Update on GCOS Plans and Activities & Requests to CEOS

Stephan Bojinski, GCOS Secretariat

CEOS SIT-25, 13-14 April 2010
Tokyo, Japan

Outline

1. Space Agencies contributing to UNFCCC and GEOSS Climate Strategic Target
2. 2010 Update of GCOS Implementation Plan
3. The emerging GCOS Reference Upper-Air Network (GRUAN)
4. GCOS Key Activities 2010
5. Considerations for CEOS SIT

UNFCCC 2009 Sessions

- **Two (consensus!) decisions by Parties at COP-15 related to satellite-based observations**
- On *Systematic observation*, Parties:
  - noted the role of GCOS and recognized key findings of the 2004-2008 GCOS progress report,
  - encouraged CEOS to continue coordinating and supporting the implementation of the satellite component of the GCOS, and
  - urged to continue to implement CEOS actions in support of GCOS by ensuring long-term continuity of observations and data availability.
- On *Methodological guidance on REDD/REDD+*, Parties:
  - Agreed to establish national forest monitoring systems as part of national monitoring systems that use a combination of remote sensing and ground-based forest carbon inventory approaches

GEOSS Climate SBA Target

- Agreed at GEO-VI Washington D.C. (Nov 2009)

- Before 2015, GEO aims to:

  "Achieve effective and sustained operation of the global climate observing system and reliable delivery of climate information of a quality needed for predicting, mitigating and adapting to climate variability and change, including for better understanding of the global carbon cycle.

  This will be achieved through:

  [GOOS, GTOS, WMO GOS/GAW, WCRP…]

  - CEOS, as coordinator of the satellite components of GCOS

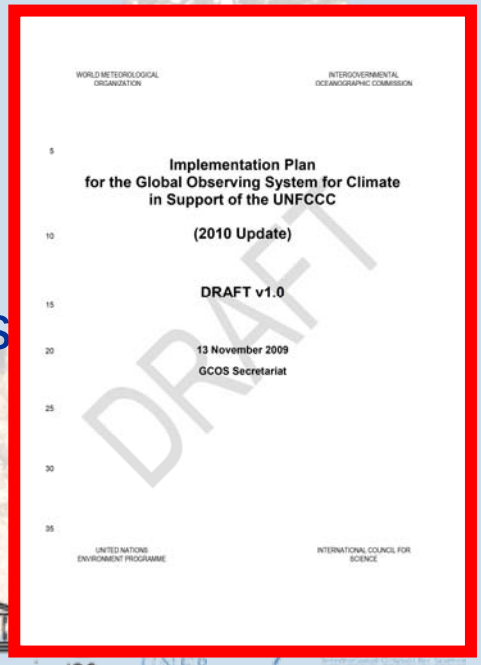
  […] "

2010 Update of GCOS Implementation Plan

Contains Actions related to:

- Updated list of ECVs (Atmosphere, Oceans, Terrestrial)
- Climate Data Records from space (FCDRs, ECV products)
- Satellite Missions for climate
- Modelling, Research and Analysis
- Planning, Cal/Val, Data Access, Other
- Draft considered by UNFCCC COP 15

- Open review 13 Nov 2009 – 31 Jan 2010
- Comments received by 50 countries, institutions
- CEOS comments received in Jan/Feb 2010
  - Adjusted Cost Estimates
- To be finalized by August 2010


WORLD METEOROLOGICAL ORGANIZATION

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION

Implementation Plan
for the Global Observing System for Climate
in Support of the UNFCCC

(2010 Update)

DRAFT v1.0

13 November 2009

GCOS Secretariat

DRAFT

UNITED NATIONS ENVIRONMENT PROGRAMME

INTERNATIONAL COUNCIL FOR SCIENCE

2010 Update of GCOS Implementation Plan: Cross-cutting

Continuity in stressing:

- Coordinated action on climate
- Adherence to the GCOS Climate Monitoring Principles (unchanged - CEOS endorsed them in 2003)
- Data stewardship
- Importance of maturity assessment and complete documentation (Guideline on Generation of Datasets and Products)
- Integrated products
- Distributed data services, emphasizing benefit for all nations

2010 Update of GCOS Implementation Plan: Atmosphere, Oceans, Terrestrial

Detailed requirements (FCDRs, ECV products, accuracy, stability, etc.):

- Update of “Satellite Supplement” in line with 2010 GCOS IP
- Needed by agencies (SIT-24)
- Approved by GCOS Steering Committee, Oct 2010

- Start in May 2010
- Collaboration with / support by CEOS sought re possible expert meeting later in 2010

