

University of Jaén, Spain, 19 November 2014

Serving society with relevant and reliable information from imagery

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Treasurer
International Society for Photogrammetry and Remote Sensing



UNIVERSIDAD DE JAÉN



School of
**Civil Engineering
& Geosciences**

CESER





Overview

- Newcastle University
- ISPRS
- Challenges
- Meeting the challenges
- Some advertisements...

Newcastle University







River Tyne

City Centre

University Campus

Chinatown

Football Ground

Business School

Science Central



Vision and Mission

- We aim to be a world-class, research-intensive university, to deliver teaching and learning of the highest quality, and to play a leading role in the economic, social and cultural development of the North East of England.
- *Our vision is of Newcastle as a civic university with a global reputation for academic excellence.*



Facts and figures

- Russell Group University
 - Ranked c. 20 – 30 in UK league tables
 - Ranked c. 120 – 200 in world league tables
- International outposts in Malaysia, Singapore, China
- 22,874 students
 - 16,872 Undergraduate students (2,017 int'l)
 - 6,002 Postgraduate students (2,861 int'l)
- 5,429 staff
- Annual income £405.3m (c. Euro 515m)



School of Civil Engineering and Geosciences

Research and teaching in civil engineering, geomatics and geochemistry

- 184 staff, 877 students
- 2013-14
 - Income > £18.3M
 - > £8M new research awards p.a.
- RAE 2008:
 - 20% 4* (world leading)
 - 70% 3* (internationally excellent)
 - 10% 2* (internationally recognised)
- NSS 2014: 90% satisfaction





Some of our staff





Our disciplines



Geoscience

- Earth Systems Biogeochemistry
- Geoenergy

Water

- Catchment hydrology and sustainable management
- Hydroinformatics
- Flood risk and coastal management
- Climate change impact assessment

Environmental Engineering

- Application of ecological principles to wastewater treatment systems
- Treatment systems for acidic and metaliferous waters
- Chemical and biological interactions in contaminated milieu

Geomatics

- Geophysical geodesy
- Geodetic and photogrammetric engineering
- Geographic information science

Geotechnical and Structural Engineering

- Numerical methods in multi-phase and solid mechanics
- Constitutive modelling of geo-materials and composites
- Multiple scales measurements for geo-materials and structural mechanics

Transport

- Intelligent Transport Systems
- Environment??
- Travel behaviour

International Society for Photogrammetry and Remote Sensing

ISPRS





ISPRS is...

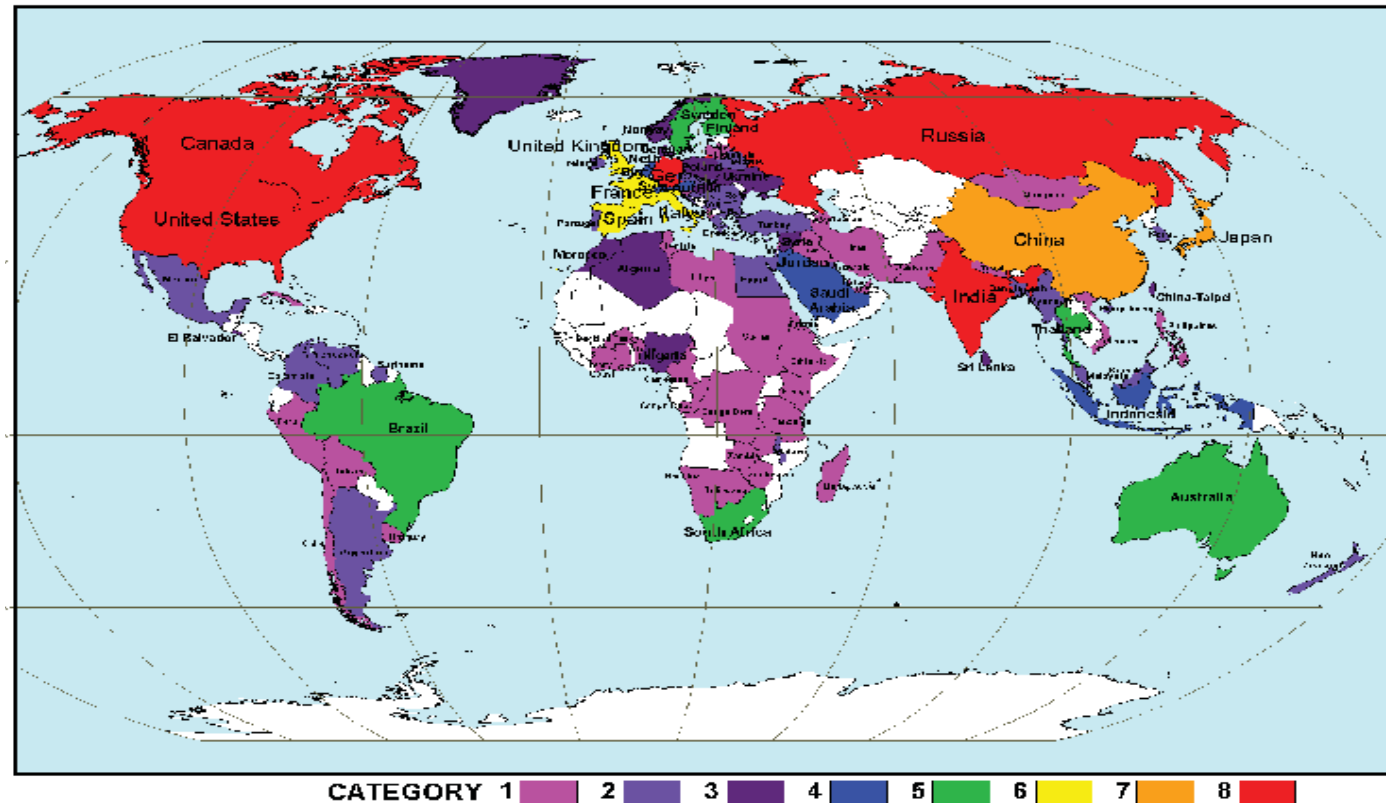
- ...an international NGO with a focus on
 - **science and development** in
 - photogrammetry, remote sensing, spatial information
 - cooperation between **different stake holders**
 - academia, private industry, government, end users
 - truly **global** cooperation
 - **education**, technology transfer, capacity building



ISPRS

A global society of organisations

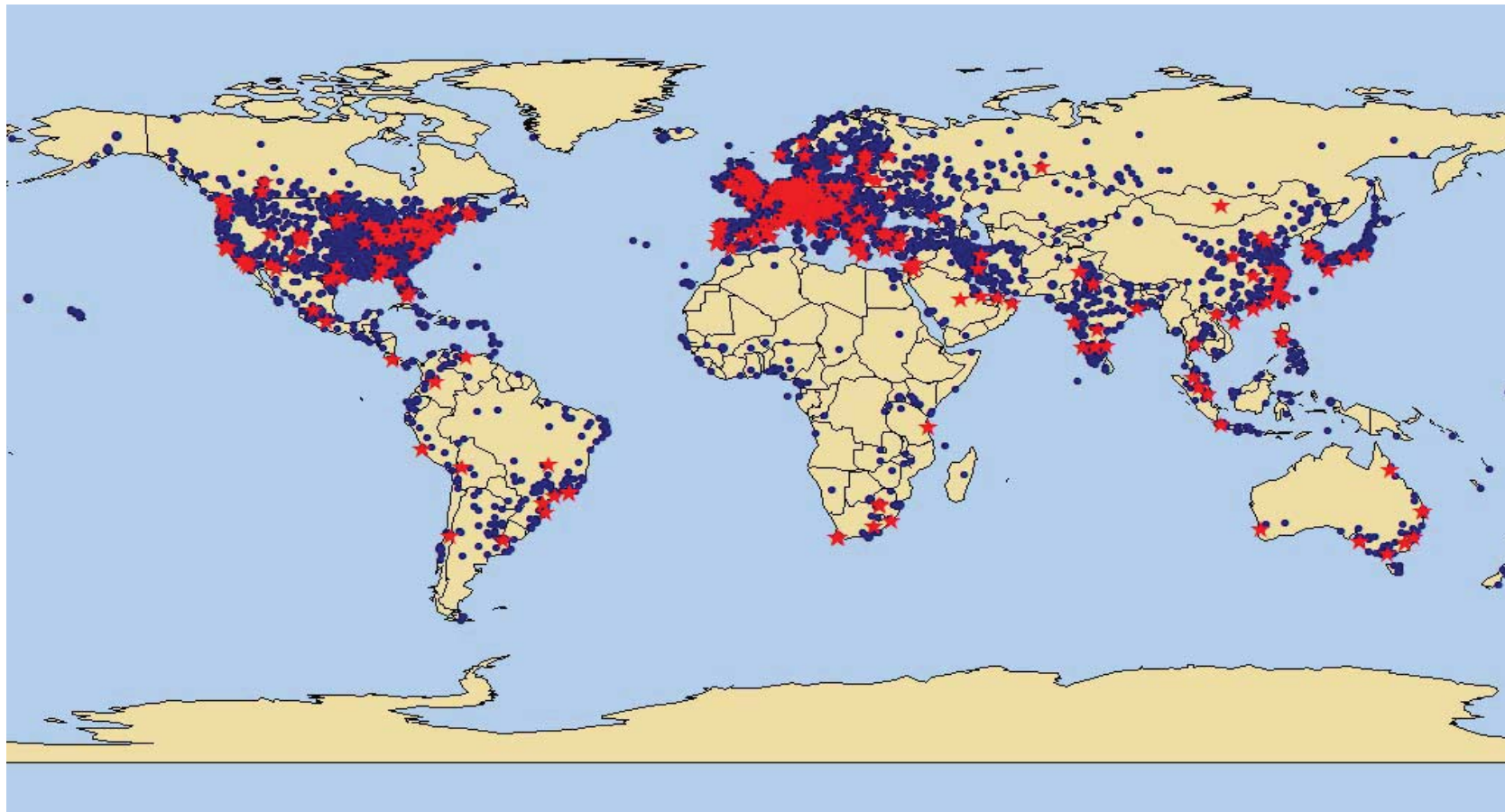
ISPRS Ordinary Members



Produced by: Yoav Steinberg, GIS & RS Laboratories, University of Haifa, Israel
 2004-11-10



Visitors to ISPRS webpage





ISPRS mission: why we exist

- ... to advance the photogrammetry, remote sensing and spatial information **sciences** through international cooperation in **research**, **development** and **education** for the benefit of society and for environmental sustainability.

(from ISPRS Strategic Plan 2010)



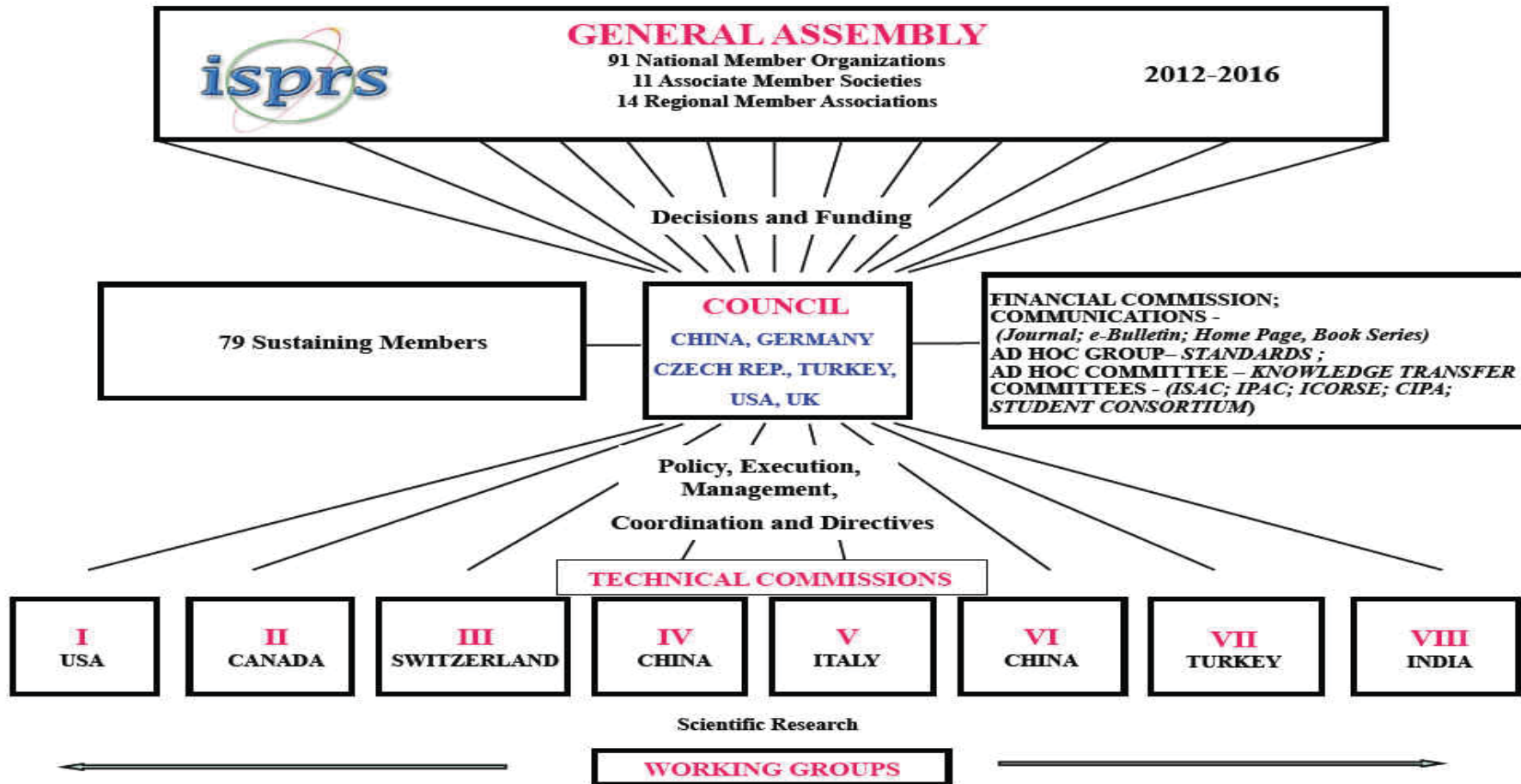
ISPRS: beyond photogrammetry

- Today, ISPRS activities include acquisition, modelling, analysis, database management and visualisation of geospatial data in different applications with a focus on imagery:

Information from Imagery



ISPRS structure



“ISPRS is a Society of National Societies and Organizations”



8 Technical Commissions (2012 – 16)

No.	Commission title	President
I	Sensors and platforms for remote sensing	Charles Toth (USA)
II	Theory and concepts of spatial information science	Songnian Li (CAN)
III	Photogrammetric computer vision and image analysis	Konrad Schindler (CH)
IV	Geospatial databases and location based services	Jie Jiang (China)
V	Close-range imaging, analysis and applications	Fabio Remondino (Italy)
VI	Education, technology transfer and capacity building	Jianya Gong (China)
VII	Thematic processing, modeling and analysis of remotely sensed data	Filiz Sunar (Turkey)
VIII	Remote sensing applications and policies	Vinay K. Dadhwal (India)

Ample cooperation within and across commissions



Challenges





Challenges: society, policy, industry

- **ICT development, internet time**
 - I want it **NOW**, 24/7
 - open source, open data, open standards
- **Need for global geospatial information**
 - rapid response to key global challenges
 - climate change, disaster management, peace and security, environmental quality, demographic change, migration, ...
- **Changing roles of governments**
 - lean state: from producer to clearing house
 - relaxed resolution restrictions
 - consequences of financial crisis in many countries



Challenges: society, policy, industry

- **Changes in the commercial sector**
 - new big players: Google, Microsoft, Oracle, ...
 - fusion of formerly independent companies
 - growing capability in GIS development and LBS
 - production in countries with low wages
- **Need for coordination** of GI management
 - among countries and commercial companies
 - between **countries and internat. organizations**
 - “spatial is not special any more”



Challenges: society, policy, industry

- **standardization, interoperability and sharing**
 - of data and services
 - by overcoming legal and institutional barriers
- **best practices** of geospatial information management
 - compilation and dissemination
- effective strategies for **capacity building**
 - for management of geospatial information
 - especially in developing countries



Challenges: research & development

- **better** sensors, **new** sensors, sensor

- nadir and oblique aerial im
- ever improving res
- image sen
- ...

