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GEOSS for Climate: Activities and achievements

Giovanni Rum
GEO Secretariat
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THE GLOBAL EARTH OBSERVATION SYSTEM OF SYSTEMS

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GEOSS Climate SBA

Understanding, assessing, predicting, mitigating, and adapting to climate variability and change

- The climate has impacts in each of the other eight societal benefit areas.
- Coping with climate change and variability demands good scientific understanding based on sufficient and reliable observations.
- GEOSS outcomes will enhance the capacity to model, mitigate, and adapt to climate change and variability.
- Better understanding of the climate and its impacts on the Earth system, including its human and economic aspects, will contribute to improved climate prediction and facilitate sustainable development while avoiding dangerous perturbations to the climate system. (*GEOSS 10-Year Implementation Plan)*

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Expected Benefits

Climate observations, modelling and data sets

- **Essential to and supports all SBAs**
  - **Vast range of user communities**
- **Support adaptation and mitigation under UNFCCC**
- **Support to IPCC assessments**
- **Climate information as a global public good**
  - **Data Sharing Principles with open access**
- **Support science and research community**
  - **Including modellers**

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Climate Change Adaptation: The Cross-cutting Dimension of GEOSS

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Fighting Emerging Diseases

Climate

Weather

Biodiversity

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Defining Energy Policies

Agriculture

Water

Weather

Biodiversity

Climate

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Securing Food

Weather

Water

Agriculture

Health

Biodiversity

Ecosystems

Climate

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Reducing Impact of Disasters

Water

Weather

Climate

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GEOSS Climate Tasks

- **A Climate Record for Assessing Variability and Change**
  - Sustained Reprocessing and Reanalysis of Climate Data
  - Extending the Record of Climate Variability at Global Scale
  - Key Climate Data from Satellite Systems
- **Environmental Information for Decision-making, Risk Management and Adaptation**
  - Towards Enhanced Climate, Weather, Water and Environmental Prediction
  - Climate Information for Decision-making, Risk Management and Adaptation
- **Global Carbon Observation and Analysis System**
  - Integrated Global Carbon Observation
  - Forest Carbon Tracking
  - Global Monitoring of Greenhouse Gases from Space
- **Sustained Observing Systems**
  - Global Terrestrial Observations for Climate
  - Legacy of the International Polar Year
  - Global Ocean Observation System
  - Global Observing System (GOS)

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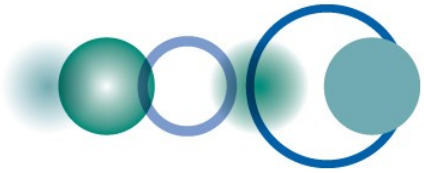

A Climate Record for Assessing Variability and Change

- Extend and improve the quality of the past climate record through advanced data reanalysis and reconstruction in the atmosphere, ocean, land and sea ice domains.
- Generate high-quality temporally-homogeneous estimates of the past climate to support analyses of climate variability and change.

Sub-Tasks

- Sustained Reprocessing and Reanalysis of Climate Data
- Extending the Record of Climate Variability at Global Scale
- Key Climate Data from Satellite Systems

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Environmental Information for Decision-making, Risk Management and Adaptation

- Support the integration of climate and environmental risk management into adaptation processes.
- Coordinate and drive the development of tailored climate products and services.
- Encourage the use of this information by policy and decision makers (at all levels), and initiate user-oriented activities to do both increase the demand, and foster the supply, of climate and environmental services for development.

Sub-Tasks

- Towards Enhanced Climate, Weather, Water and Environmental Prediction
- Climate Information for Decision-making, Risk Management and Adaptation

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Global Carbon Observation and Analysis System

- Implement a global carbon observation and analysis system addressing the three components of the carbon cycle (atmosphere, land and ocean).
- Develop robust tools and methodologies for high-precision CO2 measurements and carbon storage evaluation.

Sub-Tasks

- Integrated Global Carbon Observation (IGCO)
- Forest Carbon Tracking
- Global Monitoring of Greenhouse Gases from Space

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Sustained Observing Systems

- Establish actions for the maintenance and expansion of observing systems for climate and weather, including terrestrial, oceanic, air-borne and space-based.
- Promote stable, reliable and long-term operations of climate and weather observing networks.
- In particular, accelerate the implementation of the Global Climate Observing System (GCOS) in line with the “Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC”.

Sub-Tasks

- Key Terrestrial Observations for Climate
- Legacy of the International Polar Year 2007-08
- Global Ocean Observation System
- Global Observing System (GOS)

Environment and Climate Change

To respond to the growing demand for Earth observation data, **we will accelerate efforts within the Global Earth Observation System of Systems (GEOSS),** which builds on the work of UN specialized agencies and programs, in priority areas, inter alia, climate change and water resources management, by strengthening observation, prediction and data sharing. We also support capacity building for developing countries in earth observations and promote interoperability and linkage with other partners.

