

GEO Task CL-09-02b

Key Climate Data from Satellite Systems

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GEO Sub-Task CL-09-02b

- Key Climate Data from Satellite Systems
 - This sub-task is led by USA (NASA, NOAA, mitch.goldberg@noaa.gov), CEOS, GCOS and WMO to:
Establish actions securing the provision of key data from satellite systems for climate studies and forecasting.
 - Output is highly relevant to CL-06-01a*, since CL-09-02b provides critical datasets for reprocessing & reanalyses
 - **Key data for climate are crosscutting, essential climate variables (ECVs) are also essential for other societal benefit areas**

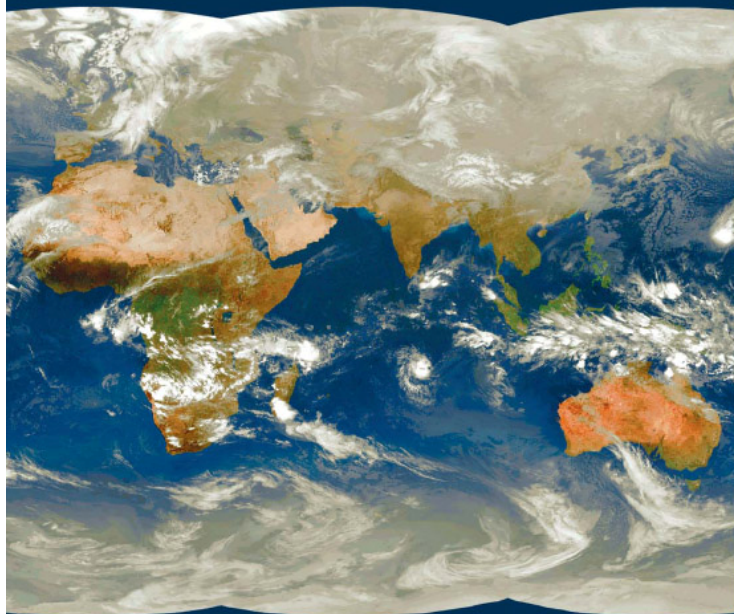
*: CL-06-01a : Sustained Reprocessing and Reanalysis of Climate Data

Overview of Progress

- **Requirements are established by GCOS.**
 - The new GCOS-Implementation Plan (**GCOS-IP**) will be released in August 2010.
- **In 2006, CEOS responded to previous GCOS-IP through actions and working teams** (e.g. Virtual Constellations, Carbon Task Force,..), and will develop a new response
 - CEOS Progress Report submitted to UNFCCC SBSTA in 2008
 - SBSTA requested new progress report for November 2010
- WMO established **GSICS** and **SCOPE-CM** to improve satellite intercalibration and to begin a sustained international collaboration for generate climate data records. : SCOPE-CM started 5 pilot projects
- Space Agencies have initiated **sustained climate data records programs.**
- **CEOS Climate Advisory Group** discussion to further improve collaboration amongst space agencies and existing scientific working groups (e.g. GEWEX)
- **CEOS Climate Diagnostic Portal** for easy access to key climate information
- A number of **key datasets** are now available (examples provided)

GEO 1000R
February 2005

Global Earth Observation System of Systems GEOSS



10-Year Implementation Plan Reference Document

Group on Earth Observations

THE CEOS IMPLEMENTATION PLAN FOR SPACE-BASED OBSERVATIONS FOR GEOSS

Version 0.1.10
7th May 2007



Satellite-based ECVs

Atmosphere	Surface (0, 0, 6)	<i>Air Temperature; Precipitation ; Air pressure; Water vapour; Surface radiation budget; Wind Speed & direction;</i>
	Upper air (1, 1, 3)	<i>Cloud properties, Wind speed & direction Earth radiation budget; Upper-air temperature; Water vapour;</i>
	Composition (3, 0, 0)	<i>Carbon dioxide Methane & other <u>GHGs</u>; Ozone; Aerosol properties</i>
Ocean	Surface (4, 2, 1)	<i>Sea-surface Temp; Sea-level; Sea-ice; Ocean colour; Sea state; Sea-surface salinity Carbon dioxide partial pressure</i>
	Sub-surface (0, 0, 7)	<i>Temperature; Salinity; Current; Nutrients; Carbon; Ocean tracers; Phytoplankton</i>
Terrestrial (3, 7, 4)	<i>Glaciers & ice caps; Land Cover; Fire disturbance Fraction of absorbed photo-synthetically active radiation; LAI , <u>Albedo</u> Biomass, Lake levels, Snow cover, Soil moisture Water use, Ground water, River discharge Permafrost and seasonally-frozen ground</i>	

CEOS 59 Climate Actions in response to GCOS-92 (IP2004) and GCOS-107 (satellite supplement)