.. not to be forgotten:

terra or **petabytes of dump data** (pixels) per

day (in part for crowd sourcing)

- **non-conventional** platforms: UAV, mobile mapping, ...



Challenges: research & development

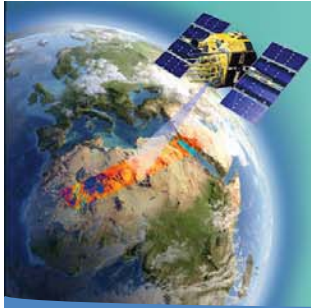
- **full 3D**, needing data fusion, e.g. airborne + terrestrial
- **change** monitoring, database **update**, **prediction**
- **real-time processing** (navigation, driver assistance, traffic monitoring, safety and security applications, ...)
- **distributed** processing (speed, integrity, scalability)
- crowd sourcing: new mechanisms for **trust and reliability**
- increased **automation** (a sheer necessity)
- towards **consumer market** products (another necessity)
 - embedded photogrammetry
 - connection to CV, CG and game engines



Meeting the challenges



KEEP
CALM
AND
CARRY
ON



Climate change

Direct observations of recent climate change



Global average temperature

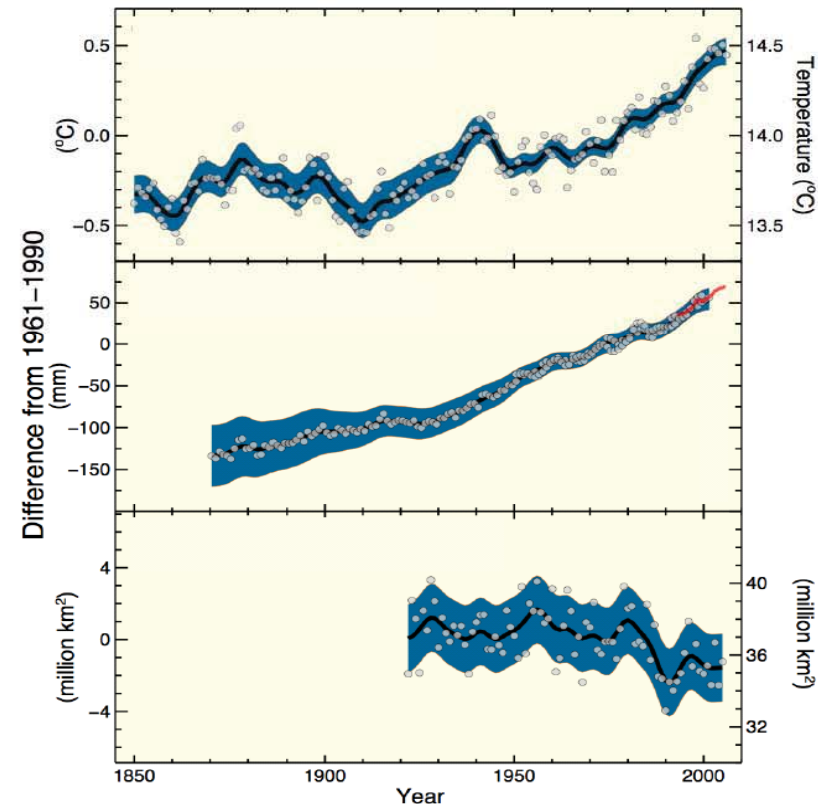


Global average sea level



Northern hemisphere
snow cover

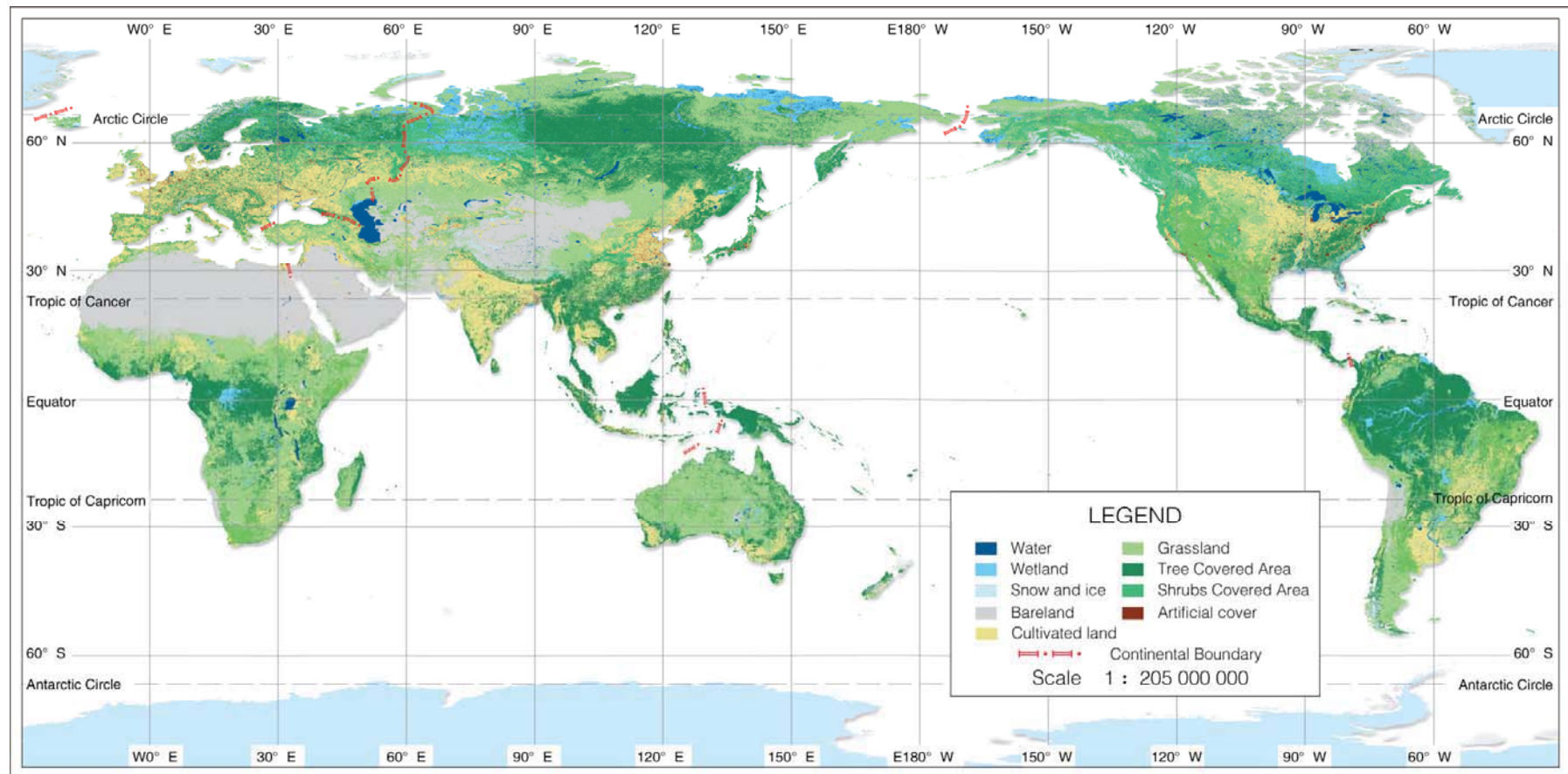
Changes in temperature, sea level and
northern hemisphere snow cover

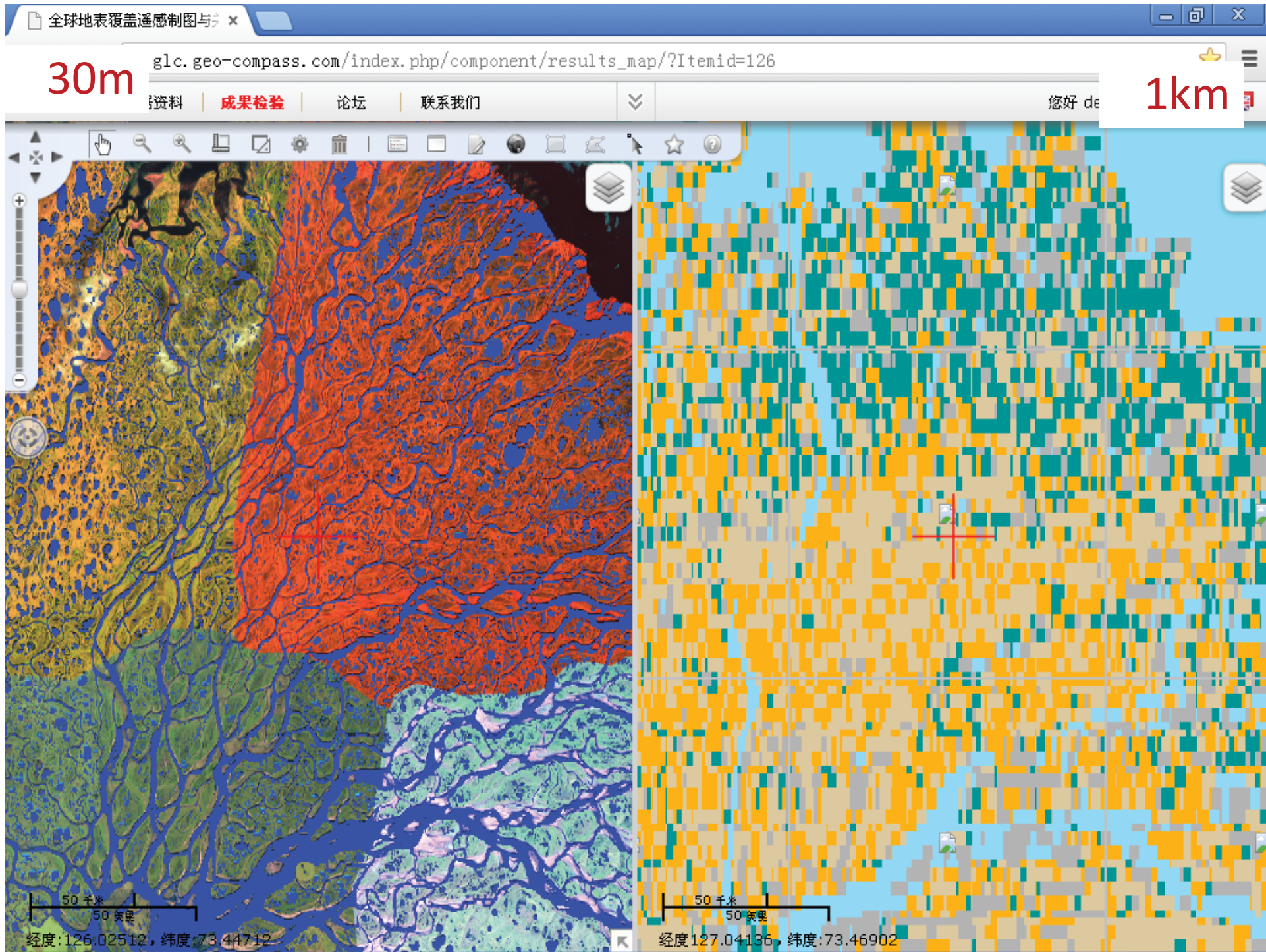


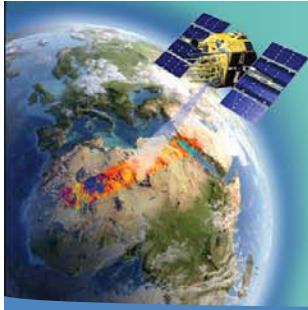


Global change

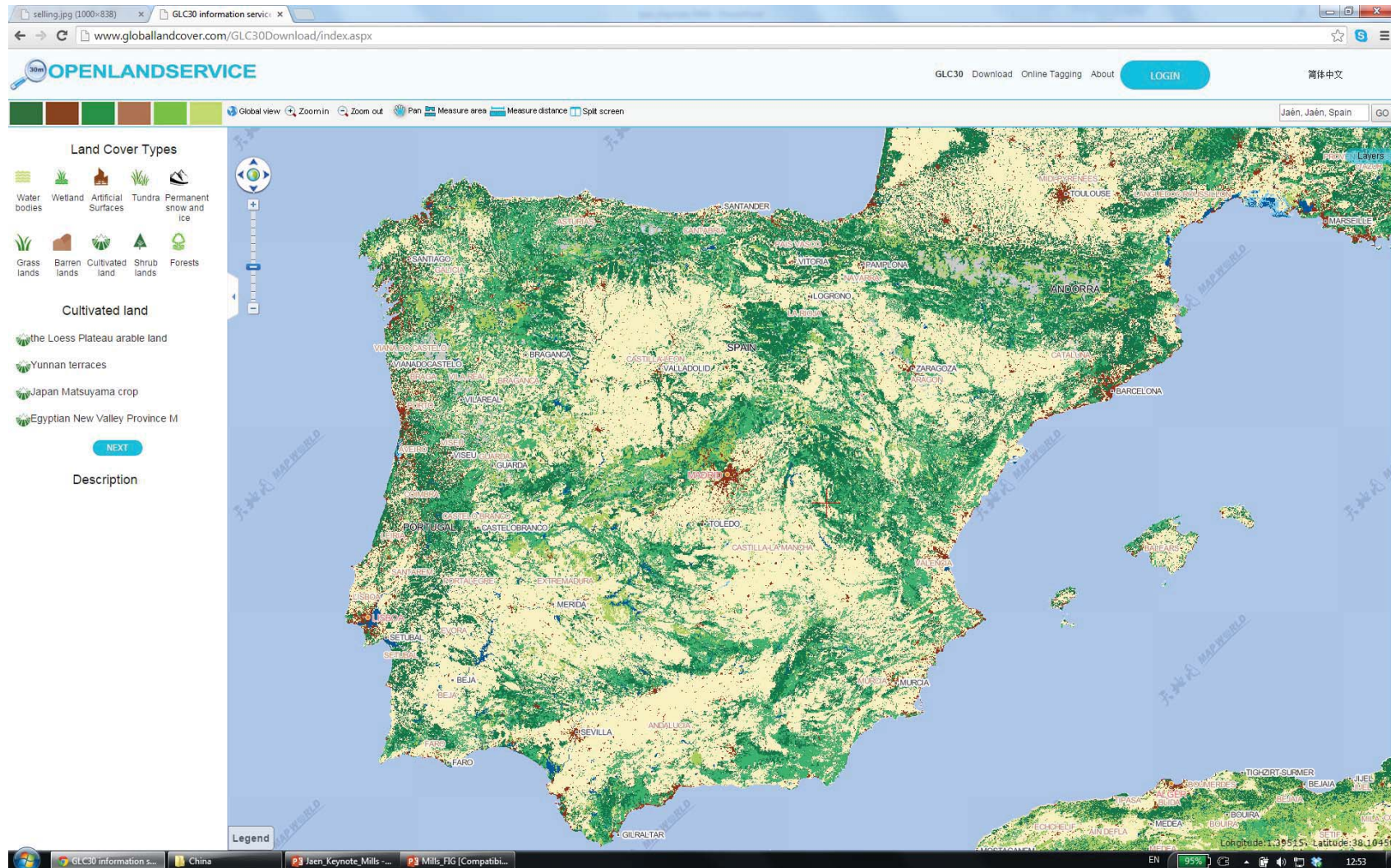
GlobalLand 30: 2010







www.globallandcover.com





Antarctica

BBC News - Esa's Cryosat x

www.bbc.co.uk/news/science-environment-27465050

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19 May 2014 Last updated at 10:33

Esa's Cryosat mission sees Antarctic ice losses double

By Jonathan Amos
Science correspondent, BBC News



Antarctica is now losing about 160 billion tonnes of ice a year to the ocean - twice as much as when the continent was last surveyed.

