



# (A)ATSR instrument series

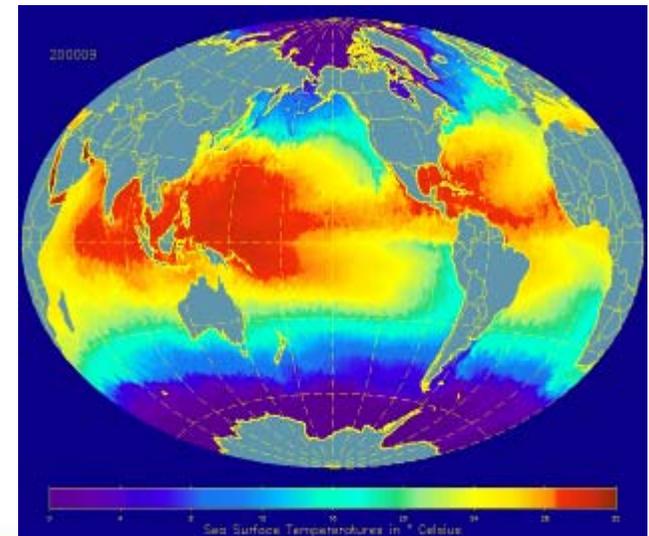
Prof. José Pereira

Tuesday 4 September 2007, Lecture D2L3-2



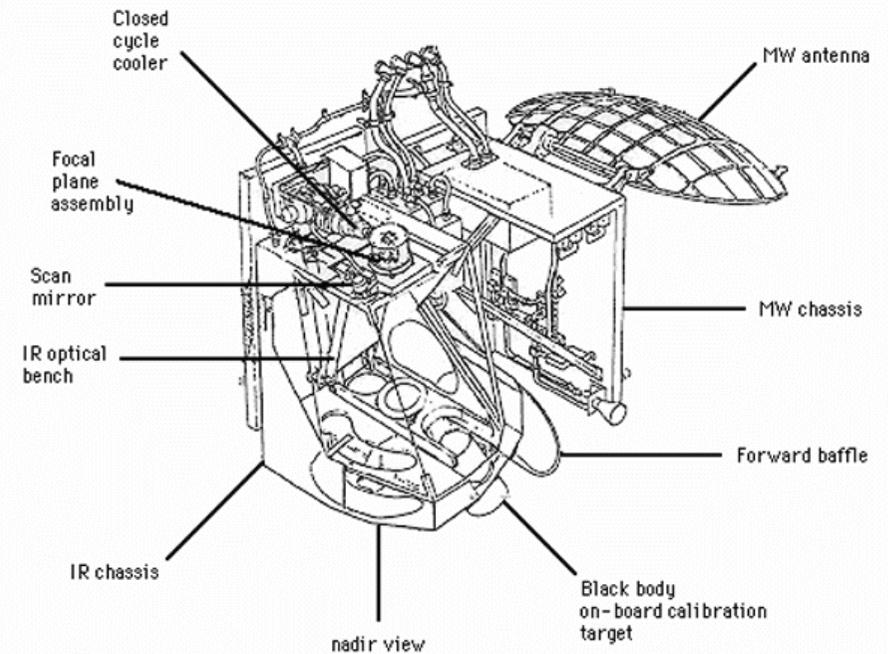
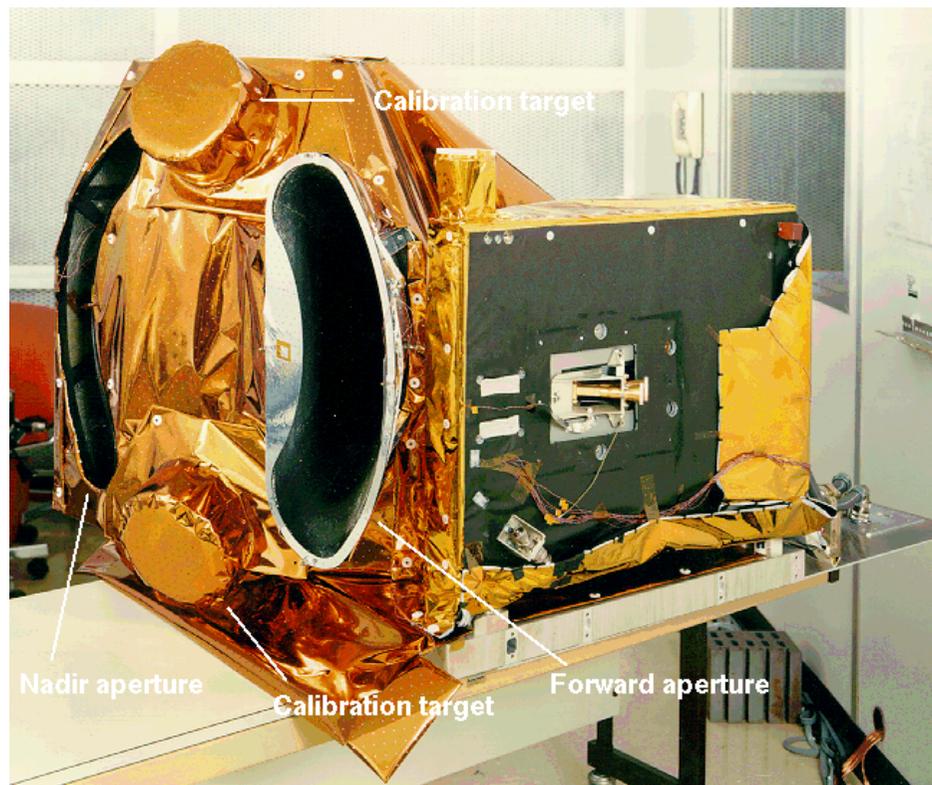
## ***ATSR-AATSR toward a long term data record for climate studies***

- Announcement of Opportunity (AO) Instrument:
  - ATSR-1, ATSR-2 developed by RAL
  - AATSR developed by University of Leicester, funded jointly by the UK Department for Environment, Food and Rural Affairs (Defra), the Australian Department of Industry, Science and Resources (DISR), and the UK Natural Environment Research Council (NERC).
  