Action plan adopted by CEOS in Sep. 06

Overall goals

- Ensuring continuity of climate-relevant satellite measurements (13 actions);**
- Taking a systematic approach to generating fundamental climate data records (FCDRs) (11 actions);**
- Preserving climate data records (4 actions);**
- Ensuring access to climate data products (10 actions);**
- Coordinating international communities and interaction with users (10 actions); and**
- Addressing future measurement needs (11 actions).**

CEOS Virtual Constellations

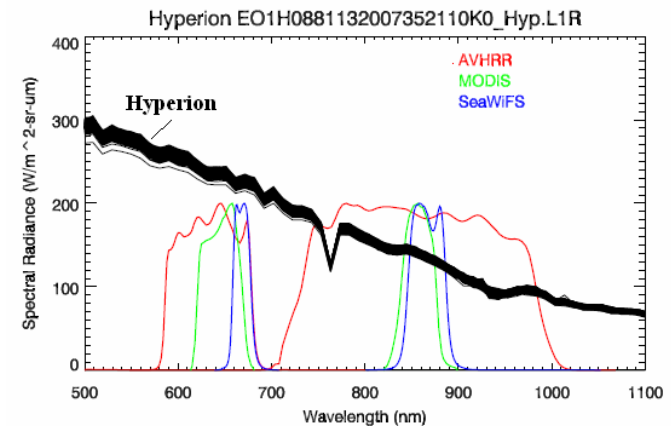
CEOS Response supported by the 6 CEOS Virtual Constellations ..

- Precipitation
- Land Surface Imaging
- Atmospheric Composition
- Ocean Surface Topography
- Ocean Color Radiometry
- Ocean Surface Vector Winds

Virtual Constellations (and the WMO)
also identify future gaps in the observing system

CEOS Working Groups Support to GCOS

- **Working Group on Cal/Val**
 - GEO Data Quality Assurance Guideline document (QA4EO, DA-09-01a)
 - Antarctic Dome C calibration campaign
 - verified Dome C as excellent satellite intercalibration and long term monitoring site,
 - transfer SeaWiFS stable lunar calibration to AVHRR and other sensors at Dome C
- **Working Group on Information Systems and Services**
 - Developing a [Climate Portal](#) for easy access to climate diagnostics
- **Working Group on Education**
 - Workshops/training for data utilization



GCOS Independent Assessment of Space Agency Progress is very favorable

**Assessment of Progress involving Space Agencies after 5 years
into 10-year plan (88% above moderate)**

Progress	Low	Moderate /Low	Moderate	Good/ moderate	Good
Number of Actions	2	1	5	8	9
Percentage of Actions	8%	4%	20%	32%	36%

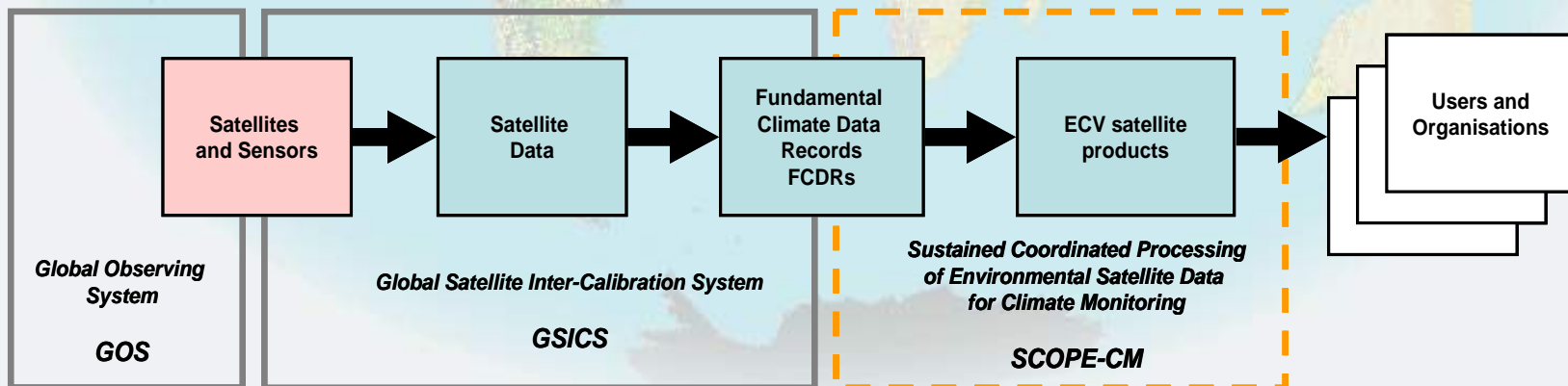
Organizational groups where CEOS agencies are members

- **GSICS** – Global Satellite InterCalibration System
- **SCOPE-CM** – Sustained COordinated Processing of Environmental Satellite Data for Climate Monitoring
- **CGMS** – Coordinated Group of Meteorological Satellites
- **WCRP** – World Climate Research Programme
- **International Working Groups**














We actually do communicate with each other!