The new assessment comes from Europe's Sentinel-1A satellite, which has

Top Stories

- UK house prices 'up 8% in a year'
- Man guilty of Syria terror plan
- US Coast Guard 'did all it could'
- PM extradition call after Hamza case
- Thailand army declares martial law

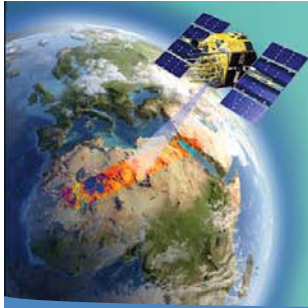
Features

- Cool it**
10 ways to take the heat out of housing
- Quantum conundrum**
Is \$15m machine a glimpse of future computing?
- Piscine Molitor**
The pool where Tarzan was a lifeguard
- Disabled and broody**
'Why I decided not to have children'
- 'Poorest president'**
Spaniards swoon over a president - but not their own

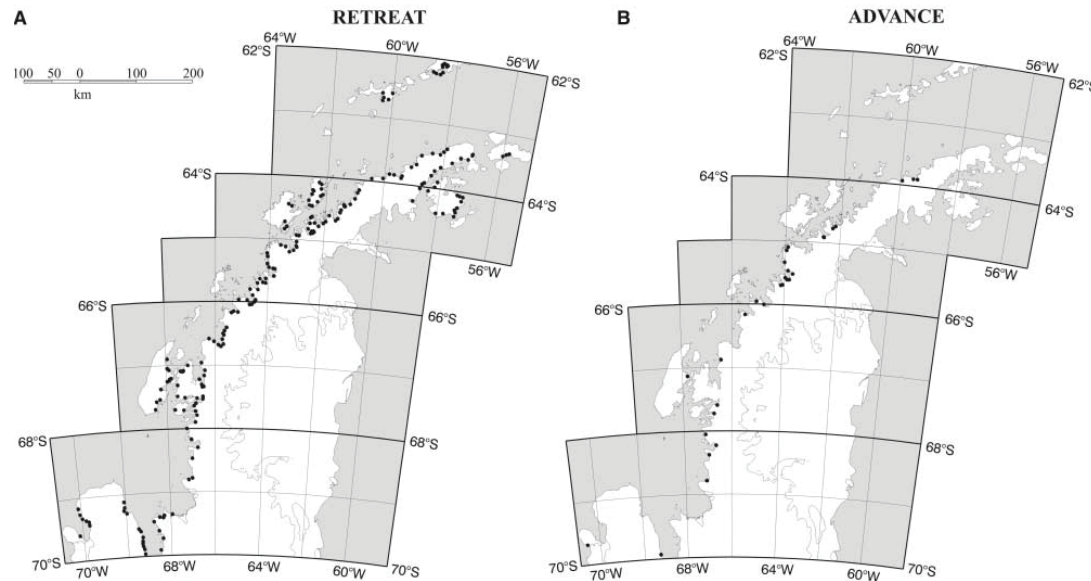
Related Stories

- 'Nothing can stop election' retreat

Most Popular



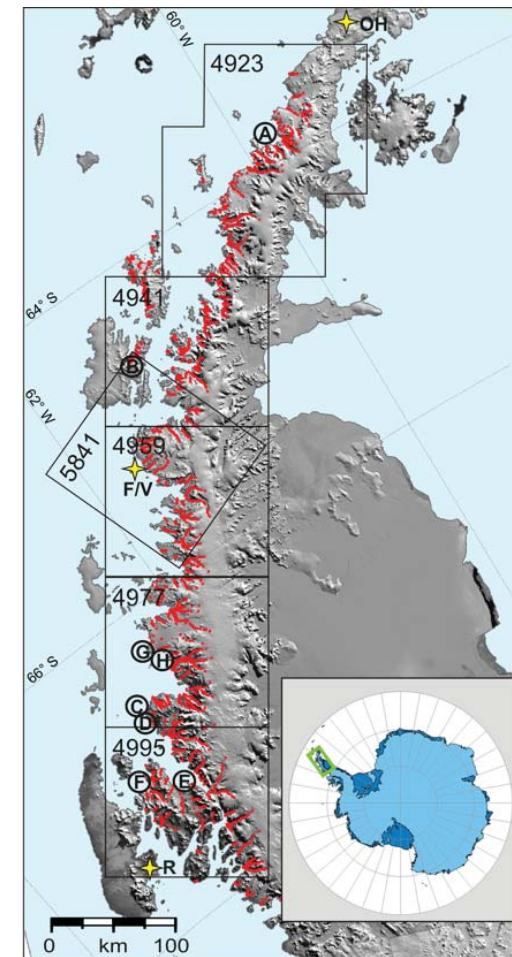
Western Antarctic Peninsula



Cook et al. (2005), Science

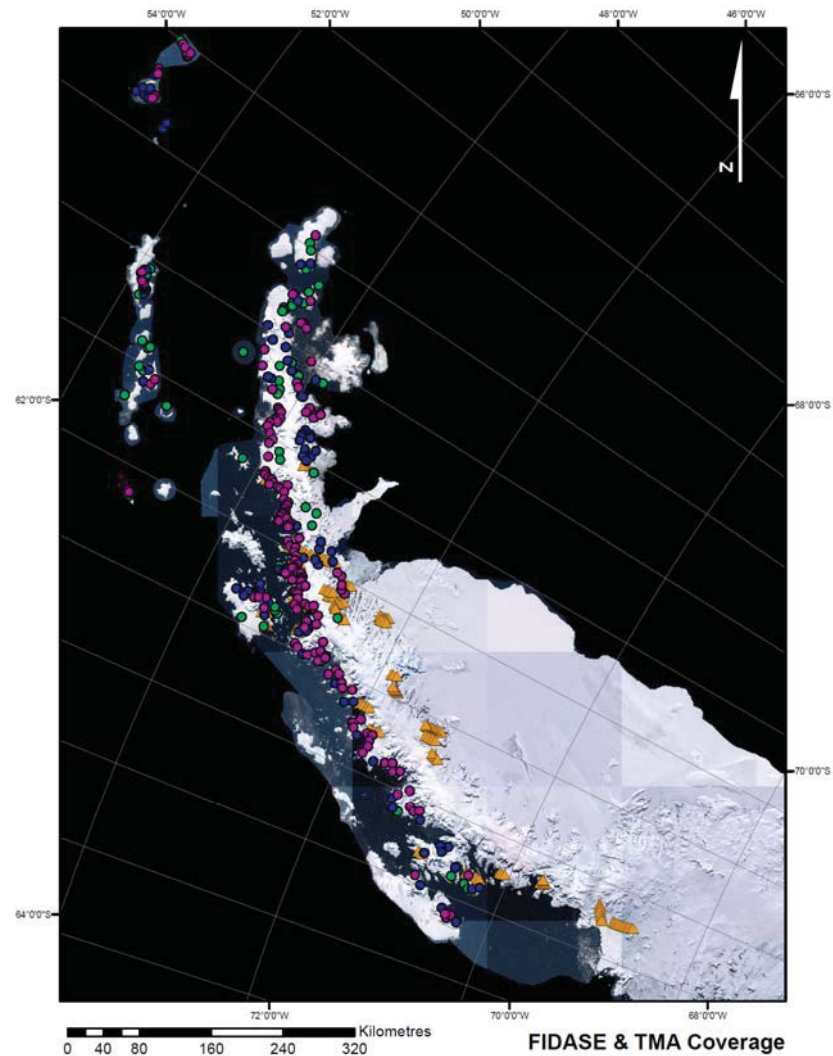
- Temperature increase
- Glacier retreat and acceleration
- Surface lowering?