- ATRS-1/ERS-1 launched in 1991.
  
- Purpose: SST with accuracy of 0.3K, required for climate research purposes





- ATSR = **A**long **T**rack **S**canning **R**adiometer

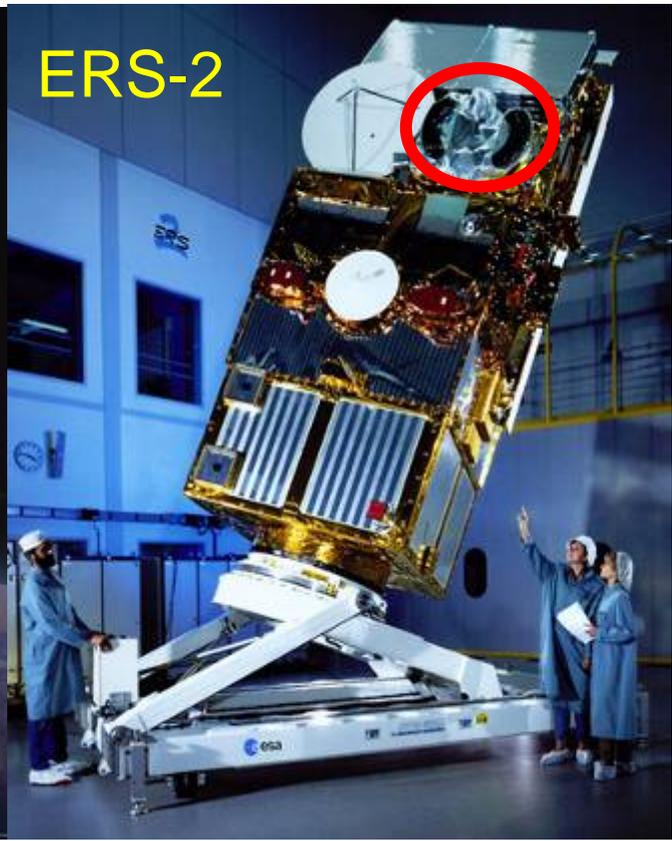
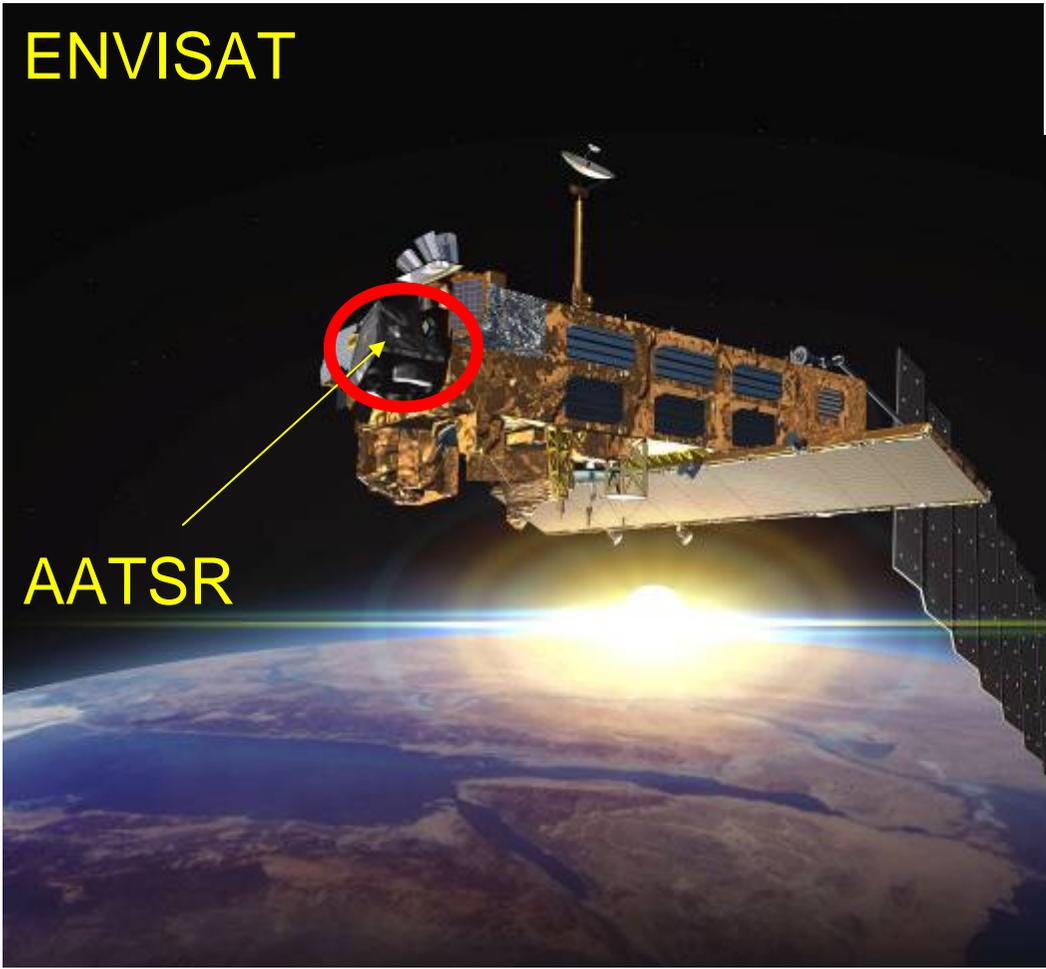
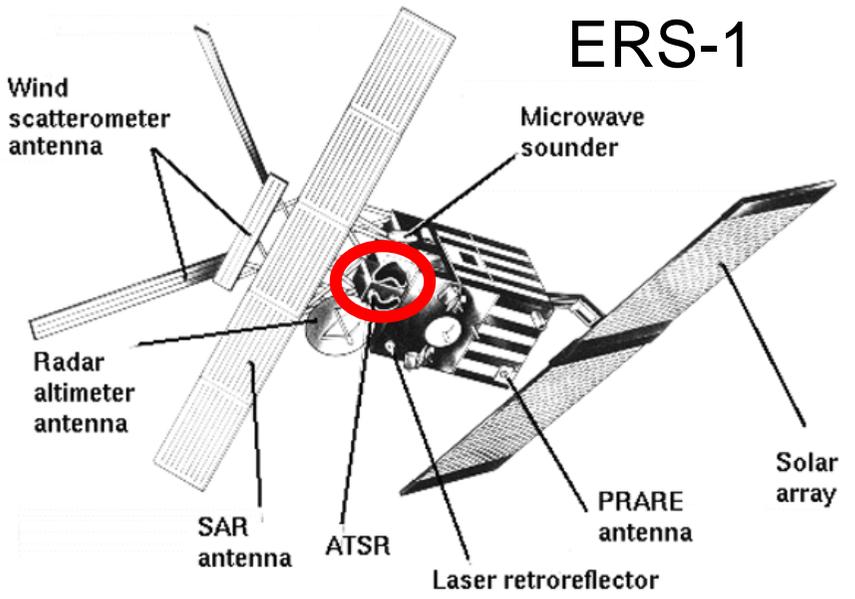