2010 Update of GCOS Implementation Plan

- An updated space agency (CEOS) reponse to Plan in 2010-2015 would contribute to:
  - Global observations addressing Essential Climate Variables
  - Associated analysis, research, infrastructure and capacity building
  - UNFCCC: adaptation (assessments of vulnerability) & mitigation (effectiveness of policies); current change and predictions (seasonal to decadal); projections (long-term); model development
  - Continuity in CEOS agencies' response to climate needs
  - GEOSS Climate SBA Strategic Target
  - GEO 2009-2011 Work Plan Task CL-09-03b ("Accelerating the implementation of the global climate observing system – Key climate data from satellite systems")
  - Other Tasks in the GEO Work Plan (AR-09-02a, CL-06-01 …)

GCOS Reference Upper-Air Network (GRUAN)

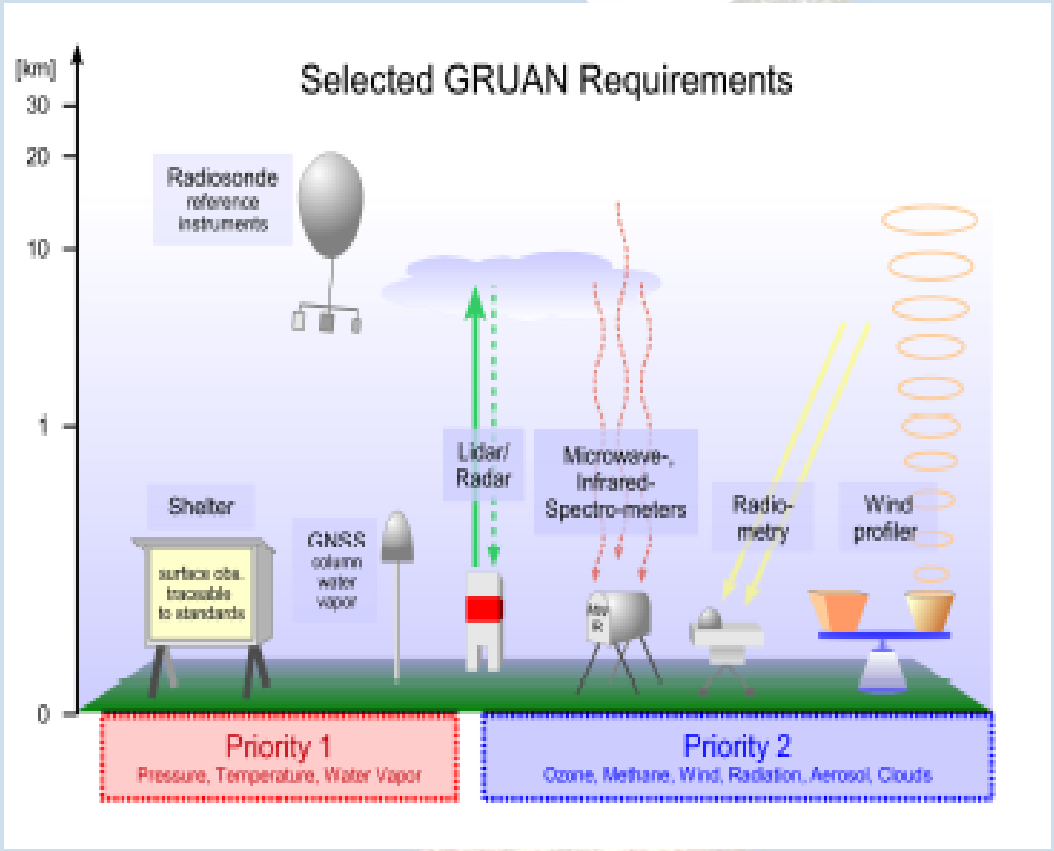
GRUAN aims:

- Provide long-term, high quality upper-air climate records, with uncertainty estimates/full QC
- Historical upper-air records (T, RH) are not as good as required for studying climate change
- Measure a large suite of co-related climate variables with deliberate redundancy
- Become a global network of 30-40 upper-air “supersites”
- Satellites:

→ Anchor (cal/val, RT)