Pritchard & Vaughan (2007), JGR





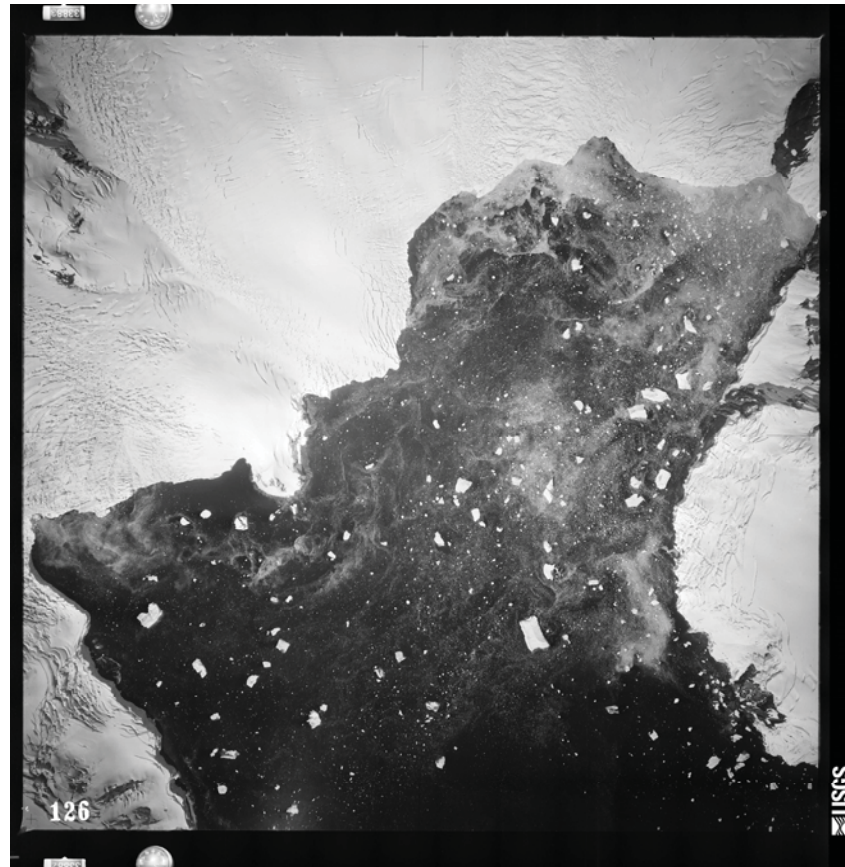
Data and study area

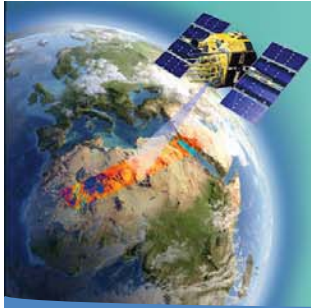




FIDASE imagery

- 1956-57 Falklands Islands Dependencies Aerial Survey Expedition

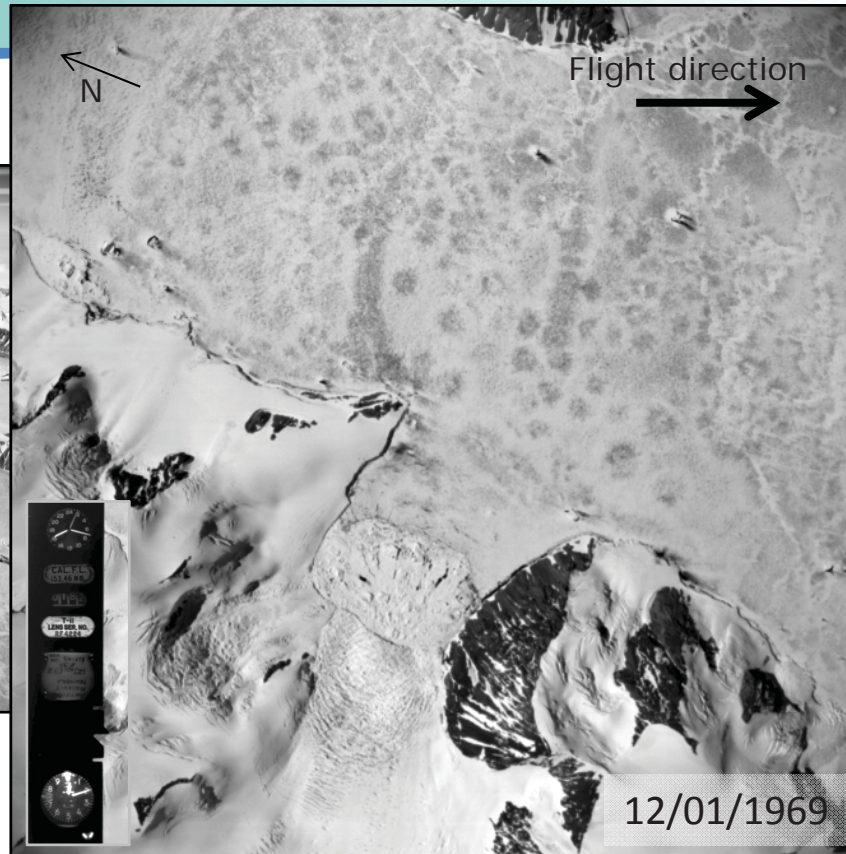




TMA imagery



Left oblique



Metadata

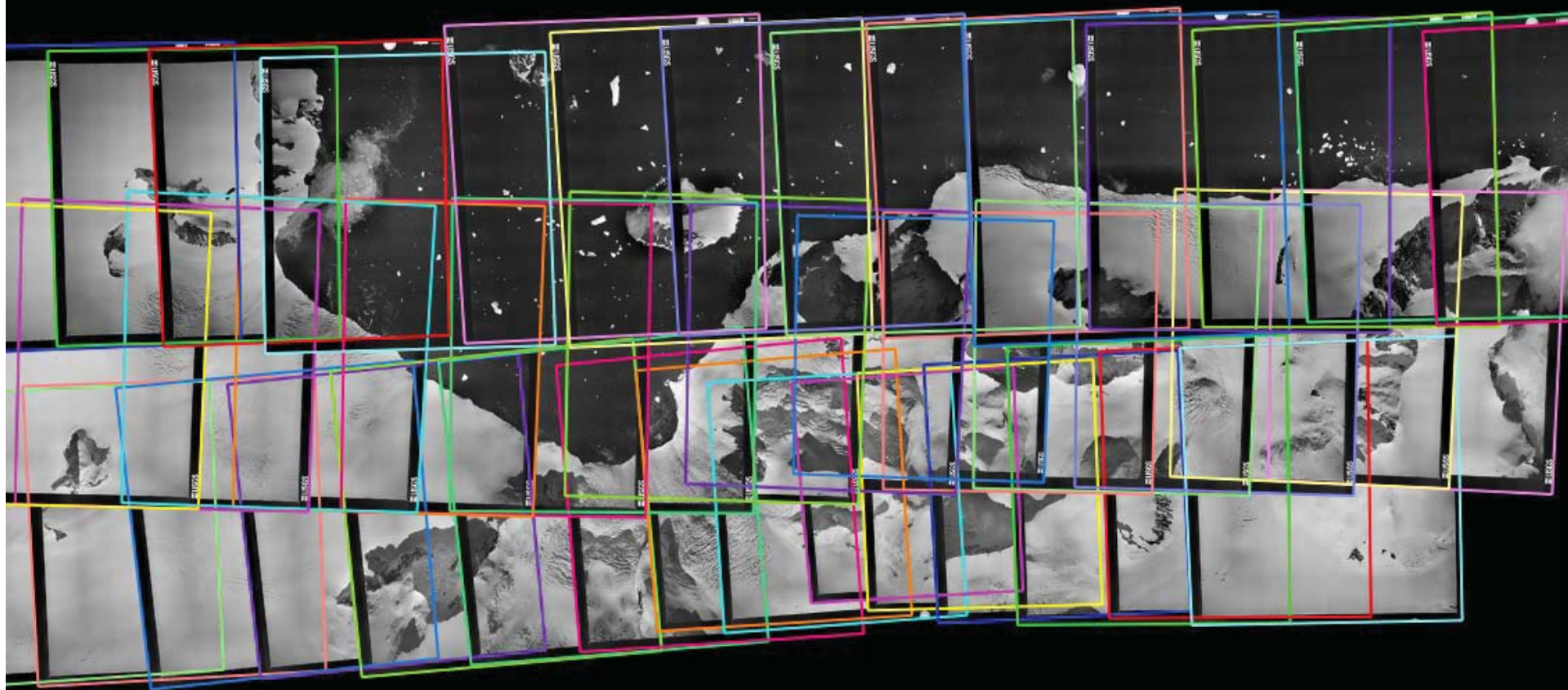
Vertical



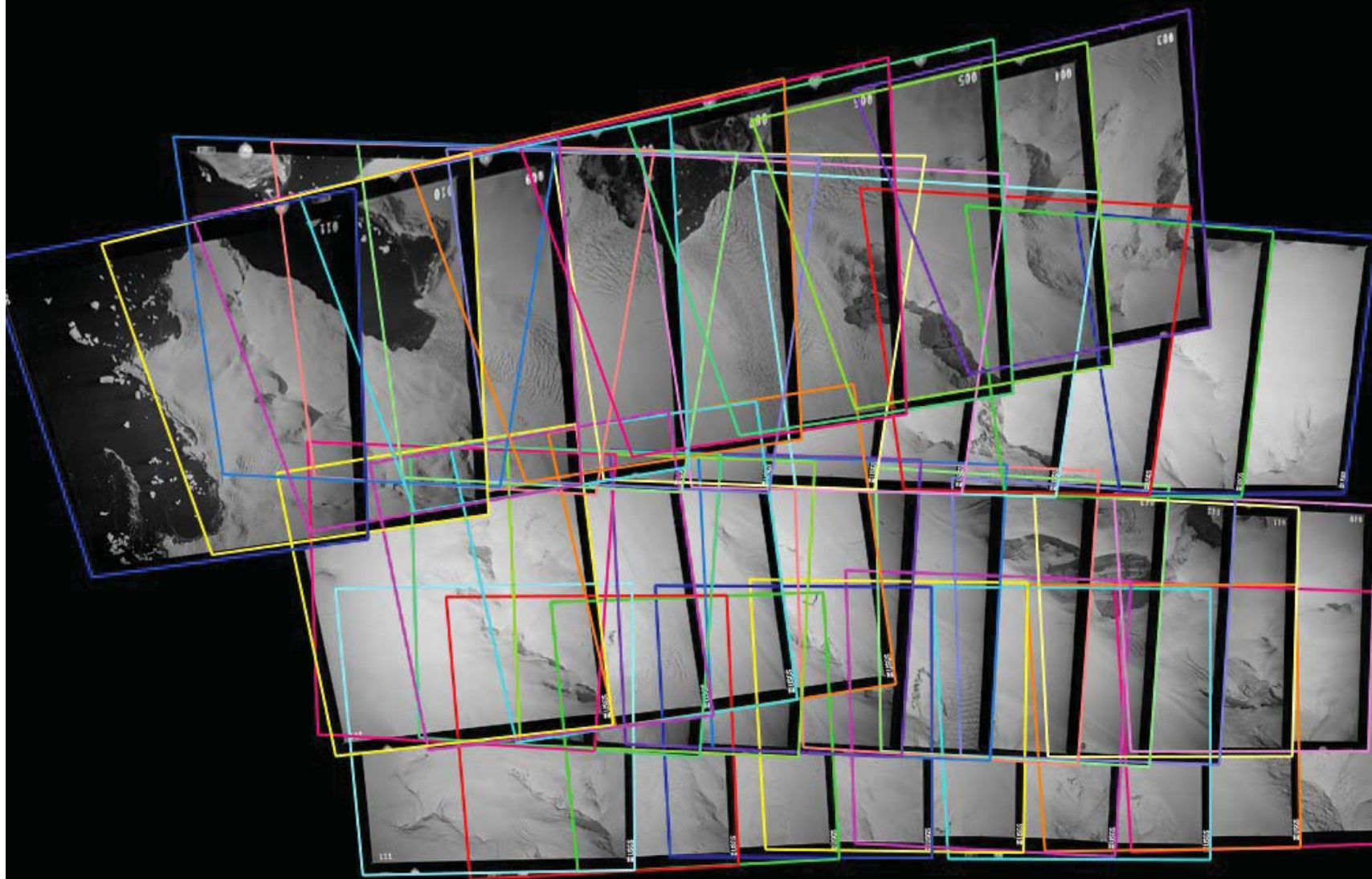
Right oblique

- Freely available at [EarthExplorer.usgs.gov](https://earthexplorer.usgs.gov)

Sheldon and adjacent glaciers

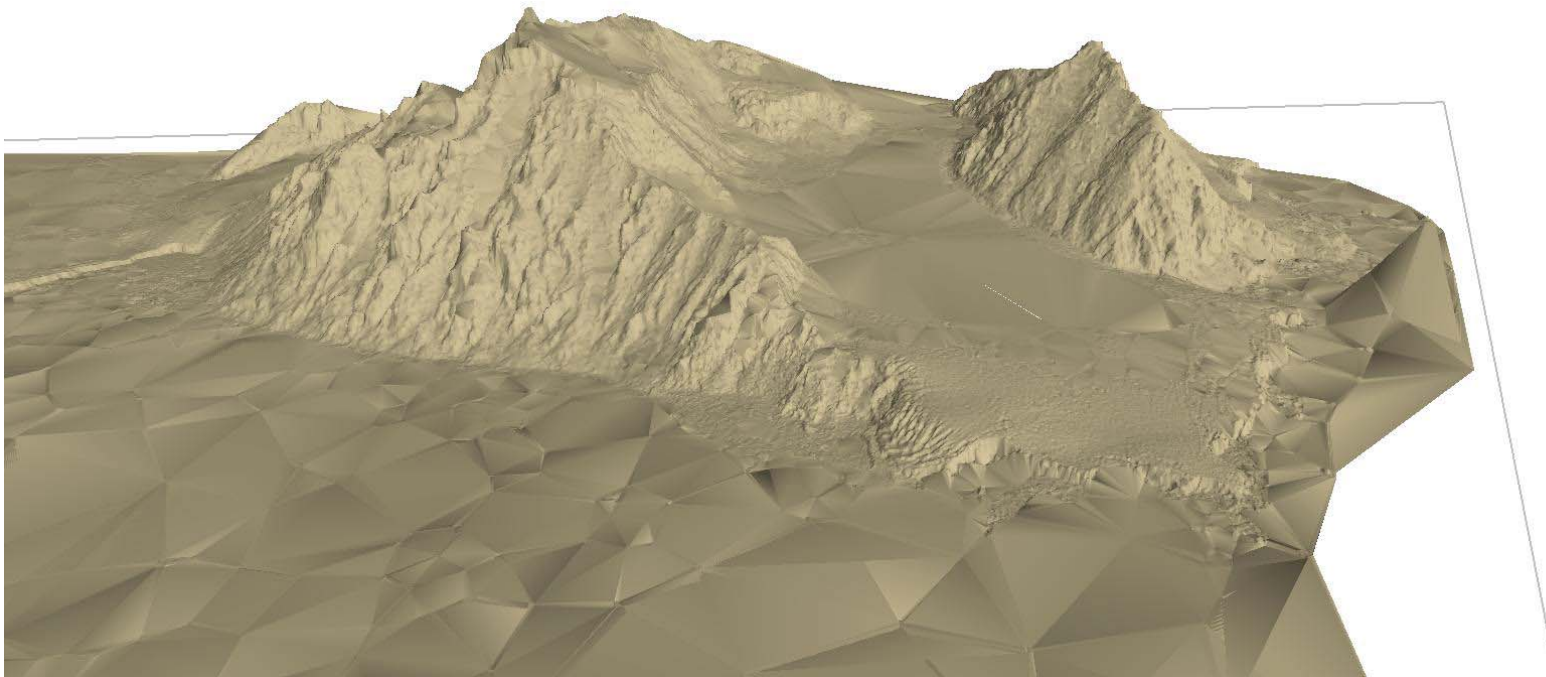
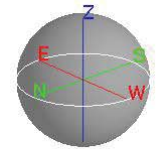


Breguet Glacier



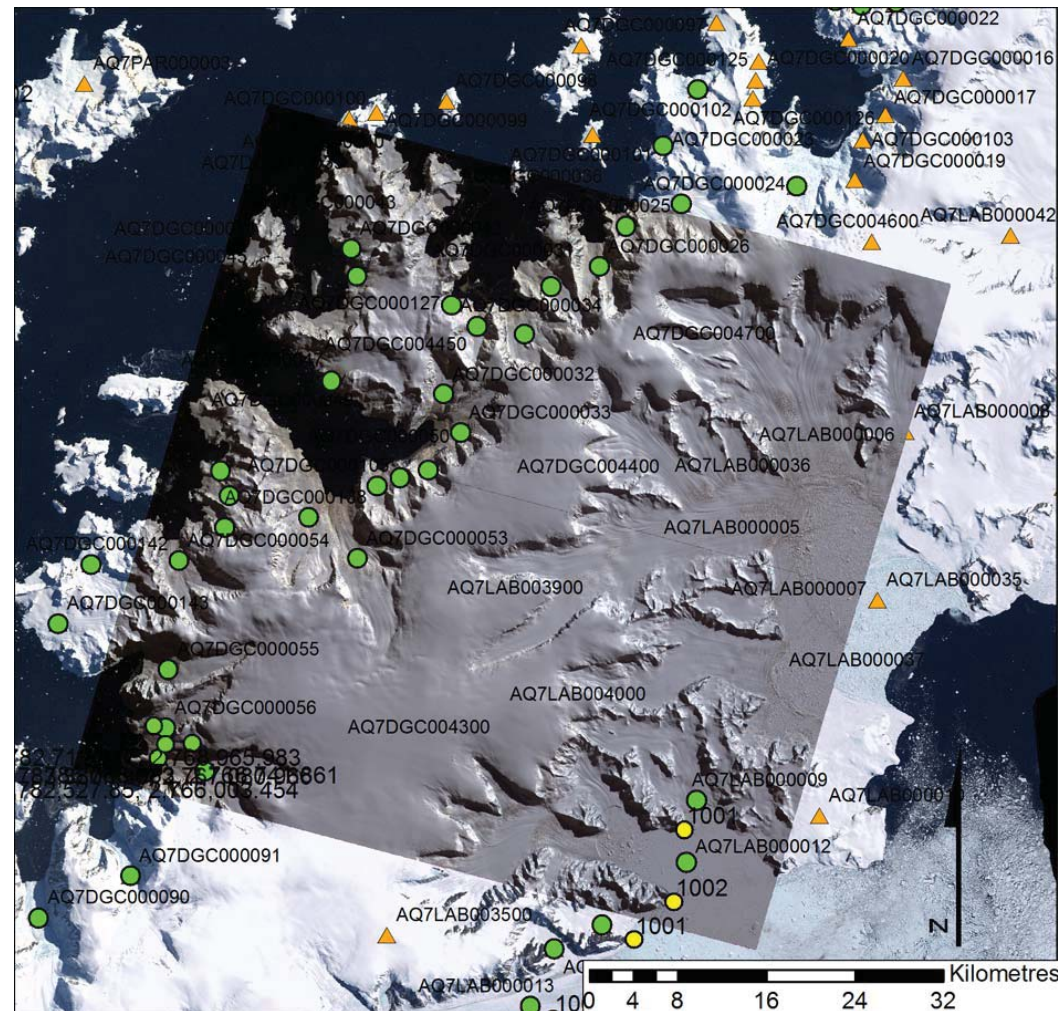


DEM (1m TIN) from FIDASE

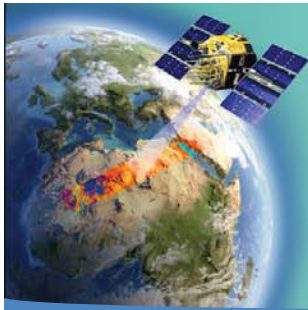




ASTER data







Methodology

1940s-1980s

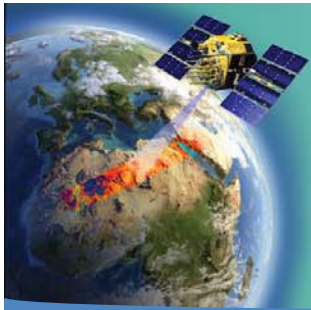
- USGS / BAS aerial photography

2000s

- ASTER imagery
- BAS aerial photography
- Lidar / LVIS / EarthWatch, etc...

