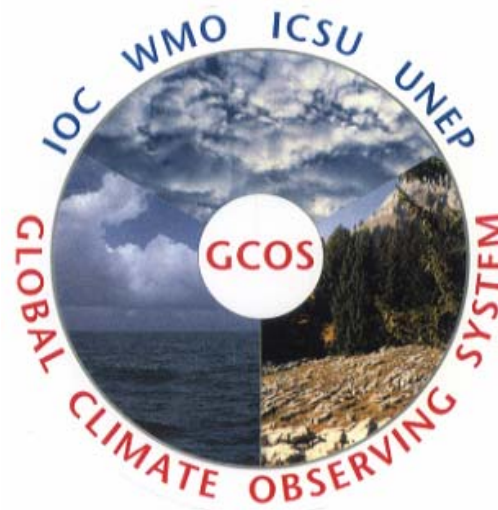


Views on cross-cutting use of observations for climate in GEOSS

Global Climate Observing System (GCOS)

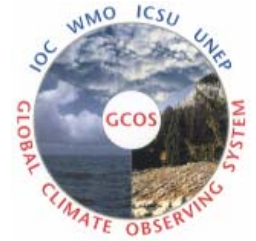


**Stephan Bojinski, GCOS Secretariat
GEO User Interface Committee, 2-3 April 2007, Geneva**

GCOS Overview



- Since 1992
- To ensure that the data required to meet the needs of users for climate information are obtained and made available for:
 - **Climate system monitoring, climate change detection and attribution;**
 - **Research to improve modelling and prediction of the climate system;**
 - **Assessing impacts, vulnerability & supporting adaptation;**
 - **Application to sustainable economic development.**
- Global, long-term, high-quality, sustainable, reliable data
- Sponsored by
 - World Meteorological Organization (WMO), Int'l Oceanographic Commission/UNESCO, UNEP, Int'l Council for Science (ICSU)
- Science panels (Atmosphere, Oceans, Terrestrial), Secretariat, Steering Committee, Experts
- National GCOS coordinators and focal points, National support



GCOS Baseline Networks

● Atmosphere

- GCOS Upper-Air Network (GUAN) (164 stations, 80 countries)
- GCOS Surface Network (GSN) (1016 Stations, 145 countries)
- Global Atmosphere Watch (GAW) (among 23 global, 300+ regional stations)
- WCRP/GEWEX Baseline Surface Radiation Network (BSRN) (35 stations)

● Ocean

- Ship of Opportunity Program (SOOP) (~120 ships/27,000 XBTs, 7 countries)
- Data Buoy Cooperation Panel (DBCP) components (~1300 drifting buoys, plus moored buoys, subsurface floats; 21 countries)
- Voluntary Observing Ships (VOS) (~7000 ships, 52 countries)
- ENSO Observing System (TAO/Triton Array, tide gauges, VOS)
- Automated Shipboard Aerological Programme (ASAP) (21 units, 9 participants)
- Global Sea-Level Observing System (GLOSS) (~300 global stations)
- Argo (up to 3000 profiling floats, 14 countries)

● Terrestrial

- Global Terrestrial Network for Glaciers (GTN-G) (~750 glaciers monitored)
- Global Terrestrial Network for Permafrost (GTN-P) (300 boreholes, 15 countries)
- Global Terrestrial Network for Rivers (GTN-R) (380 river gauges, 82 countries)



Essential Climate Variables (ECVs)

● Atmospheric (16)

- **Surface** – Air temperature, Precipitation, Air pressure, Surface radiation budget, Wind speed and direction, Water vapour
- **Upper Air** – Earth radiation budget (including solar irradiance), Upper-air temperature (including MSU radiances), Wind speed and direction, Water vapour, Cloud properties
- **Composition** – Carbon dioxide, Methane, Ozone, Other long-lived greenhouse gases, Aerosol properties.

