The Role of Science and Technology in GEOSS

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Contents

- Group on Earth Observations (GEO)
- Global Earth Observation System of Systems (GEOSS)
  - coordinated, comprehensive and sustained Earth observations and information for the benefit of all
- Scientific Challenge Examples
  - GEO Societal Benefit Area: Weather
  - GEO Societal Benefit Area: Climate
- GEO Science and Technology Committee
  - GEO Governance
  - GEO Tasks
  - GEO Data Sharing Principles
  - GEOSS Common Infrastructure Initial Operating Conditions Task Force

Earth Observation Summit, 31 July 2003

http://www.earthobservationsummit.gov/images/eos_group.gif

QuickTime™ and a
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are needed to see this picture.

Apollo 17, 7 Dec 1972

Declaration: Develop coordinated and sustained Earth observation system or systems, minimize data gaps, exchange observations with minimum time delay and minimum cost, assist developing countries.

http://www.earthobservationsummit.gov/declaration.html

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Kaguya, 6 Apr 2008

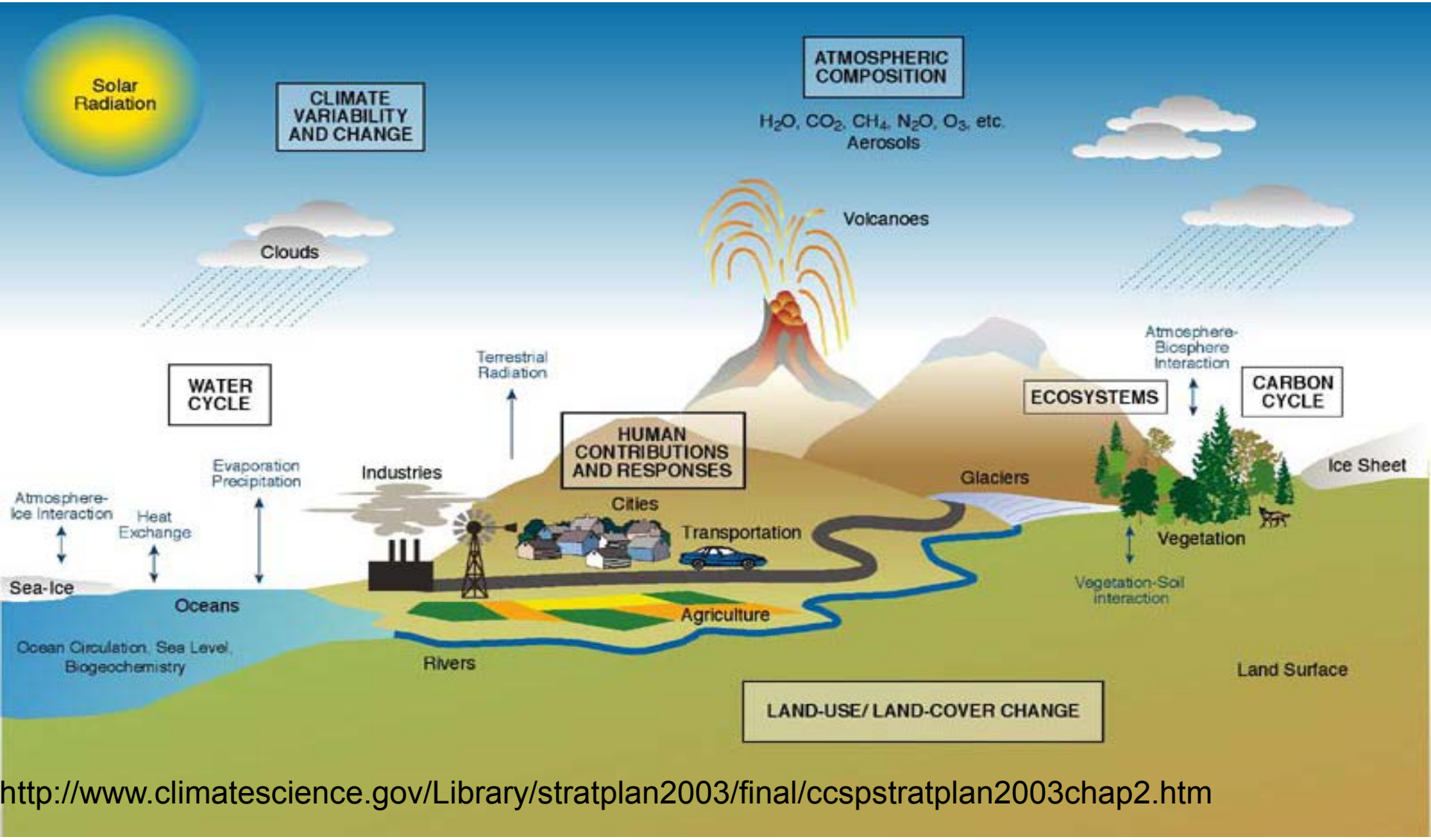
Global Earth Observation System of Systems

GEOSS has nine interconnected societal benefit areas (SBAs). Each SBA requires many observation data and decision-support tools. Each data set and tool can serve many SBAs.