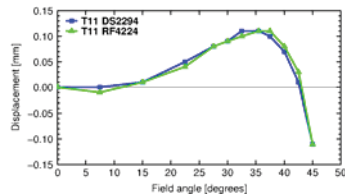
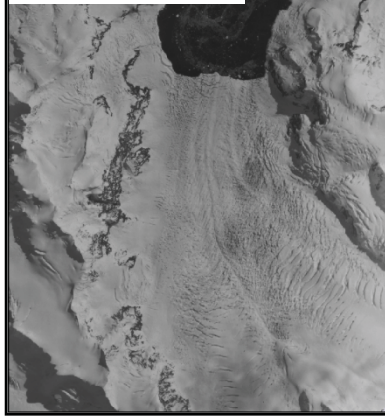
Problem of orientation between archival (USGS/BAS) & modern (ASTER/photography/lidar) data due to lack of ground control or lost calibration data

Biased measurements of change



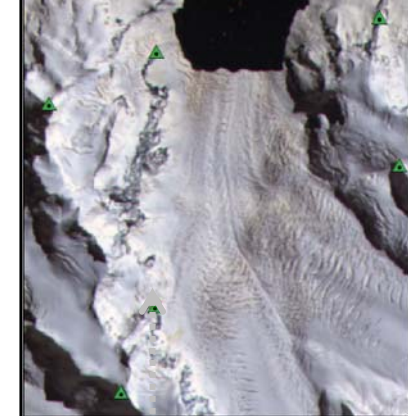
Workflow

USGS 1968

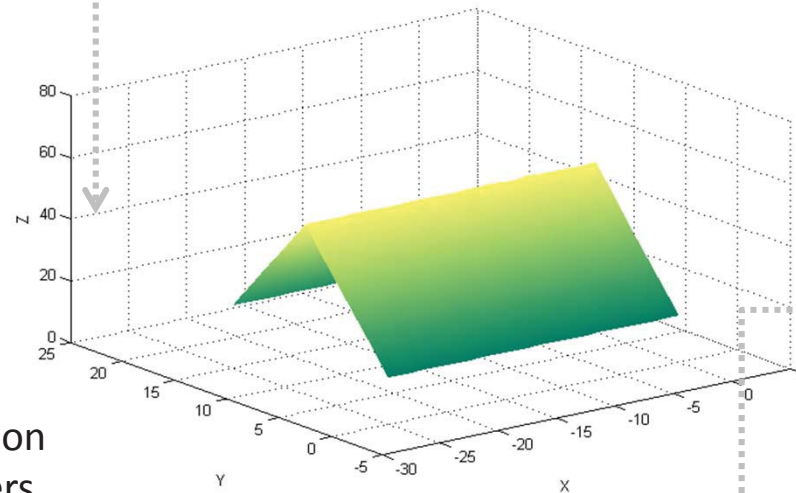


DEM extraction

ASTER 2005



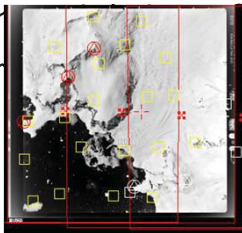
Robust surface matching



- 7 Parameter transformation

- Downsample outliers

- Minimise distance



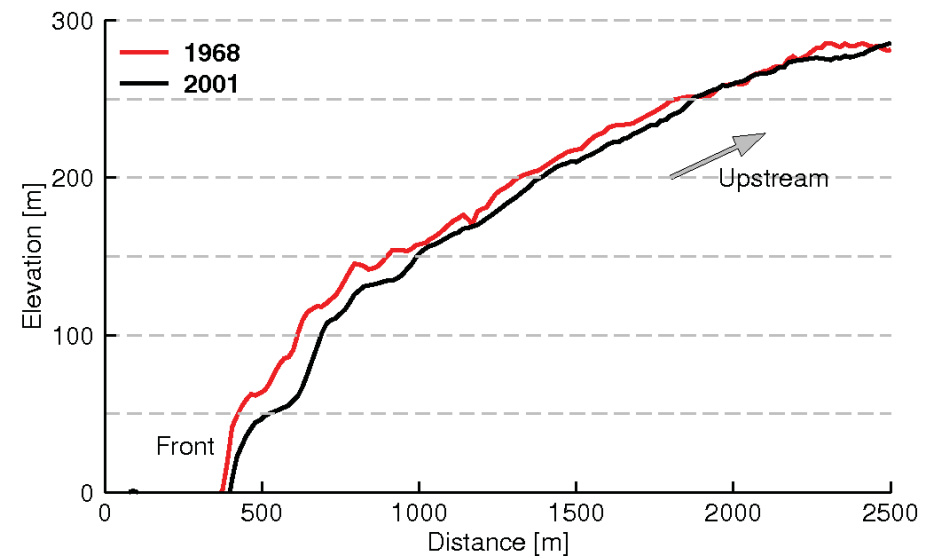
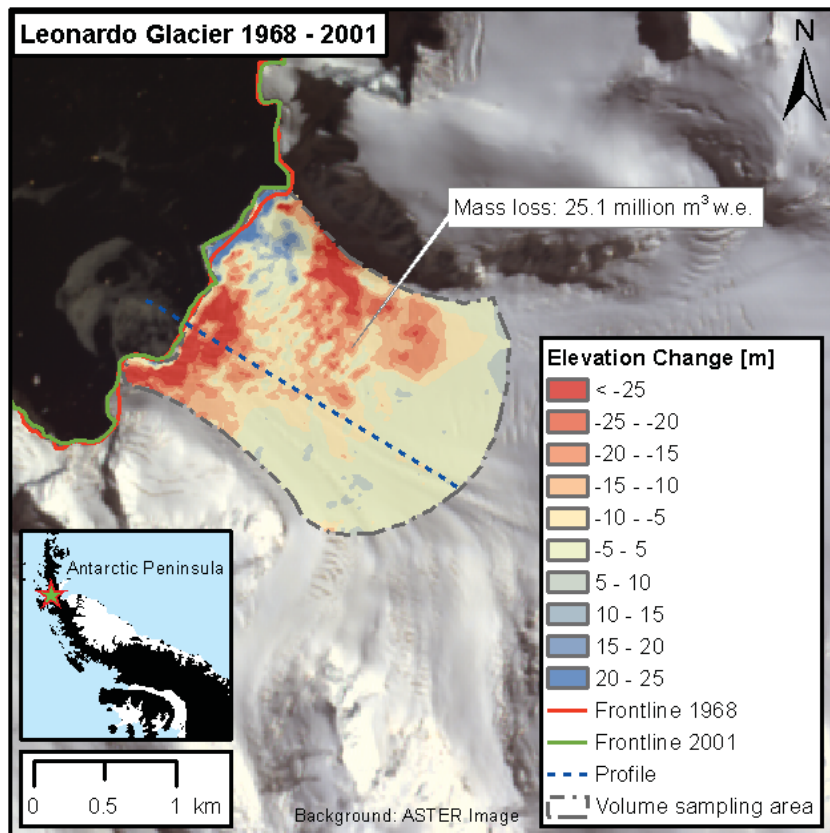
- Ground control extracted from ASTER DEM to

initialise USGS DEM absolute orientation

• Difference and change measurement



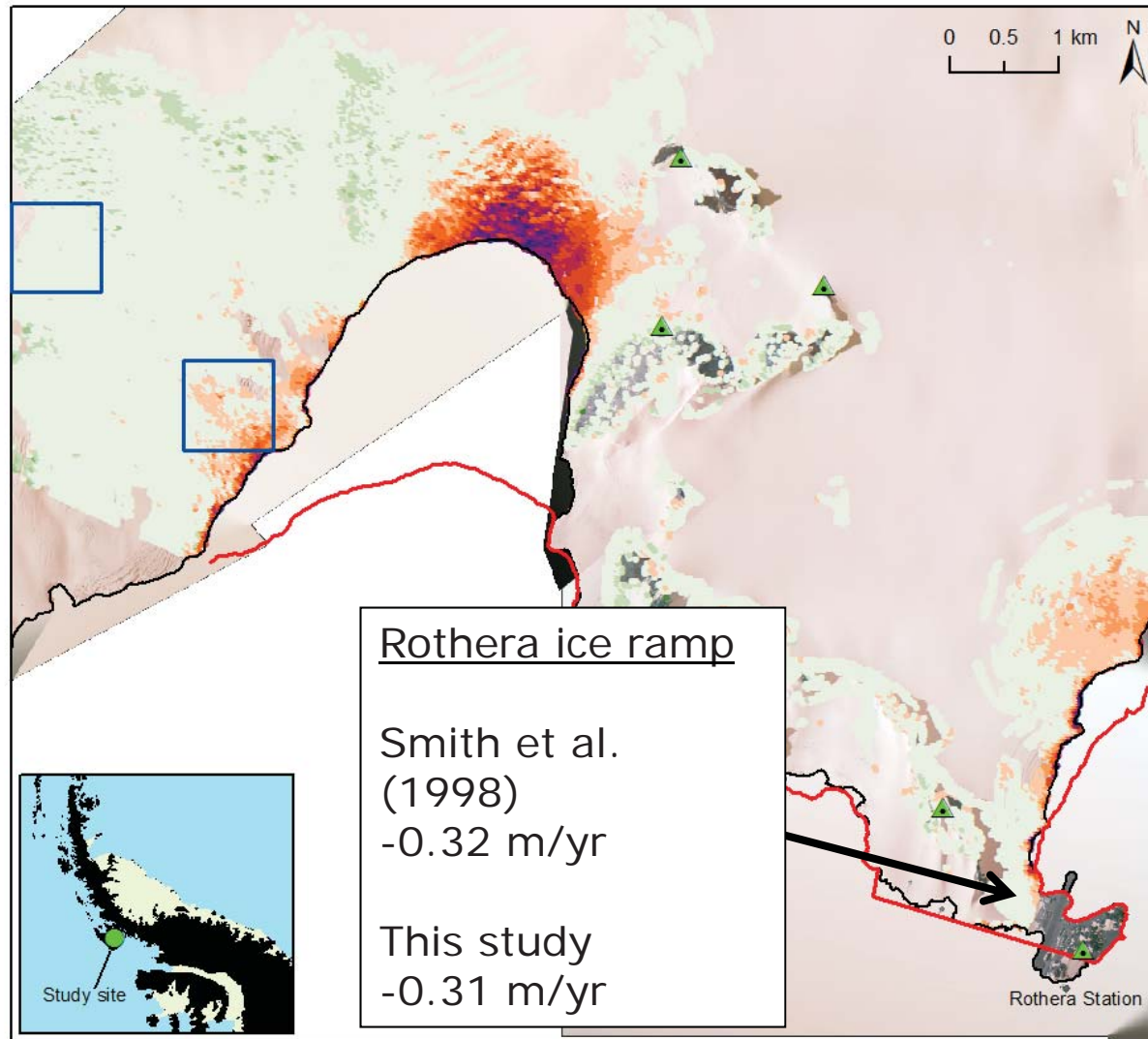
Glacier surface lowering



- Significant frontal lowering (up to 50 m)
- Surface thickening at advanced glacier parts
- Negative surface mass balance at glacier front
- No glacier wide mass balance

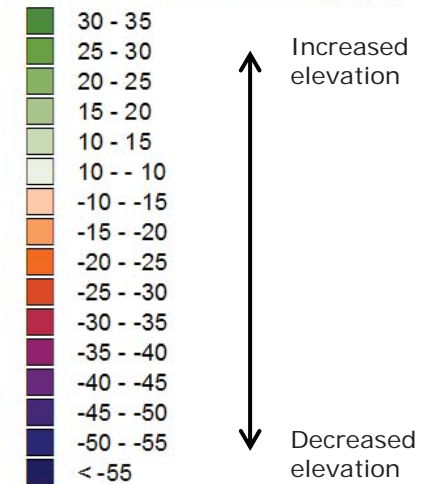


Sheldon Glacier (1989 - 2005)



Mean rate of
surface elevation
change:
Lower part -0.57 m/yr
Upper part +0.20 m/yr

Surface elevation change [m]



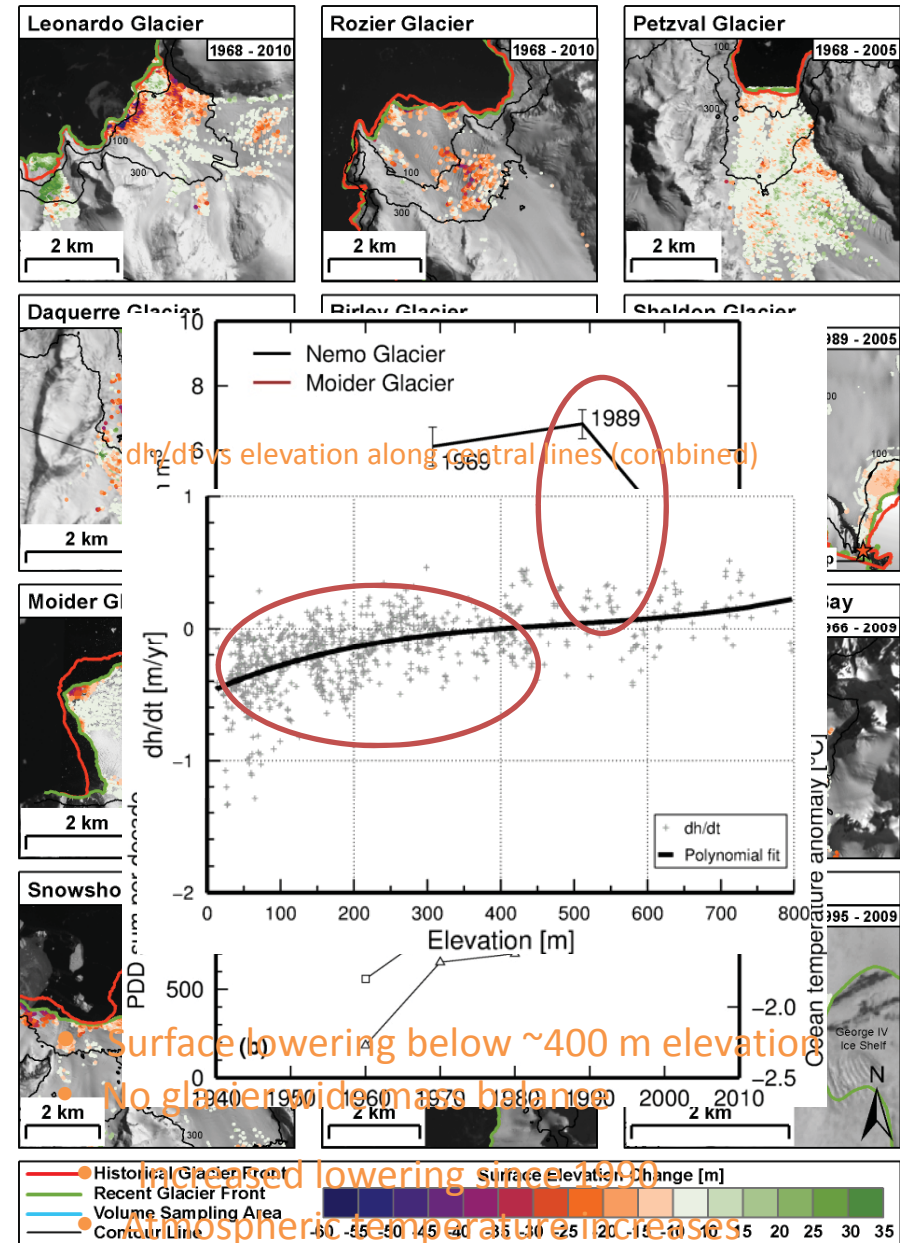
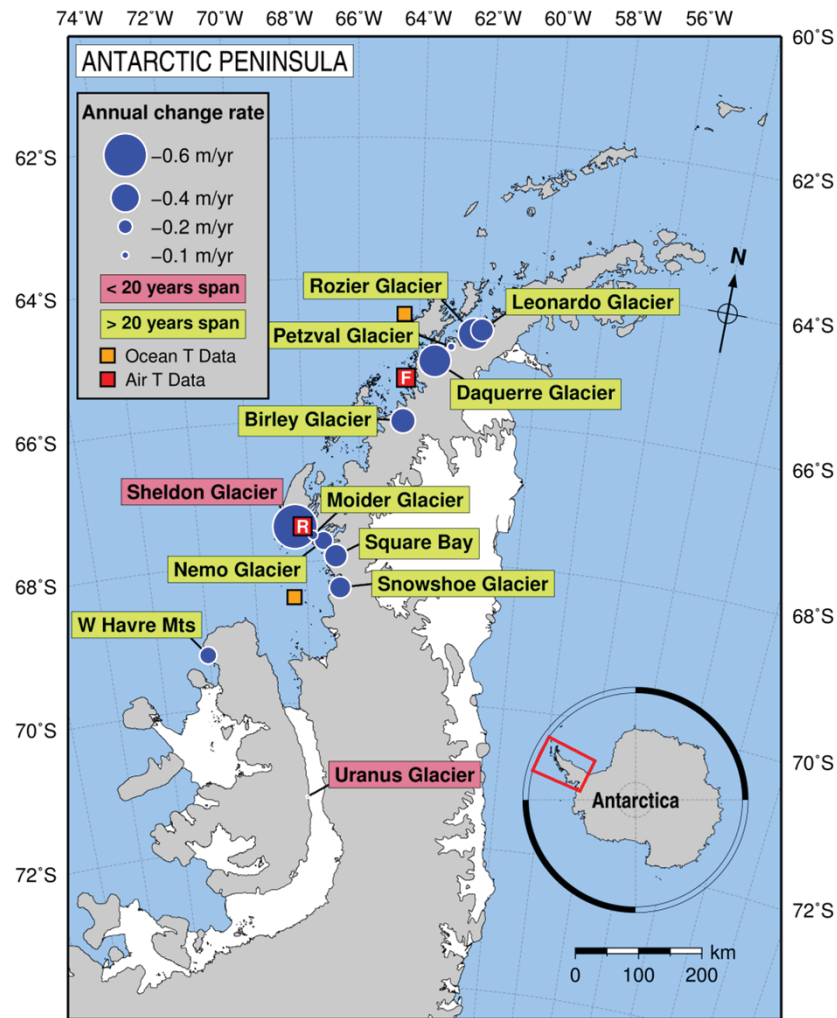
— 1989