● Oceanic (15)

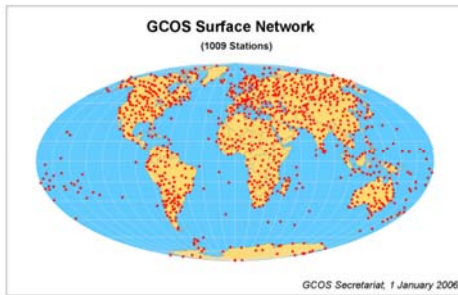
- **Surface** – Sea-surface temperature, Sea-surface salinity, Sea level, Sea state, Sea ice, Current, Ocean colour (for biological activity), Carbon dioxide partial pressure
- **Sub-surface:** Temperature, Salinity, Current, Nutrients, Carbon, Ocean tracers, Phytoplankton

● Terrestrial (13)

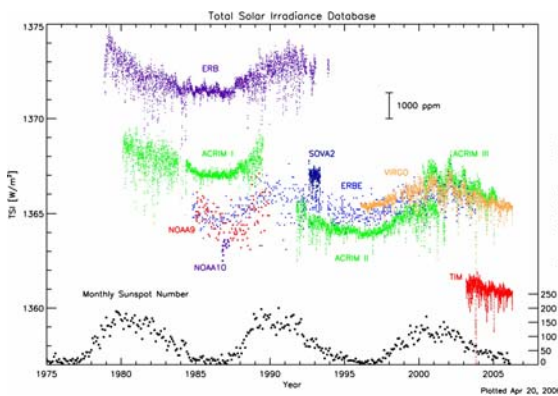
- River discharge, Water use, Ground water, Lake levels, Snow cover, Glaciers and ice caps, Permafrost and seasonally-frozen ground, Albedo, Land cover (including vegetation type), Fraction of absorbed photosynthetically active radiation (FAPAR), Leaf area index (LAI), Biomass, Fire disturbance, [soil moisture]



GCOS Milestones

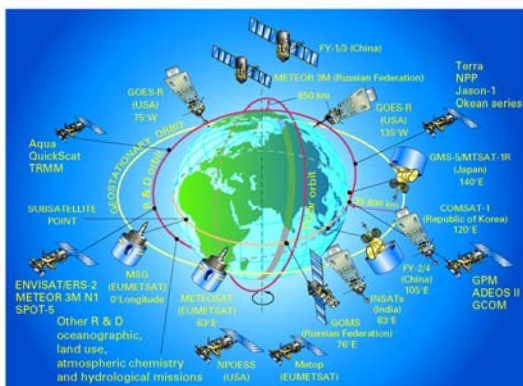


- GCOS 2nd Adequacy Report in Support of the UNFCCC (2003): identified gaps and deficiencies in observing systems for climate



- GCOS Implementation Plan in Support of the UNFCCC (2004) : the roadmap for the global climate observing system in the next 5-10 years (in situ, space-based, models, institutions, agents)

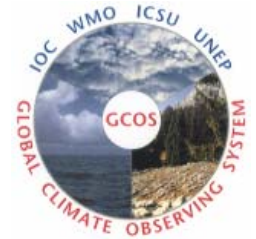
- September 2006: Publication of GCOS-107 “Systematic Observation Requirements for Satellite-based Products for Climate” (‘Satellite Supplement’ to GCOS IP)



- October/November 2006: Publication by Space Agencies (CEOS): “Satellite Observation of the Climate System”; as a response to space component of GCOS IP

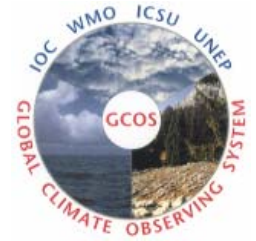
Major and ongoing contribution to GEOSS

GCOS and GEOSS



- **GCOS recognized as climate component of GEOSS**
- **GCOS to satisfy global, sustained observation needs of the 'Climate SBA'**
- **This includes sustained observations for research (World Climate Research Programme, ...)**
- **GCOS ultimately to satisfy most climate observation needs of all SBAs**