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2009 Key Climate Events

- Expert Meeting on Updating the GCOS Implementation Plan: Feb 2-5
- 3rd GEOSS Asia-Pacific Symposium: Feb 4-6
- WMO EC Working Group on Climate and Environmental Matters: Feb 11-13
- Joint IPCC-WCRP-IGBP Workshop: New Science Directions and Activities relevant to the IPCC AR5: March 3-6
- World Water Forum: March 16-22
- Closure Meeting on the 2009 GCOS Progress Report: Mar 19-20
- Thirtieth session of the WCRP Joint Scientific Committee (JSC), Apr 6-9
- 33rd International Symposium on Remote Sensing of Environment : May 4-8
- The WMO/GEO/WCRP IPY Legacy Workshop on Sustaining Projects' Contributions to WMO Global Cryosphere Watch and GEOSS: May 2009
- GEOSS Forest symposium: July 1-3
- International Geoscience & Remote Sensing Symposium, IGARSS 09: July 13-17
- OceanObs'09 Ocean Information for Society: Sustaining the Benefits, Realizing the Potential: Sept 21-25
- WCC: Aug 31-Sept 4
- GEO-VI Plenary: Nov 17-18
- COP-16: Nov 30-11 Dec

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GEOSS Climate Achievements

Ozone Climate Data Records

- SBUV/2 data
  - NOAA-16 SBUV/2 (2004 to 2007)
  - NOAA-17 SBUV/2 (2003 to 2007)

- Reprocessed with the latest instrument characterization and calibration

- Extend the previously released Ozone Climate Data Record (1979 to 2003) from SBUV(/2) instruments by four years.

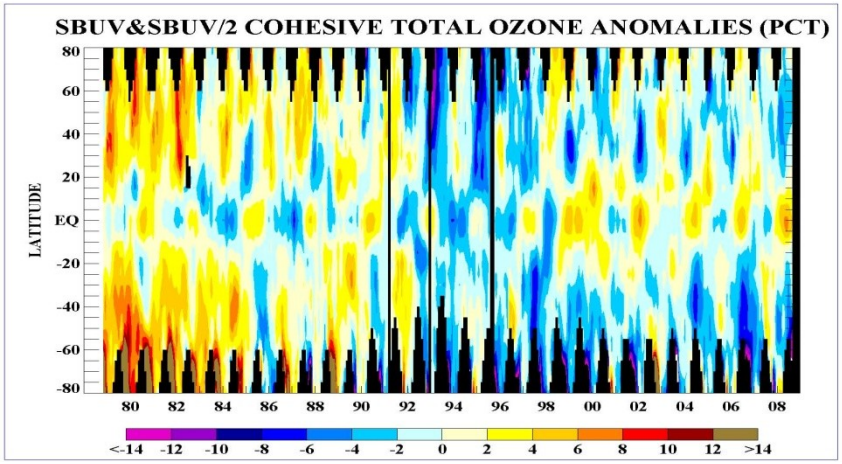


Figure from NOAA's 2007 S.Hemisphere Winter Summary showing total ozone anomalies versus time and latitude.
www.cpc.ncep.noaa.gov/products/stratosphere/winter_bulletins

Significance: The SBUV(/2) ozone CDR's are used to determine and monitor atmospheric ozone trends and variations. These are compared to models and other results in creating the international ozone assessments. The latest report is available at:
www.esrl.noaa.gov/csd/assessments/2006/

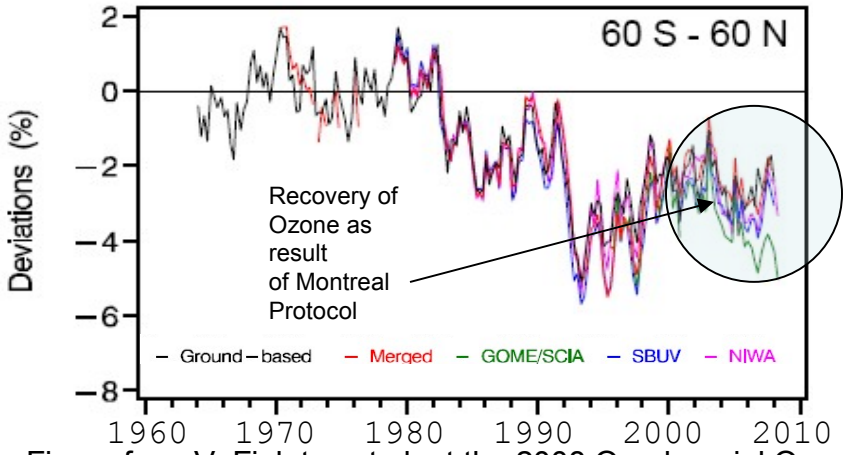


Figure from V. Fioletov et al. at the 2008 Quadrennial Ozone Symposium in Tromso Norway showing deseasonalized global mean ozone time series from SBUV(/2) and other sources.