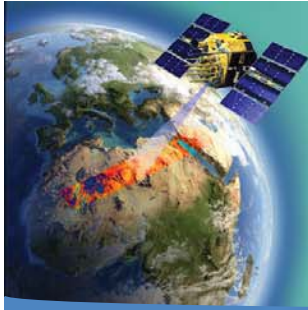
▲ 'Artificial' GCPs

Reference/Background image:
Aerial Photography - BAS 2005

Comparison:
Aerial Photography - 1989 (Precision ± 11.8 m)

Pattern of change






Earth Systems Engineering

- Combines new scientific understanding of the functioning of the Earth's coupled human-technological-natural systems with engineering analysis and design, in order to provide adaptation and mitigation solutions to global change at a range of scales.

The logo for CESER, featuring a stylized green dome or arch above the word "CESER" in large, bold, purple capital letters.

CESER



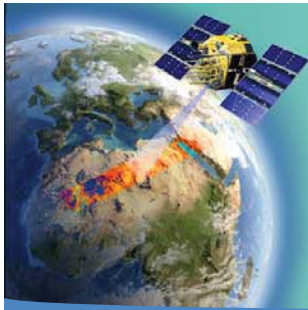
CESER Research Programme: Integrated systems demonstrations





Urban resilience

- Cities focal points of consumption and emissions:
 - 50% global population, ~80% global GHG emissions
- Cities concentrations of vulnerability to chronic climate stress and extremes:
 - Flooding, heat, air quality etc.
- Improved tools for urban design and adaption, both today and in the future



Urban resilience: heat

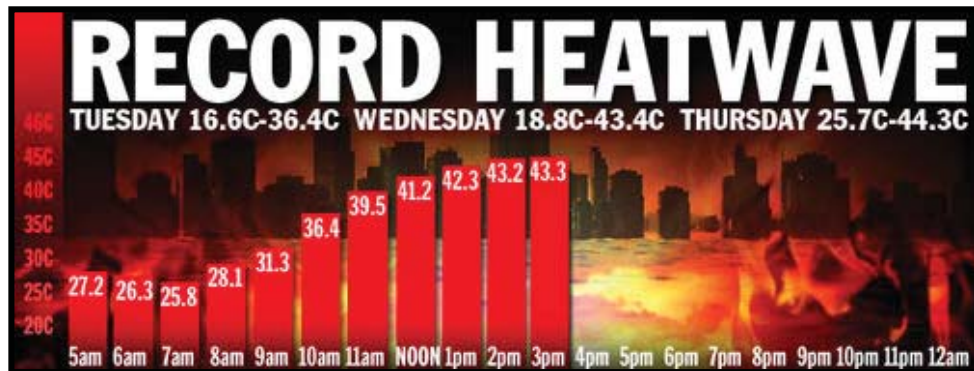
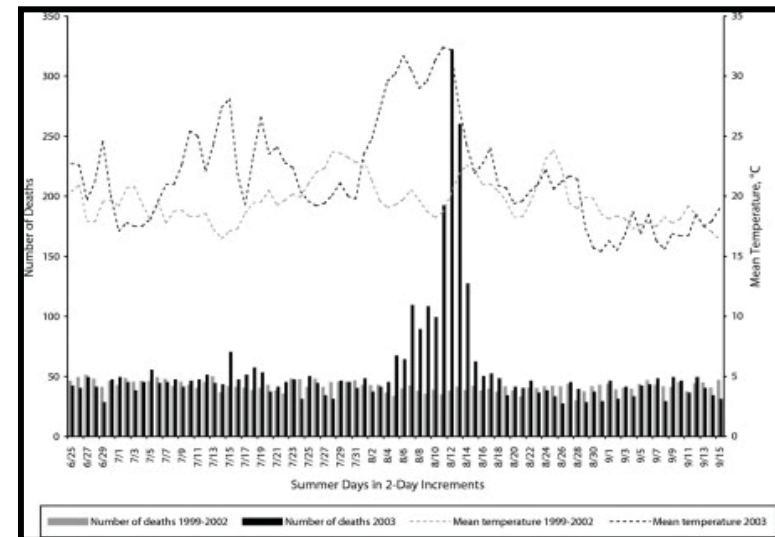
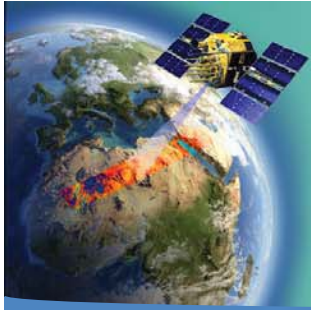


Table 1. Health costs in climate change-related case study areas, with costs per health effect, 2002 through 2009.

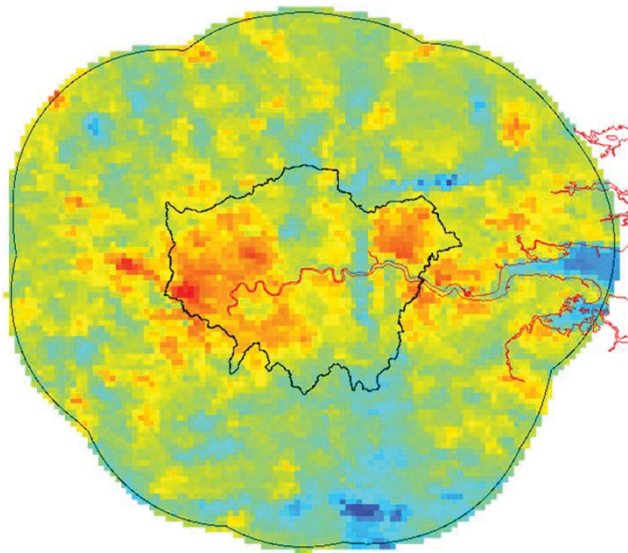
Climate Change-Related Case Study	Premature Death	Illness	Total Health Cost by Case Study
Ozone smog pollution	\$6.3 Billion	\$254 Million	\$6.5 Billion
Heat wave	\$5.2 Billion	\$179 Million	\$5.3 Billion
Hurricane	\$1.1 Billion	\$255 Million	\$1.4 Billion
Wildfire	\$545 Million	\$34 Million	\$578 Million
Mosquito-borne infectious disease	\$190 Million	\$18 Million	\$207 Million
River flooding	\$16 Million	\$5 Million	\$20 Million
Total costs (in U.S. dollars, 2008)	\$13.3 Billion	\$744 Million	\$14.1 Billion



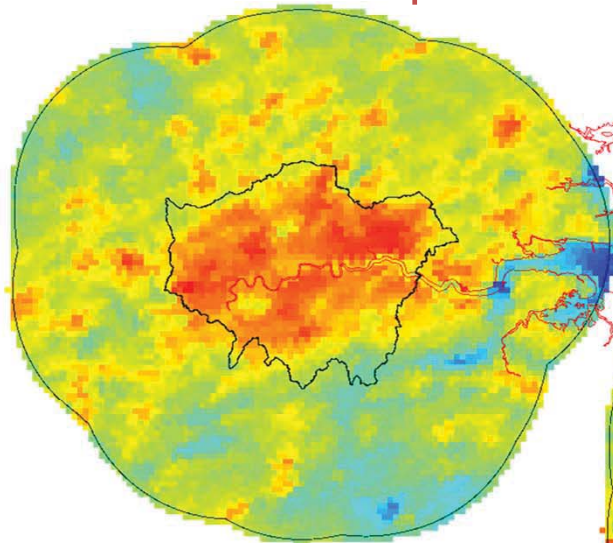


Daily urban temperature dynamics

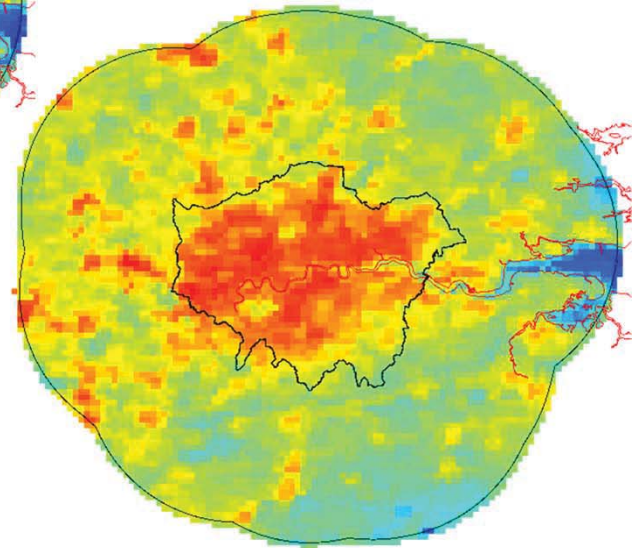
Diurnal development of London surface temperatures during a day in the 2003 heatwave (AVHRR)



11:42



12:25

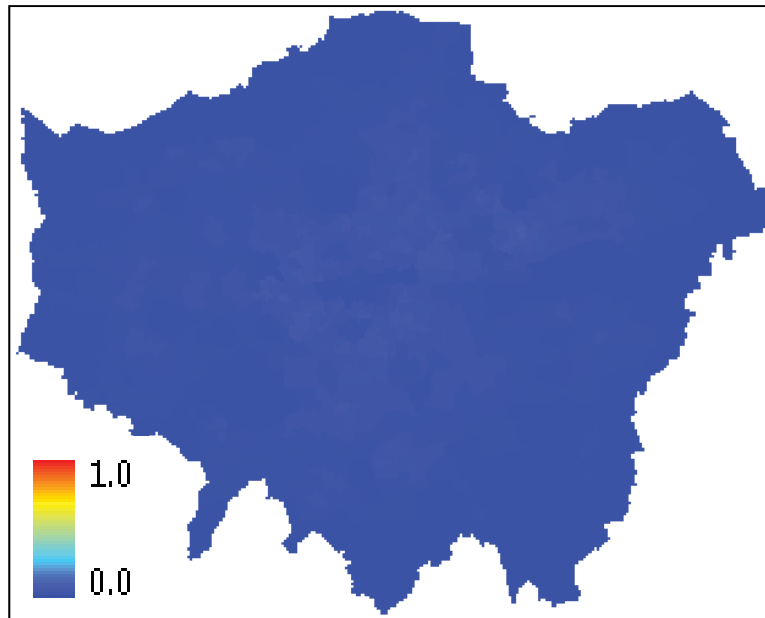


14:06

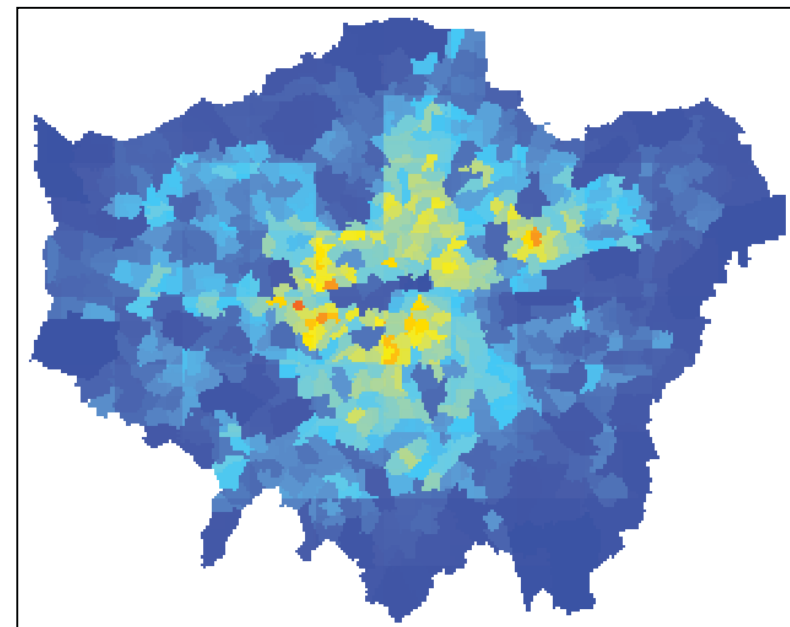


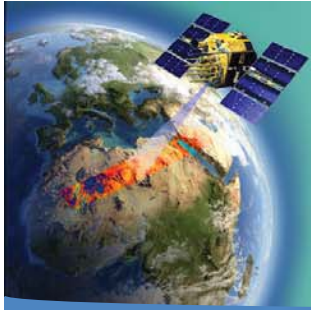
London future spatial heat risk

Heatwave Risk Control
(1961-1990)



Heatwave Risk 2050s
(90th percentile)

