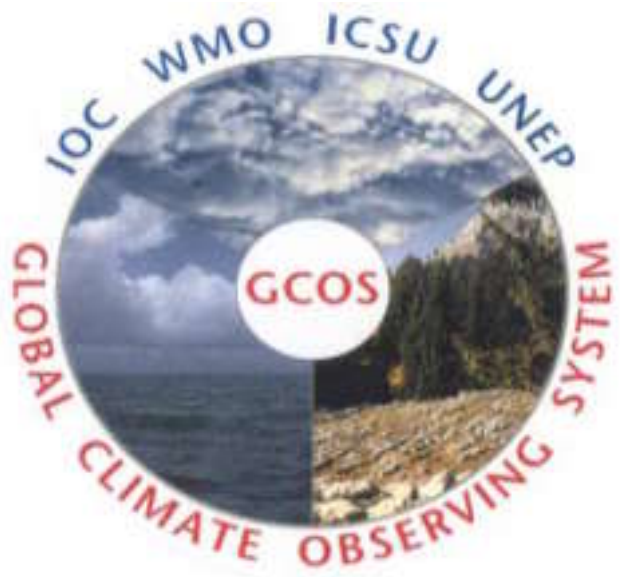
WMO IOC UNEP ICSU

Global Climate Observing System



COP9 - Milan

Sue Barrell

UNFCCC/COP and GCOS

Decision 5/CP.5: Research and Systematic Observation

- **Invites Parties to provide detailed reports on global climate observing systems by Nov 2001**
  - **GCOS Steering Committee proposed the Second Report on the Adequacy of the Global Observing Systems for Climate**
  - **WMO EC LIII & SBSTA endorsed its preparation**

- **Requests GCOS Secretariat to organize regional workshops to identify priority capacity-building needs and deficiencies in climate observing systems**

- **Urges Parties to address deficiencies in observing systems, capacity building needs and funding options**

UNFCCC/COP and GCOS

Decision x/CP.9: Research and Systematic Observation

- **Requests Parties to implement findings of the Second Adequacy Report, esp. data exchange & reporting, historical data and continuity of long-term stations**
- **Requests GCOS to coordinate phased 5-10 year plan to implement integrated global observing systems for climate**
- **Invites development of terrestrial climate framework**
- **Seeks more comprehensive reporting guidelines**
- **Urges Parties to support improved climate observing systems in developing countries, including through GCOS Cooperation Mechanism**

Second Report on the Adequacy of the Global Observing System for Climate

- **Goals of the Adequacy Report are to:**
  - **Determine progress since the first Adequacy Report (COP-4);**
  - **Determine the degree to which current networks / systems meet scientific requirements and observing principles;**
  - **Assess how well current and planned systems meet the needs of the Convention.**
- **Basis for Adequacy Report**
  - **Based on national reports to UNFCCC / COP**
  - **Involve international experts (including IPCC experts) in analysing the adequacy of the current global observing systems for climate;**
  - **Integrated approach to global climate observing systems, including the exploitation of new and emerging methods.**
- **Report now available - http://www.wmo.ch/web/gcos**

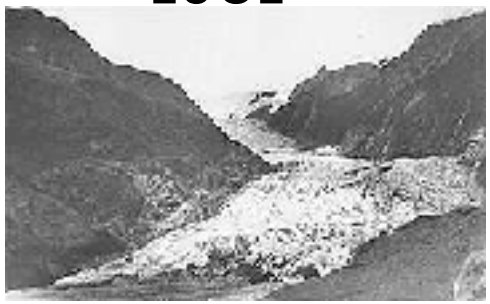
UNFCCC needs for systematic observations

- **Characterizing the state of the global climate system and its variability;**
- **Monitoring the forcing of the climate system, including both natural and anthropogenic contributions;**
- **Supporting the attribution of the causes of climate change;**
- **Supporting the prediction of global climate change;**
- **Projecting global climate change information down to regional and national scales; and**
- **Characterizing extreme events important in impact assessment and adaptation, and to assess risk and vulnerability.**

The reality of climate change

Global mean temperature increase
Temperatures for land, ocean, NH, SH
Ocean temperatures, upper 300m rising
Glaciers melting
Sea level rise
Arctic sea ice retreat
Arctic sea ice thinning (40%)
NH snow cover decrease
Freeze dates of lakes, rivers
Cooling in stratosphere
Increases in water vapor NH
Increases in precipitation mid latitudes
Increased intensity of precipitation