Project Lead: Lawrence Flynn

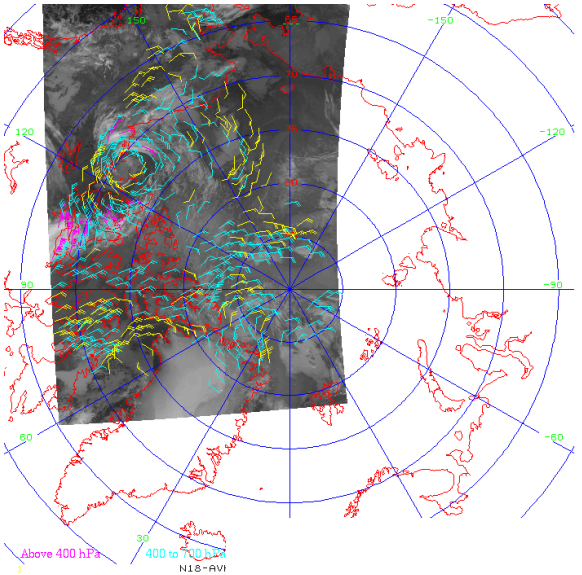
International Polar Year
Arctic and Antarctic products

•Real-time and historical satellite products (1981 to present) from AVHRR are available in support of the International Polar Year (IPY)

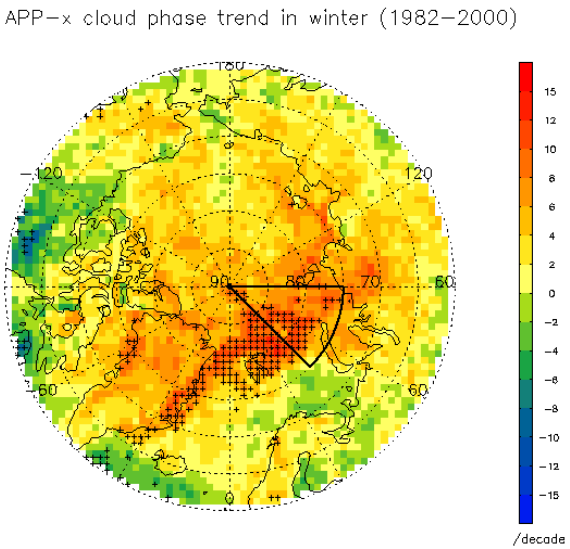
•*Real-time* products being generated at direct readout sites in the Arctic and Antarctic include:

•Atmospheric products:
polar winds, cloud fraction, cloud phase, cloud top pressure, cloud optical depth and cloud particle size

•Surface products:
ice/snow surface temperature and albedo, snow cover, sea ice cover, concentration, motion, and thickness/age.



Left: Real-time winds from direct readout AVHRR data acquired at Barrow, Alaska, Sept 22, 2008.



Right: Decadal trends in Arctic winter cloud phase (100= ice, 0=liquid) from APP-x 1982 - 2000. Trends with confidence levels larger than 95% are indicated with +.

Significance: This unique suite of real-time and historical satellite products will provide data for meteorological and climatological studies, and will be part of the IPY legacy.

Project Lead: Jeff Key

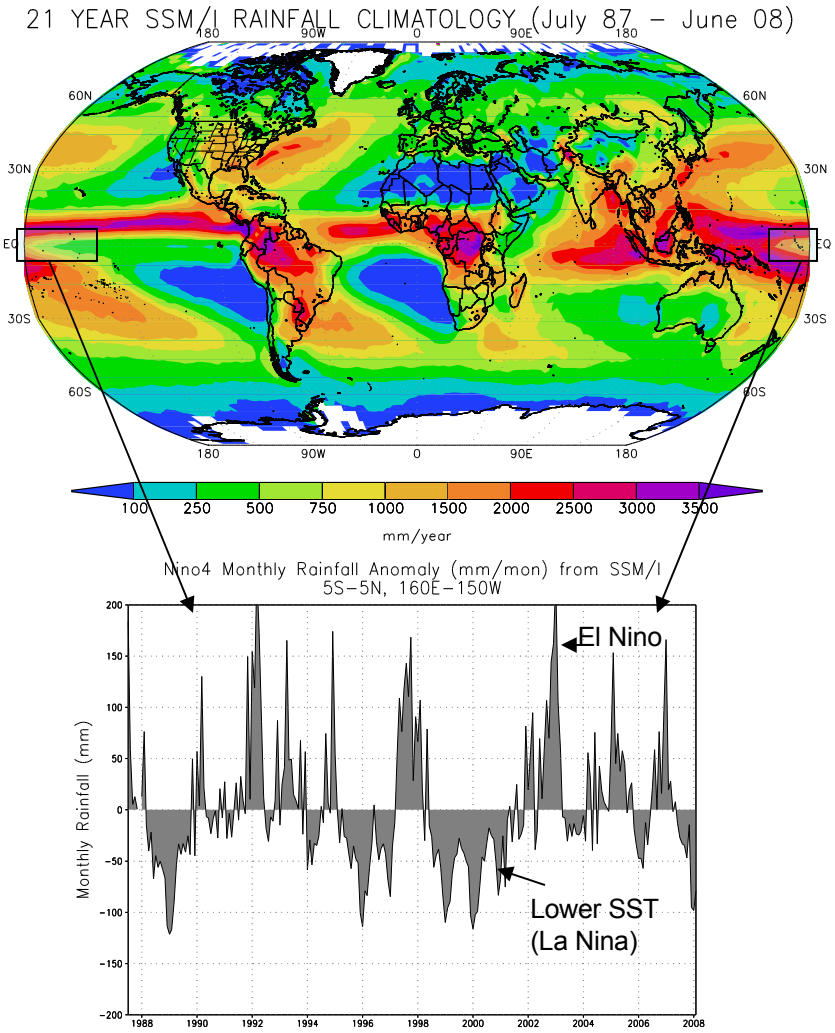
Water, Rain Rates and Snow Cover Products

- The Special Sensor Microwave/Imager (SSM/I) monthly products was extended to twenty-one years (July 1987 – June 2008)

- Products include rainfall rate, snow cover, and total precipitable water. Data is available from NCDC.