Building Together What Cannot Be Built Alone

The Role of Science and Technology in GEOSS (2008)
http://www.earthobservations.org/documents/committees/stc/the_role_of_science_and_technology_in_geoss.pdf

GEOSS Societal Benefit Area: Climate



http://www.climatescience.gov/Library/stratplan2003/final/ccspstratplan2003chap2.htm

IF THE LORD ALMIGHTY HAD CONSULTED ME BEFORE EMBARKING ON THE CREATION, I WOULD HAVE RECOMMENDED SOMETHING SIMPLIER.

Alfonso X of Castile, 1221 - 1284

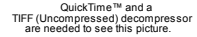
GEOSS occurs in a changing climate

- Past realizations of average environmental conditions are no longer applicable:
  - global sea level is rising
  - global land ice is decreasing
  - global sea ice is decreasing
  - global ocean is acidifying
  - global stratosphere ozone is recovering
  - global troposphere pollution is increasing

Satellites provide global observations with high space-time resolutions.

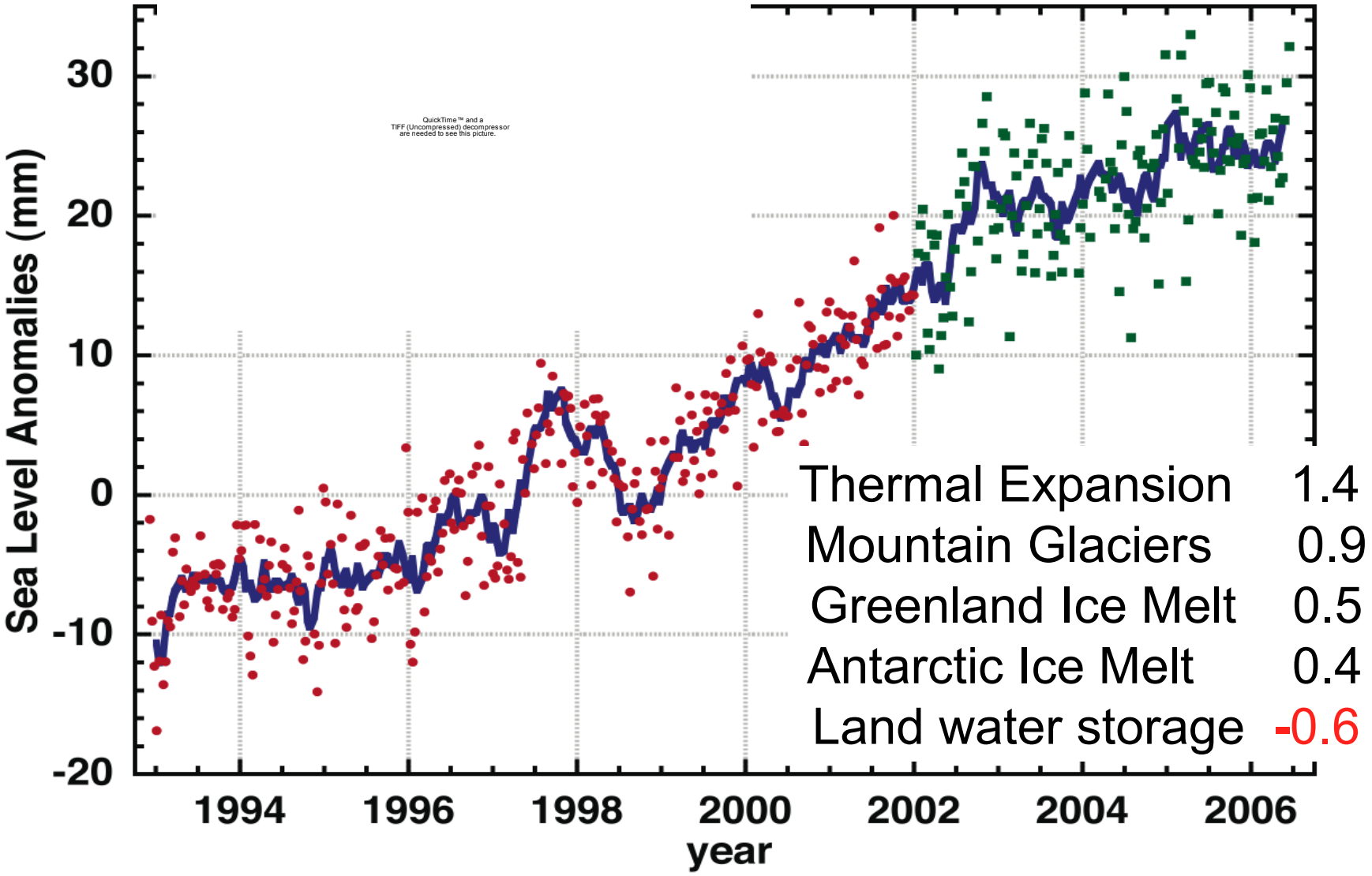
TIROS-1

- 1.0 m x 0.5 m; 120 kg
- 1 Apr 1960; 78 days
- First view of global cloud cover



Global Mean Sea Level Rise

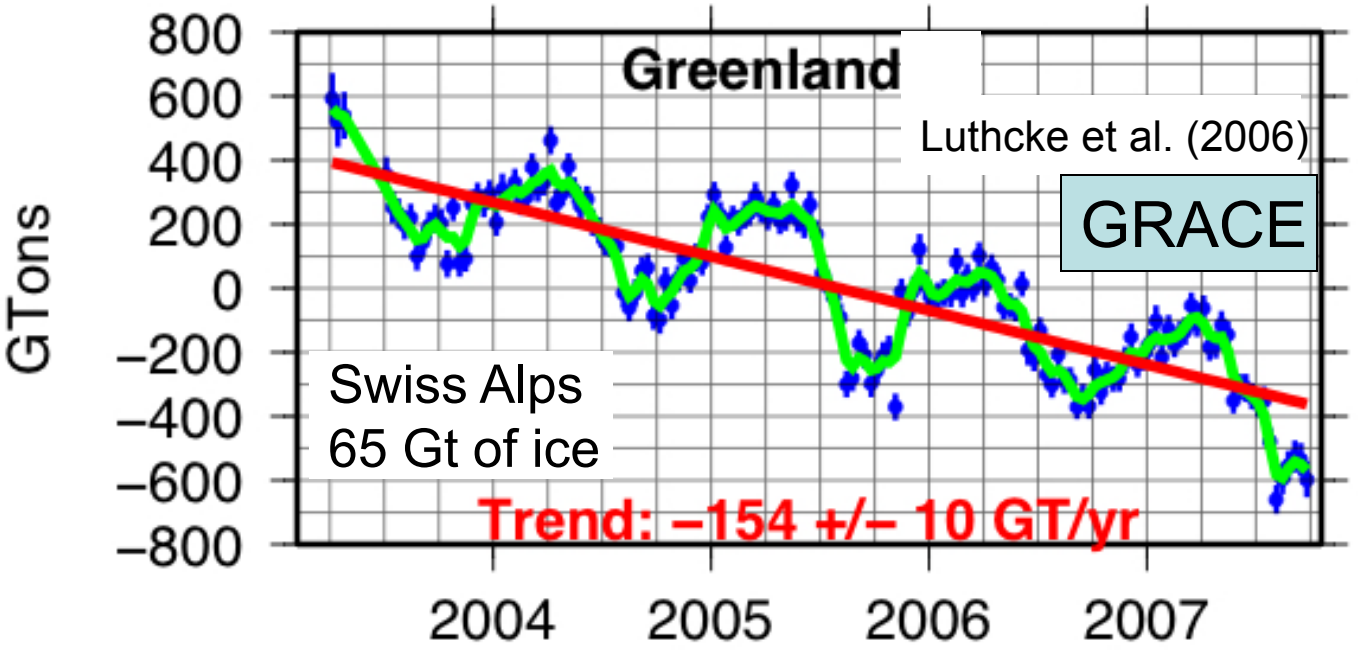
Average Rate = 3.5 mm per year

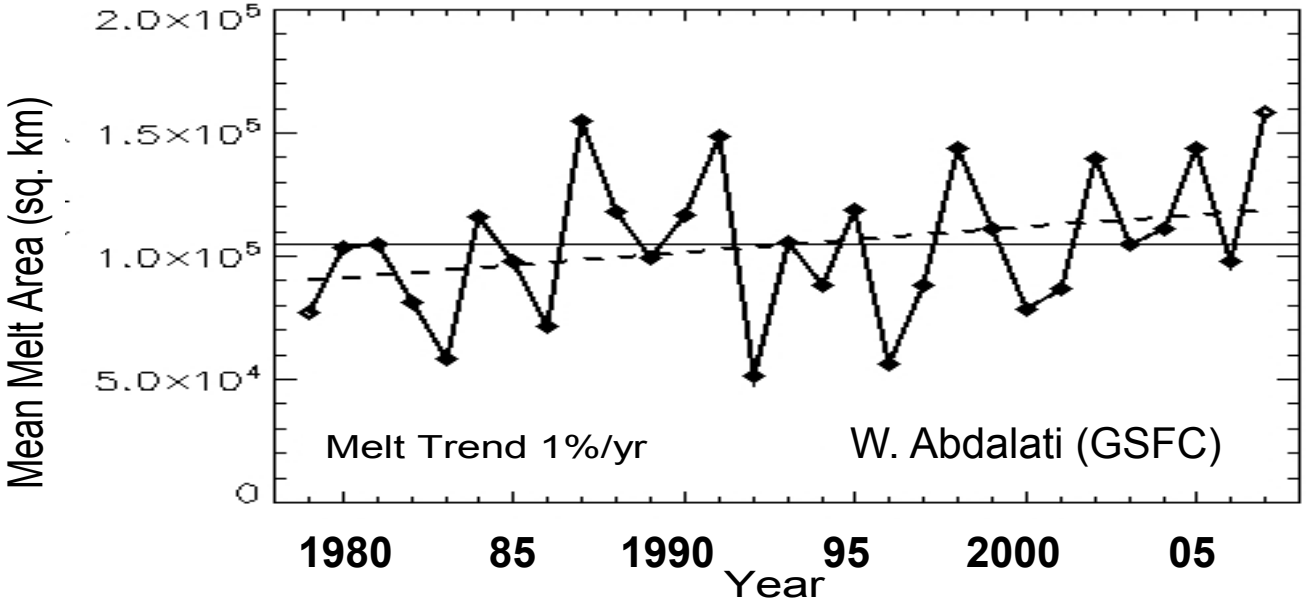


