COP-9 Kiosk, 11 Dec 2003

Satellite Earth Observation - supporting the implementation of the Kyoto Protocol

Josef Aschbacher, European Space Agency

- **Undisputed challenges for mankind**
- **Montreal – An example to follow for Kyoto?**
- **How can Satellites support Kyoto ?**
- **A Vision**

Climate Change happens already

Intergovernmental Panel on Climate Change states

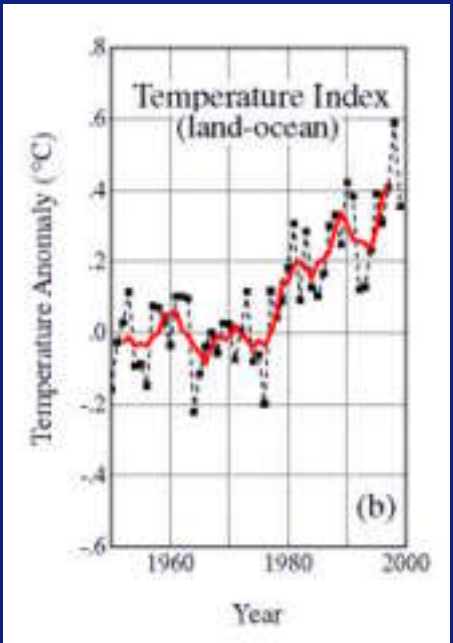
- Global average surface temperature has increased by 0.6 C over 20th century
- Globally, the 1990s were warmer than any other 10-year period in the last 1000 years
- Since 1750, carbon dioxide concentration has increased by 31%, methane by 151%, nitrous oxide by 17%

Increased damage through natural disasters

- 60 bn US$ total damage in 2003
- Europe's 2003 heat wave caused 10 bn $ in agricultural loss
- Flooding in China's Huai and Yangtse rivers cost 8 bn $

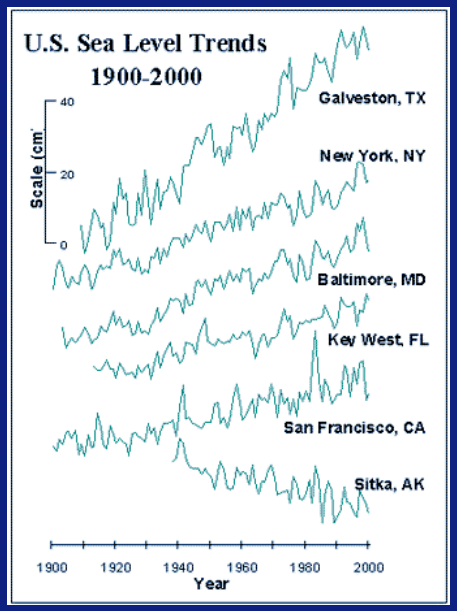
Sufficient evidence for climate change

Global temperature anomaly 1950-2000



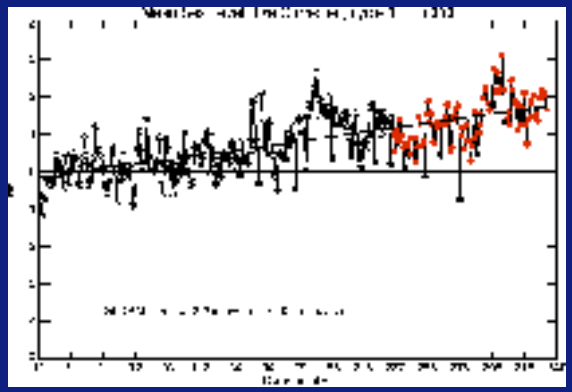
Courtesy of: NASA /Goddard Institute for Space Studies

U.S. sea level trends 1900-2000



Courtesy of: EPA (USA)

Global mean sea level 1992-2001



Courtesy of: CNES, CLS (F)