- Rainfall rates are used by the international Global Precipitation Climatology Project (GPCP).

- Future work includes reprocessing entire record using improved satellite intercalibration.



Significance: The extended time series of SSMI products allows us to more accurately monitor and detect change in the amount and pattern of climatically important surface and atmospheric processes such as rainfall.

Project Lead: Ralph Ferraro

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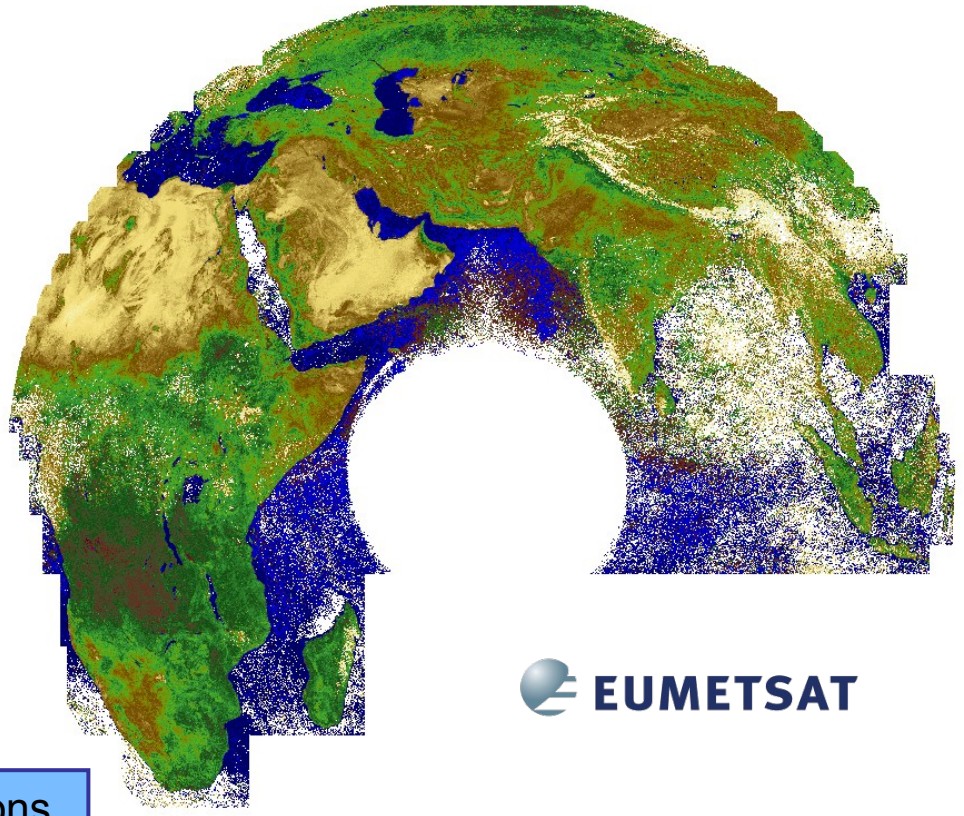
Reprocess Surface Radiation Product
Indian Ocean Data Coverage

- Since 1998, Meteosat satellites of the First Generation (Meteosat 5 – Meteosat 7) are placed over the Indian Ocean.
- EUMETSAT processed the whole Meteosat 5 period and completed the generation the Surface Radiation Product MVIRI for IODC Service (1998-2006, Meteosat-5).
- The picture shows the first 10 day composite product from 1998.



Significance: Filling a data gap of observations from the pre-MODIS era

Project Lead: Leo van de Berg, Yves Govaerts EUMETSAT

MSA_V2.1_DHR30_1998_161_170_MP20

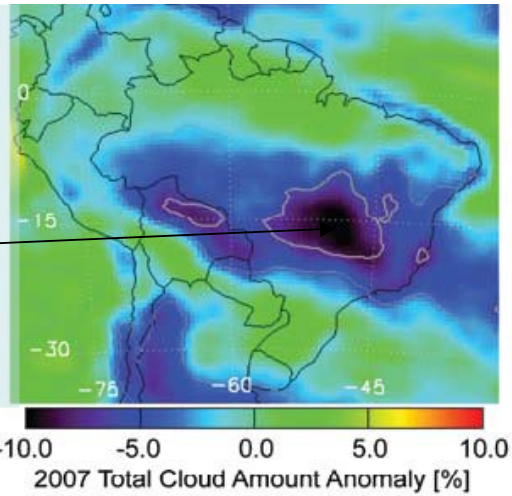
Extend long-term time series of AVHRR

Clouds, Aerosol, Surface temperature, Vegetation index

- AVHRR data from 2006 – July 2008 was reprocessed
- This extends the AVHRR Pathfinder Atmospheres Extended (PATMOS-x) data-record from September 1981 – July 2008.
- Products include clouds, land and sea surface temperatures, aerosols and vegetation index.