IPCC FAR Fig. 5.14

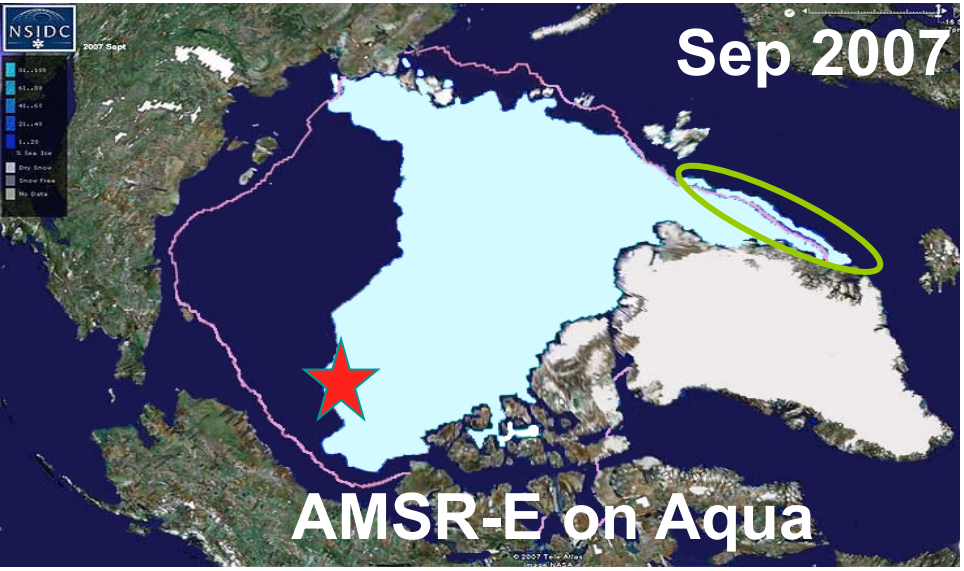
Greenland Ice Sheet Depletion

Photo: R Braithwaite





Arctic Sea Ice Depletion



NSIDC

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Holland et al. (2008)

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10% per decade

18% 1998-2007

2006

2007

NSIDC

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TIFF (LZW) decompressor
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Perovich et al. (2008)

Gaia:
Earth Breathing

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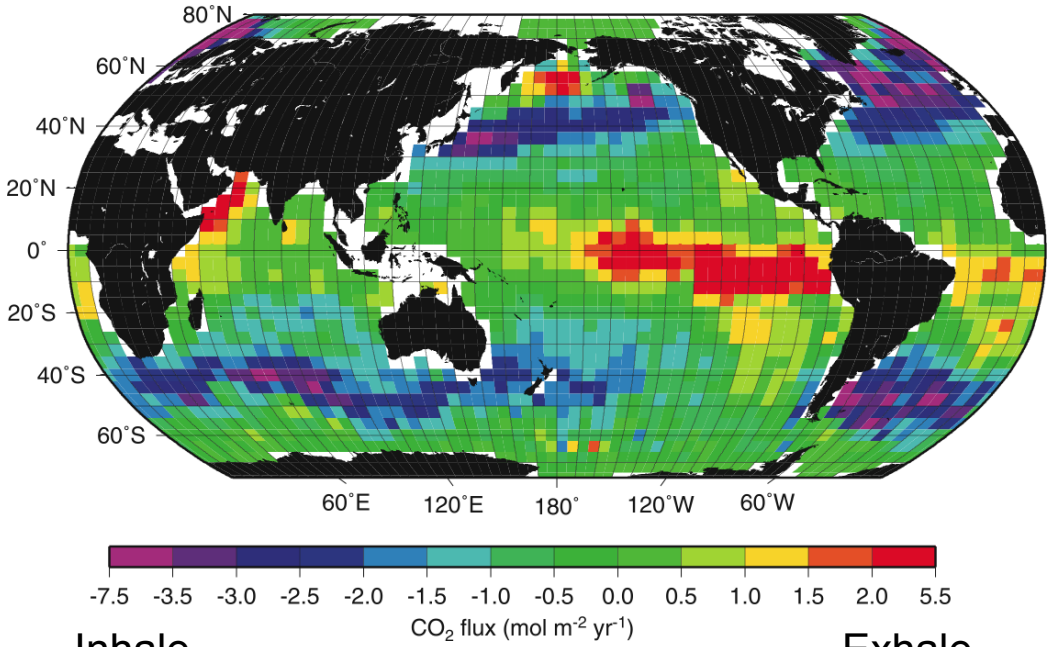