WMO SCOPE-CM

- **Aim:** To address the requirements of GCOS in a cost-effective, coordinated manner, capitalizing on existing expertise and infrastructures
- **Objective:** Continuous and sustained provision of high-quality Essential Climate Variables satellite products (Climate Data Records) on a global scale
- **Structure:** The SCOPE-CM Network is:
 - » Based on activities of **existing initiatives** (GOS, GCOS and GSICS)
 - » Built upon existing operational infrastructures
 - » Serve users and other organizations (WMO Regional Climate Centres RCCs, National Weather Services NMHSs)



SCOPE-CM Pilot Projects

	<i>Sensors</i>	<i>Parameters and topics</i>	<i>Lead</i>	<i>Contributors</i>
1	AVHRR	Clouds and Aerosols		
2	SSM/I	Water vapour, clouds, precipitation		
3	GEO	Surface albedo, clouds and aerosols		 
4	GEO	Winds and clear sky radiances		
5	GEO	Upper tropospheric humidity		  

Significant progress in CEOS agencies commitments to sustained generation of climate data records

- **WMO GSICS & SCOPE-CM efforts**
 - Both efforts are engaging WCRP/GEWEX
 - GSICS held its first user workshop in September 09
- **EUMETSAT Climate SAFs**
- **NOAA Climate Data Records Program**
- **NASA on-going reprocessing of EOS datasets**
- **ESA Climate Change Initiative**

Establishing CEOS Climate Advisory group

- Mission: coordinating the implementation of the CEOS climate activity plans from the various CEOS Agencies
 - Review generation of FCDRs and derived ECV satellite products by Member Space Agencies
 - Identify multi-agency implementation teams for each product and review their actions
 - Ensure coherent implementation plan exists for each product
 - Ensure coordination of climate product generation with other relevant international initiatives
 - Make recommendations to above teams and receive recommendations from them, for transmission to SIT
 - Ensure compliance of satellite products with GCOS Monitoring Principles and with the GCOS 128 doc*.

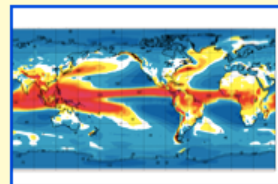
*: Guideline for the Generation of Satellite-based Datasets and Products meeting GCOS Requirements

Climate Diagnostic Portal

- Provide visualizations that could be readily interpreted by decision makers.
- Include attributes for peered review papers and validation so users can make own assessment how to use the information.
- URL:
<http://idn.ceos.org/climdiag/Home.do?Portal=climatediagnostics&MetadataType=0&lbnode=mdlb3>

CEOS Climate Diagnostics

Sample Visualization. Caption: Column climatologies, European Centre for Medium-Range Weather Forecasts (ECMWF).
[View Record](#)



Example, click

This website is experimental. Members from the Committee on Earth Observation Satellites are interested in your comments and additions. Please send comments to WGISS through the CEOS IDN [User Support Office](#).



OR

Full-text Search

Search by Essential Climate Variables

Search by Societal Benefit Areas

Add Climate Diagnostics

Share your visualization with the Science Community by entering a description using our online tool.



CEOS Climate Diagnostics

[Home](#) [Add a Visualization](#) [Contact Us](#)

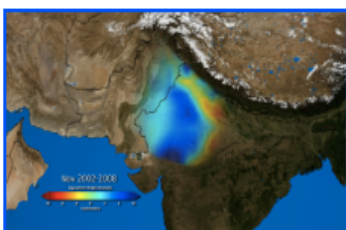
Search Query: Science Keywords **TERRESTRIAL HYDROSPHERE**

Viewing 1 through 4 of 23 titles that match your query

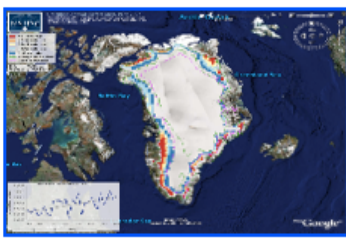
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Refine by Full-text
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Refine by Category
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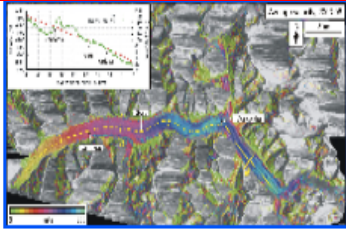
Groundwater Depletion in India Revealed by GRACE 2002-2008
Scientists using data from NASA's Gravity Recovery and Climate Experiment (GRACE) have found that the groundwater beneath Northern India has been receding by as much as one foot per year over ...