Cloud anomaly over Brazil in 2007

Climatogically significant low cloud amounts may be due to excessive agricultural burnings in response to higher demands of biofuels

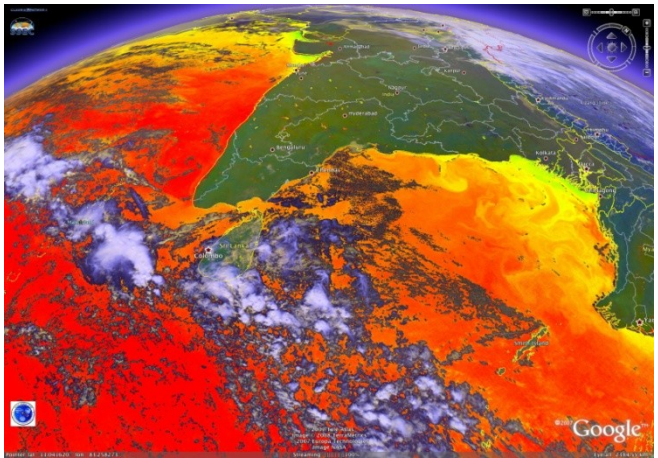


Significance: Provides the longest satellite record of clouds, aerosols and surface temperatures for climate studies.

Project Lead: Andrew Heidinger

Example AVHRR false-color image from NOAA-18

Corresponding derived Cloud+SST image

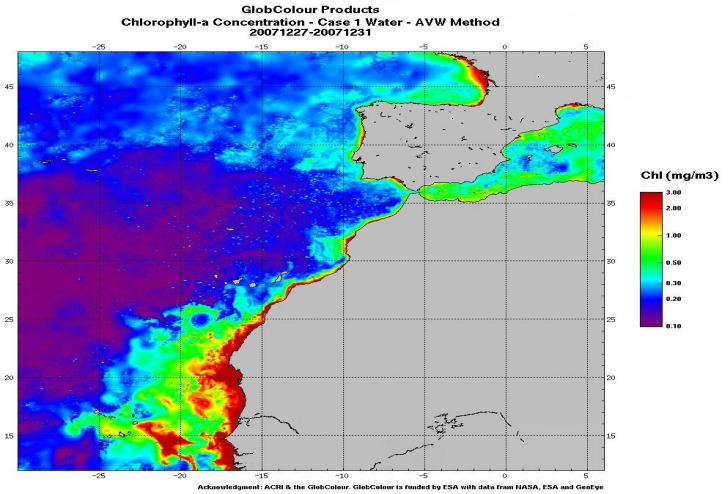


GlobCarbon and GlobColour

Global datasets & accessibility

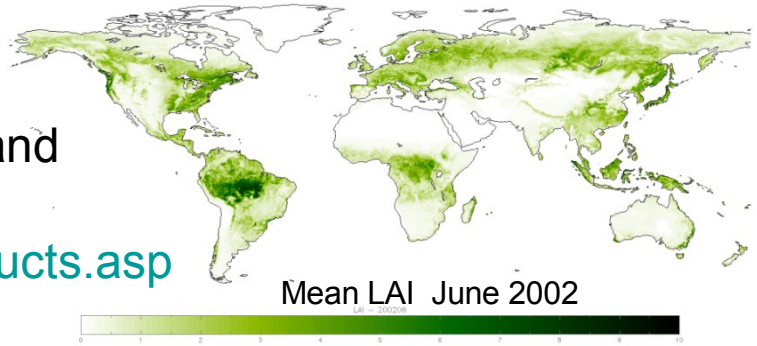
GlobColour:

- Ten year dataset (1997 – 2007)
- Derived from MODIS, MERIS, SeaWifs
- www.globcolour.info



GlobCarbon:

- 9 years available
- derived from SPOT-4 , SPOT-5, ATSR-2, AATSR and MERIS
- consists of land products such as Burn Scar, Leaf Area Index, fraction of absorbed photosynthetically active radiation (fAPAR), and vegetation growth cycle.
- http://dup.esrin.esa.int/ionia/globcarbon/products.asp



Mean LAI June 2002

Significance: Provides essential datasets for carbon surface/air exchange studies and carbon modeling.