Inhale
-2.2 GtC/y

IPCC WG1 FAR

Exhale
0.6 GtC/y

Ocean Acidification Impact on Salmon

- Pteropod comprise 45% of salmon diet
- pH decrease leads to shell dissolution
- 10% increase in water temperature leads to 3% drop in salmon body weight
- 10% decrease in pteropod production leads to 20% drop in salmon body weight

Aydin et al. (2005)

Surface Ocean

360
340
320

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TIFF (Uncompressed) decompressor
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CO_2 (ppm)

8.12
8.10
8.08

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TIFF (Uncompressed) decompressor
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pH

1985 95 05

Stratosphere Ozone Recovery

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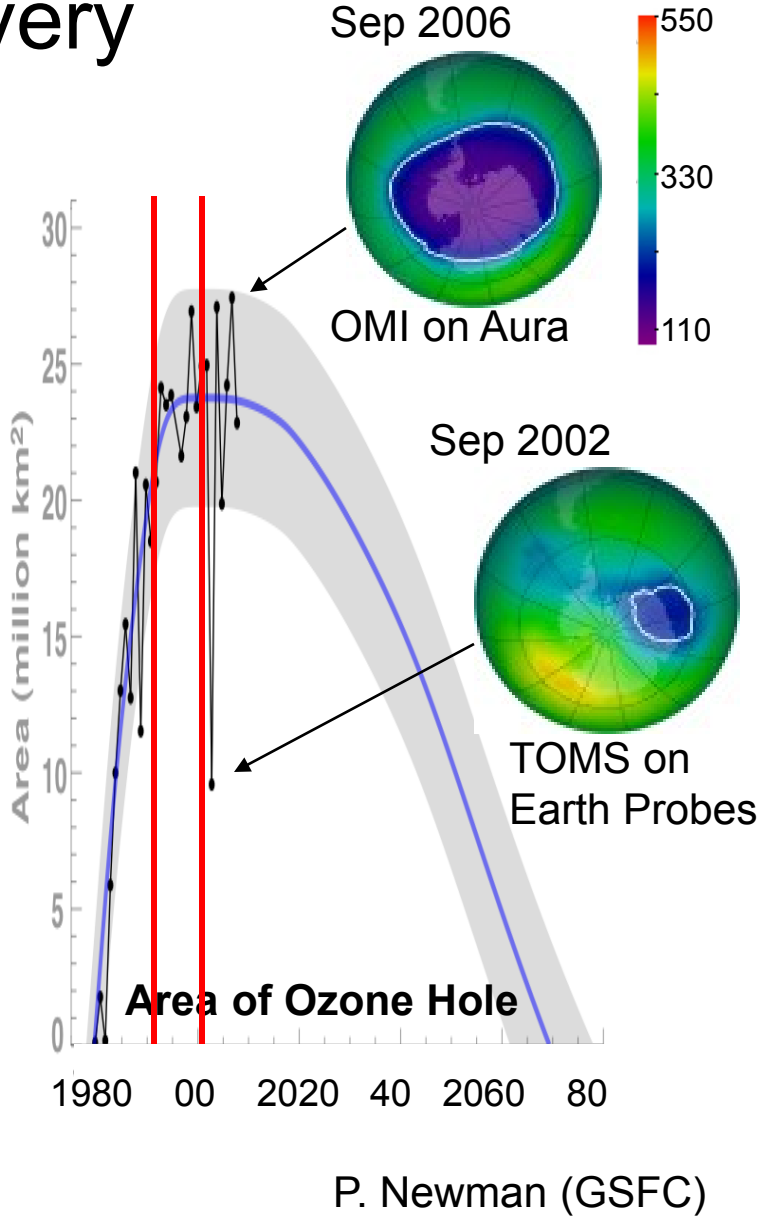


P. Newman (GSFC)

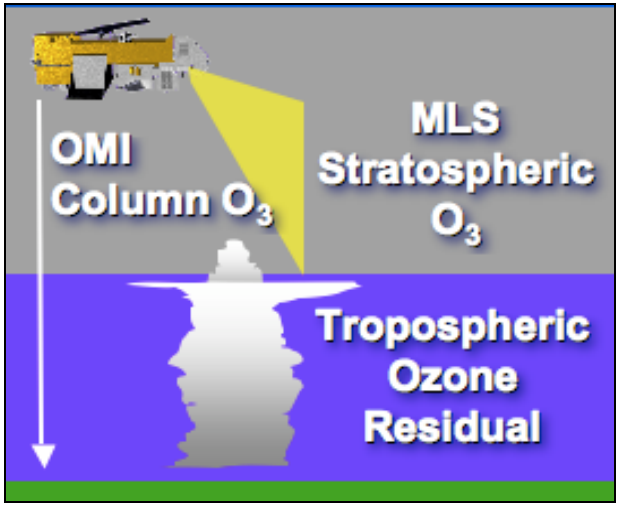
IPCC FAR (2007)