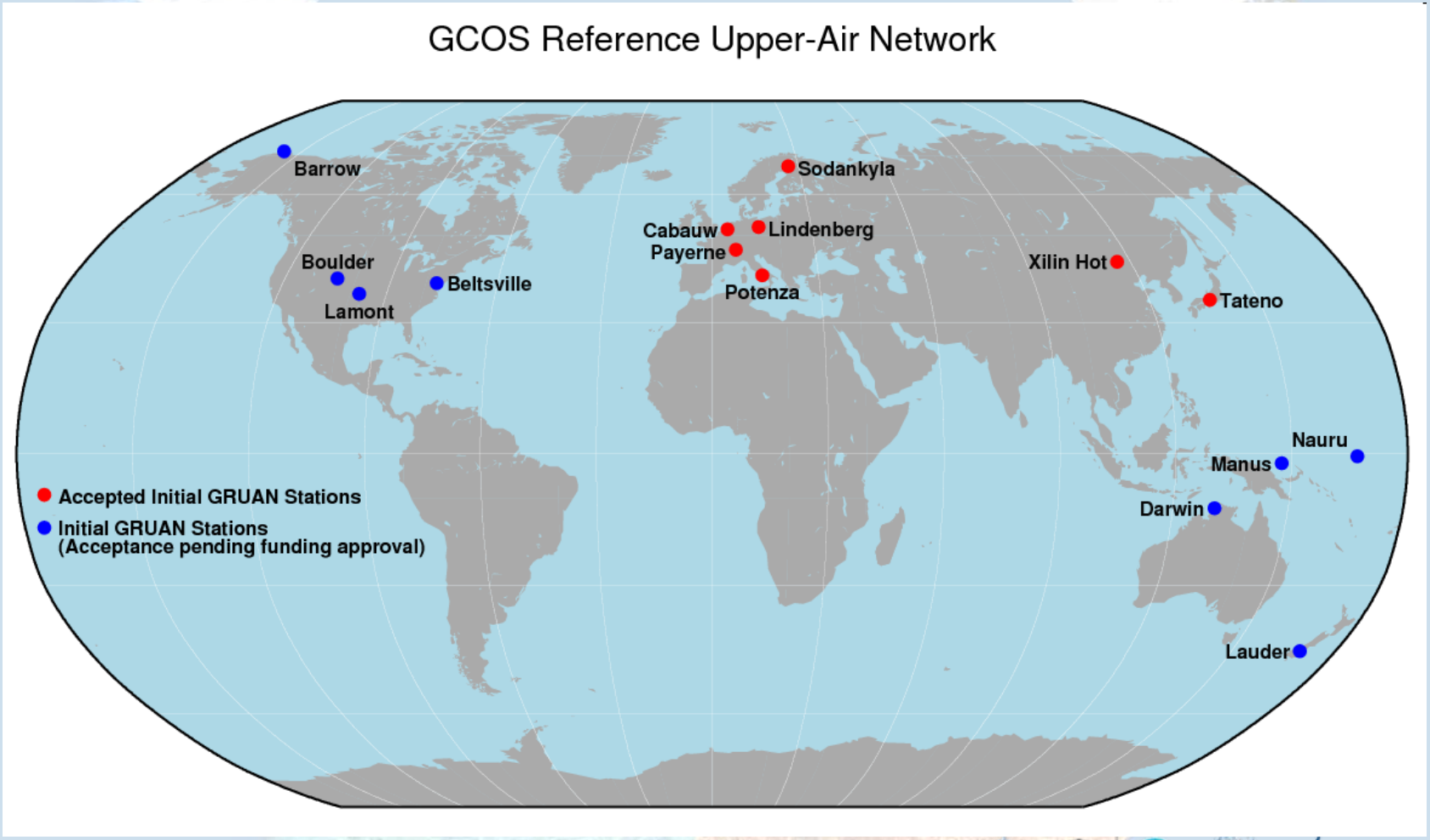
→ Transfer standard in case of gaps

- One of “The First 100 Steps to GEOSS” (2007)



GRUAN sites

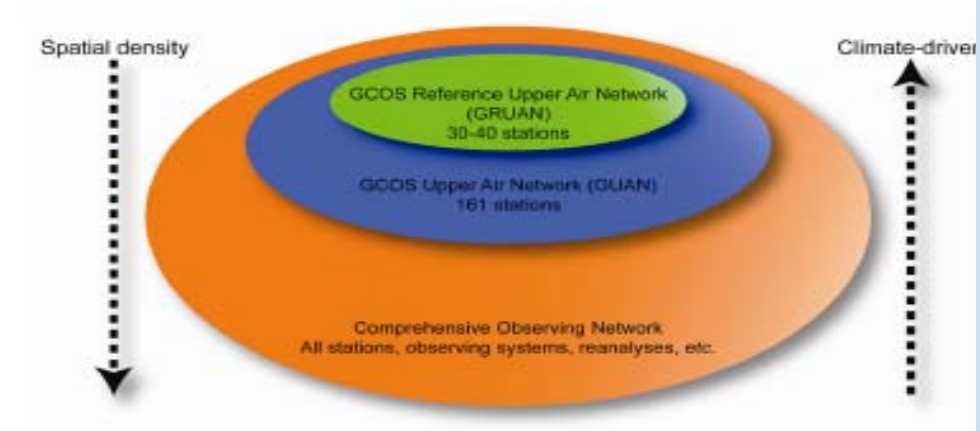
- 15 currently
- 30-40 eventually (from 2013 on).