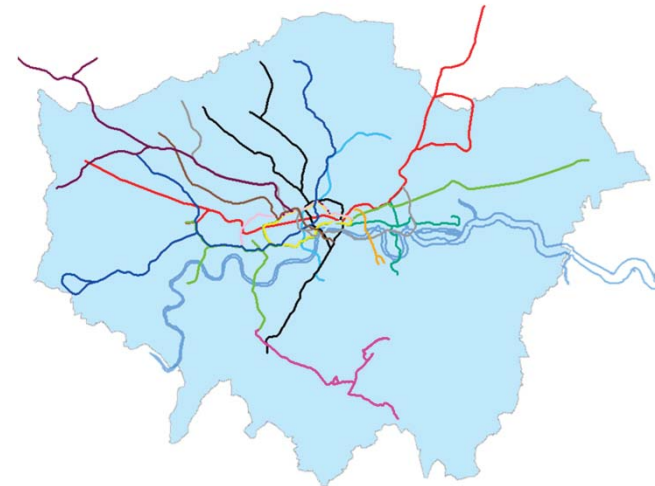
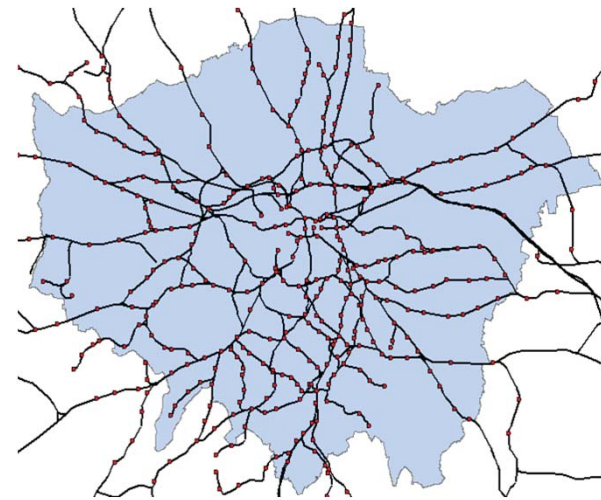
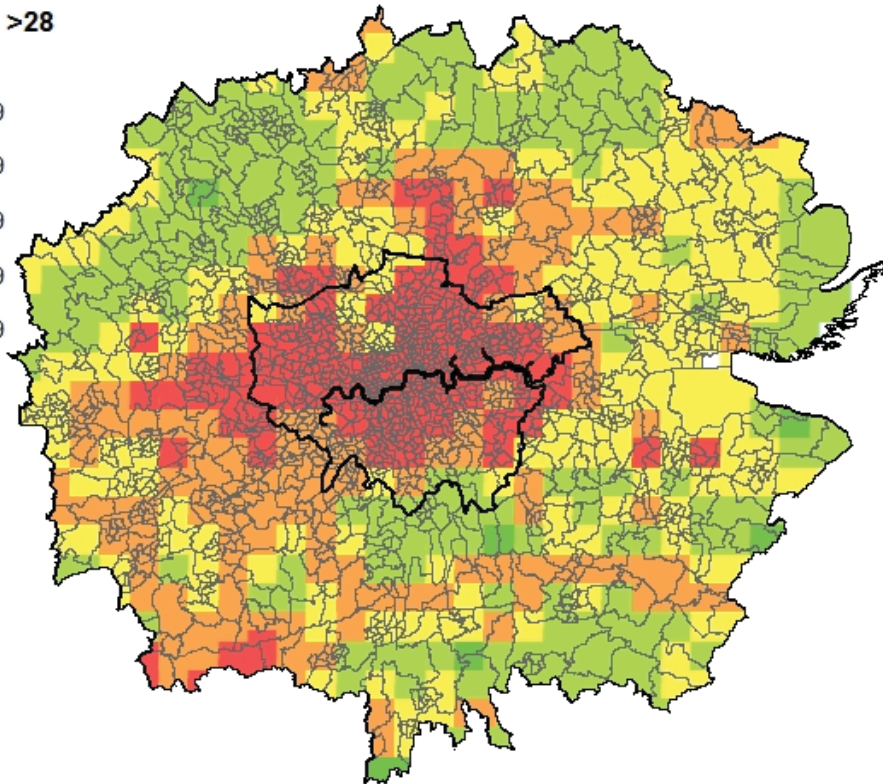
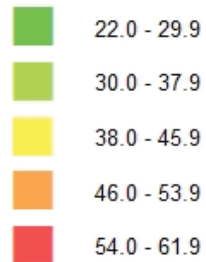