- 1-km resolution
- Multi-spectral
- Multi-view



## ***Instrument Specifications***

Orbit	Near polar, sun synchronous
Swath Width	500 km
Spatial Resolution	1 * 1 km at nadir
View Zenith	Nadir, 55°
Spectral Bands	0.545-0.565 $\mu\text{m}$ 0.649-0.669 $\mu\text{m}$ 0.855-0.875 $\mu\text{m}$ 1.58-1.64 $\mu\text{m}$ 3.55-3.93 $\mu\text{m}$ 10.4-11.3 $\mu\text{m}$ 11.5-12.5 $\mu\text{m}$



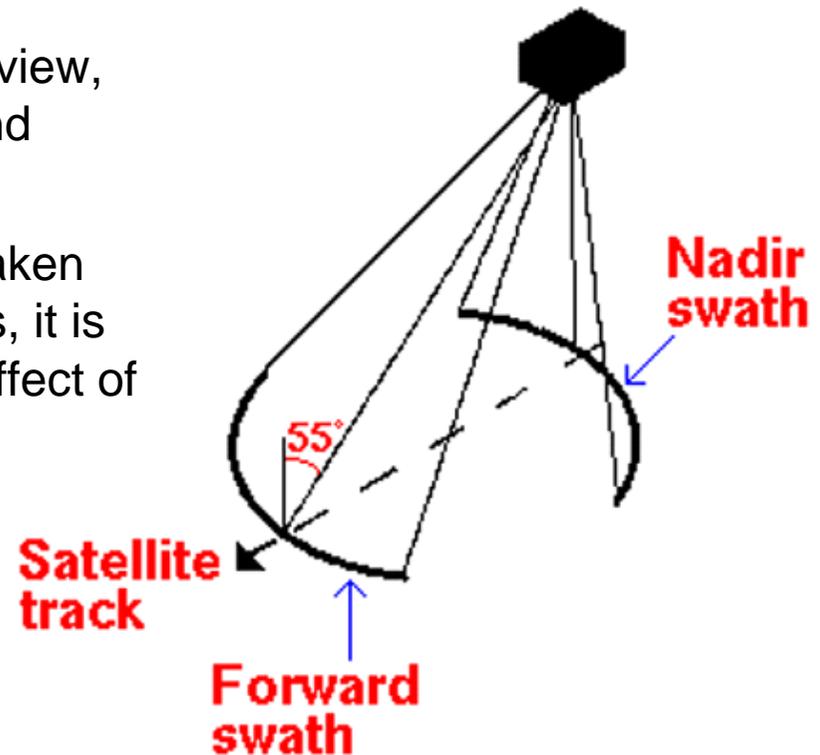


# Purpose of the Dual View

- ATSR sensors are designed to measure surface temperature with climate-standard accuracy
- Precise **Atmospheric Correction** is key to surface radiometry
- Dual View gives a direct indication of the Total Atmospheric effect on a view of surface

- Principle:

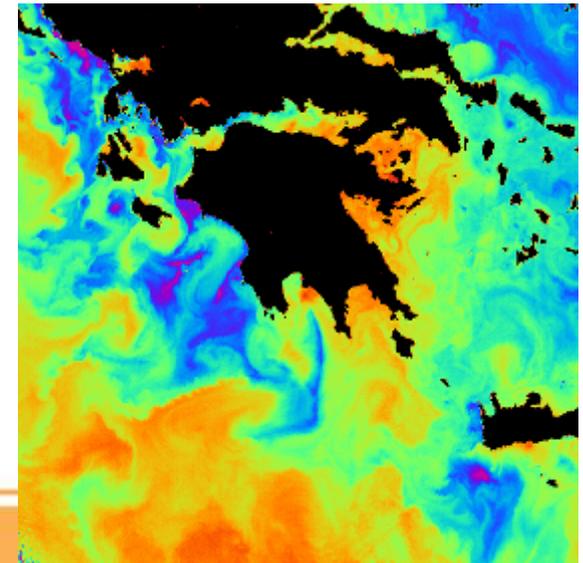
- Each scan takes readings from the nadir position and then sweeps round to take measurements from a point about 900 Km along the satellite's track.
- A few minutes after acquiring the forward view, the satellite passes over the same spot and takes readings for the nadir view.
- As the two views of the same scene are taken through different atmospheric path lengths, it is possible to calculate a correction for the effect of atmospheric absorption.