Montreal Protocol
and Amendments

Air Pollution: Transcontinental Transport of Ozone

- NH pollution in summer
- SH biomass burning in spring

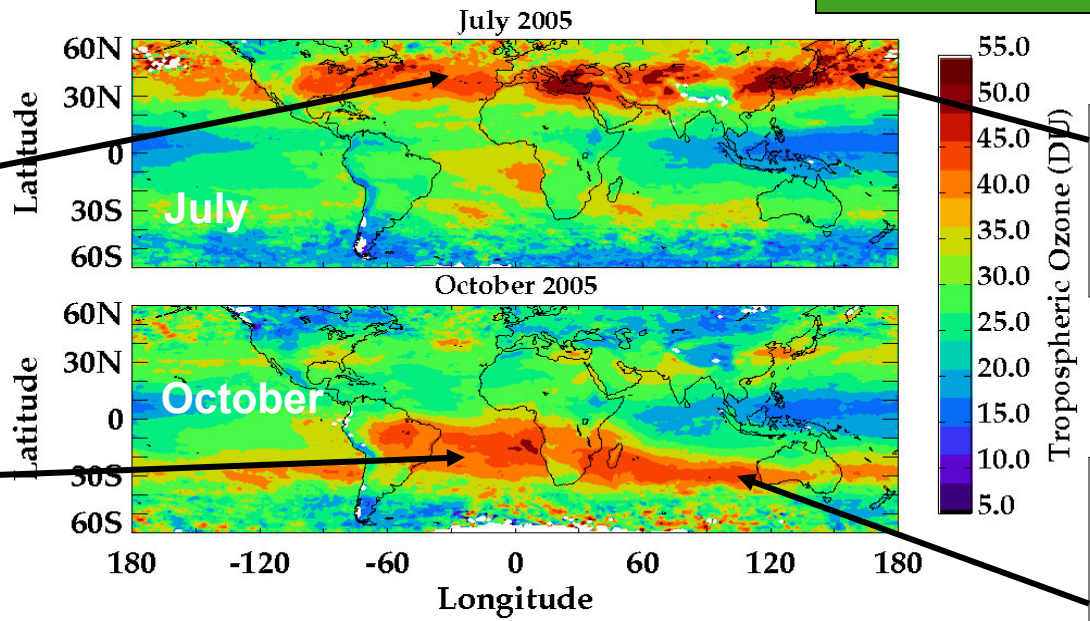
NASA Aura



July and October 2005

Pollution from North America reaches Europe

Pollution from South America fills the South Atlantic



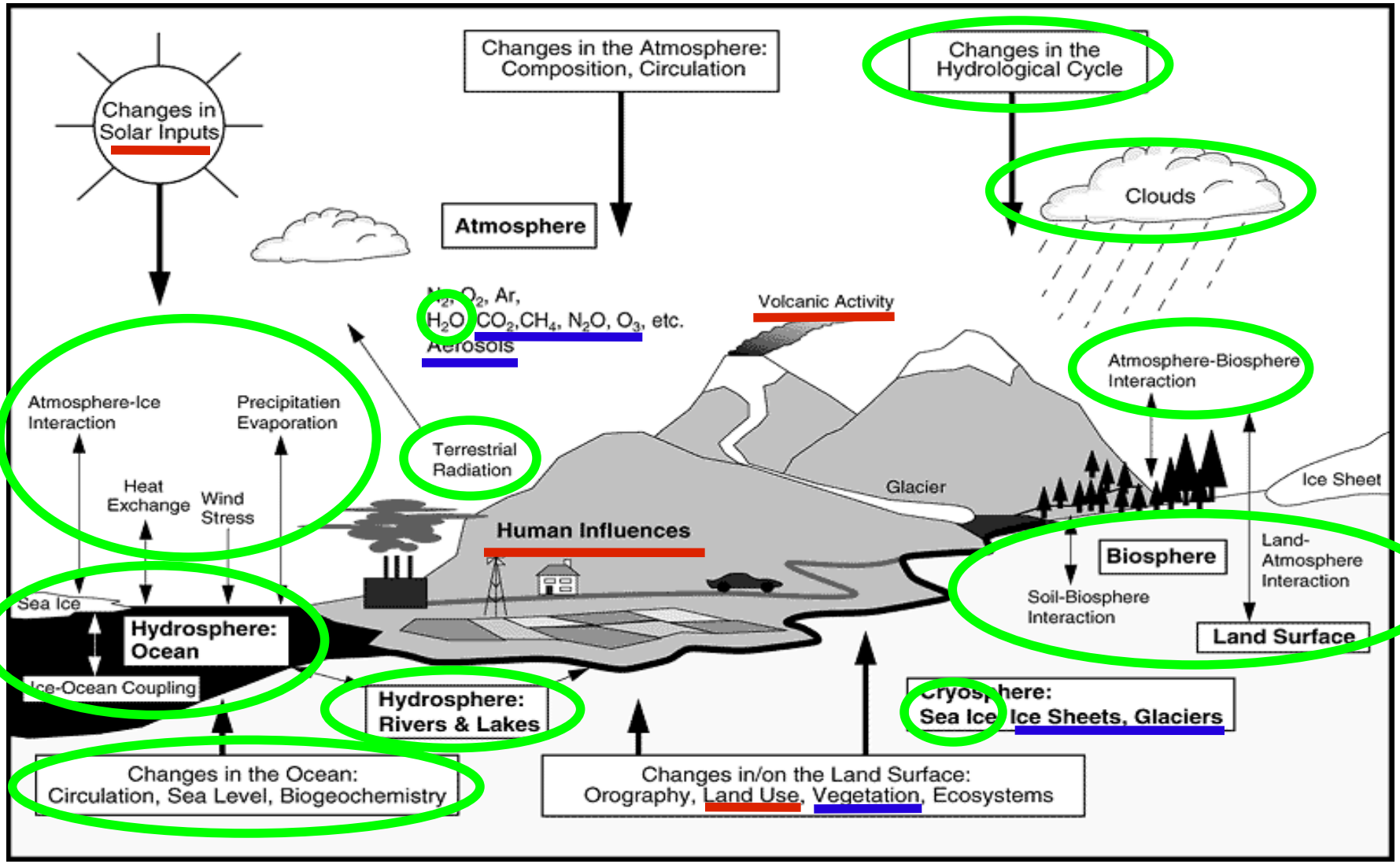
Pollution from China reaches North America