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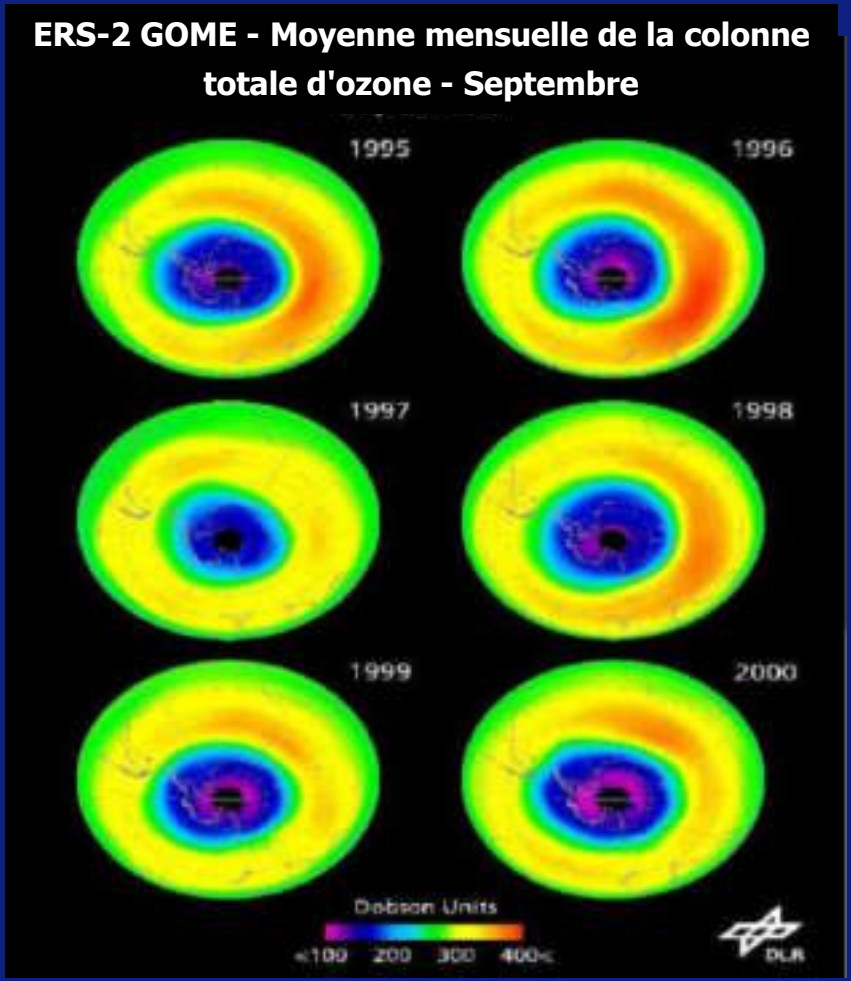
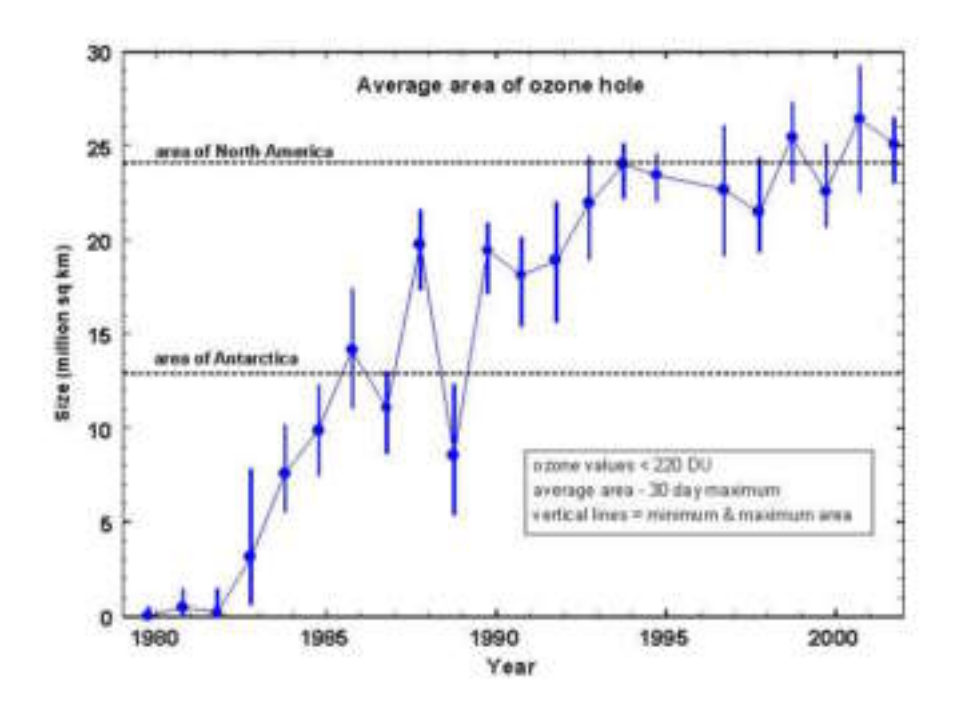
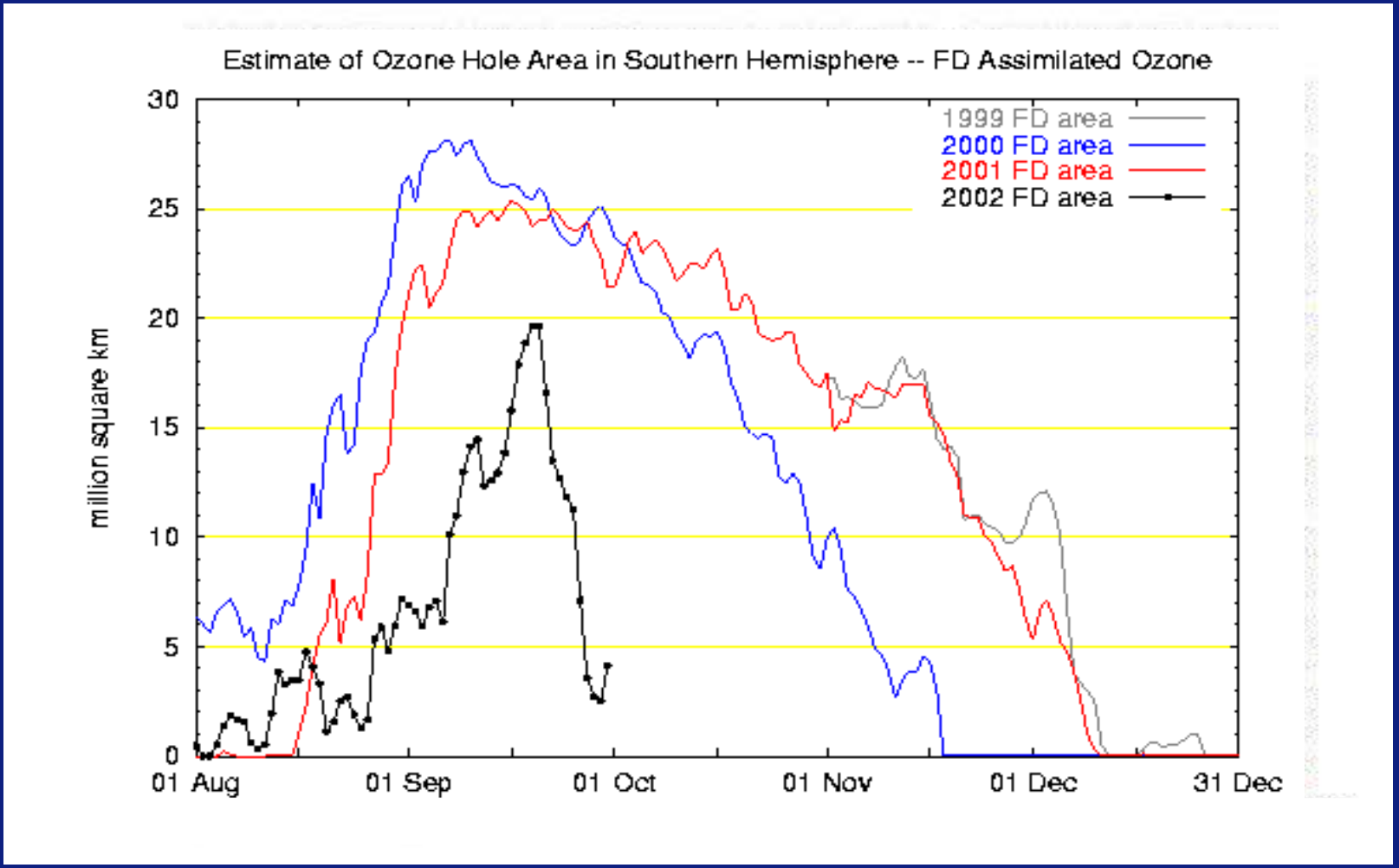
The Montreal Protocol





A model - how information from space can lead to political action?