## ***ATSR-AATSR innovative features***

- Two viewing angles, Nadir and 55° forward
- A novel type of stirling cooler to maintain the detectors temperature very low, giving very high sensitivity
- On-board calibration with two black bodies designed for high emissivity, uniformity and long term stability.
- Visible calibration performed once per orbit using a Russian opal diffuser
- Very good noise performance
- Good geolocation accuracy
- High digitization allowing fine structures detection





## ***ATSR-AATSR products***

### 1 km resolution products

- Level 1:
  - Brightness Temperature (12, 11, 3.7 micron)
  - Visible and Infra-red (0.55, 0.67, 0.87, 1.6 micron)
- Level 2:
  - Sea Surface Temperature
  - Vegetation Index
  - Land Surface temperature

### Spatially Averaged products (10 and 30 arc/mn, 17 and 50 km)

- Level 2:
  - Sea Surface Temperature
  - LST
  - BT/TOA

Meteo products SST for meteo applications



## ***Instruments***

- **ATSR-1/ERS-1** launch in July 1991.
  - ✓ Loss of 3.7 $\mu$  channel after about 1 year (May 1992)
  - ✓ Good instrument performance but increase in the detector temperature at the end of mission
- **ATSR-2/ERS-2** launch in April 1995
  - ✓ Problem with the scan mirror from end Dec 1995 to early July 1996.
  - ✓ Attitude problem. Yaw information reprocessed.
- **AATSR/Envisat** launch in February 2002
  - ✓ Excellent instrument performance

As result: 16-year time series from ATSR from end 1991 to now (2007) with only one month interruption (June 1996).

- Continuity: **SLSTR** (Sea and Land Surface Temperature Radiometer) onboard Sentinel-3, launch 2012



# Processor

- Version 6.0 in operation since 28 March 2007.
- It will be used for the 2<sup>nd</sup> reprocessing
- It includes:
  - New SST coefficients introduced in December 2005. These provide considerable improvement over the pre-launch coefficients in use before.
  - Several improvements to cloud clearing over land and the LST retrieval.
  - Correction of data not already corrected for the visible channel drift
  - Amend data not already corrected for the problem with the 1.6 micron non-linearity correction



# AATSR Data Products

Product ID	Name	Description
ATS_NL_0P	Level 0	Source Packet
ATS_TOA_1P	GBTR	Full resolution top-of-atmosphere BT/Reflectance for all channels and both views.
ATS_NR_2P	GST	Full resolution SST, NDVI over land
ATS_AR_2P	AST	Spatially averaged ocean, land and cloud parameters
ATS_MET_2P	Meteo product	SST and averaged BT for Meteo users
ATS_AST_BP	Browse product	3 band colour composite browse image