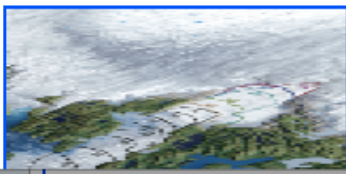
Greenland Ice Sheet Melt Characteristics Derived from Passive Microwave Data
The Greenland ice sheet melt extent data, acquired as part ...

click

Viewing Specifications: Visualization requires Google Earth to be displayed



Ice velocity and climate variations for the Baltoro Glacier, Pakistan 2003-2008
Surface velocity field for the Baltoro Glacier in Pakistan based on six Envisat Advanced Synthetic Aperture Radar images taken from 2003 to 2008. The analysis of multi-temporal data such as ...



SVS-CSB: Poster of the Jakobshavn Glacier Calving Front Recession from 1851 to 2009
Jakobshavn Isbrae is located on the west coast of Greenland at Latitude 69 N. The ice front, where the glacier calves into the sea, receded more than 40 km between 1850 and 2006. Between 1850 ...



Greenland Ice Sheet Melt Characteristics Derived from Passive Microwave Data

Entry ID: NSIDC-0218

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Beta

- [Visualization URL](#)
- [Visualization Thumbnail](#)
- Visualization Type:
 - 2-D Visualization > Time Series
- Analysis Type:
 - Statistical Method/Geostatistics > Trend Analysis
- Format: PNG
- Viewing Specifications: Visualization requires Google Earth to be displayed
- Visualization Duration: 10 Seconds
- Visualization File Size: 404 Kilobytes

Visualization Citation

Visualization Creator: Waleed Abdalati
Visualization Title: Greenland Ice Sheet Melt Characteristics Derived from Passive Microwave Data
Visualization Release Date: 2008-02-25
Visualization Release Place: Boulder, Colorado USA
Visualization Publisher: National Snow and Ice Data Center (NSIDC)
Data Presentation Form: digital media
[Online Resource](#)

- ▶ Summary
- ▶ Data Resolution
- ▶ Related URL
- ▼ Publications/References

Abdalati, Waleed and Konrad Steffen. 2001. Greenland Ice Sheet Melt Extent: 1979-1999. Journal of Geophysical Research (Atmospheres) 106(D24): 33983-8. Abdalati, Waleed and Konrad Steffen. 1997. Snowmelt on the Greenland Ice Sheet as Derived from Passive ...
[Click to view more](#)