GCOS and the GEO UIC



GCOS contributes to:

- CL-06-03 ('Terrestrial Mechanism'), CL-06-05 (IPY), CL-06-06 (Coastal/Marine obs)
- DA-07-02 (Land Cover Datasets), DA-07-03 (CEOS Constellations)
- US-06-01:
« Establish a GEO process for identifying critical Earth observation priorities common to many GEOSS SBAs, involving scientific and technical experts, taking account of socio-economic factors, and building on the results of existing systems' requirements development processes. »
- US-07-02 (Inter-institutional coordination towards achieving the Millennium Development Goals)
- US-07-03 (Integration of environmental risk management into development processes)

US-06-01: Cross-cutting aspects

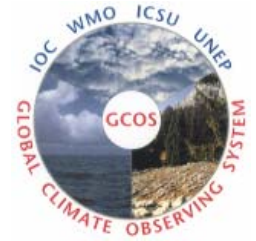


SBA ECV	Weather	Health	Agriculture	Water	Ecosystems	Biodiversity	Disasters	Energy
Atmosphere								
Surface wind speed and direction	X	X	X	X	X	X	X	X
Surface temperature	X	X	X	X	X	X	X	X
Precipitation	X	X	X	X	X	X	X	X
Surface pressure	X							
Surface radiation budget	X	X	X		X	X		X
Surface water vapour	X	X	X	X	X	X		
Earth radiation budget	X							
Upper-air temperature	X							
Upper-air wind speed and direction	X	X					X	
Upper-air water vapour	X							
Cloud properties	X							X
CO2								
CH4								
O3	X	X						

Reference (e.g.):
GEOSS TYIP
 Reference
 Document
 (2005)

... Oceans, Terrestrial

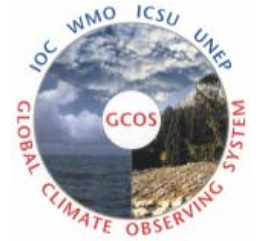
US-06-01: Cross-cutting aspects



Examples

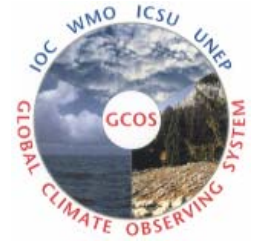
SBA ECV	Weather	Health	Agriculture	Water	Ecosystems	Biodiversity	Disasters	Energy
Precipitation	X	X	X	X	X	X	X	X
Surface pressure	X							
Surface radiation budget	X	X	X		X	X		X

US-06-01: Cross-cutting aspects



- Importance of observations of ECVs/geophysical variables (atmosphere, oceans, terrestrial) for a wide range of SBAs
- Prevent duplication of effort in GEOSS: coordination between providers & users across SBAs
- Data-related, user-dependent factors:
 - Direct, indirect use of data
 - Temporal and spatial resolution
 - Accuracy, stability, QC/QA
 - Metadata needs, Indices
 - Capacity to utilize data

US-07-02, US-07-03



- Promote the use of climate products and climate forecast products to support development goals
- “Climate for Development in Africa” strategy:
 - UNECA, AU, GCOS, WMO, UK DfID, IRI, AfDB
 - major initiative for the improvement of end-to-end user services based on Earth observations (in situ and space-based) in Africa
 - inclusive stakeholder participation from the climate, health, agriculture, and water resource management communities.
 - involves key policymakers, development institutions, and the financial sector.
 - particularly addresses the capacity-building efforts necessary in Africa to achieve effective user services based on observations.