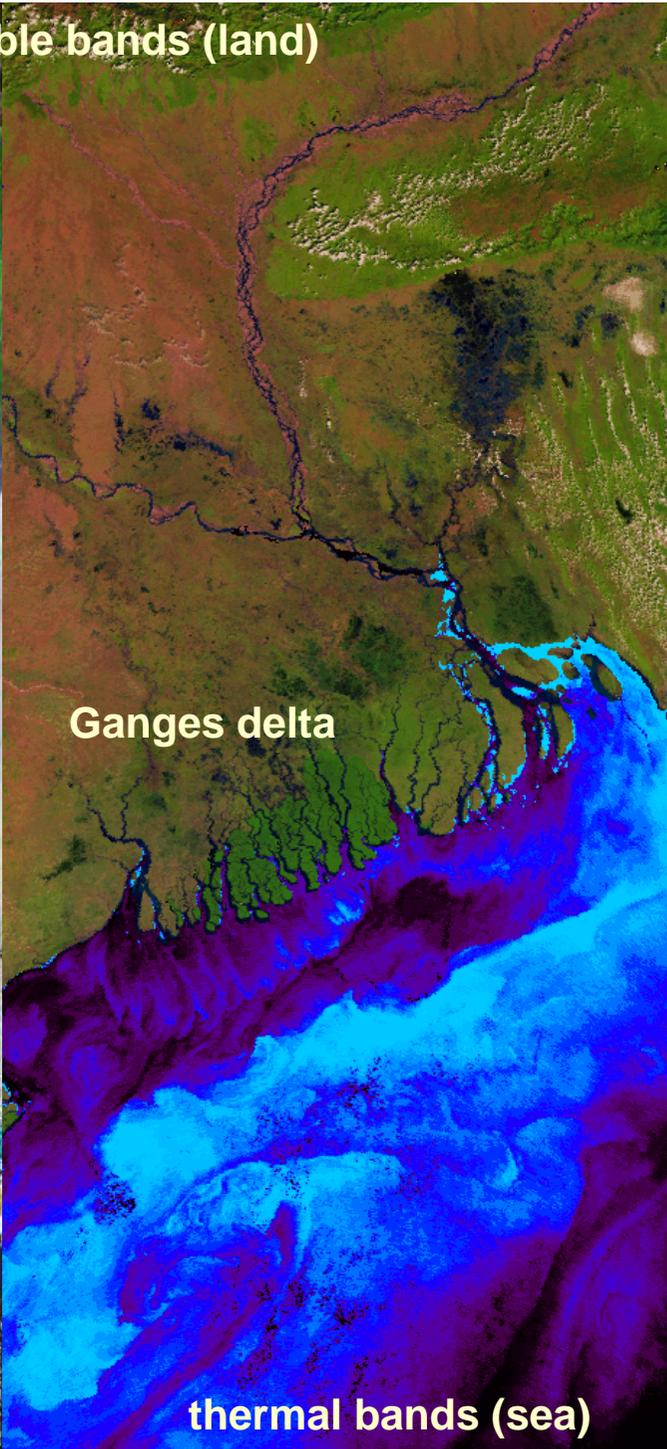
- Image examples



**Indus Valley,  
Pakistan,  
12 June 2003**

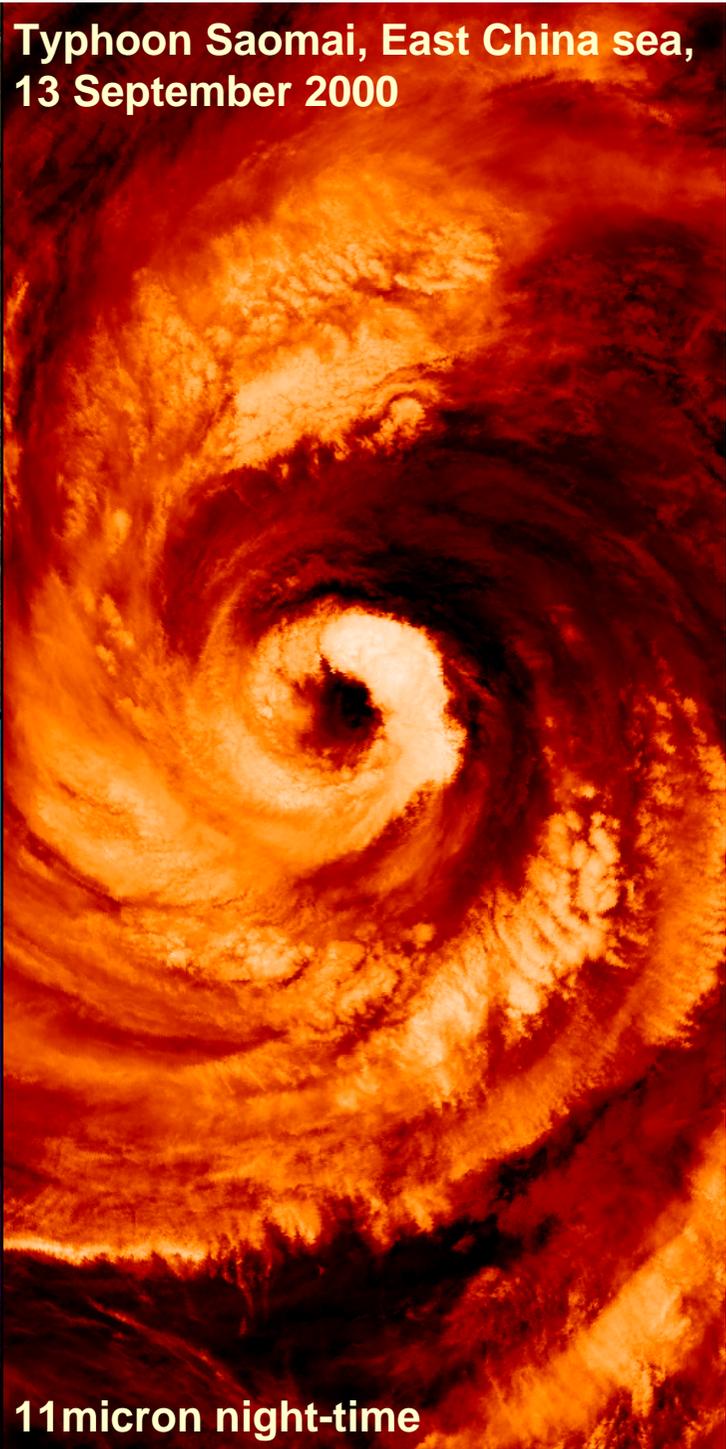
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**Visible bands (land)**