Project Lead: Olivier Arino

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Wall-to wall Forest Carbon Monitoring

Four key outcomes expected:

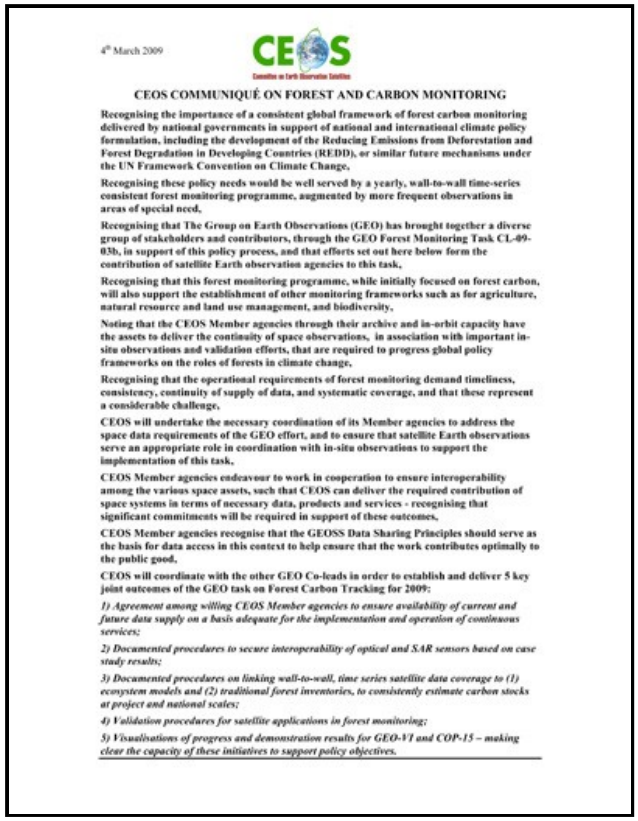
- Data and processing
  - Affordable, continuous, accessible supply of mid-resolution satellite data, both optical and radar, supported by processing to relevant forest cover information (areas of deforestation and degradation)
- Interoperability
  - Both optical and radar instruments must be used, on a “fit-for-purpose” basis, and interoperability is crucial to achieve the goals
- Linking remote sensing to emissions estimation
  - Methods and protocols for this linking should be standardised to the extent that users can presume robustness in technical applications
- Validation procedures
  - Protocols and practices for validation need to be developed so that users can presume consistency and accuracy in standards derived

Forest and Carbon Monitoring

CEOS communiqué

- Agreement among CEOS Member agencies
  - Ensure availability of current and future data supply
  - Adequate for the implementation and operation of

    continuous services
- Documented procedures to secure interoperability of optical and SAR sensors based on case study results



4th March 2009

CEOS

CEOS COMMUNIQUÉ ON FOREST AND CARBON MONITORING

Recognising the importance of a consistent global framework of forest carbon monitoring delivered by national governments in support of national and international climate policy formulation, including the development of the Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD), or similar future mechanisms under the UN Framework Convention on Climate Change,

Recognising these policy needs would be well served by a yearly, wall-to-wall time-series consistent forest monitoring programme, augmented by more frequent observations in areas of special need,

Recognising that The Group on Earth Observations (GEO) has brought together a diverse group of stakeholders and contributors, through the GEO Forest Monitoring Task CL-09-03b, in support of this policy process, and that efforts set out here below form the contribution of satellite Earth observation agencies to this task,

Recognising that this forest monitoring programme, while initially focused on forest carbon, will also support the establishment of other monitoring frameworks such as for agriculture, natural resource and land use management, and biodiversity,

Noting that the CEOS Member agencies through their archive and in-orbit capacity have the assets to deliver the continuity of space observations, in association with important in-situ observations and validation efforts, that are required to progress global policy frameworks on the roles of forests in climate change,

Recognising that the operational requirements of forest monitoring demand timeliness, consistency, continuity of supply of data, and systematic coverage, and that these represent a considerable challenge,

CEOS will undertake the necessary coordination of its Member agencies to address the space data requirements of the GEO effort, and to ensure that satellite Earth observations serve an appropriate role in coordination with in-situ observations to support the implementation of this task,

CEOS Member agencies endeavour to work in cooperation to ensure interoperability among the various space assets, such that CEOS can deliver the required contribution of space systems in terms of necessary data, products and services - recognising that significant commitments will be required in support of these outcomes,

CEOS Member agencies recognise that the GEOSS Data Sharing Principles should serve as the basis for data access in this context to help ensure that the work contributes optimally to the public good,

CEOS will coordinate with the other GEO Co-leads in order to establish and deliver 5 key joint outcomes of the GEO task on Forest Carbon Tracking for 2009:

1) Agreement among willing CEOS Member agencies to ensure availability of current and future data supply on a basis adequate for the implementation and operation of continuous services;

2) Documented procedures to secure interoperability of optical and SAR sensors based on case study results;

3) Documented procedures on linking wall-to-wall, time series satellite data coverage to (1) ecosystem models and (2) traditional forest inventories, to consistently estimate carbon stocks at project and national scales;

4) Validation procedures for satellite applications in forest monitoring;

5) Visualisations of progress and demonstration results for GEO-VI and COP-15 – making clear the capacity of these initiatives to support policy objectives.

