image Processing – Intermediate

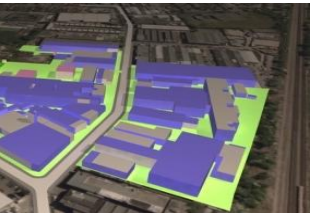
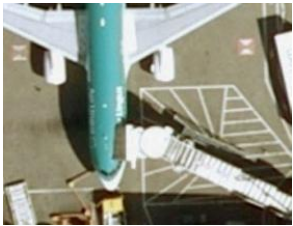
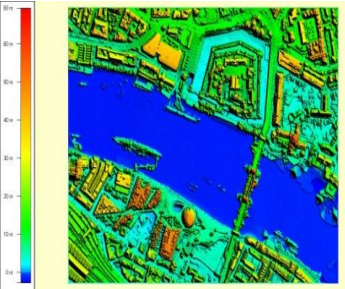
- Masters students wanting to gain essential image processing skills to incorporate satellite data into their research

- Radar Imaging – Basic/Intermediate

- Ecology Masters/PhD students wanting to learn Radar for the first time and use the data for assessing the phenology of vegetation

- Classification Methods – Advanced

- Environmental scientists wanting to create a vegetation map using an object oriented approach



OTHER SPATIAL SERVICES

TODAY'S MESSAGES:

New: Data Download!

Draw a box and get the tiles that cover your area; take all the map products you want in one order; data updates all year round; previous releases available for certain datasets. Use it now to get the most recent releases of OS Street View and OS Locator! [More Info.](#)

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Digimap News

Find us on Facebook



Digimap



Facebook social plugin

Map and Data Collections



Ordnance Survey Collection †

Contemporary Ordnance Survey maps and map data. [More information](#)



Marine Digimap †

(Access denied, subscription required)
Hydrographic and marine data from SeaZone Solutions Ltd. [More information](#)



Historic Digimap †

Historical Ordnance Survey maps from 1843 to 1996. [More information](#)



Geology Digimap †

Current British Geological Survey map data and Lexicon of named Rock Units. [More information](#)

Find and Share



GoGeo †

Search for geospatial data, information and services. [More information](#)



ShareGeo (Beta) †

Find, contribute and share geospatial data with others. [More information](#)



GeoDoc †

Create geospatial metadata for publication in GoGeo.

Did you know about...



Unlock †

Middleware gazetteer service and developer tools for georeferencing and tagging.




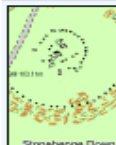

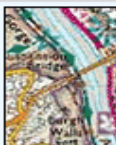


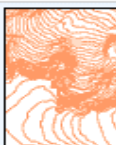
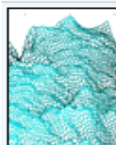
OpenStream

A free API service offering OS OpenData using WMS technology. Requires separate registration.




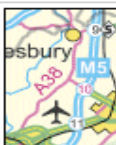

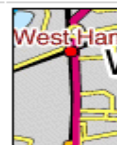
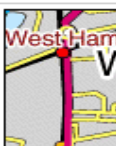


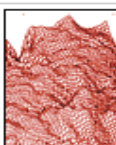
JISC † JISC funded ‡ JISC supported

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Products available under the Digimap Agreement:

	OS MasterMap (Raster) 1:1000 <input type="radio"/> TIFF*		OS MasterMap (Raster) 1:2000 <input type="radio"/> TIFF*		OS 1:10000 Scale Raster <input type="radio"/> TIFF (Compressed)
	OS 1:25000 Scale Colour Raster <input type="radio"/> TIFF (Compressed)		OS 1:50000 Scale Colour Raster <input type="radio"/> TIFF (Compressed)		OS VectorMap Local <input type="radio"/> GML (GZIP compressed)
	OS Land-Form PROFILE, 1:10000 <input type="radio"/> NTF <input type="radio"/> DXF		OS Land-Form PROFILE DTM, 1:10000 <input type="radio"/> ASC* <input type="radio"/> NTF <input type="radio"/> DXF <input type="radio"/> GeoTIFF*		

OS OpenData Products [More Info](#) (opens in new window):

	OS Street View (Raster) <input type="radio"/> TIFF (Compressed)		OS VectorMap District (Raster) <input type="radio"/> TIFF (Compressed)		OS 1:250000 Scale Raster <input type="radio"/> TIFF (Compressed)
	OS MiniScale 1:1000000 (Raster) <input type="radio"/> TIFF (ZIP compressed)		OS VectorMap District <input type="radio"/> SHP		OS Meridian 2, 1:50000 <input type="radio"/> NTF <input type="radio"/> DXF
	OS Meridian 2, 1:50000 <input type="radio"/> SHP		OS Strategi, 1:250000 <input type="radio"/> NTF <input type="radio"/> DXF <input type="radio"/> SHP <input type="radio"/> MID/MIF		OS Land-Form PANORAMA, 1:50000 <input type="radio"/> NTF <input type="radio"/> DXF
	OS Land-Form PANORAMA DTM, 1:50000 <input type="radio"/> NTF <input type="radio"/> DXF <input type="radio"/> ASC <input type="radio"/> GeoTIFF*				