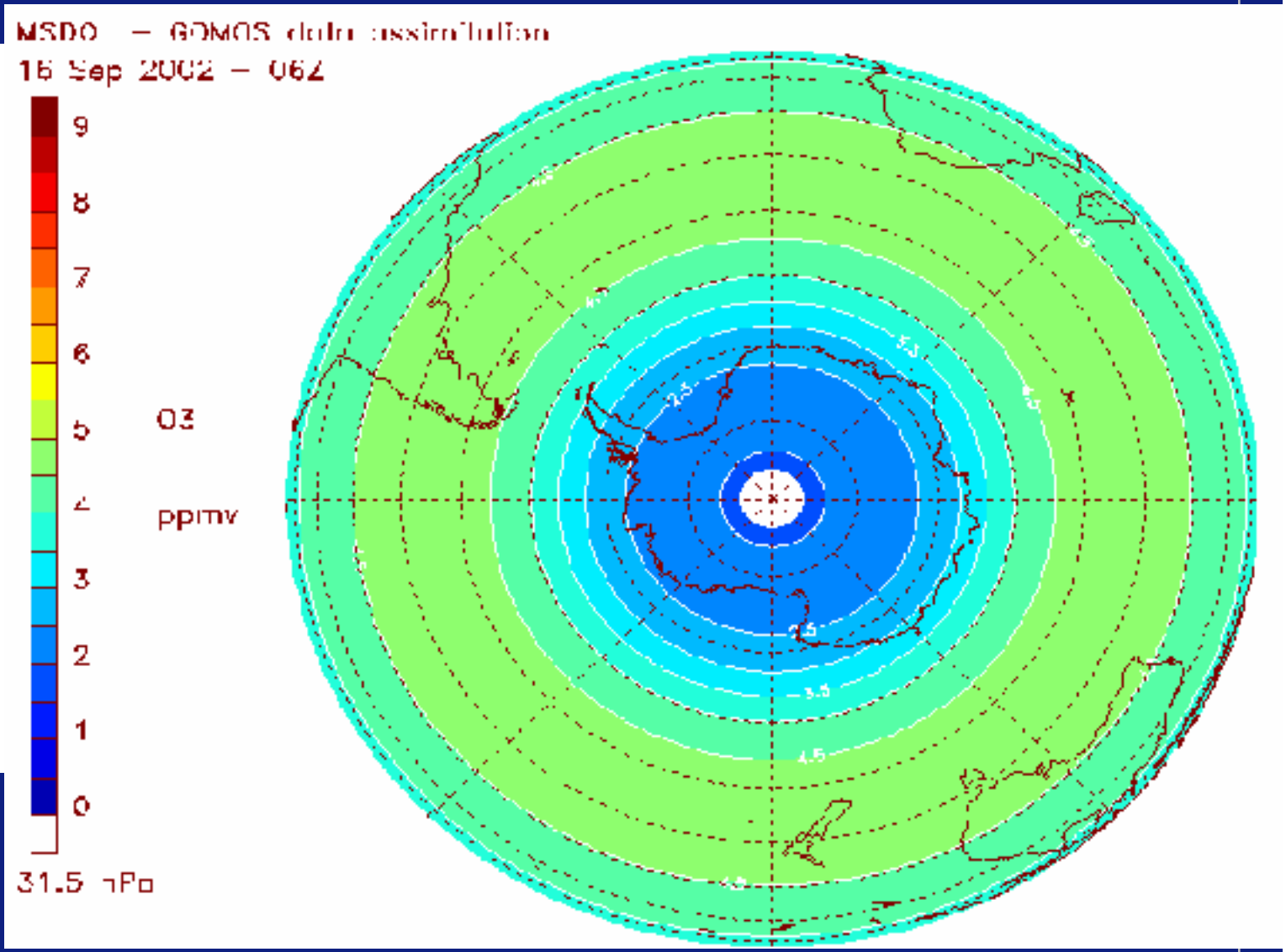


Size of the Antarctic continent: about 14 million km²
(USA ~ 9 million km², Italy ~ 0.3 million km²)

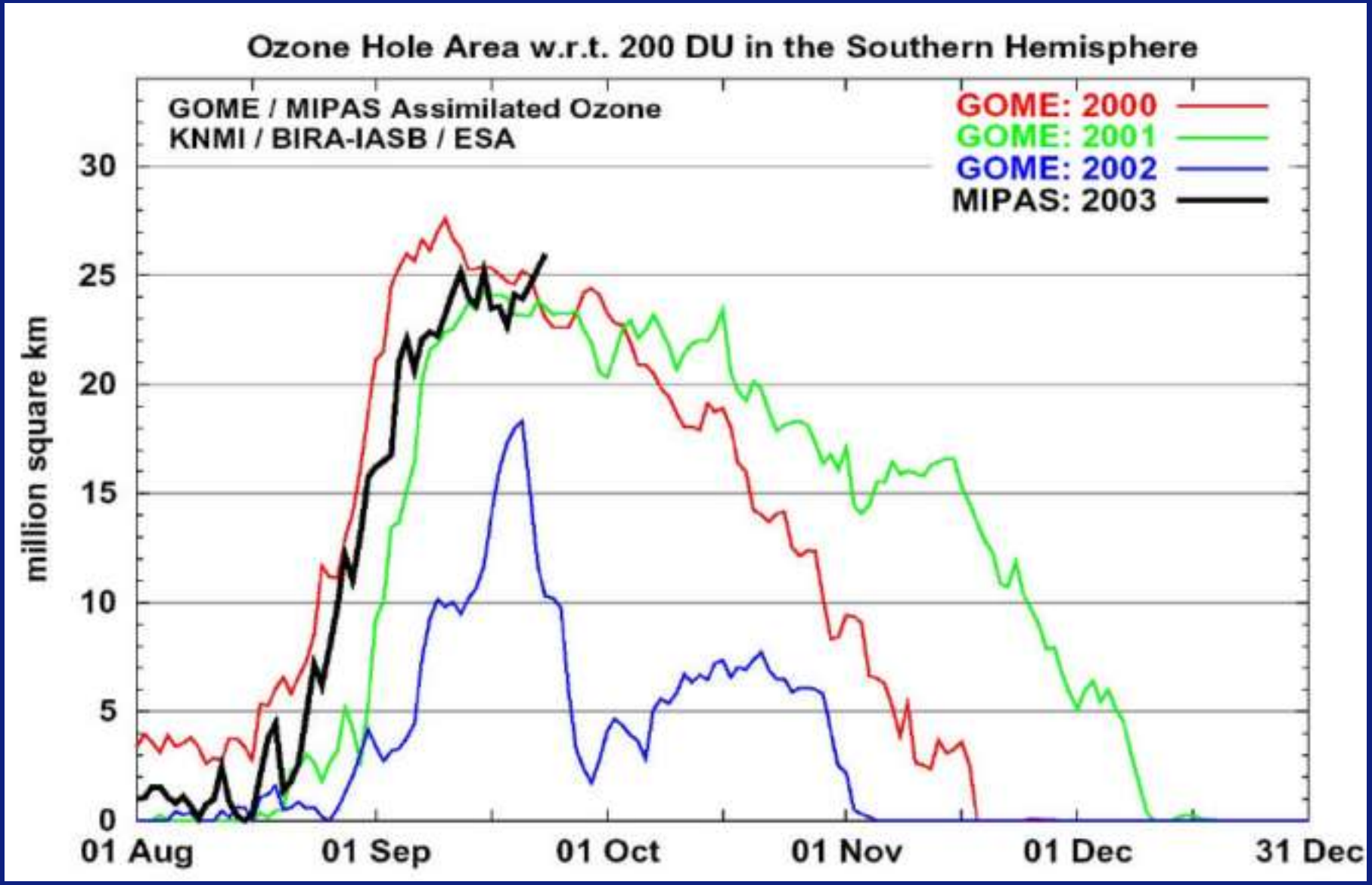
Antarctic ozone hole break-up

September 2002

<u>GOMOS</u> assimilated ozone field



ENVISAT Atmospheric Measurements



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Kyoto Protocol – primary parameters from space