**Ganges delta**

**thermal bands (sea)**

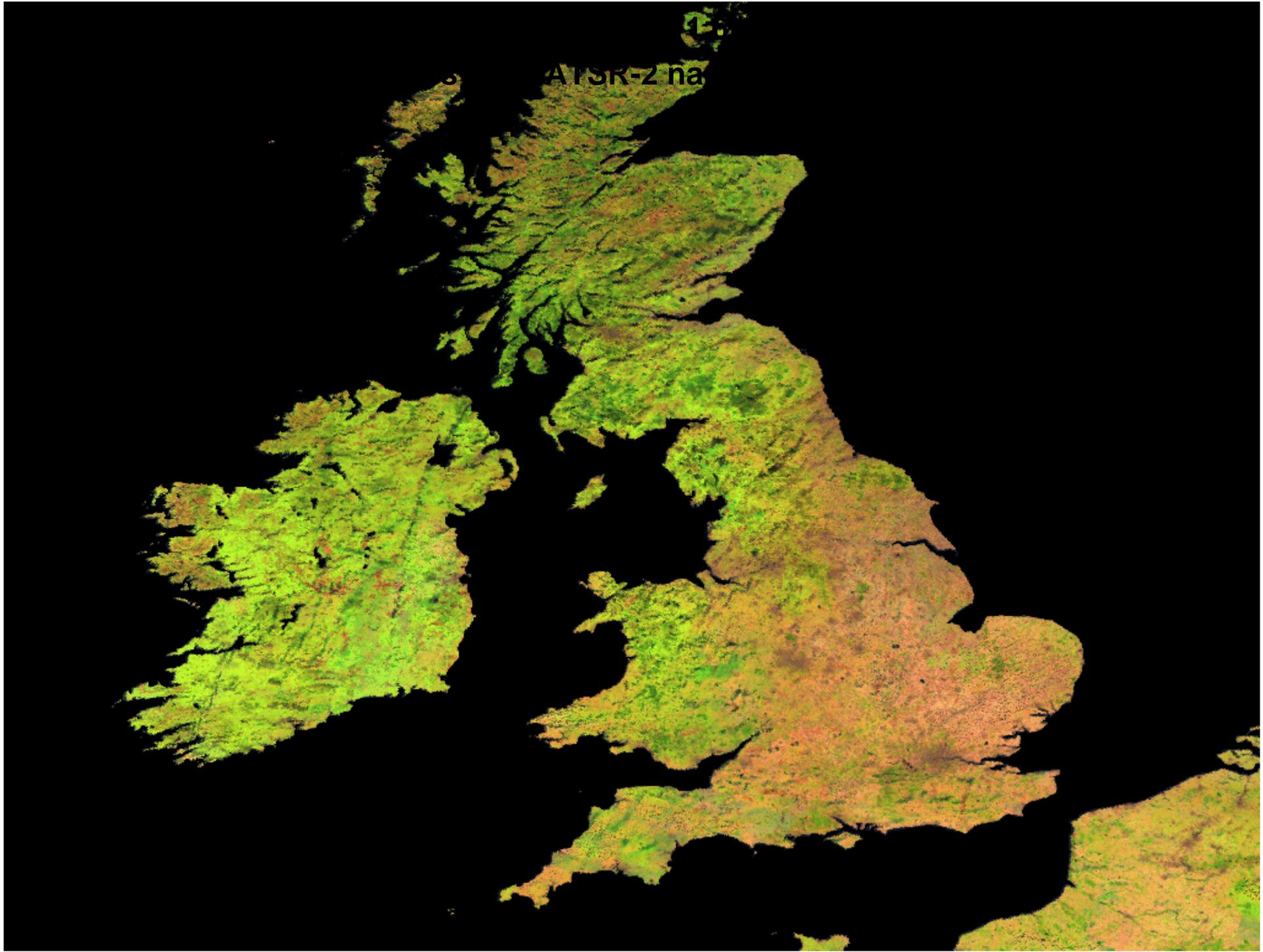


**Typhoon Saomai, East China sea,  
13 September 2000**

**11micron night-time**

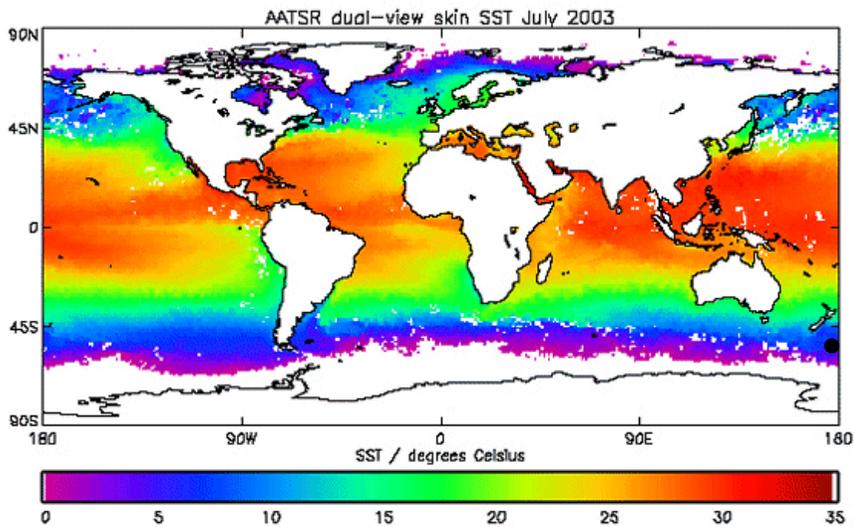
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8. АТСК-2 на