Pollution from Africa spreads to Australia

Schoeberl et al. (2007)

GISS Global Integrated Earth System Model

G. Schmidt (GISS)

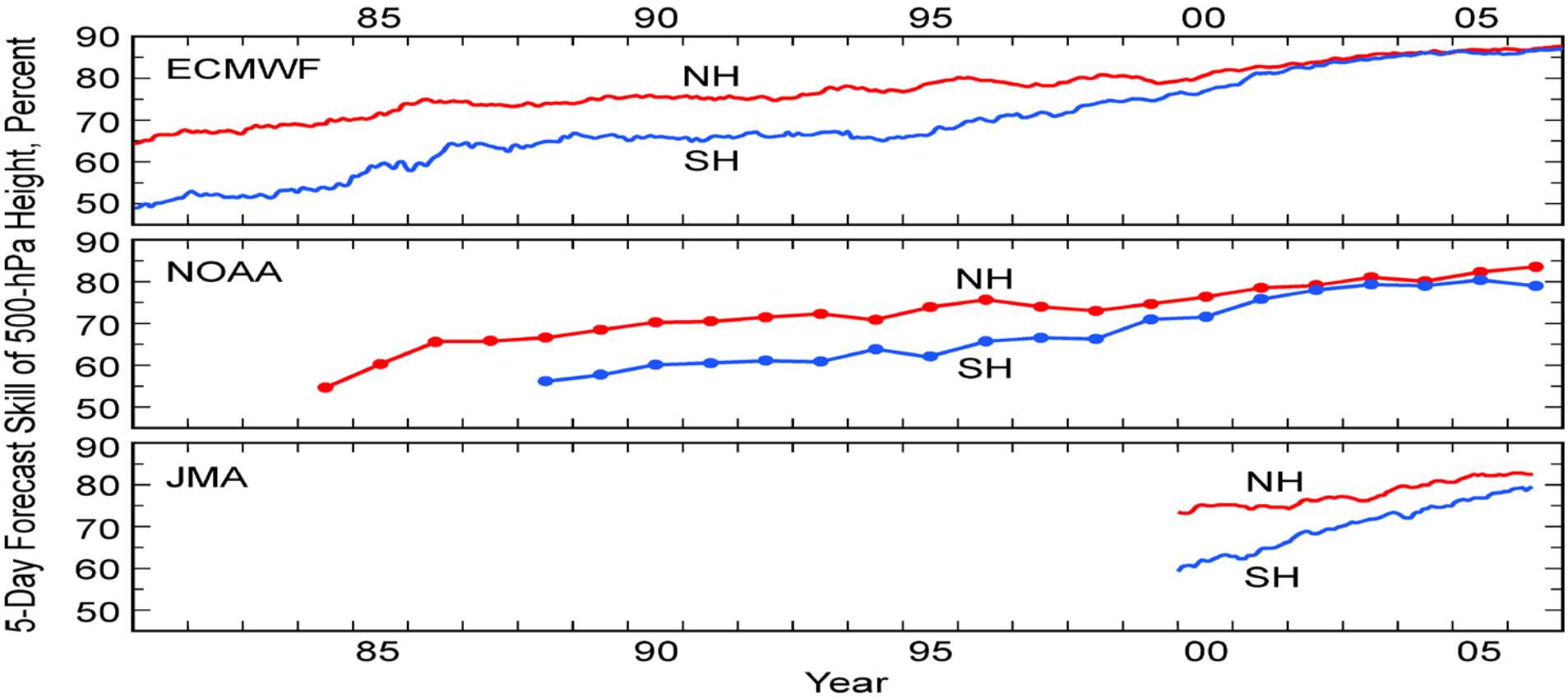


External

Internal to Earth System Models

Calculated in all AOGCMS

GEOSS Societal Benefit Area: Weather



Time evolution of improvement of forecast skill for operational NWP 5-day forecasts of 500-hPa geopotential heights over the Northern Hemisphere (NH) and Southern Hemisphere (SH) computed at ECMWF (12-month running average values of monthly-mean skill over 90S-20S, 20N-90N; at NOAA (annual mean skill over 80S-20S, 20N-80N; and at JMA (monthly mean skill over 90S-20S, 20N-90N). The NWP centers used different model physics and data assimilation schemes.