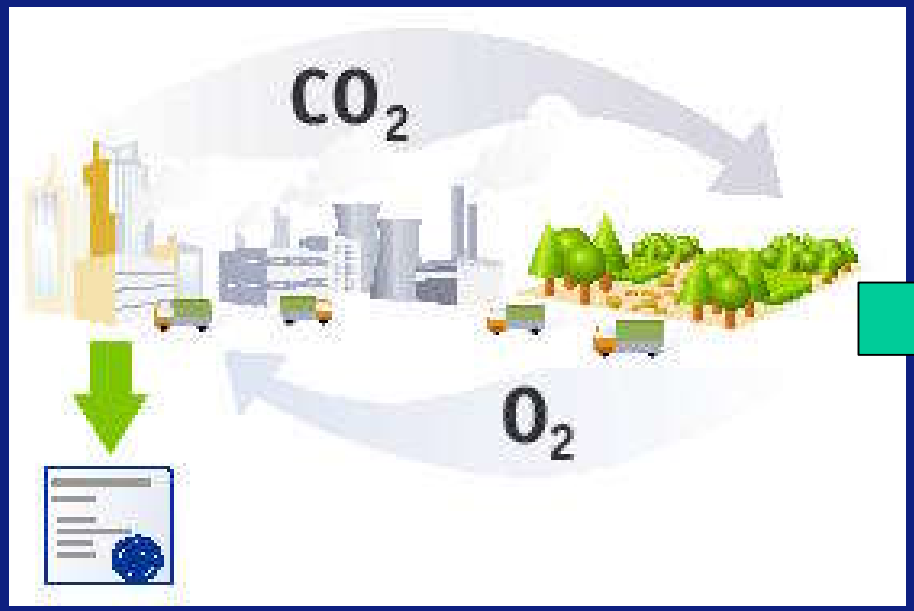
1) National Reporting

- Support to 1990 baseline mapping
- Monitoring of carbon sinks and sources during 2008-12 reporting period, i.e. monitoring of ARD and land-use changes

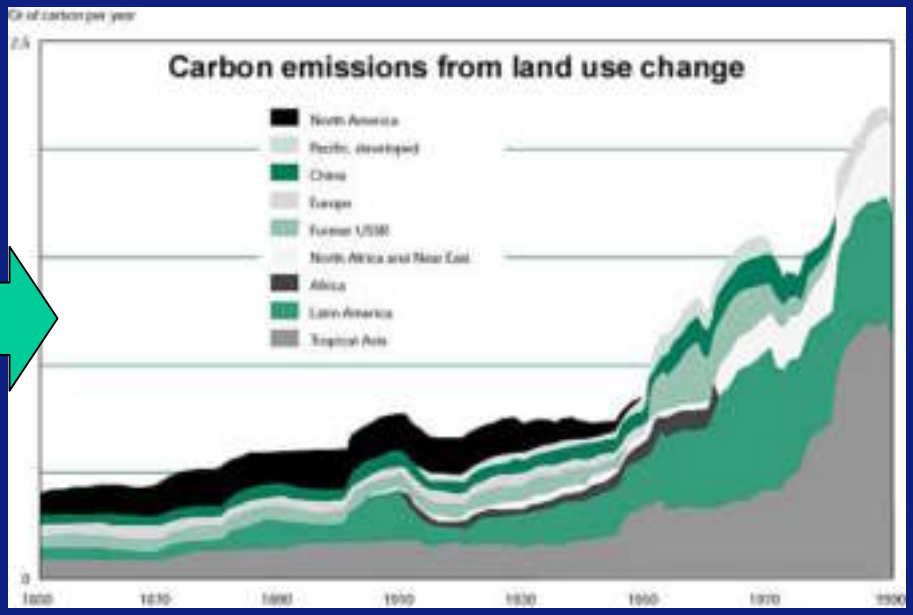
2) Updating of climate change estimates with new science for future evolutions of Kyoto Protocol

- Monitoring of climate relevant parameters, e.g. trace gases (CO2, CH4, NOx, SO2, etc.)
- Environmental impact assessments, e.g. land-cover changes, desertification, ice melting, sea level rise, etc.