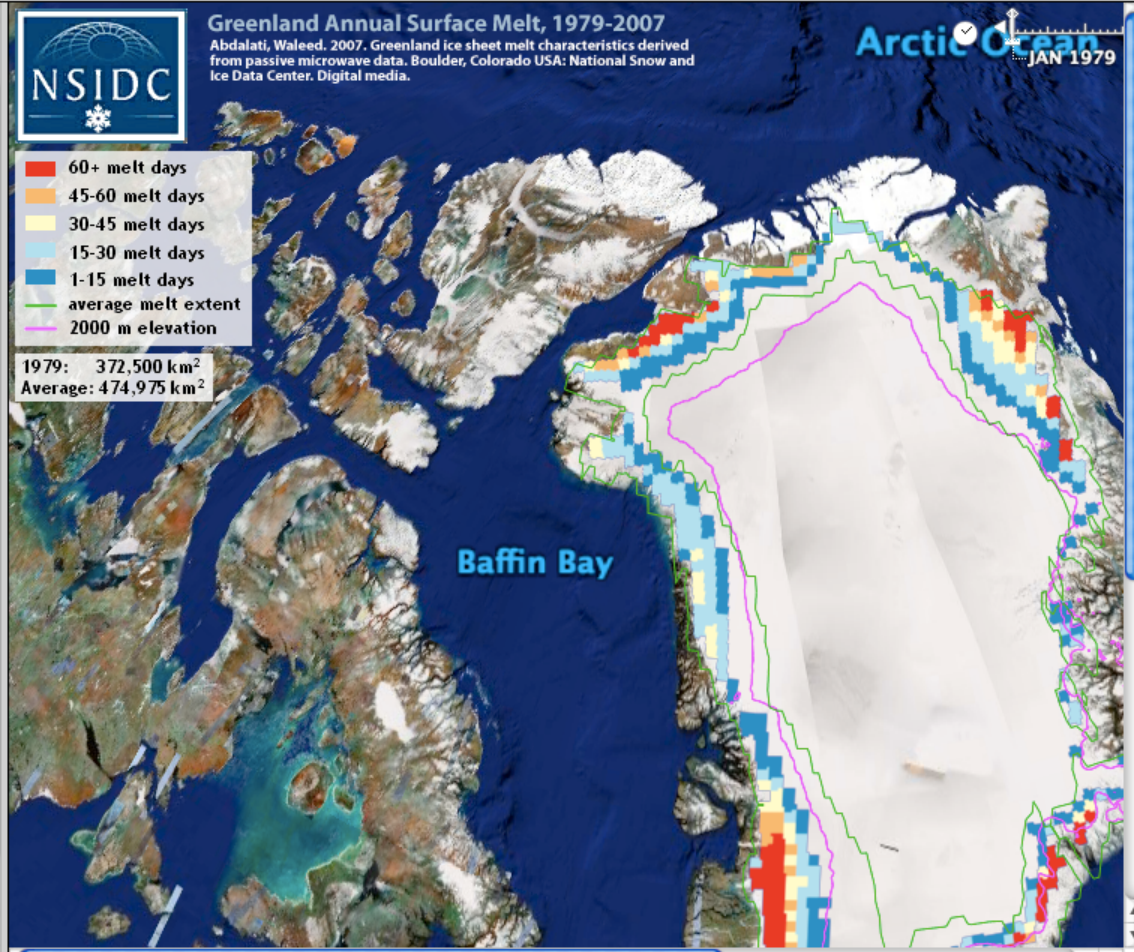
Visualization Provider



Greenland Annual Surface Melt, 1979-2007
 Abdalati, Waleed. 2007. Greenland ice sheet melt characteristics derived from passive microwave data. Boulder, Colorado USA: National Snow and Ice Data Center, Digital media.



1979: 372,500 km²
 Average: 474,975 km²





Examples of multi-decadal datasets* generated by CEOS agencies

*: all registered in GEOS Components & Services Registry

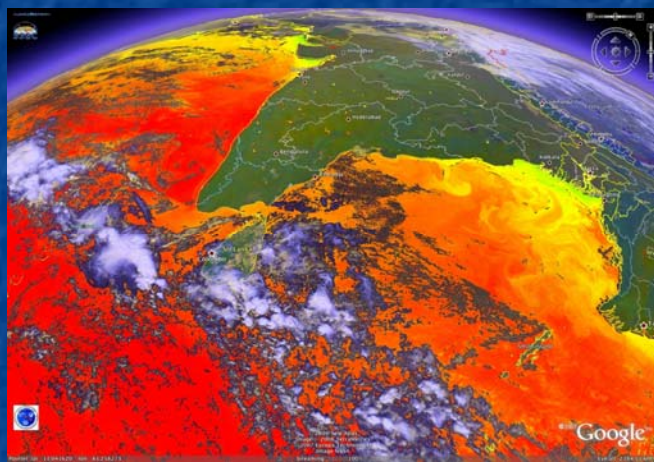
Long-term time series of AVHRR (clouds, aerosol, surface temperature, vegetation index) extended using NOAA-19

- AVHRR climate records were generated for 2009 including those from NOAA-19 (launched February 2008).

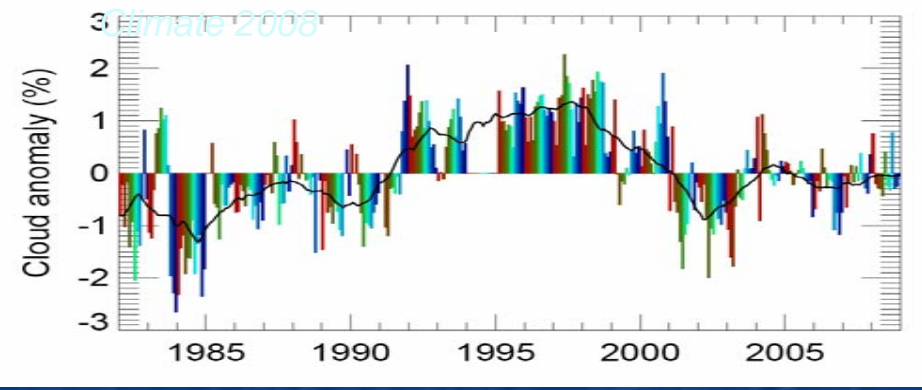
- This extends the AVHRR Pathfinder Atmospheres Extended (PATMOS-x) data-record from September 1981 – July 2009.