Conclusions

- **GCOS views on cross-cutting use of observations across SBAs: Draft paper v0.6 available**
- **Invitation to GEO UIC to discuss and give feedback**



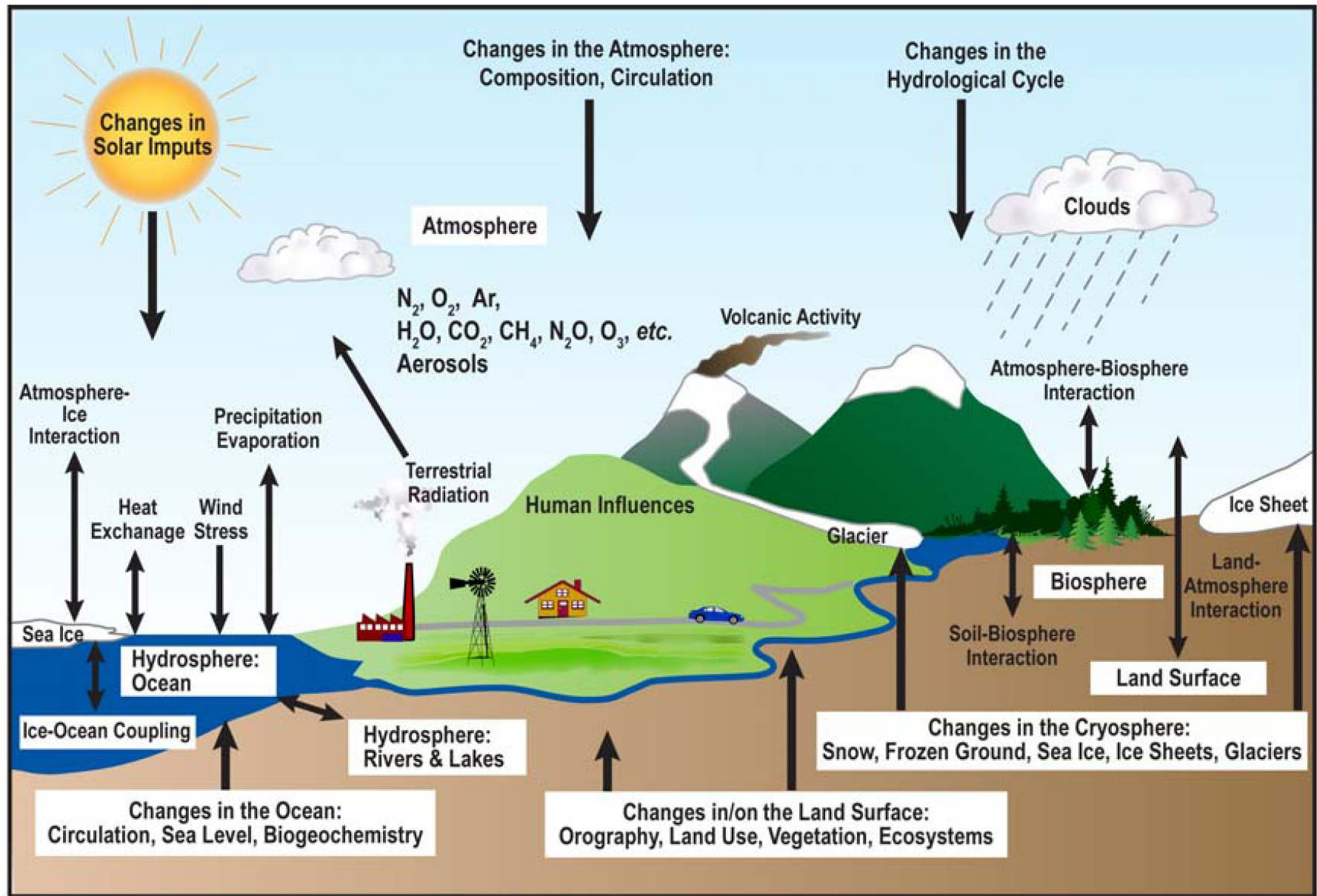
Thank you.