Kyoto - Carbon budget linked to land use change

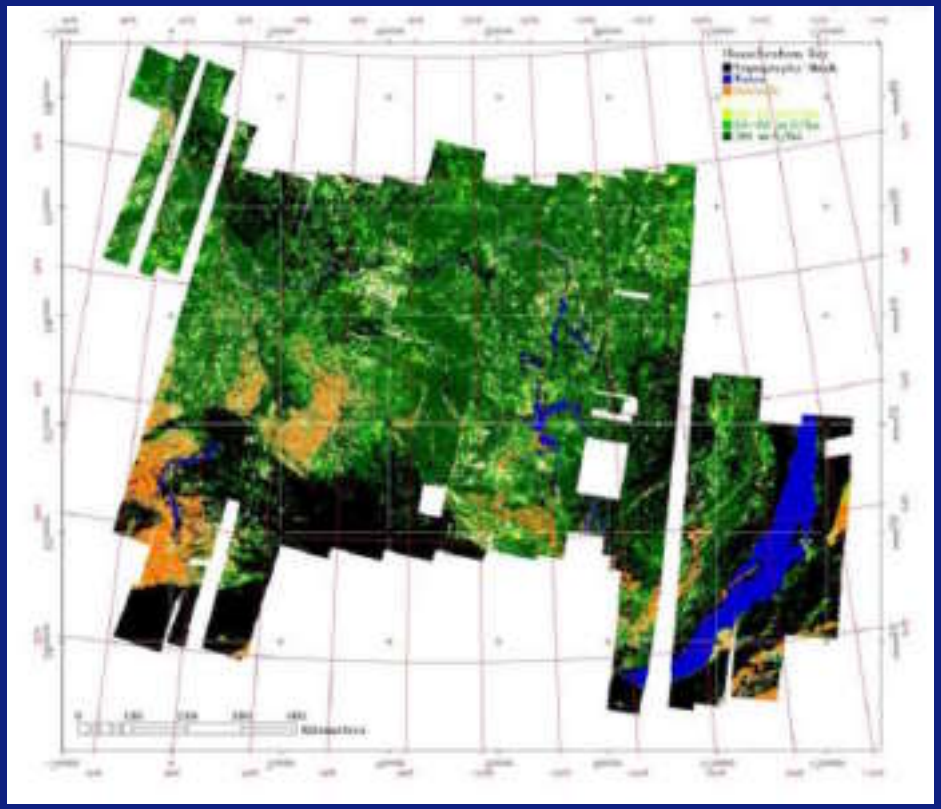


Understanding the global carbon cycle

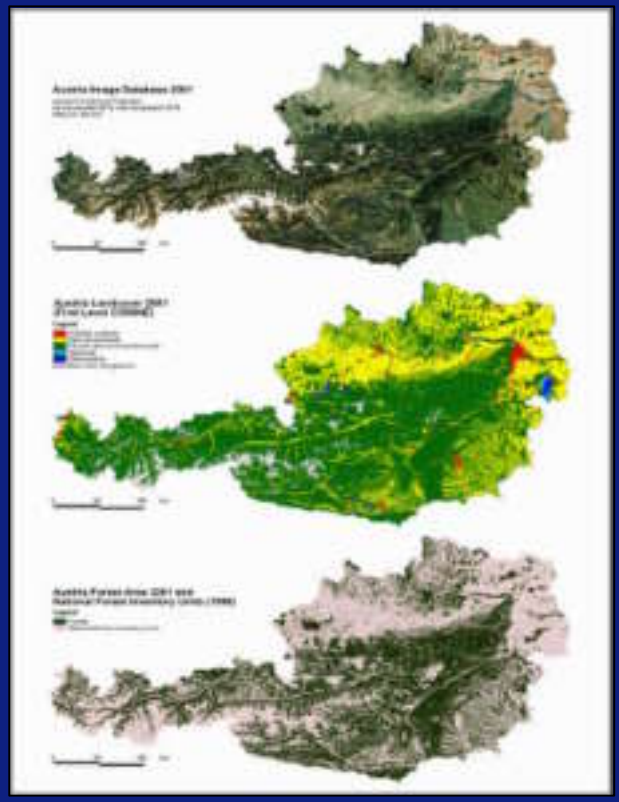


Carbon emissions from land use change 1850-1990

Kyoto - Carbon budget linked to land use change



Regional forest mapping
- Siberia -



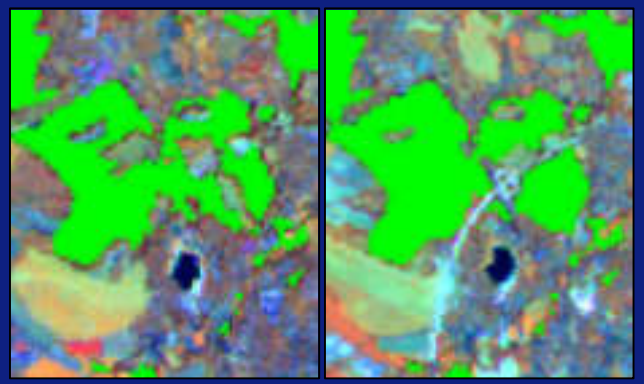
Sources - ledft
Analysis: DLR (D)
Data: ERS (ESA)

Sources - ledft
Analysis: GeoVille (A)
Data: Landsat (USA)
FBVA (A)

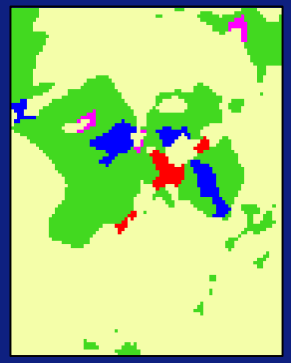
National forest mapping
- Austria -

Kyoto - Sample Products

Contribution to National UNFCC/ KP Report - Germany

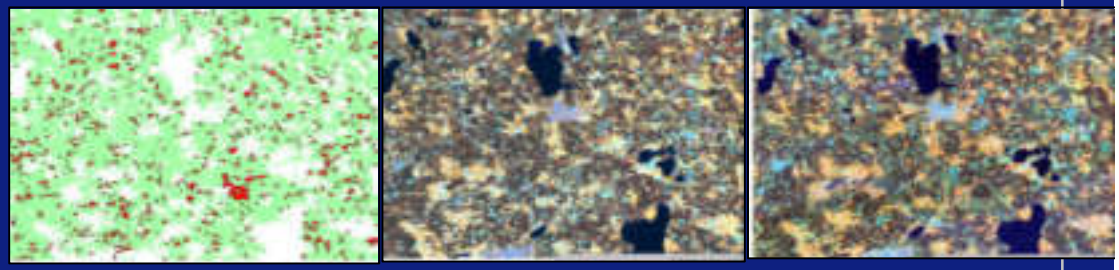


1989 2002



Forest Cover Change Map

Clear Cut Monitoring Service-Sweden

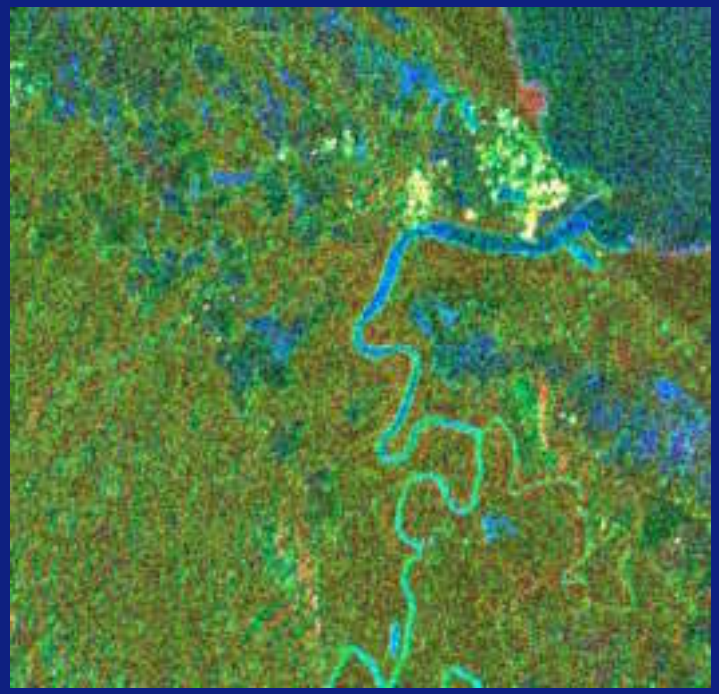


Historical Clearcut map 1988 1999

Forest Clear Cut Map

Kyoto - Sample Products

Forest Monitoring as Input to Greenhouse Gas Reporting for Cloudy Regions



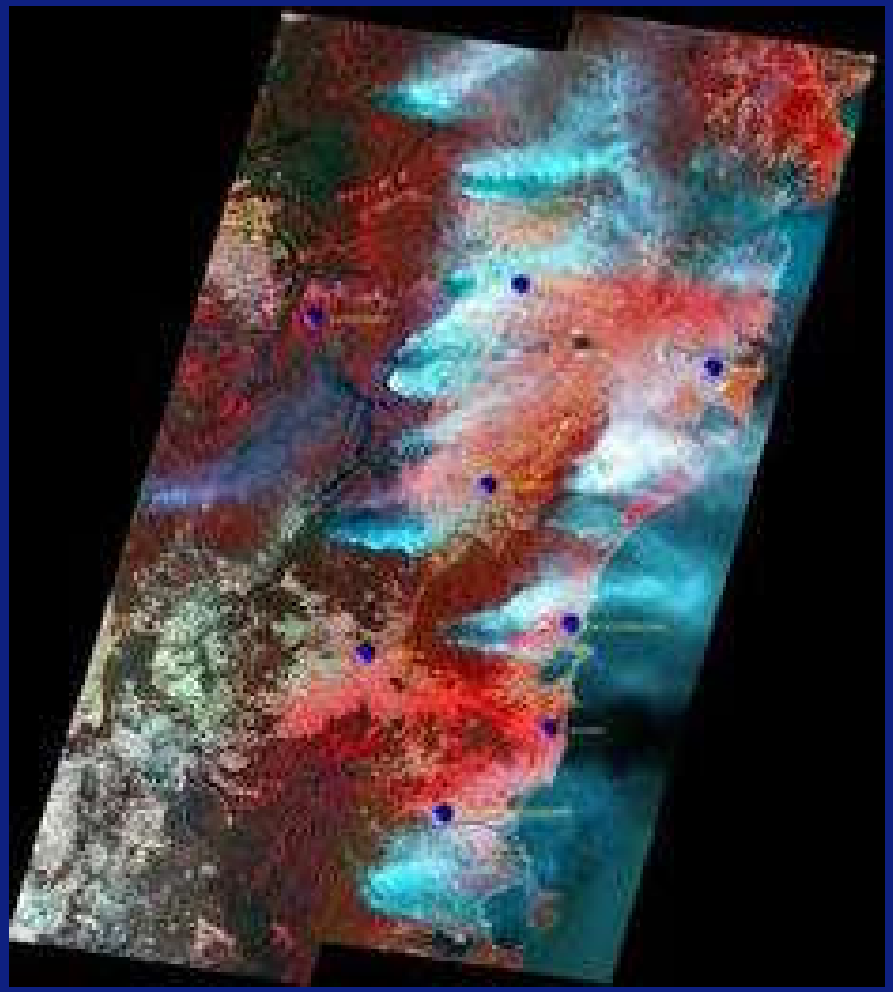
Multitemporal Radar Image

Classification (Forest Cover Map)