- Products include clouds, land and sea surface temperatures, aerosols and vegetation index

Example of AVHRR image showing derived cloud reflectance and SST

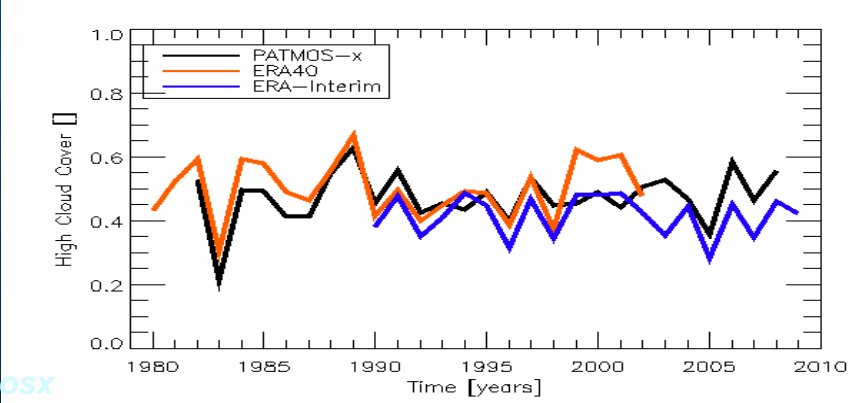


Monthly anomalies in global cloud amount (1981-2008) – Taken from BAMS State of



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

Comparison of AVHRR December Tropical High Cloud Amounts to those from ECMWF

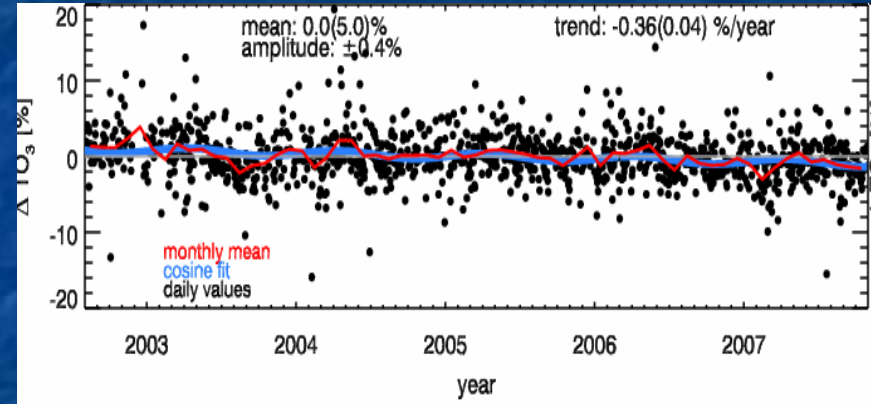


Reprocessed SCIAMACHY Products

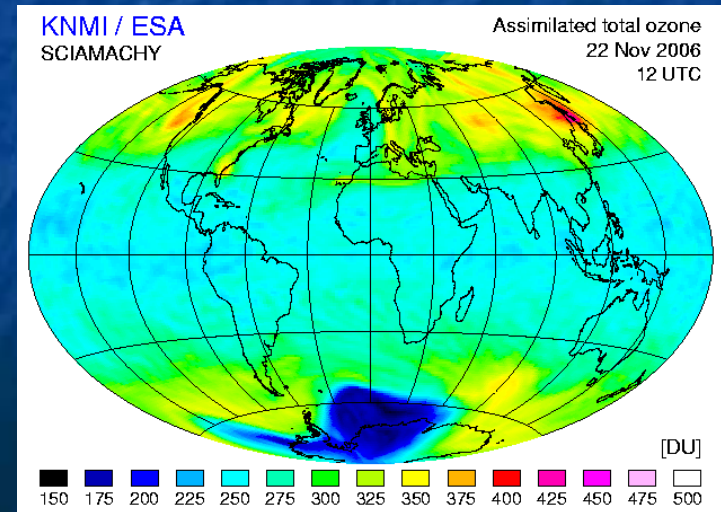
SCIAMACHY provide products of O_3 , BrO, HCHO, NO_2 , SO_2 , OClO, H_2O , CO, CO_2 , CH_4 and properties of aerosols and clouds

The data has been reprocessed from the start of operations – August, 2002 using the improved calibration and algorithms,

Significance: Provides critical atmospheric chemistry datasets for monitoring



Ozone difference in % between SCIAMACHY and Brewer data from Hohenpeissenberg, Germany



Climate Data Records for the SBUV(/2) measurement retrievals

The SBUV/2 data for NOAA-16 SBUV/2 (2004 to 2007) and NOAA-17 SBUV/2 (2003 to 2007) has been reprocessed with the latest instrument characterization and calibration to extend the previously released Ozone Climate Data Record (1979 to 2003) from SBUV(/2) instruments by four years.