Seidel et al., *BAMS*, 2008.

The GRUAN concept

GRUAN part of cascade of networks



- GRUAN Implementation Plan 2009-2013;
- Strong coordination with space agencies needed, for siting, measurement scheduling, validation needs
- SCOPE-CM
- First “GRUAN data” available in summer 2010

Partners

- National contributors
- WCRP and the climate science community
- Global Space-based Inter-calibration System (GSICS)
- Existing observational networks (NDACC, ARM, GUAN, GAW, BSRN, GSN, ...)
- WMO
  - Commissions: CIMO and CBS
  - Observations Department
- NMS international departments, development agencies

GCOS Key Activities 2010

GCOS Key Activities 2010

- Finalizing 2010 update of GCOS IP (by Aug 10)
- Updating of Satellite Supplement (start: May 10, …)
- Support to ECV product generation:
  - Finalizing GCOS Guideline (updated and amended GCOS-128) (by May 10)
  - Seeking support for scientific intercomparison/ “peer review” of products
- Supporting GRUAN implementation
- Reporting to UNFCCC COP 16 Mexico (Dec 10)
- Participating in shaping
  - SCOPE-CM
  - WMO Integrated Global Observing System (WIGOS) and
  - Global Framework for Climate Services
- Continuity in working with space agencies a priority

Considerations for CEOS SIT

Considerations for CEOS SIT

- **CEOS, on behalf of all agencies, to respond to the 2010 Update of the GCOS Implementation Plan**
  - Datasets and ECV products
  - Missions
  - Appropriate collaboration with CGMS, SCOPE-CM, agencies and groups "outside" CEOS

- **CEOS agencies to contribute to expert meeting on Satellite Supplement update (Q3-Q4 2010)**

- **CEOS to recognize importance of supersite networks such as GRUAN**

- **CEOS agencies to assist strengthening international scientific working groups performing intercomparisons ("peer-review") of algorithms, datasets and products for climate**
  - Joint GCOS/WCRP Letter to go to EO heads of space agencies and other relevant institutions by May 2010

Thank you

For more information about the GCOS programme
please visit our website

http://gcos.wmo.int

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UNFCCC Mandate to CEOS

- COP-11 (2005): Parties “welcomed and accepted the offer from the CEOS, on behalf of the Parties supporting space agencies involved in global observations, to provide a detailed report on a coordinated response to the needs expressed in the GCOS implementation plan”

Considerations for updated CEOS Response to Climate

(CEOS Climate Meeting Arlington USA, 27-28 Jan 10)

- The CEOS Response to GCOS (59-action plan) is substantial, but not complete
- CEOS agencies also included (mostly tactical) actions in the Climate SBA of the CEOS Implementation Plan for GEOSS
- The Constellations also evolve with attention to GCOS and the GCMPs
- Activities under SCOPE CM address ECV product generation for mainly meteorological ECVs
- In-situ critical for cal/val; int'l science groups critical for product generation and intercomparison

→ Can all this be mapped into an updated space agencies response, with attention to the Updated GCOS IP-10?

Summary of annual additional cost needed to implement Actions in 2010 GCOS IP Update (draft v1.X)

All numbers in million USD

Cost Category	Cross-Cutting Actions	Atmosphere Actions	Oceanic Actions	Terrestrial Actions	Total
Estimated total cost	260	810	680	360	2110
Costs for enhancements in developing countries (non-Annex-I Parties)	160	110	100	60	430
Costs for enhancements in extraterritorial systems, and in developed countries (Annex-I Parties)	100	700	580	300	1680

Status: 13 November 2009 UPDATE??