Multitemporal countrywide analysis based on 270 ERS satellite scenes

Benefit: Reliable forest information in cloud-covered regions

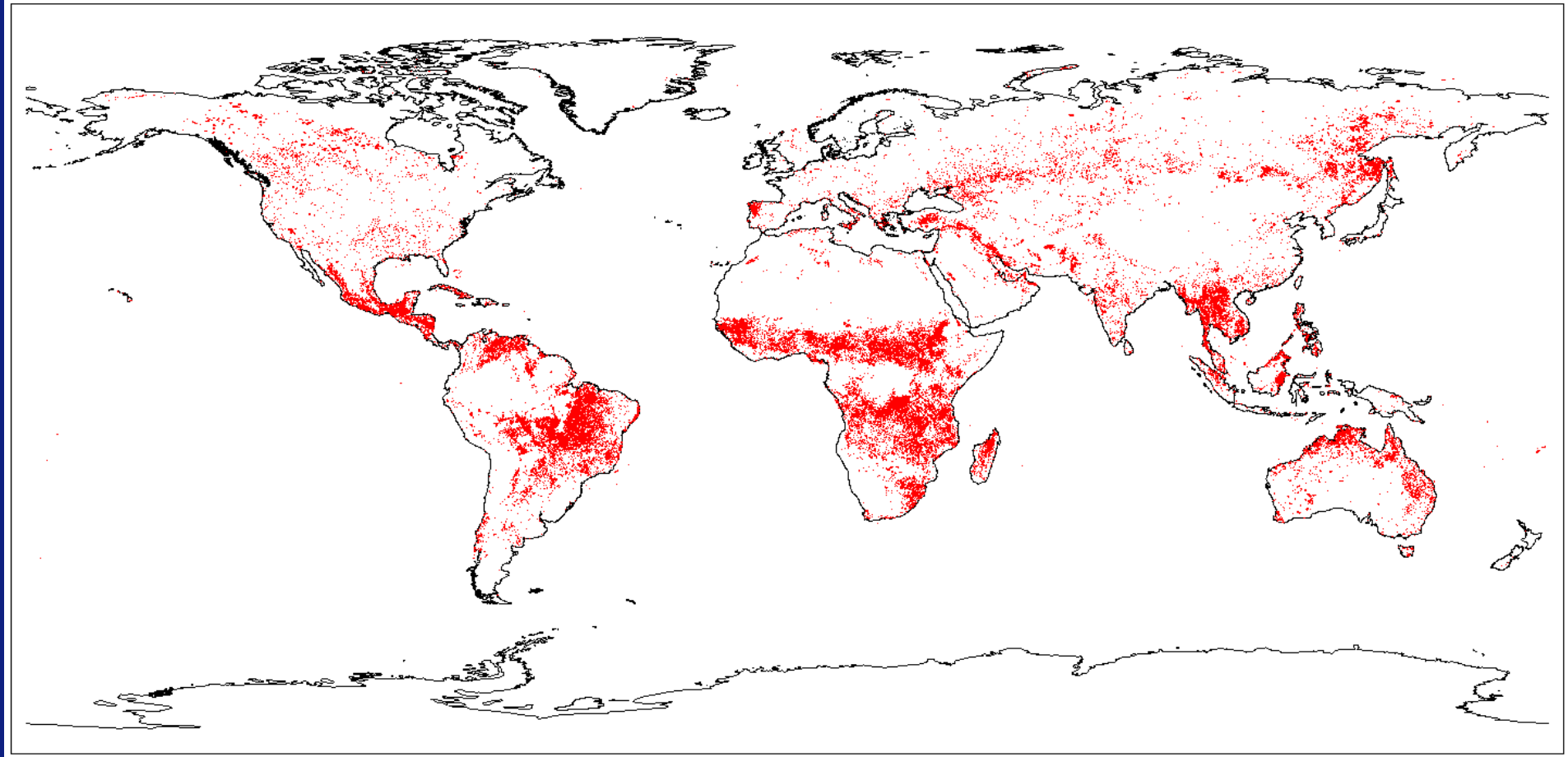
Fires from Satellites



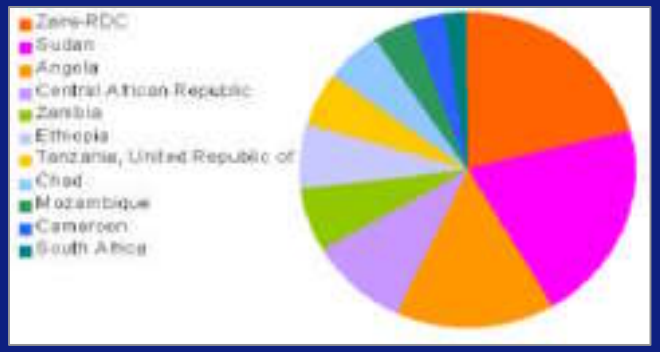
Satellite image showing Sydney Fires - acquired 8 January 2002

Sources:
Spot image, © CNES 2002
Acquisition by Australian Centre for Remote Sensing (ACRES), Geoscience Australia.