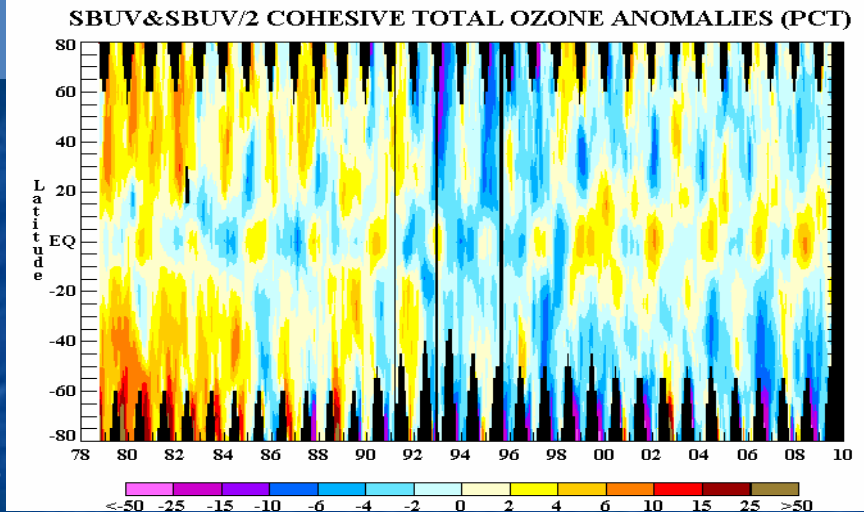


Figure from C. Long *et al.*, http://www.cpc.noaa.gov/products/stratosphere/sbuv2to/sbuv2to_cohesive.shtml

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/ This new data set is being used in the preparing the next assessment due out in 2010.

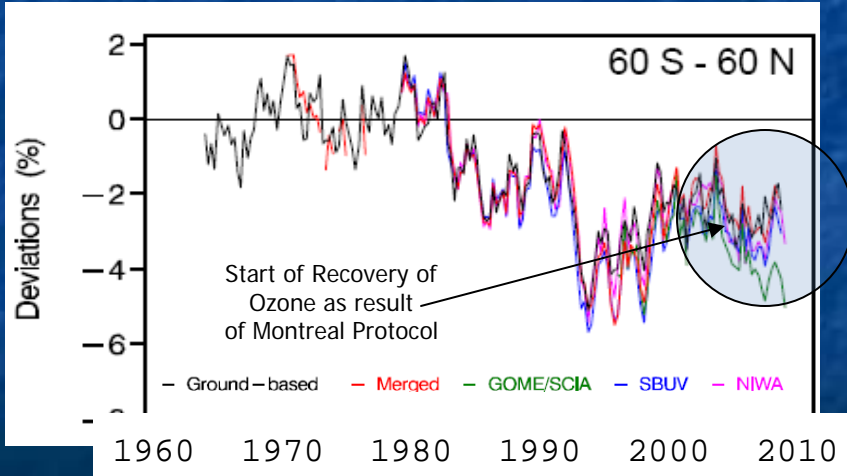


Figure from V. Fioletov *et al.* at the 2008 Quadrennial Ozone Symposium in Tromso Norway showing deseasonalized global mean ozone time series from SBUV(/2) and other sources.

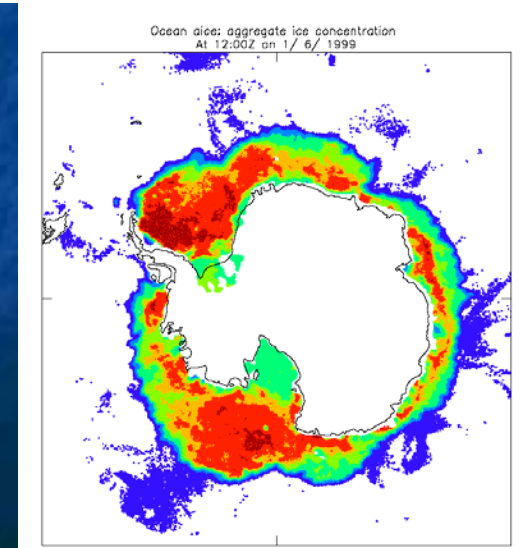
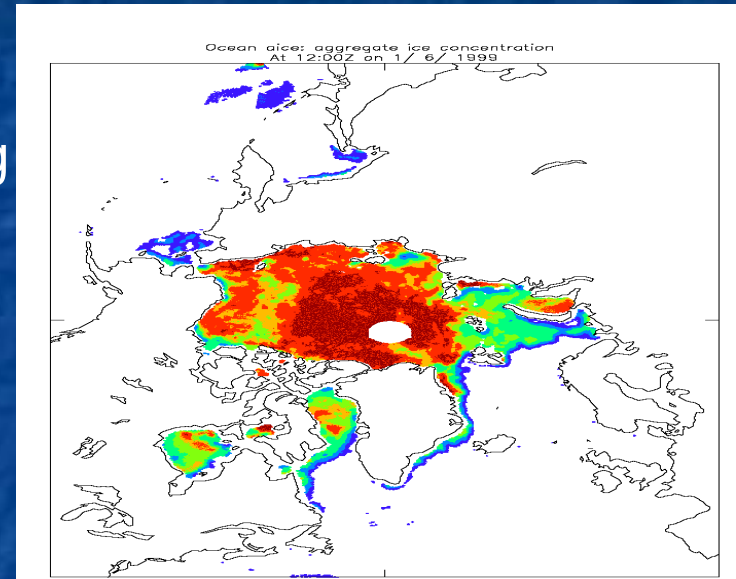
Reanalyzed global Sea Ice (1987 – 2008)

Reprocessing of daily ice concentration products from SSMI for 1987 – 2008 using latest algorithms and most current ECMWF reanalysis for atmospheric corrections.