GCOS Guideline for generation of ECV datasets and products

In working towards meeting the GCOS requirements, particular attention to:

1. Full description of all steps in the generation of datasets and products
2. Information on publications in peer-reviewed journals related to datasets and products
3. Statement of expected accuracy, stability and resolution (time, space) of the product
4. Arrangements for access to the datasets, products and all documentation
5. Version management of datasets and products, particularly in connection with improved algorithms and reprocessing
6. Particular attention to long-term stability and homogeneity of the product
7. Full application of all appropriate calibration/validation activities that would enhance product quality
8. Global coverage where appropriate
9. Timeliness of data release to the user community to enable monitoring activities
10. Facility for user feedback
11. Application of a quantitative maturity index if possible
12. Summary documenting the extent to which this guideline has been followed.

- Respond to increasing demand by producers to ensure quality / meeting GCOS requirements
- Enable: (1) Self-assessment of quality by producers
  (2) Transparency for all users to assess quality

2010 Update of GCOS Implementation Plan: Cost estimates

- Request for IP-10 by UNFCCC SBSTA 30 (2009) includes:
  - Request for cost estimations to implement the Plan, broken down by region, observing system, and between developing and developed countries

- Cost estimates:
  - Additional annual cost needed for climate on top of existing support
  - Included in costs are:
    - Missions primarily/only for climate are costed
    - Missions currently not committed but important for climate (e.g., altimetry)
  - Not included in costs are:
    - Missions primarily built for weather/marine/environmental services, but from which data are/will be important for climate
  - FCDR data analysis and ECV product generation are costed
  - Estimates given in 5 cost bands (1-10M USD/yr, 10-30M USD/yr etc.)
  - Help is needed (SIT-24 Action pending)

Considerations for SIT-24

- GCOS suggest that a few CEOS individuals critically review the cost estimates in the current draft Updated GCOS IP
  - N.B. GCOS will take full responsibility for the costings and not cite contributed advice (ultimately only an individual agency can cost its own missions).
- GCOS suggest a discussion on
  - A possible update to the Satellite Supplement, associated with
  - An updated Response by CEOS to GCOS needs
- GCOS Guideline for consideration by CEOS
- GCOS is the climate observing component of GEOSS –>
  -> New task in GEO 2009-2011 Work Plan:

  CL-09-02 “Accelerate the implementation of the GCOS”
  Sub-task a) Key Observations for Climate
  Sub-task b) Key Climate Data from Satellite Systems
  (formerly CL-06-02)

GCOS Essential Climate Variables (ECVs) in draft Update of GCOS IP (v0.5.4)

- **Priority list of variables to be observed systematically**
- **Criteria:**
  - Global observations feasible (practical, cost-effective)
  - High impact on needs of UNFCCC, climate change assessments (IPCC)

- **Atmospheric (16)**
  - **Surface** – Air temperature, Wind speed and direction, Water vapour, Pressure, Precipitation, Surface radiation budget
  - **Upper Air** – Air temperature, Wind speed and direction, Water vapour, Cloud properties, Earth radiation budget (including solar irradiance)
  - **Composition** – Carbon dioxide, Methane and other long-lived greenhouse gases, Ozone and Aerosol, supported by their precursors.
- **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, Ocean acidity, Phytoplankton
  - **Sub-surface:** Temperature, Salinity, Current, Nutrients, Carbon dioxide partial pressure, Ocean acidity**, Oxygen,** [Marine biodiversity and habitat properties]
- **Terrestrial (13)**
  - River discharge, Water use, Ground water, Lake levels, Snow cover, Glaciers and ice caps, Ice sheets, Permafrost and seasonally-frozen ground, Albedo, Land cover (including vegetation type), Fraction of absorbed photosynthetically active radiation (FAPAR), Leaf area index (LAI), Above-ground biomass, **Soil carbon**, Fire disturbance, **Soil moisture**, [Habitat properties]