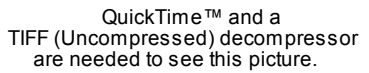
The Role of Science and Technology in GEOSS (2008)

GEO Governance

The Role of Science and Technology in GEOSS (2008)

GEO Science and Technology Committee (STC)

- Four GEO Standing Committees
  - Architecture and Data Committee
  - Capacity Building Committee
  - Science and Technology Committee
  - User Interface Committee
- STC Vision
  - build GEOSS through science and technology
  - develop GEOSS to improve understanding of the global integrated Earth system
  - engage S&T community to develop and use GEOSS
- STC Activities
  - describe role of STC
  - coordinate GEO 2007-2009 Work Plan Tasks
  - advise on GEO 2009-2011 Work Plan Tasks
  - advise on GEO Data Sharing Principles and Implementation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are needed to see this picture.

GEO Work Plan Tasks

2007-2009

V1 2009-2011

1

2

3

STC Recommendation

V2 2009-2011

GEO 2009-2011 Work Plan Tasks
STC Principles for Tasks with Oversight by STC

- minimize overlap of functions with other Tasks
  - committed leadership with 2 - 4 co-chairs
  - high relevance to value-added contributions to GEOSS
  - achievable high-priority activities in 3-year interval
- enable vision of STC
  - incorporate state-of-the-art science and technology in building GEOSS
  - develop GEOSS to generate new knowledge to improve understanding of the global integrated Earth system
- optimize number of Tasks
  - enable coordination opportunities to discover new knowledge at boundaries of Tasks
  - commensurate with resources of STC and GEO Secretariat
- enhance communication between Tasks and STC

STC Overarching 2009-2011 WP Task #1
Create GEO Strategy

- Utilize GEOSS to study global integrated Earth system
  - Generate new knowledge
    - Illuminate interactions between Earth components
    - Facilitate analyses and re-analyses
  - Improve interoperability between observations and models
  - Optimize global observations for scientific challenges
    - develop well-calibrated, high-accuracy, stable observations
    - sustain observations for time duration commensurate with science
    - minimize observation gaps
    - record data at highest space and time resolutions
    - integrate in-situ and satellite observations
    - harmonize observations recorded by different instruments
- Develop technology to reduce cost of observations
- Develop technology to record new observations
- Improve computing capability and capacity comparable to space and time resolutions of observations

STC Overarching 2009-2011 WP Task #2

- Engage national government and nongovernmental agencies to incorporate GEOSS in national programs
  - Promote collaboration with GEOSS
  - Identify funds for GEOSS activities
  - Contribute to GEO

GEO Data Sharing Principles and Implementation

- Full and open exchange of data
  - include metadata and data products
  - recognize international and national policies
    - establish coordination of vague policies and procedures
    - establish compliance through technical controls on data access
  - encourage reuse and re-dissemination without restrictions
  - attribute significant data sources and authors
- Minimum time delay
- Minimum cost
  - no shared cost for system development and data collection
  - no cost for metadata
  - online cost recovery mechanisms
  - encourage no cost for developing countries
  - encourage no cost for “research” and “education”
  - no cost for reuse of data and data products

GEOSS 10-Year Implementation Plan (Third Earth Observation Summit, February 2005, Brussels)
White Paper on the GEOSS Data Sharing Principles (CODATA Review Draft, May 2008, Paris)

GEOSS Common Infrastructure (GCI)
Initial Operating Capability (IOC) Task Force (TF)

- GEOSS Web Portal Registry Models
  - Compusult [Canada][private]
  - ESA-FAO [EU-UN][public]
  - ESRI [USA][private]
- GCI IOC TF Governance
  - reports to GEO Executive Committee
  - GEO Committee representatives
- GCI IOC TF Objectives
  - develop Concept of Operations Plan
    - operational requirements, responsibilities and interactions
  - evaluate registry models
    - provider and user requirements
    - reliability, suitability, sustainability, and quality of service
    - maintenance, enhancements, access control and security
    - intellectual property rights

Summary

- GEO
  - Intergovernmental organization, outside of UN
  - Ministerial-level coordination of Earth observations
  - New organization, growing rapidly, developing processes
  - Building GEOSS
    - GEO Web Portal
    - GEONETcast
- STC
  - One of four GEO Committees
  - Enables S&T for GEOSS SBAs
  - Enables GEOSS for S&T
  - Contributes to success of GEO
    - *The Role of Science and Technology in GEOSS* (2008)
    - The Role of GEOSS in Understanding the Global Integrated Earth System