Basis provided by GCOS Plans

- Essential Climate Variables (ECVs)
 - 44 geophysical variables
- GCOS Climate Monitoring Principles
 - 10 basic + 10 satellite-specific
- GCOS Implementation Plan
 - 131 Actions, agents for implementation, cost estimates
- Satellite Supplement to GCOS IP
 - 9 cross-cutting needs, 35 geophysical products based on ECVs
- Product Examples: Aerosols, Albedo

The Climate System





Atmosphere: Products and Data Records

(‘Sat Supplement’,
September 2006)

ECVs / Global Products requiring Satellite Observations	Fundamental Climate Data Records required for Product Generation (from past, current and future missions)
Surface Wind Speed and Direction Surface vector winds analyses, particularly from reanalysis	Passive microwave radiances and scatterometry
Upper-air Temperature Homogenized upper-air temperature analyses; Extended MSU-equivalent temperature record; New record for upper-troposphere and lower-stratosphere temperature using data from radio occultation; Temperature analyses obtained from reanalyses	Passive microwave radiances; GPS radio occultation; High-spectral resolution IR radiances for use in reanalysis
Water Vapour Total column water vapour over the ocean and over land; Troposphere and lower- stratosphere profiles of water vapour	Passive microwave radiances; UV/VIS radiances; IR imagery and soundings in the 6.7 μm band; Microwave soundings in the 183 GHz band
Cloud Properties Cloud radiative properties (initially key ISCCP products)	VIS/IR imagery; IR and microwave soundings
Precipitation Improved estimates of precipitation, both as derived from specific satellite instruments and as provided by composite products	Passive microwave radiances; High-frequency geostationary IR measurements; Active radar (for calibration)
Earth Radiation Budget Top-of-atmosphere Earth radiation budget on a continuous basis	Broadband radiances; Spectrally-resolved solar irradiances; Geostationary multispectral imagery
Ozone Profiles and total column of ozone	UV/VIS and IR/microwave radiances
Aerosol Properties Aerosol optical depth and other aerosol properties	VIS/NIR/SWIR radiances
Carbon Dioxide, Methane and other GHGs Distribution of greenhouse gases, such as CO ₂ and CH ₄ , of sufficient quality to estimate regional sources and sinks	NIR/IR radiances
Upper-air Wind Upper-air wind analyses, particularly from reanalysis	VIS/IR imagery; Doppler wind lidar
Atmospheric Reanalyses	Key FCDRs and products identified in this report, and other data of value to the analyses



Terrestrial: Products and Data Records

(‘Sat Supplement’,
September 2006)

ECVs / Global Products requiring Satellite Observations	Fundamental Climate Data Records required for Product Generation (from past, current and future missions)
Lakes For lakes in the Global Terrestrial Network for Lakes: Maps of lakes; Lake levels; Surface temperatures of lakes	VIS/NIR imagery, and radar imagery; Altimetry; High-resolution IR imagery
Glaciers and Ice Caps Maps of the areas covered by glaciers other than ice sheets; Ice-sheet elevation changes for mass-balance determination	High-resolution VIS/NIR/SWIR optical imagery; Altimetry
Snow Cover Snow areal extent	Moderate-resolution VIS/NIR/IR and passive microwave imagery
Albedo Directional-hemispherical (black sky) albedo	Multispectral and broadband imagery
Land Cover Moderate-resolution maps of land-cover type; High-resolution maps of land-cover type, for the detection of land- cover change	Moderate-resolution multispectral VIS/NIR imagery; High-resolution multispectral VIS/NIR imagery
fAPAR Maps of fAPAR	VIS/NIR imagery
LAI Maps of LAI	VIS/NIR imagery
Biomass Research towards global, above-ground forest biomass and forest-biomass change	L band / P band SAR; Laser altimetry
Fire Disturbance Burnt area, supplemented by active-fire maps and fire-radiated power	VIS/NIR/SWIR/TIR moderate-resolution multispectral imagery
Soil Moisture¹ Research towards global near-surface soil-moisture map (up to 10cm soil depth)	Active and passive microwave