Progress and demonstration of results

- For GEO-VI and COP-15
- Making clear the capacity of these initiatives to support policy objectives

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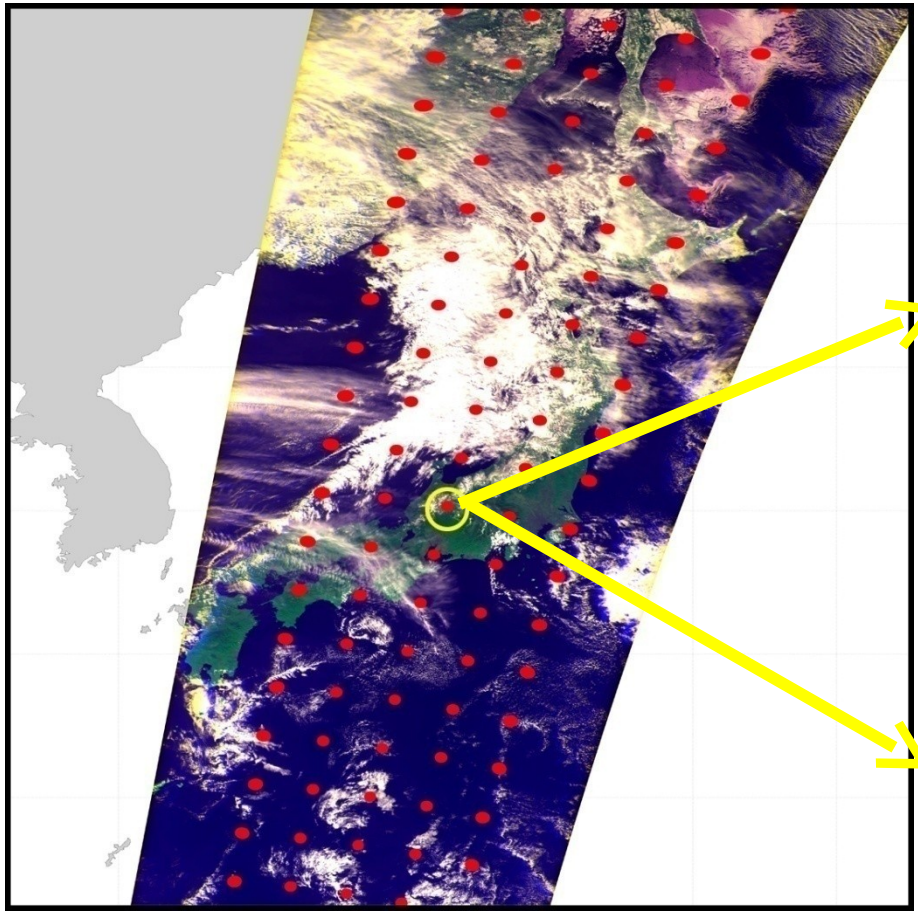
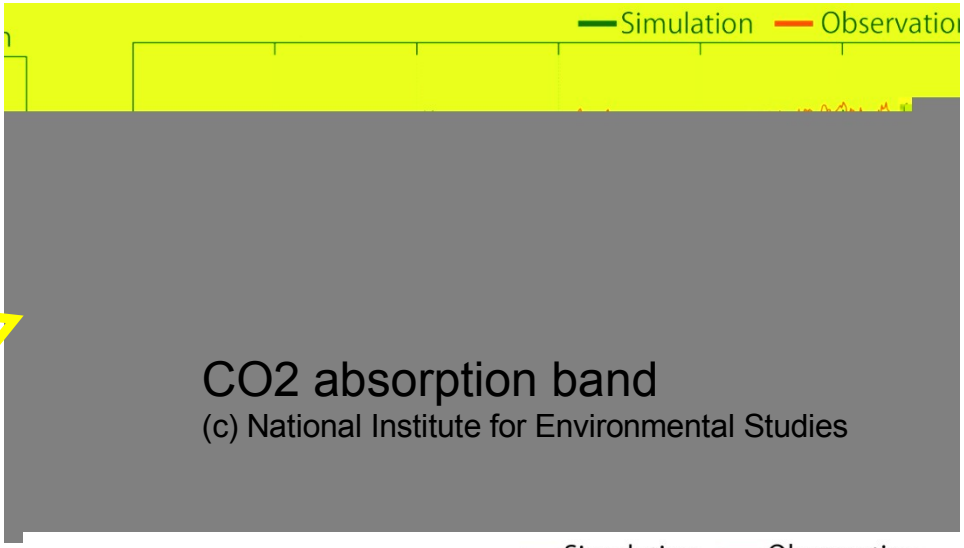
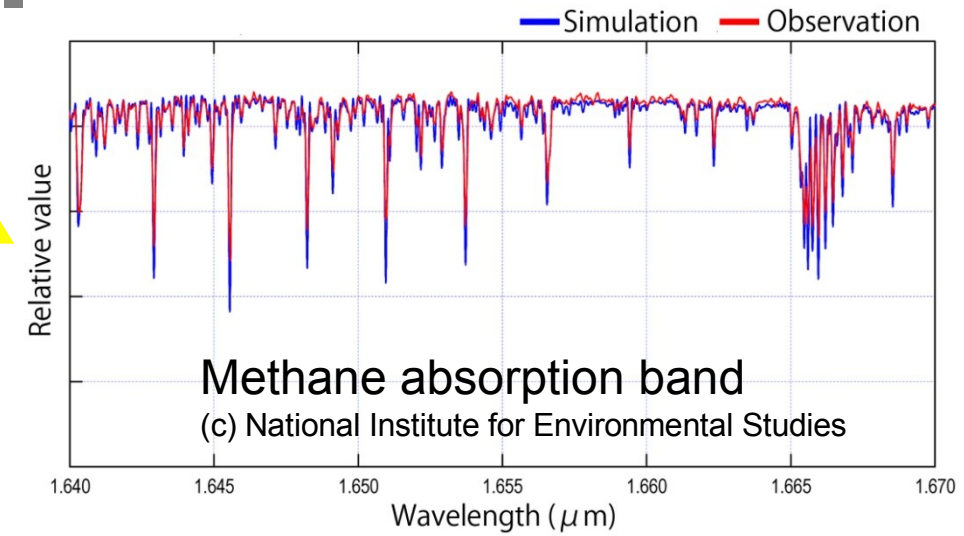
GOSAT (Ibuki) First Light