Website: <http://edina.ac.uk/digimap/>
 Helpdesk: edina@ed.ac.uk
 Twitter: @EDINA_Digimap

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- ▶ [Services](#)
- ▶ [Datasets](#)
- ▶ [Data access](#)
- ▶ [Supported science](#)
- ▶ [Collaborative projects](#)
- ▶ [Publications](#)
- ▶ [Help: FAQ](#)
- ▶ [Staff](#)
- ▶ [Contact](#)
- ▶ [Data portal](#)
- ▶ [News](#)
- ▶ [Manage My Account](#)
- ▶ [PML RSG](#)
- ▶ [UoD DSRS](#)

Datasets

NEODAAS is able to provide a range of data products derived from various polar-orbiting and geostationary sensors. To access any of these datasets, please refer to the [data access page](#). For information on how to use the data products, please see the [FAQ](#) or [contact us](#).

Products available include:

- Quicklooks and thumbnails (for all levels of data), examples include:
 - top-of-atmosphere single channel images
 - top-of-atmosphere composite images
 - [Synthetic Aperture Radar Images](#)
- Level 0 (unprocessed instrument data)
- Level 1 data (geolocated, unprocessed instrument data including calibration parameters)
- Level 2 (derived geophysical variables), examples include:
 - [Vegetation indices](#)
 - [Sea surface temperature](#)
 - [Ocean colour](#)
- Level 3 (temporally and/or spatially binned level 2 data), examples include:
 - Daily montage for a single product and region
 - Weekly and monthly binned composites for a single product and region
- Variables derived from multiple measurements, examples include:
 - Primary production
 - Front analyses
 - Inherent optical properties (IOPs)
- Third party products (user specified)

[NERC Spatial Data Services](http://www.neodaas.ac.uk/data/)
<http://www.neodaas.ac.uk/data/>
<http://neodc.nerc.ac.uk/>
<http://arsf.nerc.ac.uk/>



- Data Contributions
- Data Guides
- Data Policies
- Restricted Access

- EROS Data Center
- Global Change Master Directory
- MODIS Rapid Response
- MODIS-Terra Data in MODAPS
- USGS Global Visualization Viewer

Data & Products

Imagery and products can be accessed from this list or using the [Earth Science Data Interface](#). Users are also asked to consider GLCF [data policies](#), especially providing appropriate citations when displaying imagery or products downloaded from this site.

Satellite Imagery



L1B Imagery



Landsat ETM+
Landsat MSS
Landsat TM
GeoCover
Global Land Survey
Surface Reflectance



Fine Resolution Imagery



32-day Composites
16-day Composite



Fine Resolution Imagery



30m Elevation Imagery
90m Elevation Imagery
1km Elevation Imagery



Fine Resolution Imagery

Products Derived from Satellite Imagery



- Forest Change Products
 - Amazon Basin
 - Central Africa
 - Paraguay
- Landsat Mosaics
- Landsat Subsets
- Coastal Marsh Health Index



- GLSDEM



- Flood Maps
- Vegetative Cover Conversion (VCC)
- Vegetation Continuous Fields (VCF)
- Vegetation Index (NDVI)
- Water Mask



- Radiative Fluxes



- GIMMS
- GloPEM
- Land Cover Classification
- Tree Cover Continuous Fields
- Burned Areas in Russia



- 2008 China quake
- Hurricane Katrina
- Hurricane Rita
- 2004 Tsunami



Vector Products

Questions?

Contact the GLCF for any questions regarding these data collections and a response will be provided within three business days.

<http://glcf.umiacs.umd.edu/data/>





- OS OpenData

- MiniScale® (Raster)
- 1:250 000 Scale Colour Raster
- OS Street View® (Raster)
- Boundary-Line™ (Vector)
- Code-Point® Open (Point Data)
- 1:50 000 Scale Gazetteer (Point Data)
- Strategi® (Vector)
- Meridian™2 (Vector)
- OS Locator™ (Point Data)
- Land-Form PANORAMA® Vector (Contours), Grid (DTM)
- OS VectorMap™ District (Vector and Raster)

- **Free to Download:**

<https://www.ordnancesurvey.co.uk/opendatadownload/products.html>

Further Reading

- **Spatial Analysis Methods**

- Lillesand, T., Kiefer, R.W. and Chipman, J. (2008) Remote Sensing and Image Interpretation, 6th edition. Wiley: London [ISBN 978-0-470-05245-7]
- Longley, P. Goodchild, M and Rhind, D. (2001) Geographic Information Systems and Science John Wiley and Sons : Chichester [ISBN: 0471892750]
- Heywood I, Cornelius S and Caver S. An Introduction to Geographical Information Systems Second Edition Prentice Hall [ISBN 0130611980]

- **Online Resources**

- Geospatial Analysis - A comprehensive guide by Dr Michael de Smith and Prof Paul Longley, University College London, and Prof Mike Goodchild, UC Santa Barbara <http://www.spatialanalysisonline.com/>
- Open Geospatial Consortium: <http://www.opengeospatial.org/>

Thanks for Listening 😊

Email: Gail.Millin-Chalabi@manchester.ac.uk

Twitter: Follow @gmillin7chalabi or @landmap

Website: landmap.mimas.ac.uk