Reprocessing is on-going and is expected to be completed in December 08, using SMMR data (1978 – 1987)

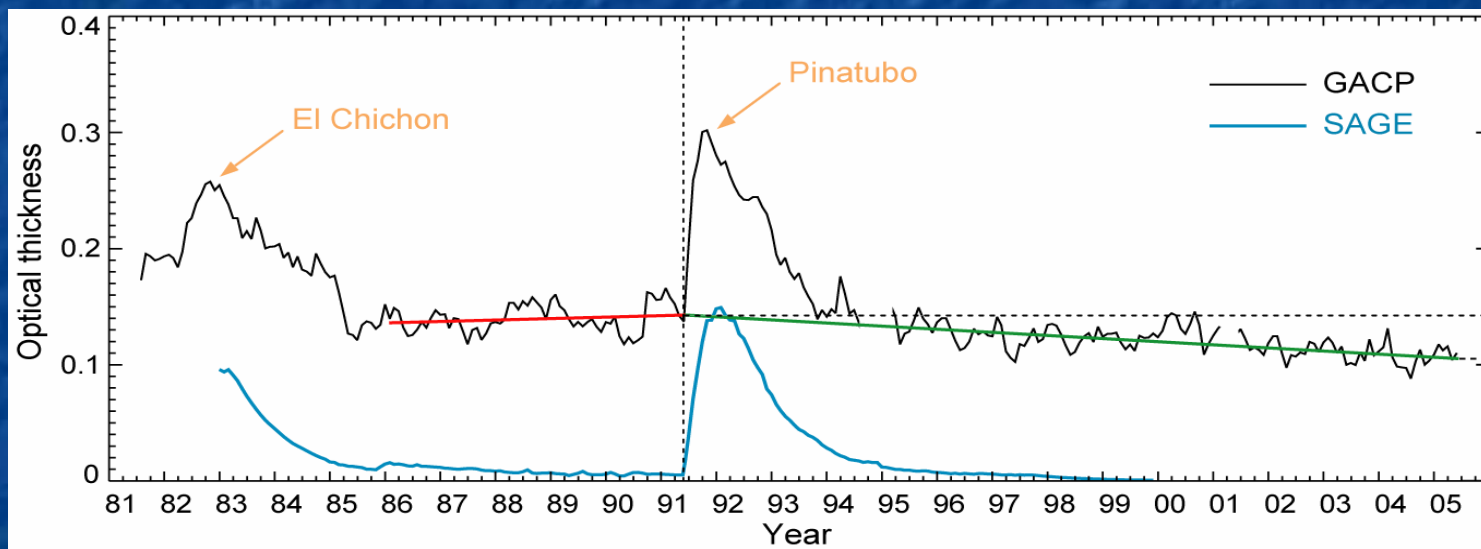
<http://sat.met.no> in NETCDF

Significance: Provides critical **ice cover datasets** for monitoring sea ice and for use in models.



WCRP/GEWEX/ Global Aerosol Climatology Project (GACP)

The complete GACP dataset is currently available at gacp.giss.nasa.gov and is composed of monthly 1 x 1 degree averages of AOT and AE for the period from August 1981 to June 2006. GACP represents the longest uninterrupted satellite record of aerosol properties.



Long-term record derived as part of GACP from multi-decadal satellite data reveals a likely 20% decrease in the global amount of tropospheric aerosols between the late 1980s and early 2000s. **This decline makes aerosols less efficient in counter-balancing the warming effect of the greenhouse gases.** Mishchenko *et al.*, *Science* 315, 1543 (2007)

Summary

- Sustainable provision of climate data is not easy because accuracy and quality are essential
- To provide accurate data it is imperative that we:
 - achieve and establish **best practices**,
 - **inter-compare datasets and algorithms** to understand and reconcile any differences due to processing,
 - continue to **improve satellite sensors and avoid gaps**.
- Scientific experts are engaged through the process and we are improving communication and collaborative structures (**Virtual Constellations, WGCV, GSICS, SCOPE-CM, CEOS Climate Advisory Group**) to meet the challenge of providing sustained and accurate datasets of the GCOS essential climate variables



Thank you ...

.... Questions ?