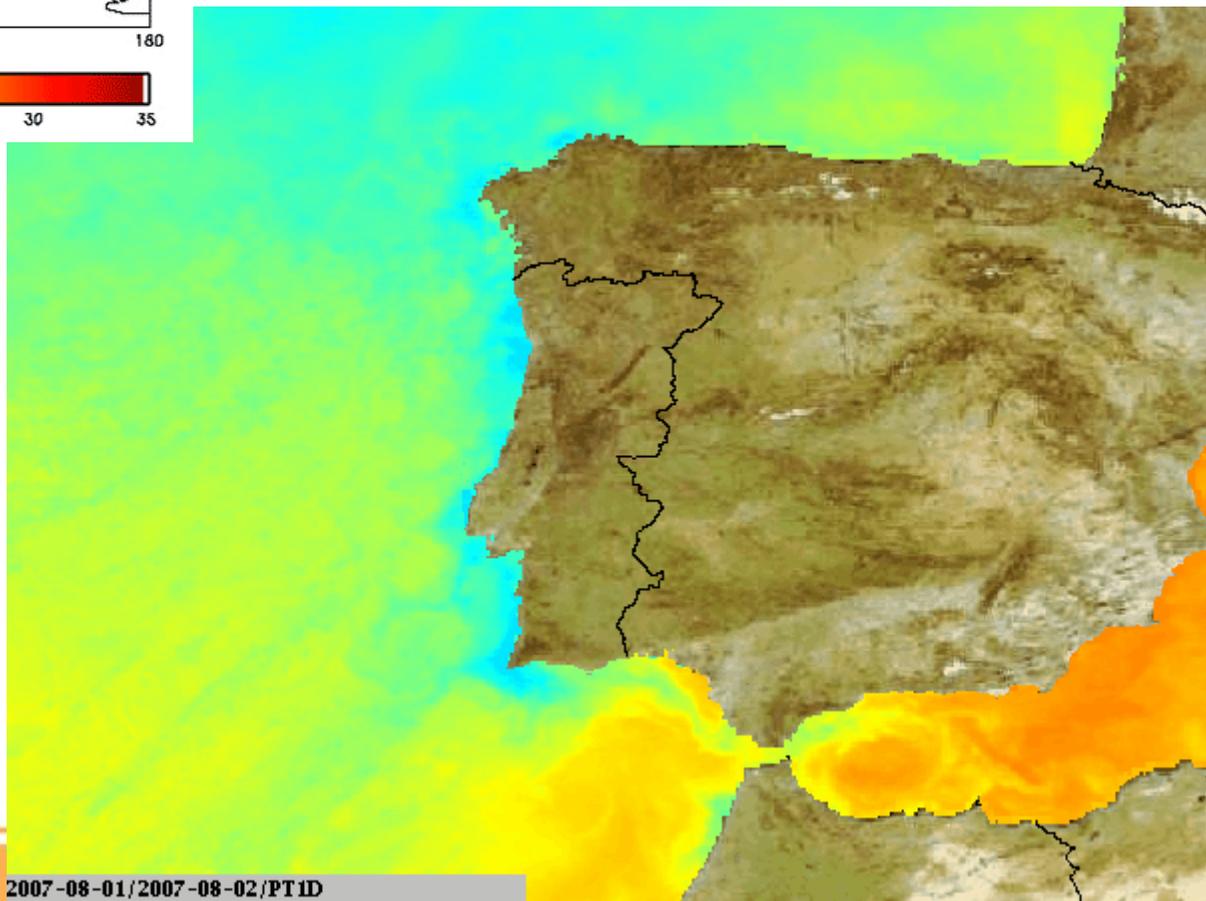


- Examples of applications



SST global map, July 2003

- Sea Surface Temperatures, 1-km  
1-15 August 2007 off the Portuguese coasts



12  $\mu\text{m}$  thermal image, 2 April 2001

B-15B

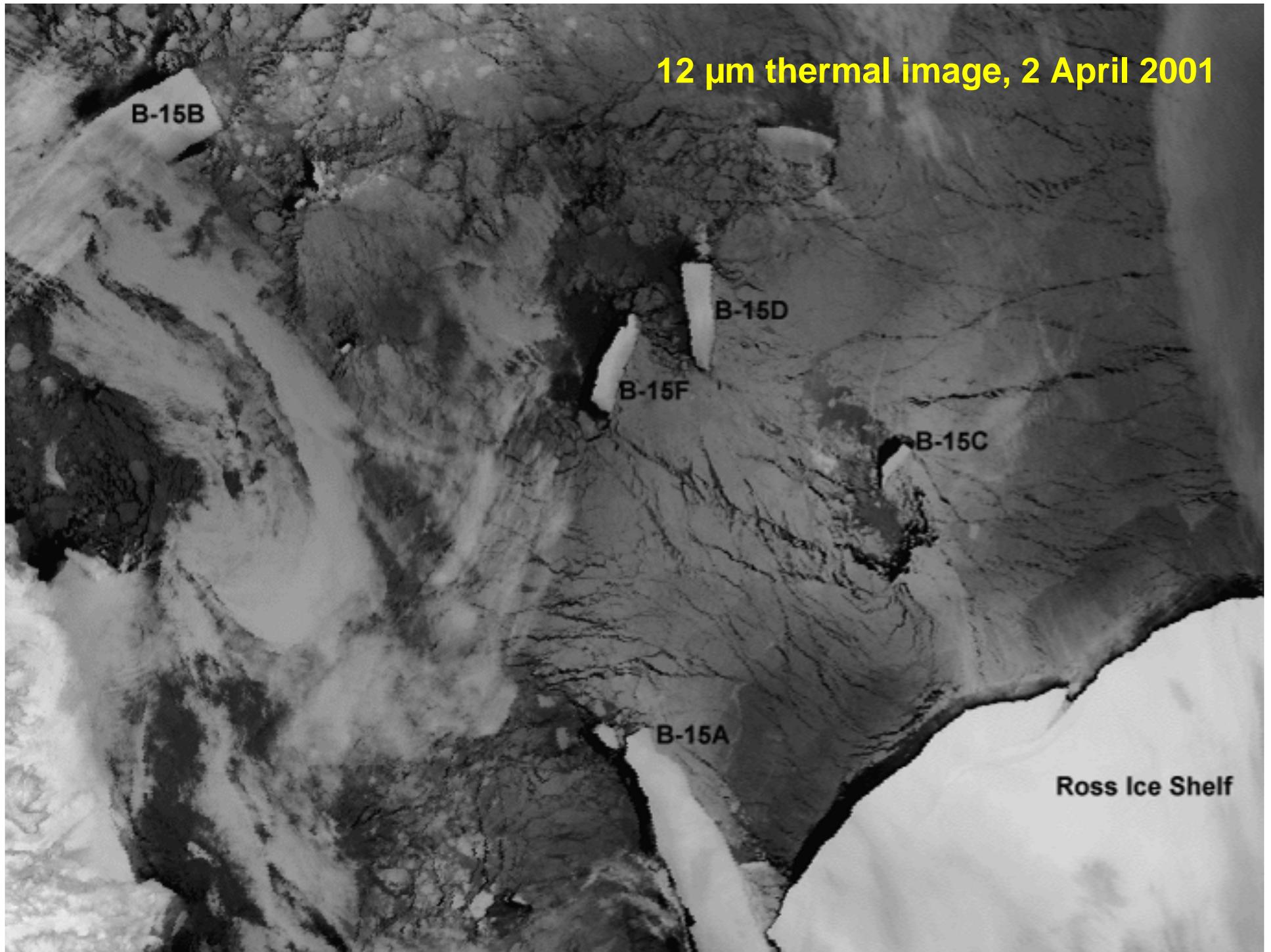
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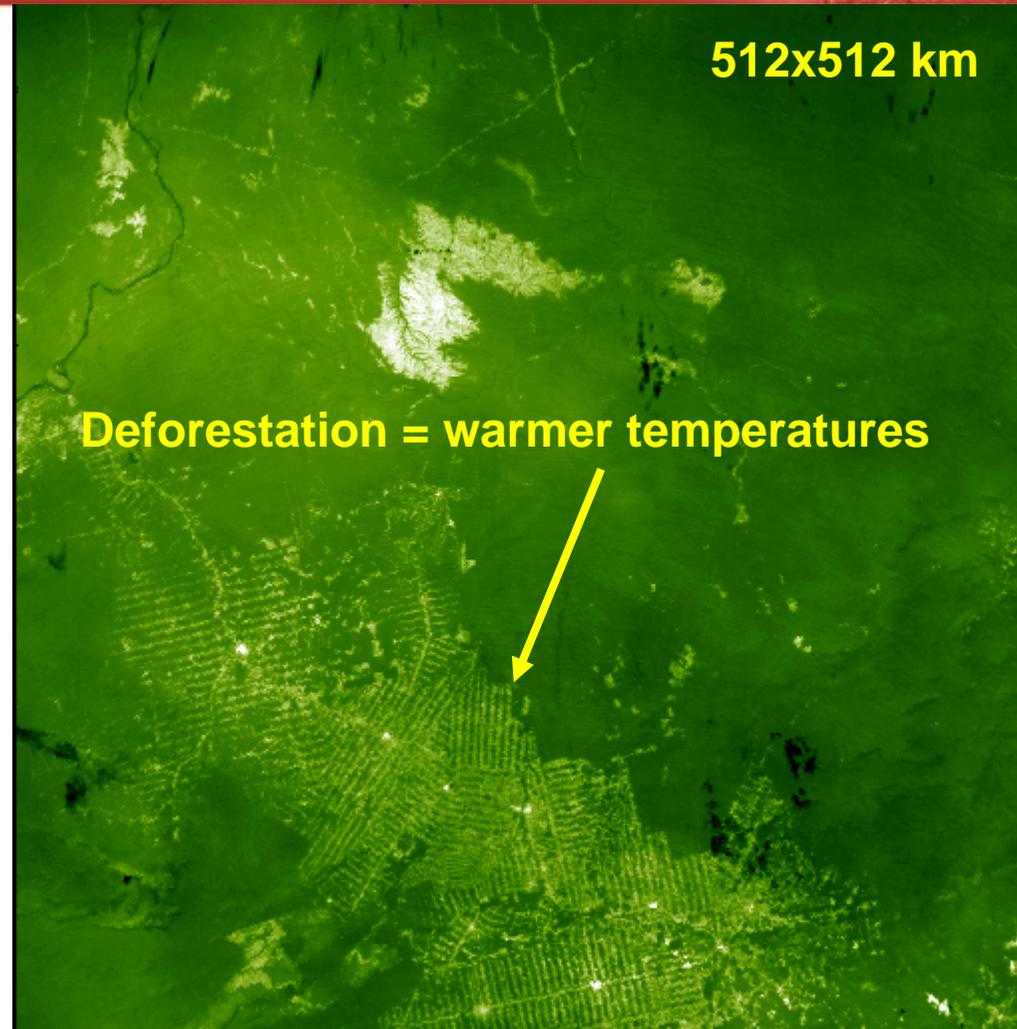
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B-15C

B-15A

Ross Ice Shelf





- ATSR-1: deforestation in Brazil. 11 micron daytime image, 28/08/1991.
- Lighter colour = Higher temperature

- **Hot spots across Southeastern Europe from 21 to 26 August 2007**
- **AATSR, 3.7 micron, night-time**





# The new ATSR Archive

- A **major milestone** for ATSR users worldwide
- To be completed in coming months
- **All ATSR-1, ATSR-2 and AATSR** processed to same format and same processing standard
- Available in UK through NEODC and in rest of world via ESA
- Online access through MERCI interface

***<http://merci-srv.eo.esa.int/merci>***



The image shows a screenshot of the 'merci Login' interface. At the top is a logo featuring a stylized globe with a white 'S' shape overlaid. Below the logo, the text 'merci Login' is displayed. Underneath, there are two input fields: 'User-Name:' and 'Password:'. To the right of the 'Password:' field is a 'Login' button. At the bottom of the interface, the text reads 'ESA Catalogue and Inventory for Envisat MERIS Reduced Resolution products'.



# Versions

- **Version 1** Summer 2007
  - ATSR-1/2 in Envisat format
  - AATSR current processing
- **Version 2** Spring 2008
  - Uniform SST and LST series across all (A)ATSR missions
  - LST complete time-series
  - 12 years of visible channel data

NEODC : [www.neodc.rl.ac.uk](http://www.neodc.rl.ac.uk)

ESA: [earth.esa.int](http://earth.esa.int)



- More information:
- ATSR website, Rutherford Laboratory: <http://www.atsr.rl.ac.uk/>
- AATSR website, Univ. Leicester: <http://www.leos.le.ac.uk/aatsr>