Transport disruption and economic risk

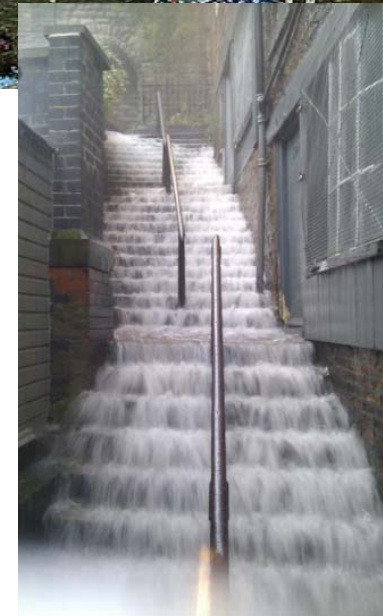
No. Days TMax >28

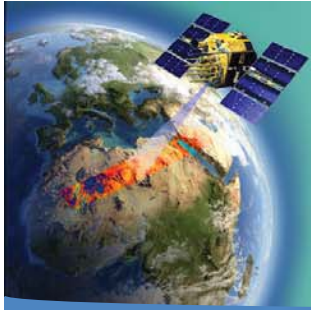
2050s_Medium





Urban resilience: flooding



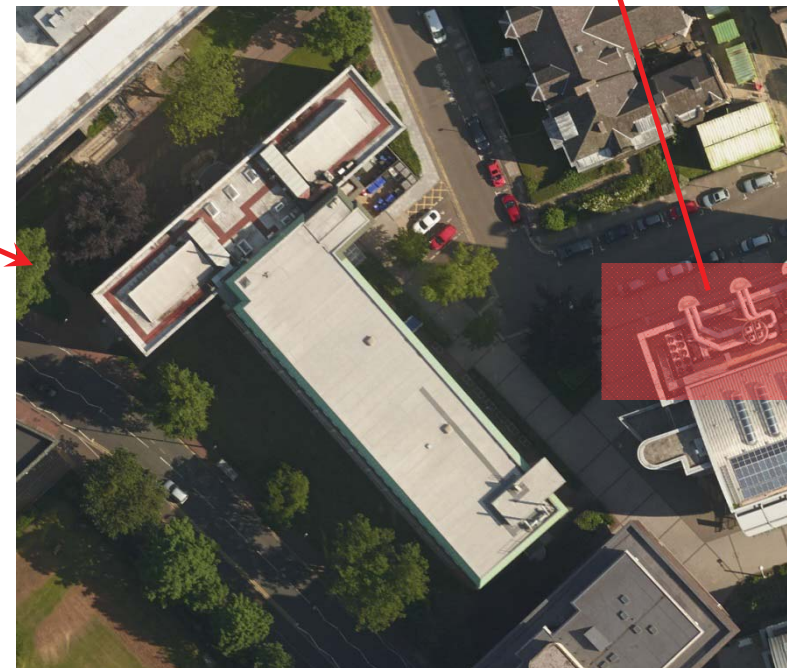


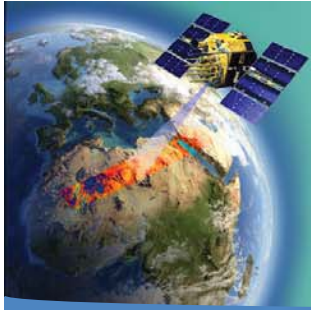
Airborne laser scanning data





Orthoimagery



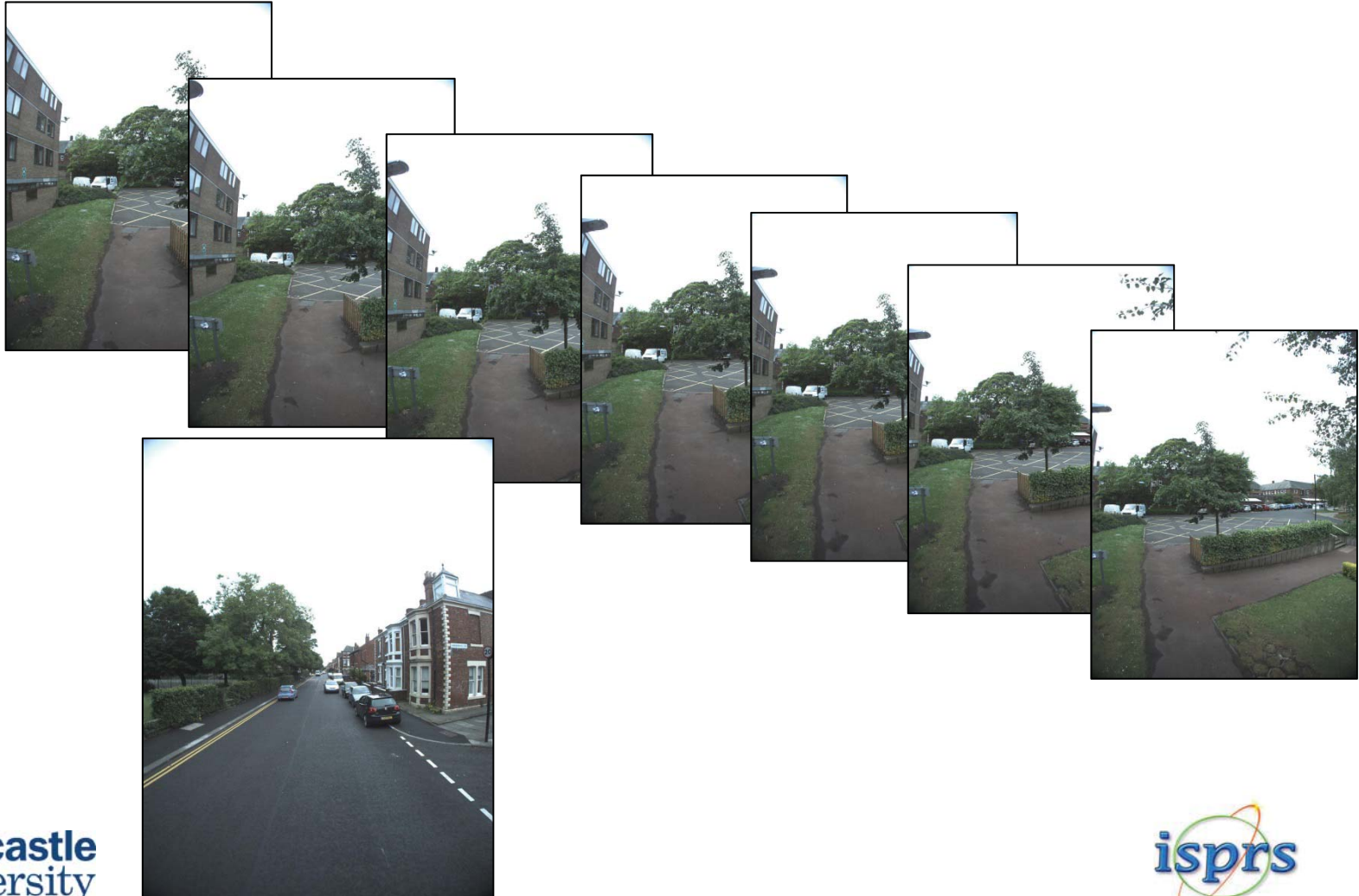


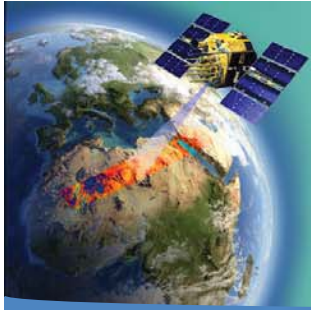
Mobile laser scanning



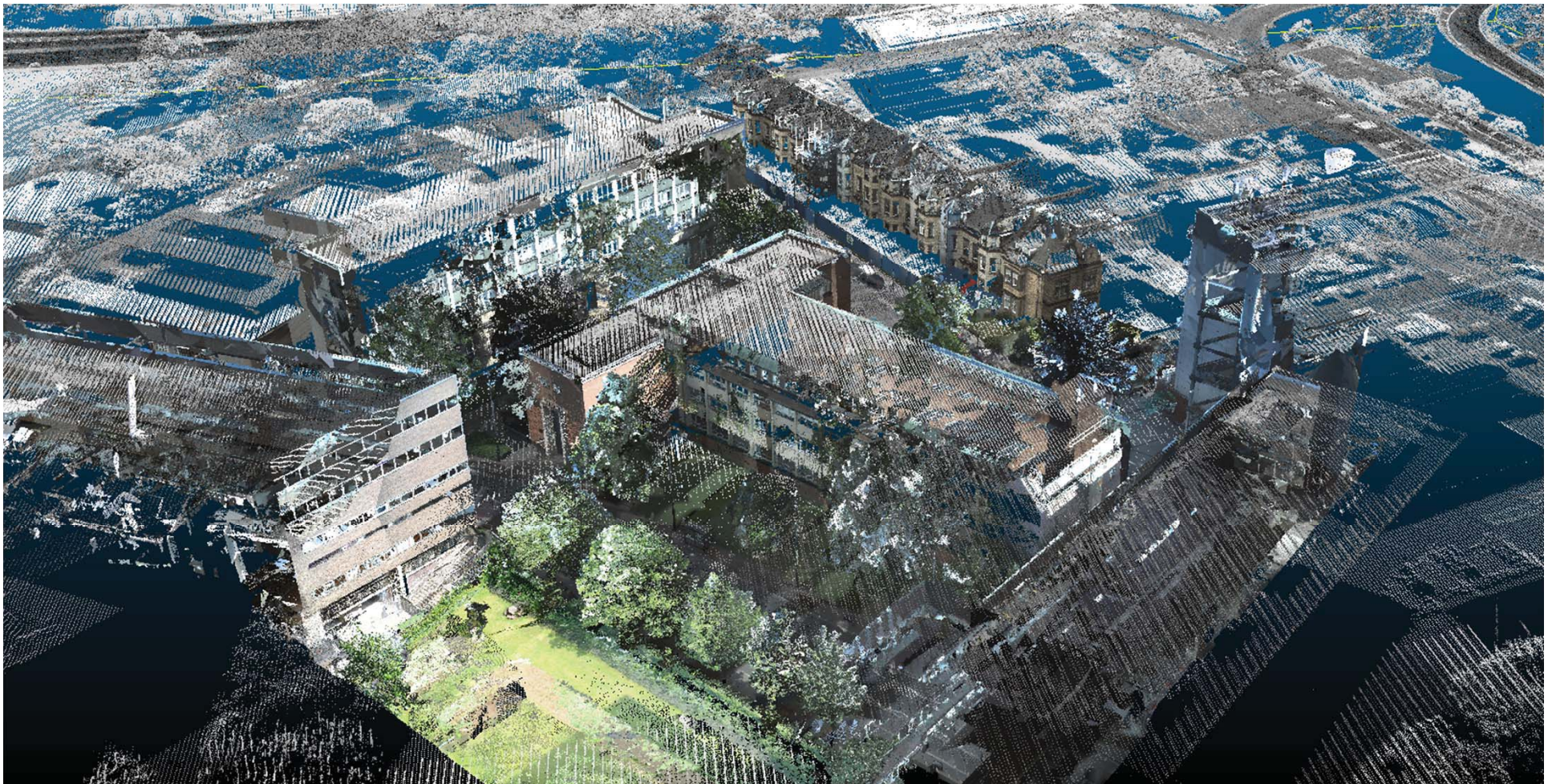


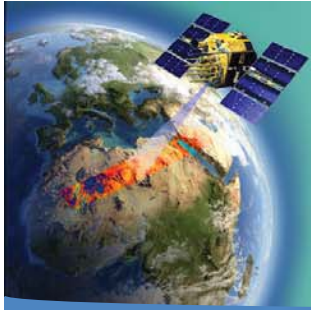
Panoramic imagery



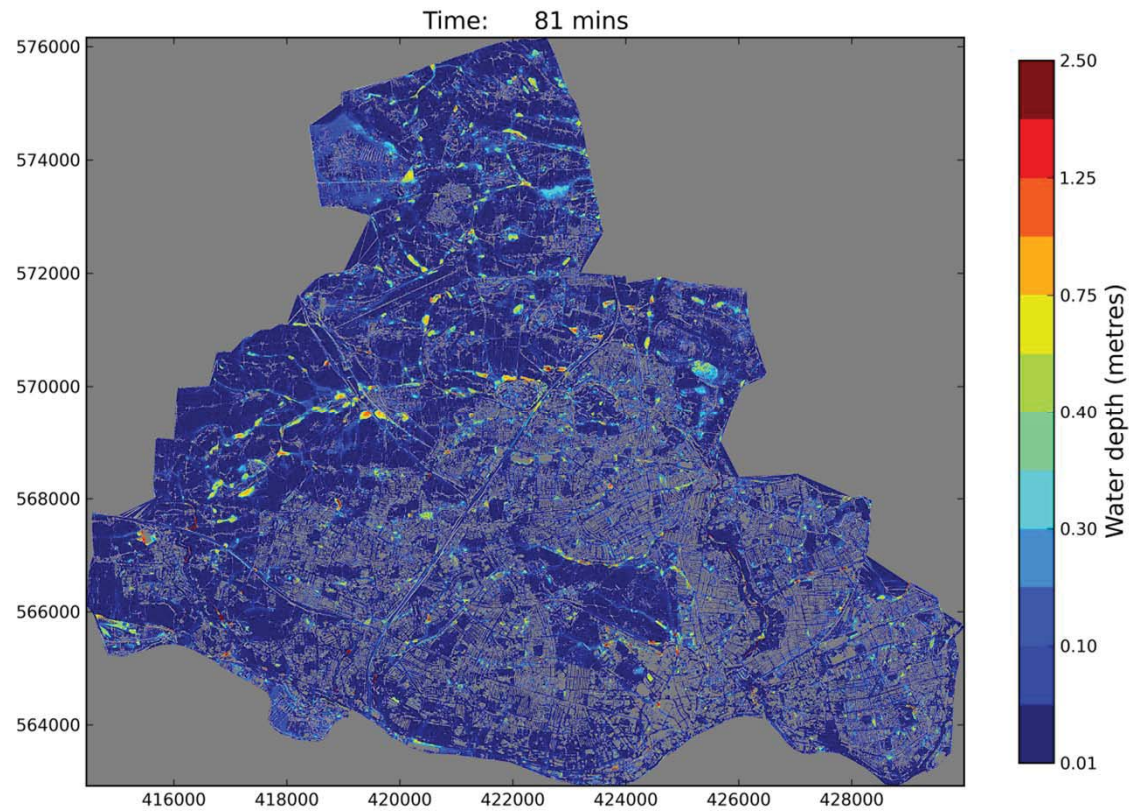


Combined mobile & airborne laser scanning





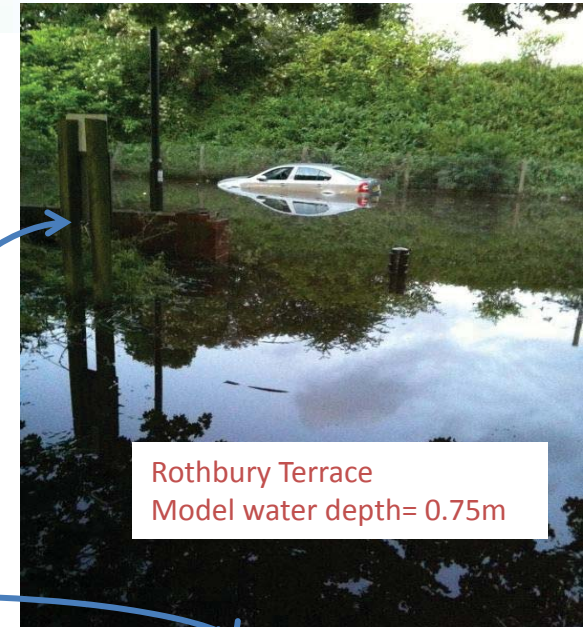
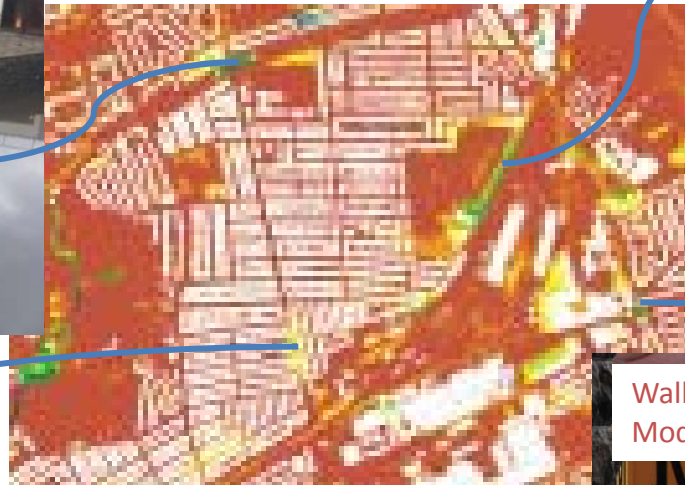
Flood modelling





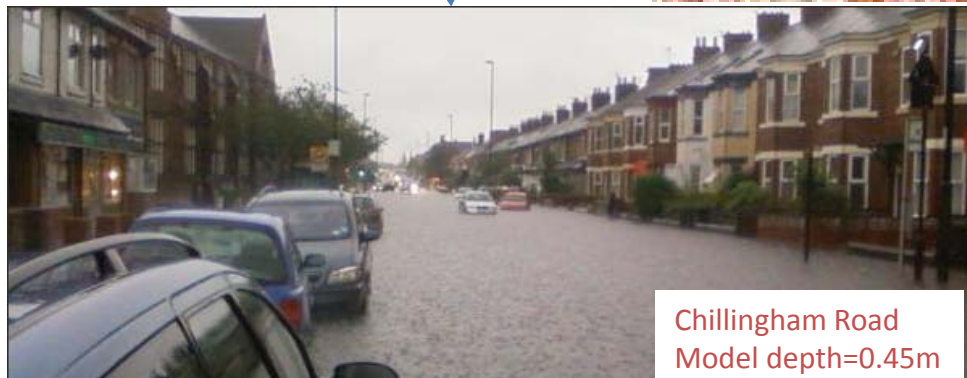
“Citizen science”

Crossing of Coast Road with Benton Road and Chillingham Road. Modelwater depth=1.45m

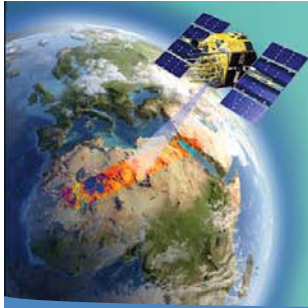


Rothbury Terrace
Model water depth= 0.75m

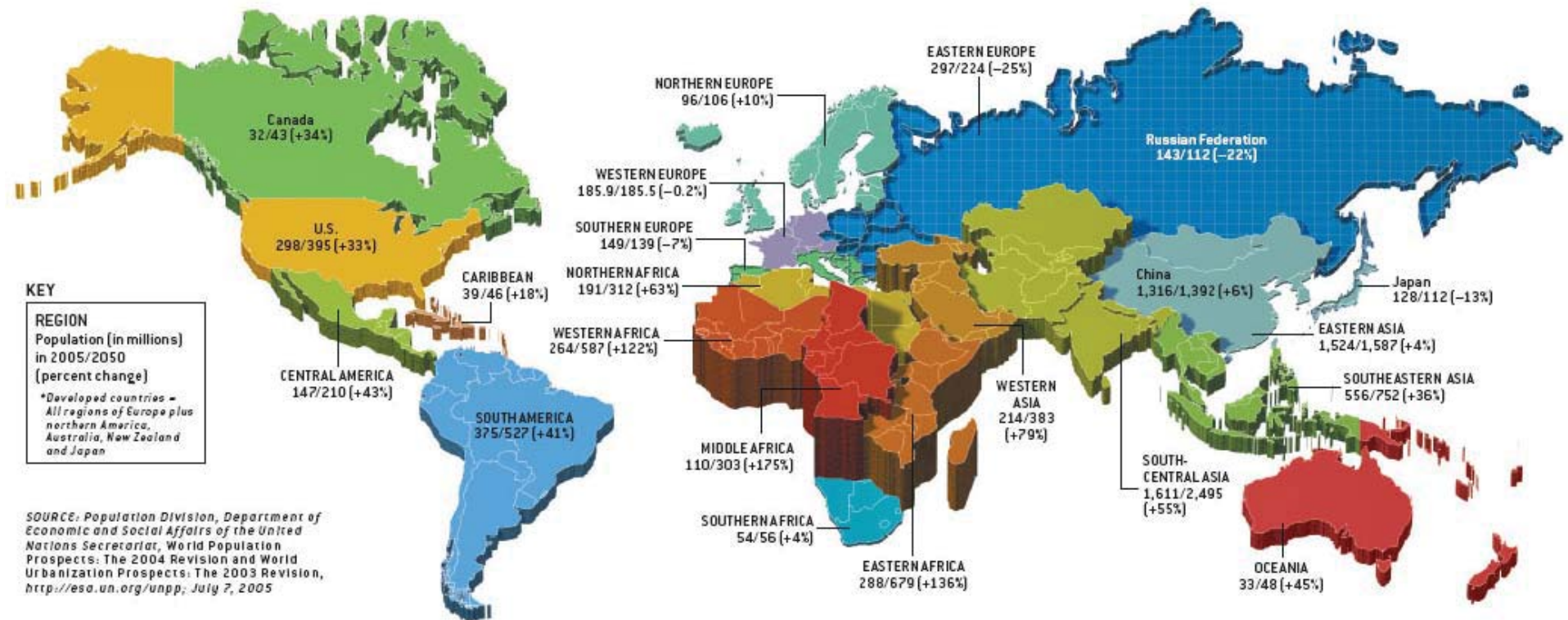
Walkergate
Model depth=1.36m

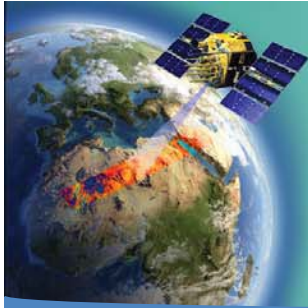


Chillingham Road
Model depth=0.45m

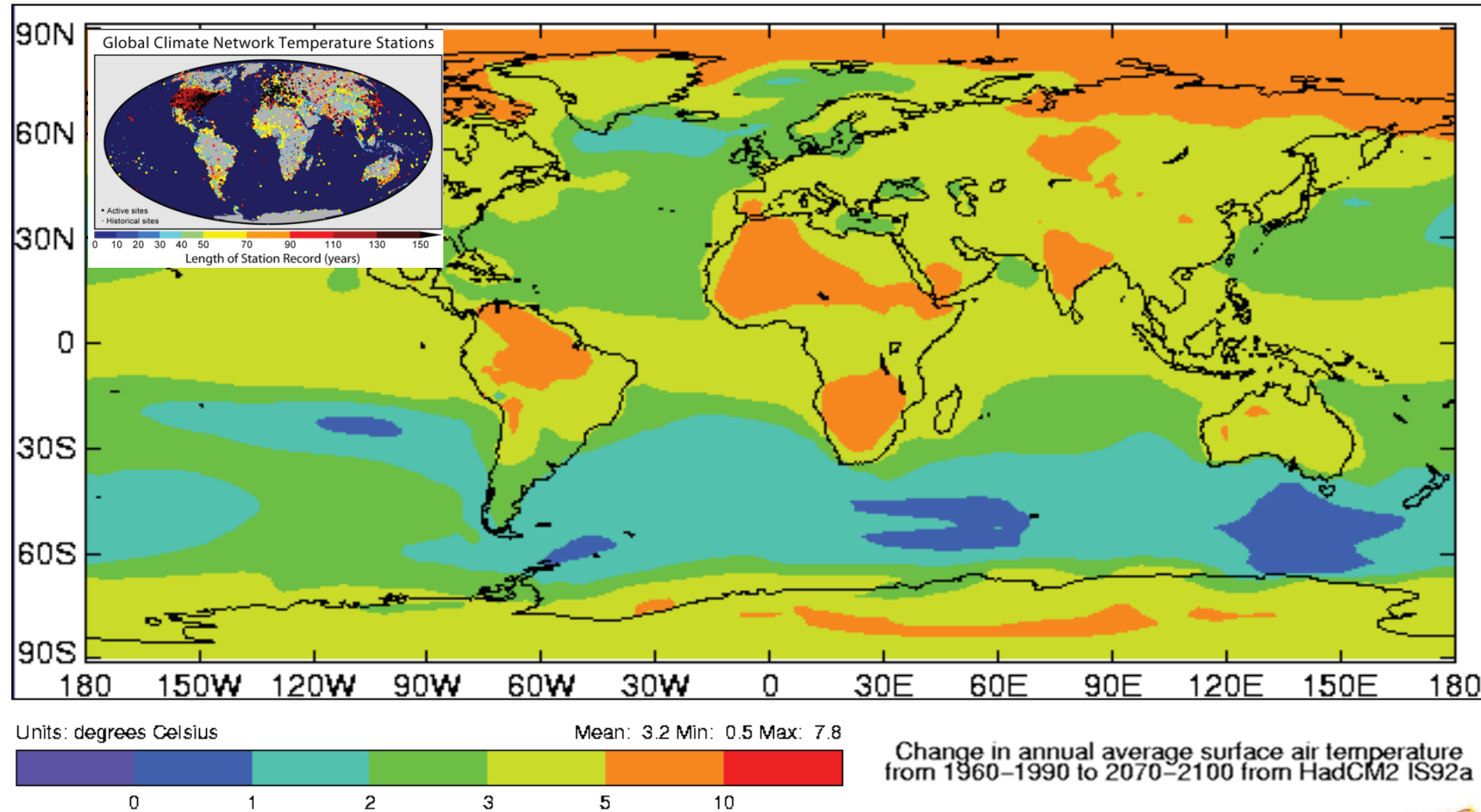


Future challenges: developing nations





Future challenges: developing nations





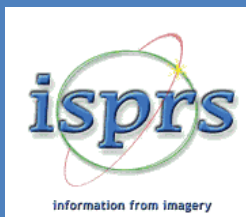
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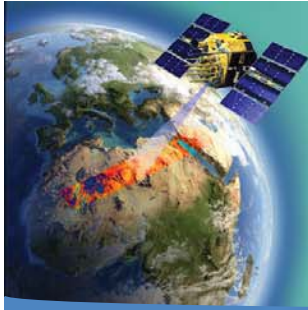
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Newcastle PhD Opportunities

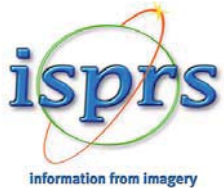
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- Faculty of SAgE PhD scholarships
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 - TBA shortly
- School of Civil Engineering and Geosciences
 - Minimum of three studentships
 - <http://www.ncl.ac.uk/ceg/study/postgraduate/research>



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- www.ncl.ac.uk/ceser

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