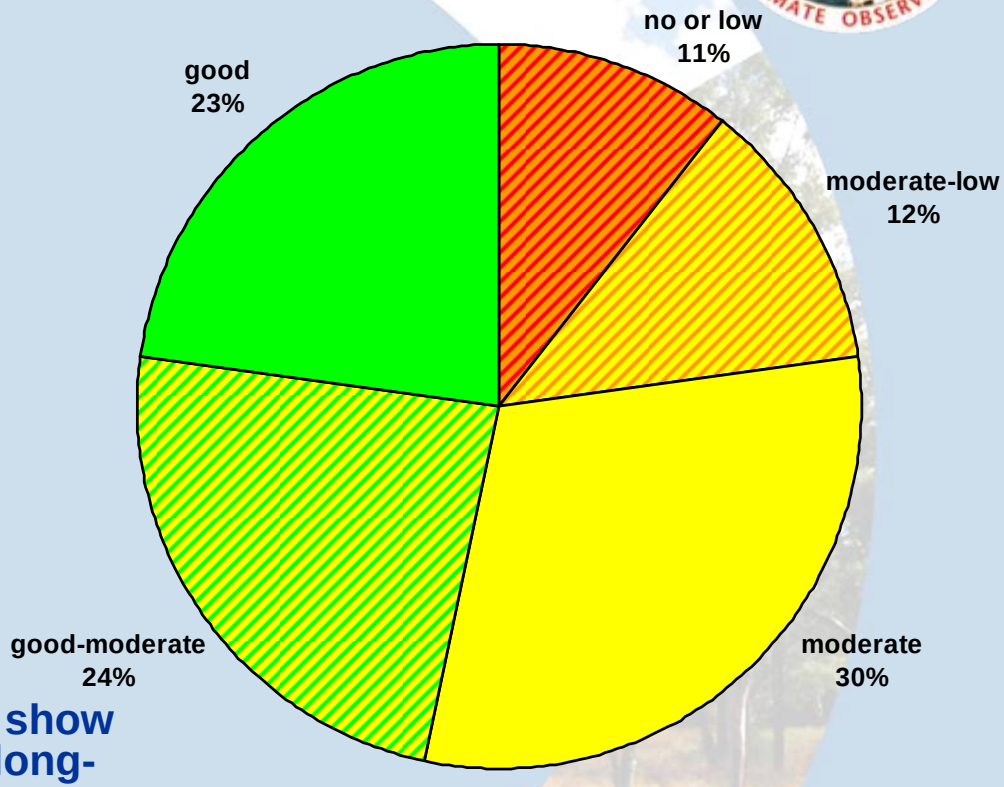
GCOS Progress Report 2004-2008

- Basis: 131 Actions in GCOS Implementation Plan (2004)
- Requested by UNFCCC SBSTA in 2005, for consideration at SBSTA 30 (June 2009)
- Open review April – June 2009
- Review by CEOS (credits to Climate Coordinator!) and by individual space agencies

- Important conclusions by SBSTA 30, including:
  - Continued encouragement for the coordinated implementation and long-term continuity of the cross-cutting space-based component of GCOS
- Draft decision on systematic observation for climate, for discussion at COP 15 in Copenhagen
- Final release of Report: 28 August 2009

GCOS Progress Report 2004-2008 – Summary

- Increasing visibility of climate change has reinforced awareness of the importance of a Global Climate Observing System
- Developed Countries have improved their climate observation capabilities, but limited progress in resolving financial issues related to long-term continuity
- Developing Countries have only made limited (in-situ) progress, with decline in some regions, and capacity building support remains small in relation to needs
- Operational and Research Networks show increasing regard to climate needs; long-term continuity a challenge
- Satellite agencies have improved both mission continuity and capability and are increasingly meeting climate needs
- GCOS has progressed, but still falls short of meeting all UNFCCC needs



Summary of progress on all 131 Actions in GCOS IP

2009 Update of GCOS Implementation Plan – Cost categories

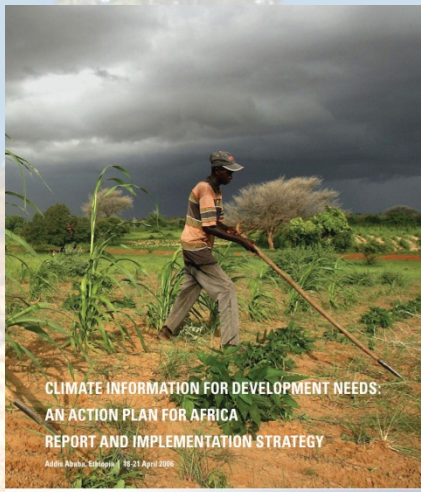
- Cost categories
  - I: <1 M USD
  - II: 1-10 M USD
  - III: 10-30 M USD
  - IV: 30-100 M USD
  - V: 100-300 M USD

  - Incremental (on top of) expected support for currently sustained obs systems & associated infrastructure
  - Full cost includes staff, buildings etc.
  - Include both cost for transition from R2O, as well as for new systems