Global Fire Atlas : 1998



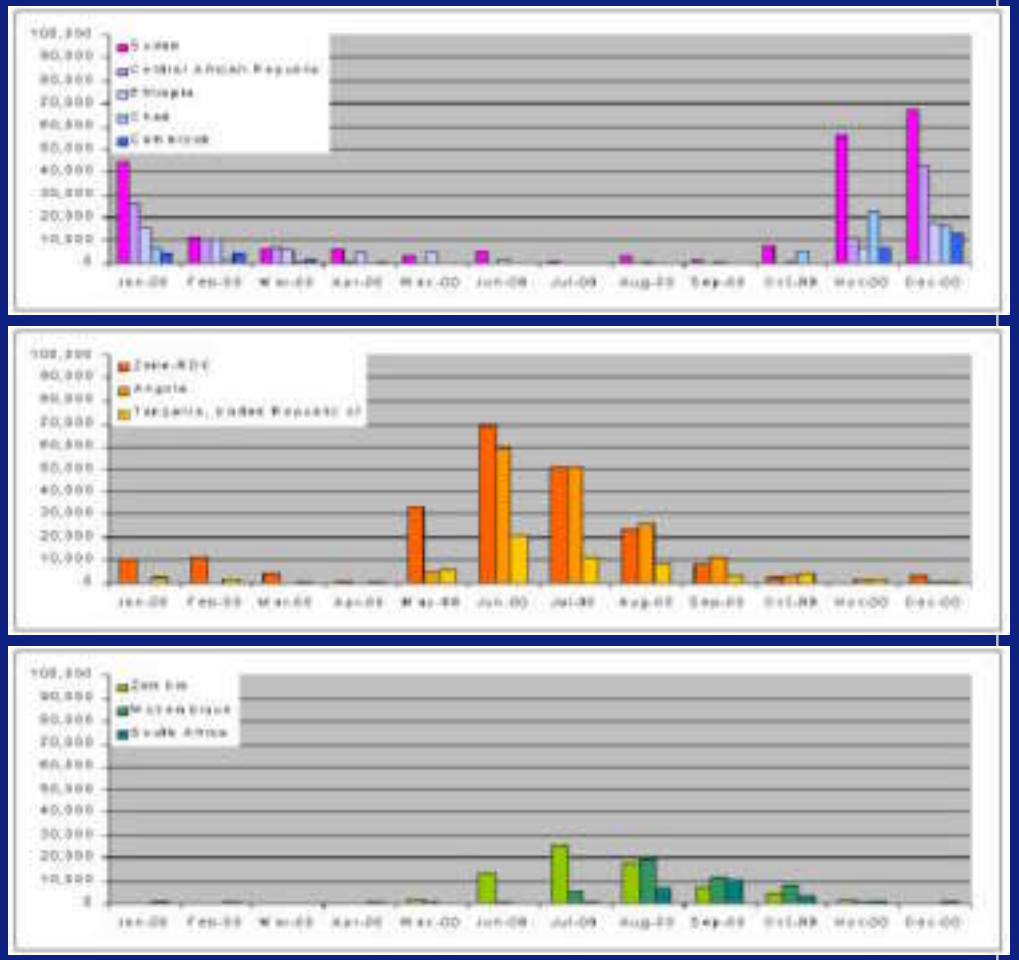
Biomass burning statistics in Africa



Repartition of biomass burning over the African continent

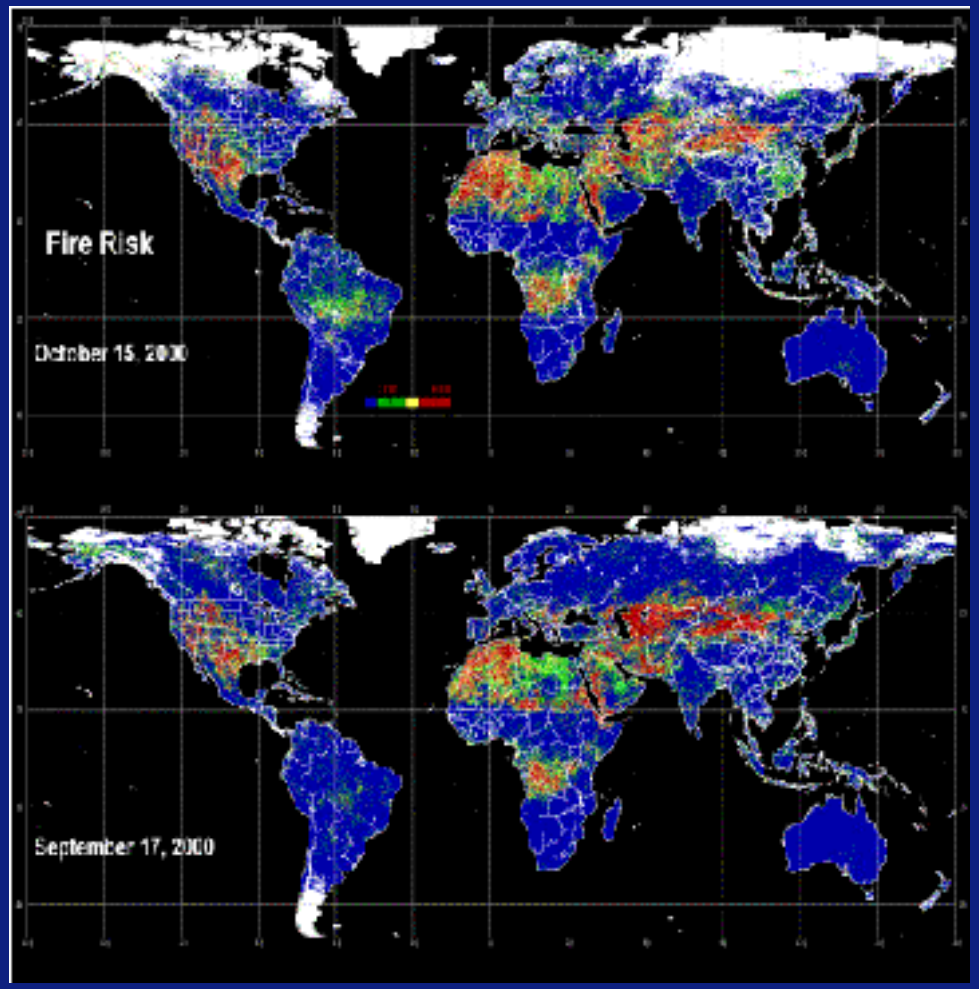
Country	Annual area burnt (Ha)
Zaire-RDC	216,814
Sudan	213,154
Angola	157,031
Central African Republic	97,272
Zambia	70,264
Ethiopia	68,026
Tanzania, United Republic of	58,820
Chad	53,122
Mozambique	44,353
Cameroon	29,643
South Africa	24,313