7 Feb, 2009







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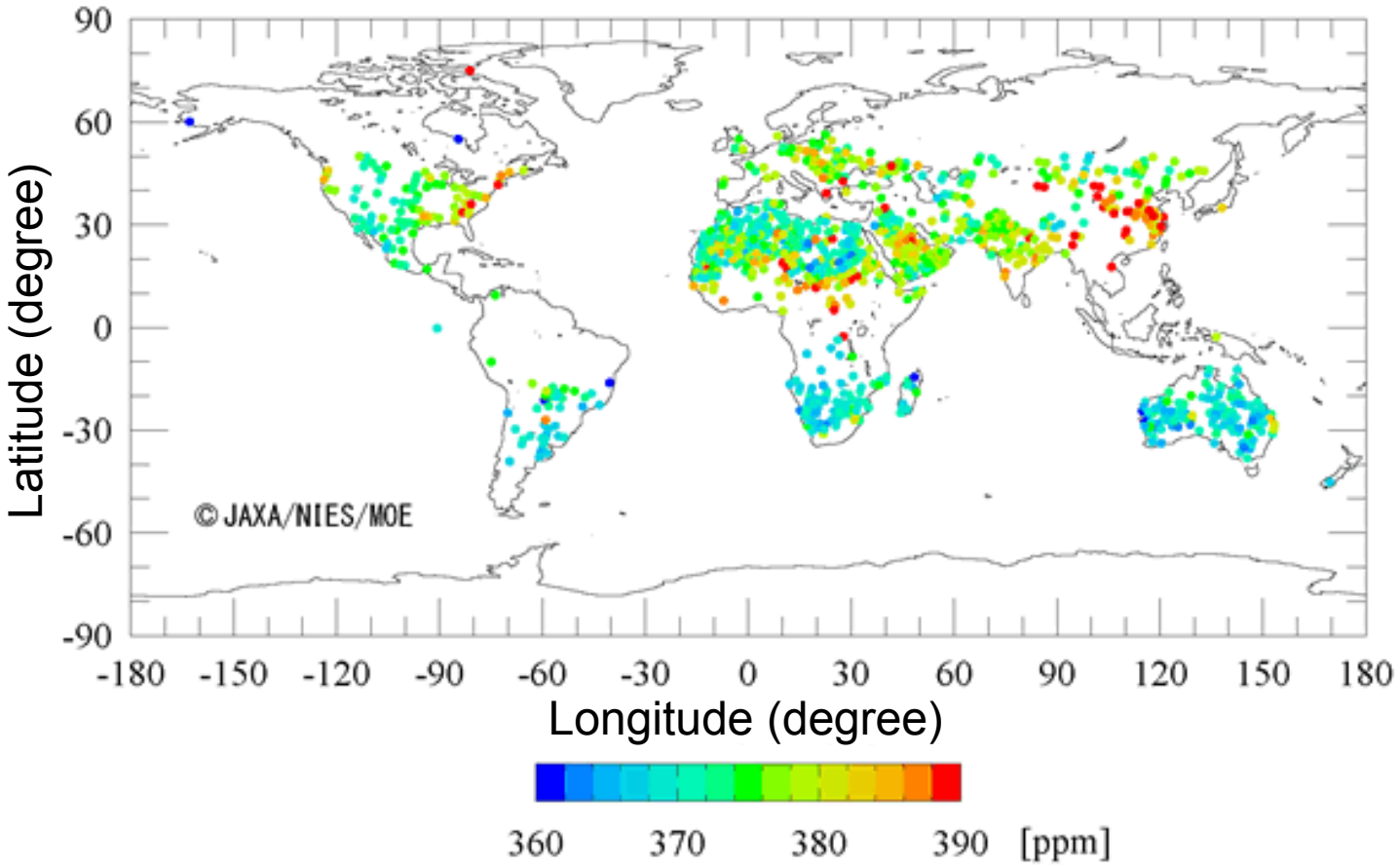
IBUKI(GOSAT)

First Analysis Results of Greenhouse Gas



CO2 Average Density (NOT CALIBRATED)

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Thank you!

grum@geosec.org

www.earthobservations.org