- Categories are total costs to complete Action in Updated IP

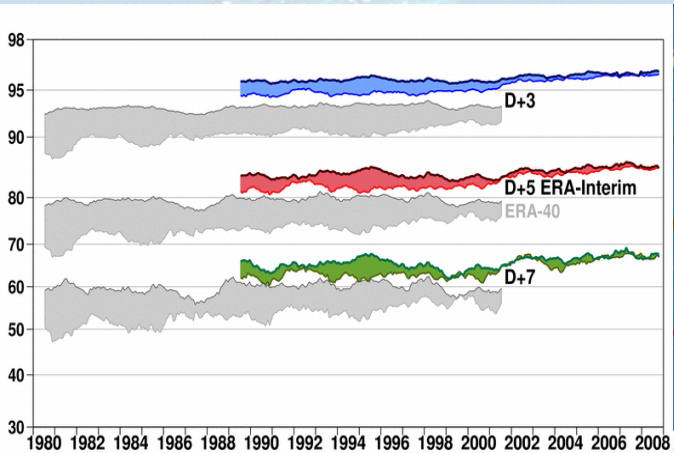
GCOS Progress Report 2004-2008 – Cross-cutting

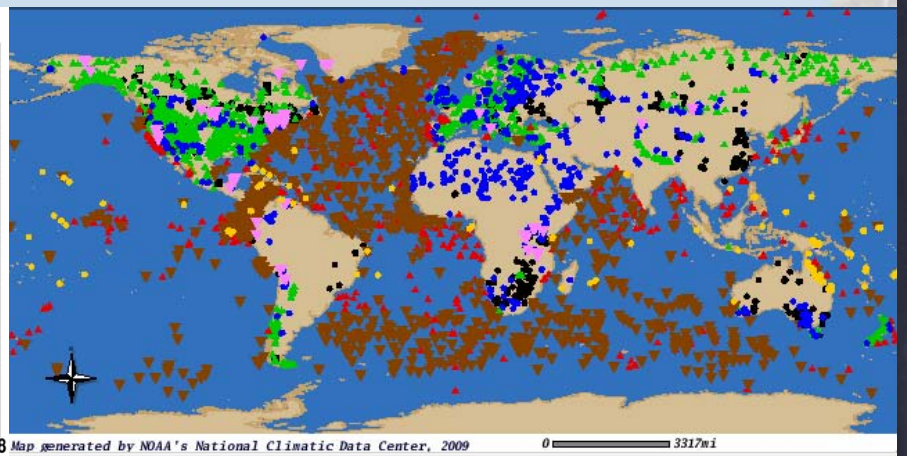
- Good engagement of GCOS IP by GCOS Sponsors and Partners
- Implementation is partial in many/most cases
- Increasing national attention to climate change observation needs, despite remaining gaps in national coordination
- Capacity building activities may have seen some improvement, but overall support to developing countries has fallen well short of needs
- Research networks and systems have been maintained, long-term continuity remains a challenge

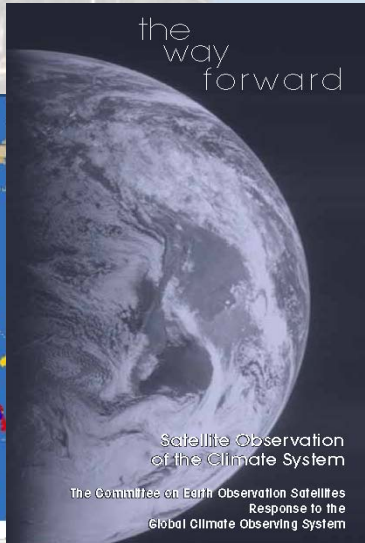


GCOS Progress Report 2004-2008 – Cross-cutting

- Good commitment to GCOS climate monitoring principles, and some improvements in data exchange
- Good engagement by satellite agencies
- Reprocessing, Analyses and Reanalysis progressing
- Moderate to good progress in the assembly of historical data records and in acquiring and archiving palaeoclimatic records
- National reports show financial difficulties and limits in most countries







GCOS Progress Report 2004-2008 – Atmosphere

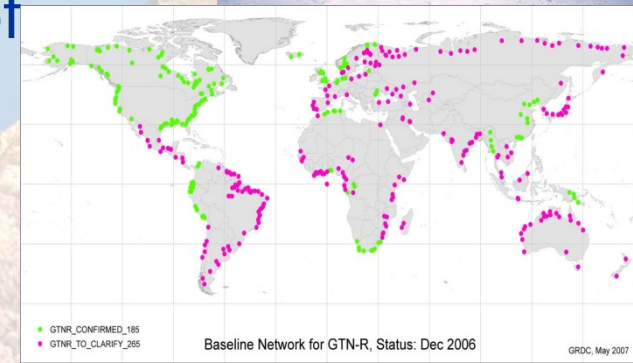
- Good progress with availability, quality and exploitation of data from **satellites** for climate purposes across the range of ECVs, from basic meteorological variables to radiation and atmospheric composition
- Good progress in general with **in-situ meteorological networks**, and support through the system improvement programme has helped maintaining a baseline; however, overall progress in developing countries has been limited
- Some **specific issues** persist (e.g., measurement of precipitation, clouds, snow depth; precipitation data exchange; sunshine obs; metadata)
- Good progress in advancing **climate reference networks**
- Improved planning and progress with implementation of **atmospheric composition networks** meeting climate needs