Annual burning figures, Africa



Fire seasonality across the continent

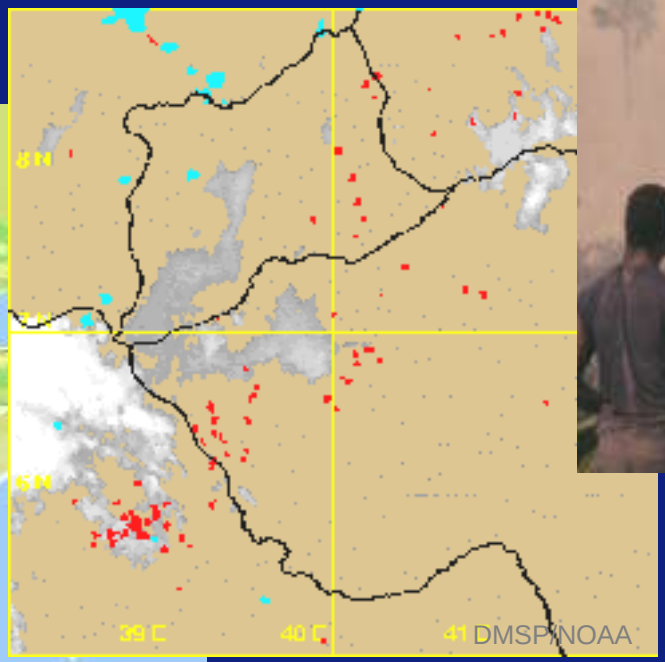
Global Fire Risk Maps



Fire Fighting in Ethiopia

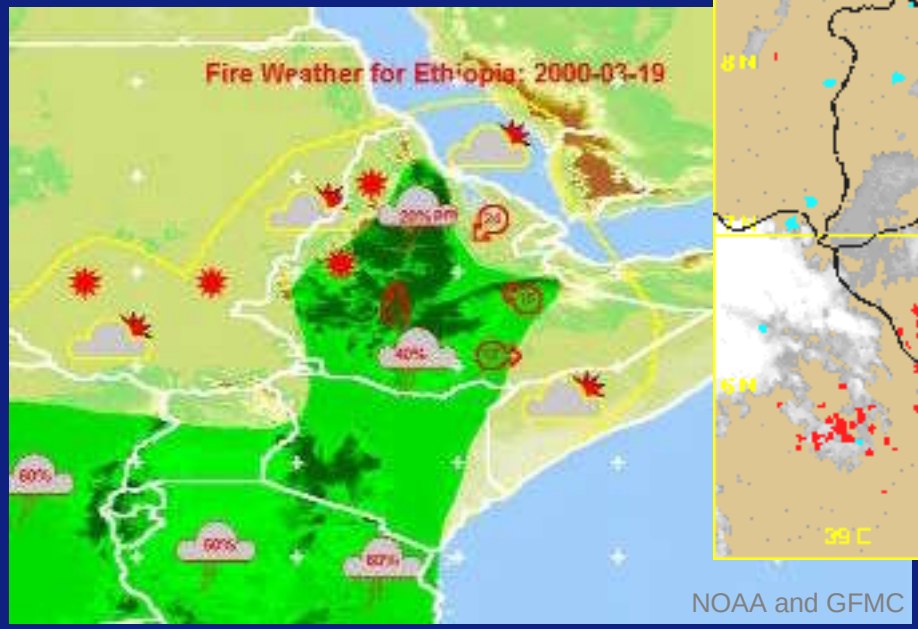
Fire fight

Fire map



Monitored from satellites

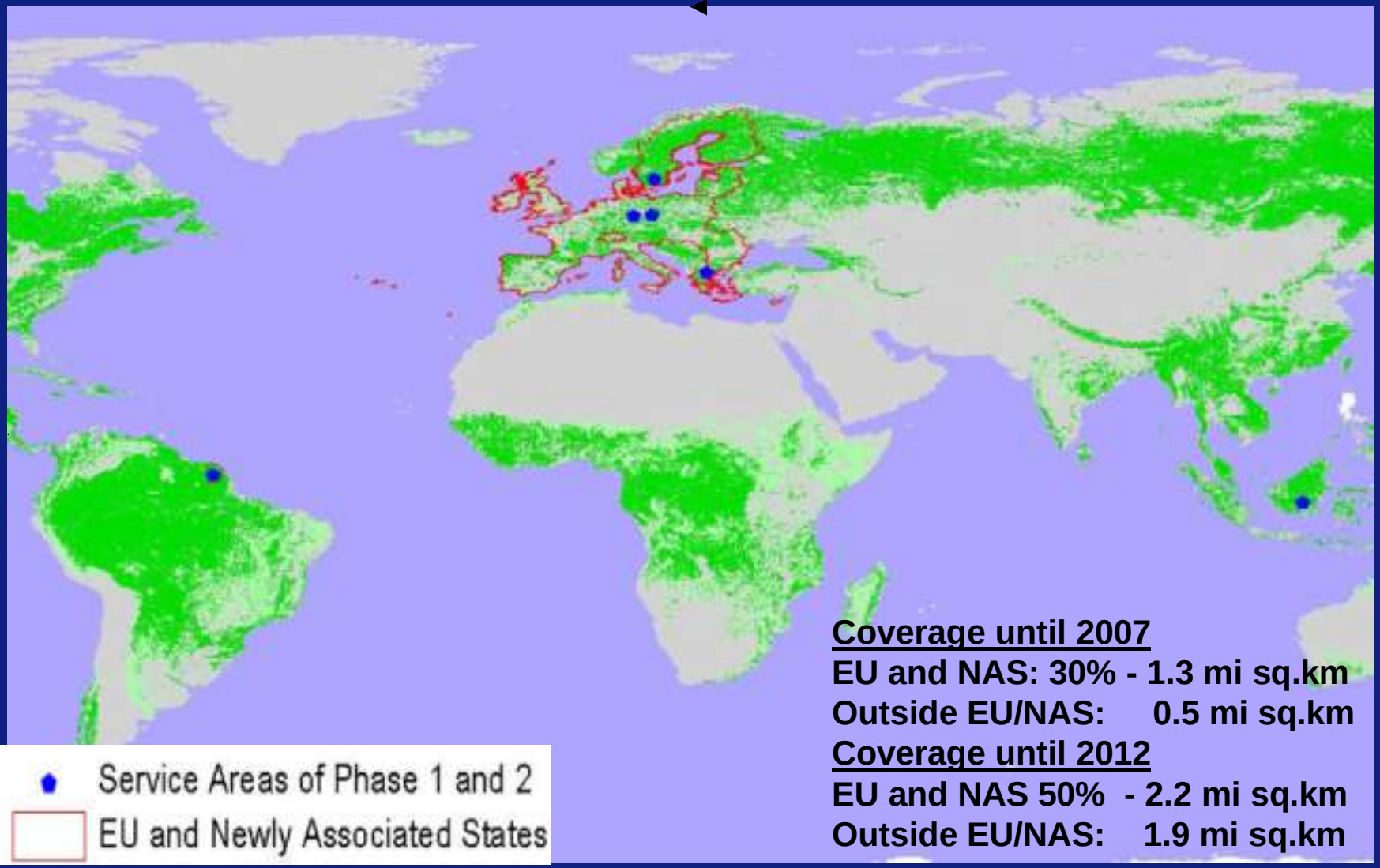
Fire Risk Map



NOAA and GFMC

Integration of satellite and ground information

Space = Global applicability



Coverage until 2007
EU and NAS: 30% - 1.3 mi sq.km
Outside EU/NAS: 0.5 mi sq.km
Coverage until 2012
EU and NAS 50% - 2.2 mi sq.km
Outside EU/NAS: 1.9 mi sq.km

ESA Supporting International Conventions

- ESA supports:
  - ✓ World Heritage Convention;
  - ✓ Ramsar Convention on Wetlands;
  - ✓ UNCCD;
  - ✓ UNFCCC;
  - ✓ MARPOL 73/78 on marine pollution;

- ESA attending key events:
  - ✓ World Summit, Johannesburg, 2002;
  - ✓ COP 7 of the UNFCCC, Bonn, 2001;
  - ✓ COP 8 of the UNFCCC, New Delhi, 2002;
  - ✓ COP 8 of the Ramsar Convention, Valencia, 2002;
  - ✓COP 9 of the UNFCCC; Milan, 2003

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A Vision for the use of satellites for every citizen in everyday life

- Thomas Edison's vision 1879: every citizen shall have access to electricity and use a light bulb for his daily life
- Tim Berners-Lee 1990: every citizen shall have access to globally distributed information sources using the internet
- Our vision 2003: every citizen shall be able to **easily** monitor the **state of his environment**, from the whole planet to his country, his village, his street…