GCOS Progress Report 2004-2008 – Oceans

- **Useful progress in almost every action called for in the Plan, but many actions remain incomplete.**
- **The ice-free upper 1500 m of the ocean are being observed systematically for temperature and salinity for the first time in history.**
- **Most in-situ networks have made progress (e.g., tide gauges, moored reference sites, tropical moored arrays, full ocean depth observations)**
- **Most in-situ observing activities continue to be carried out under research agency support and on research programme time limits.**
- **Important progress in provision of critical ocean satellite data of sea surface ECVs has been made, but not for all variables, and data access remains to be ensured.**
- **Important progress in development of historical ocean reanalysis and in high resolution ocean forecasting capabilities.**
- **Promising developments in improved methods and standards will allow wider measurement of biological and chemical ECVs and consideration of new ECVs in the years ahead.**
- **Data sharing remains incomplete, particularly for tide gauges and biogeochemical ECVs. Data archeology needs to continue.**

GCOS Progress Report 2004-2008 – Terrestrial

- Increasing **significance and recognition** of terrestrial data for climate change adaptation and impact studies
- Good progress in **defining standards** for observation of terrestrial variables
- Slow take-up of **institutional support** for terrestrial climate observations has limited some in-situ progress
- Networks dealt with by **research** community show some good progress
- Progress towards establishment of **Global Terrestrial Networks** (GTN) for many of the ECV's
- Good engagement of **satellite needs** including product development, reprocessing and continuity



Some 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) – 131 Actions
- 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
- Adoption by UNFCCC (2007) of revised national systematic observation reporting guide lines – matching the GCOS IP

2010 Update of GCOS Implementation Plan: Cross-cutting

- Continuity in stressing:
  - Coordinated action on climate
  - Adherence to the GCMPs (CEOS endorsed in 2003 - unchanged)
  - Data stewardship
  - Importance of maturity assessment and complete documentation (Guideline on Generation of Datasets and Products)
  - Integrated products
  - Distributed data services, emphasizing benefit for all nations

2010 Update of GCOS Implementation Plan: Terrestrial

- Climate Data Records from space (FCDRs, ECV products):

Lake levels/area/temperature (T6, T8); Soil moisture (T11); Snow cover (T14); Seasonally-frozen ground (T21); Albedo (T23); Land cover (T26, T27); FAPAR & LAI (T30); Fire disturbance (T35, T38)

- Missions

Glacier and ice sheet monitoring (laser, altimetry, gravity; T15);

- Modelling, Research and Analysis

- Experimental evaporation product from networks and satellites (T4)
- Feasibility of groundwater storage variation from gravity measurements
- Ice sheet model improvements to assess future sea-level rise (T18)
- Land cover accuracy assessment (T24)
- LAI product benchmarking (T29)
- Above-ground biomass demonstration product (T31)
- Estimates of terrestrial carbon flux from in-situ and satellites (T33)
- Reanalysis of fire disturbance sat data (T34);

2010 Update of GCOS Implementation Plan: Terrestrial

- Planning, Cal/Val, Other

- Develop global reference network for ecological monitoring sites (T3)
- Develop Global Terrestrial Network on Soil Moisture (T12)
- Snow water equivalent blended products
- In-situ cal/val measurements related to albedo products (T22), land cover (T25), FAPAR, LAI (T28)
- Apply validation protocol to fire disturbance data (T36)

2010 Update of GCOS Implementation Plan: Oceans

- Climate Data Records from space (FCDRs, ECV products):

Wind speed and direction (A10); SST (O7); Sea ice (O20)

- Missions

Altimeters (O10)

- Modelling, Research and Analysis

- Sea-surface salinity (O12), Surface current field (O17)
- Coordinated plans for ocean data assembly and analysis (incl GODAE) (O38)
- Pilot projects for global products based on data assimilation in models (O39)
- Pilot projects of reanalysis of ocean data (O41)

- Planning, Cal/val, Other

- Implementation of Virtual Constellations for ocean ECVs, wrt in-situ systems (O4)
- Ocean Colour Radiance Constellation (O15)
- Sea state (via altimetry, SAR)
- Phytoplanktion (via OCR)
- Marine biodiversity (indirectly by optical, SST)