1951



1964

Franz Josef glacier
New Zealand

Adequacy Report – on Progress

- **Overall significant progress from growing availability and increased use of satellite observations**
- **Stabilisation of decline in networks, since the first Report but still major gaps remain in global coverage**
- **Only limited overall progress in data exchange**
- **Planning much improved in ocean domain and improvements in some key networks**
- **Terrestrial domain has progressed in use of satellite observations but in-situ observations lack systematic engagement**

Networks in the Adequacy Report

- Reaffirms primary importance of GCOS Surface Network and GCOS Upper Air Network
- Refines GCOS strategy for water vapour, clouds, aerosols and trace species
- Supports proposed initial Global Ocean Observing System for Climate
- Defines a focus for the global monitoring of key terrestrial variables for climate
- In all domains, seeks to exploit full potential of satellite data

Issues and conclusions in the Adequacy Report

Essential Climate Variables that are both currently feasible for global implementation and have a high impact on UNFCCC requirements.

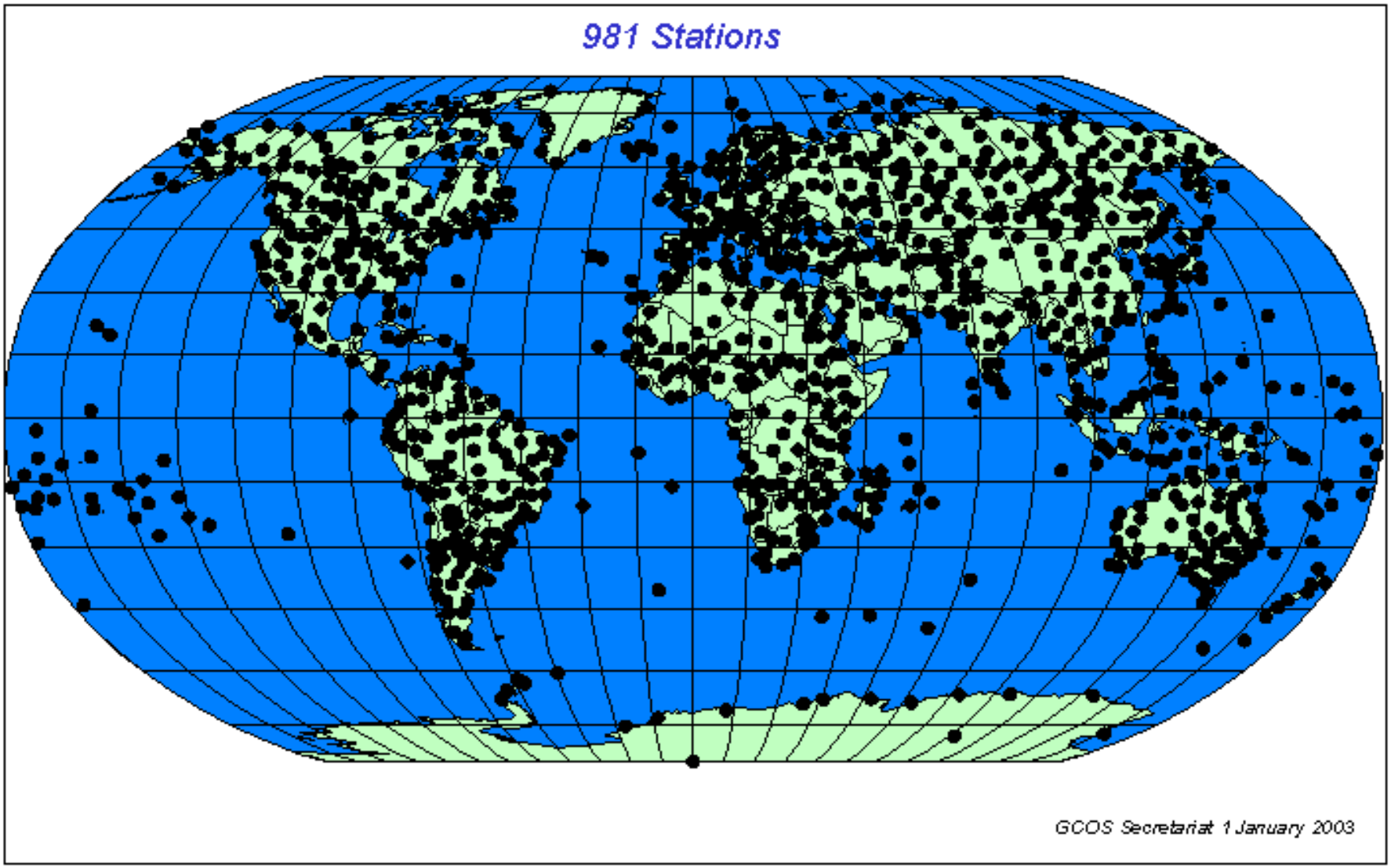
Recommendations aims to be realistic

Conclusion:

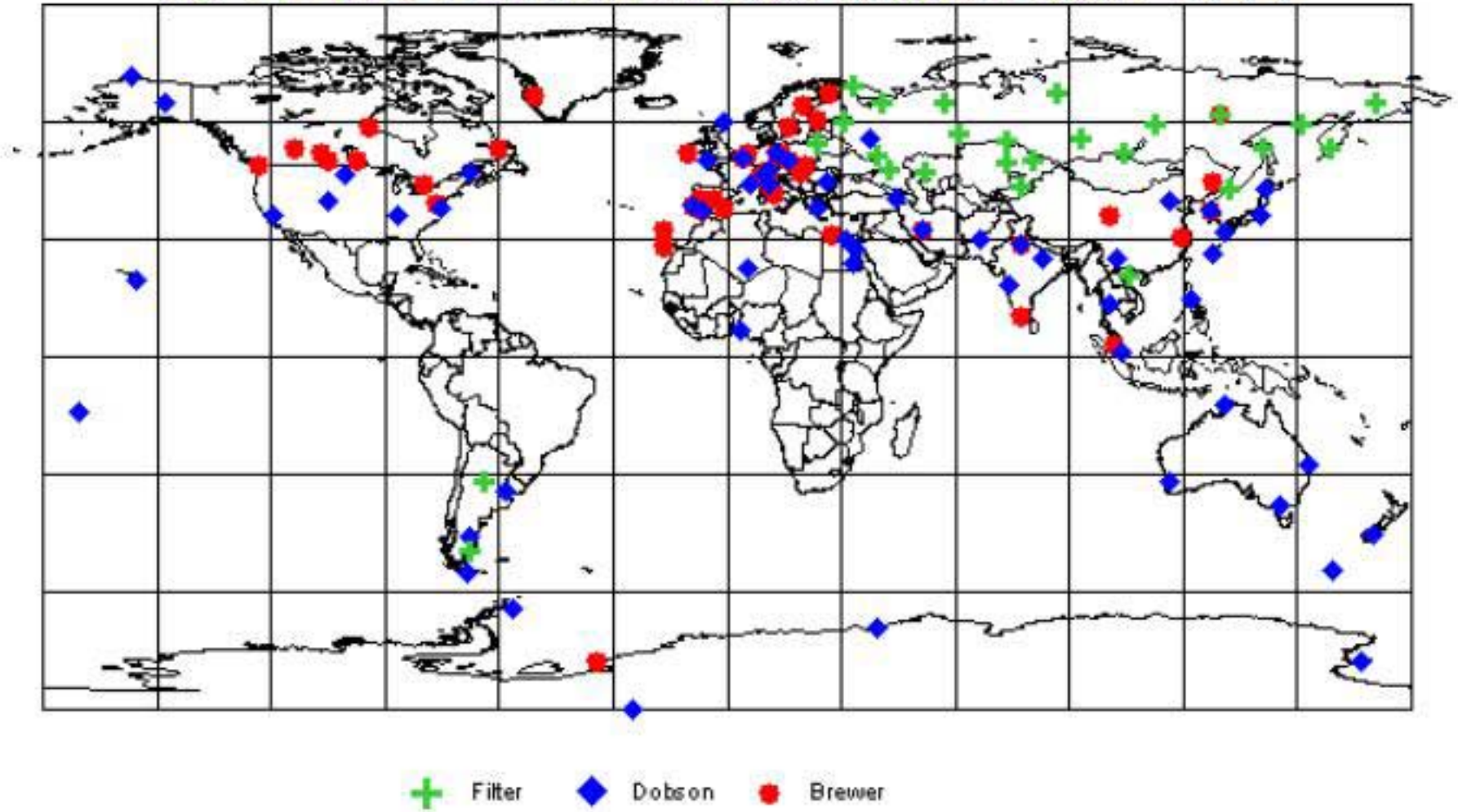
1. Achieving global coverage and climate-quality observations for the set of essential climate variables is essential to ensure that the needs of the UNFCCC and the IPCC for systematic climate information are addressed.

Domain	Essential Climate Variables
Atmospheric (over land, sea and ice)	**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	**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	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.

GCOS Surface Network (GSN)

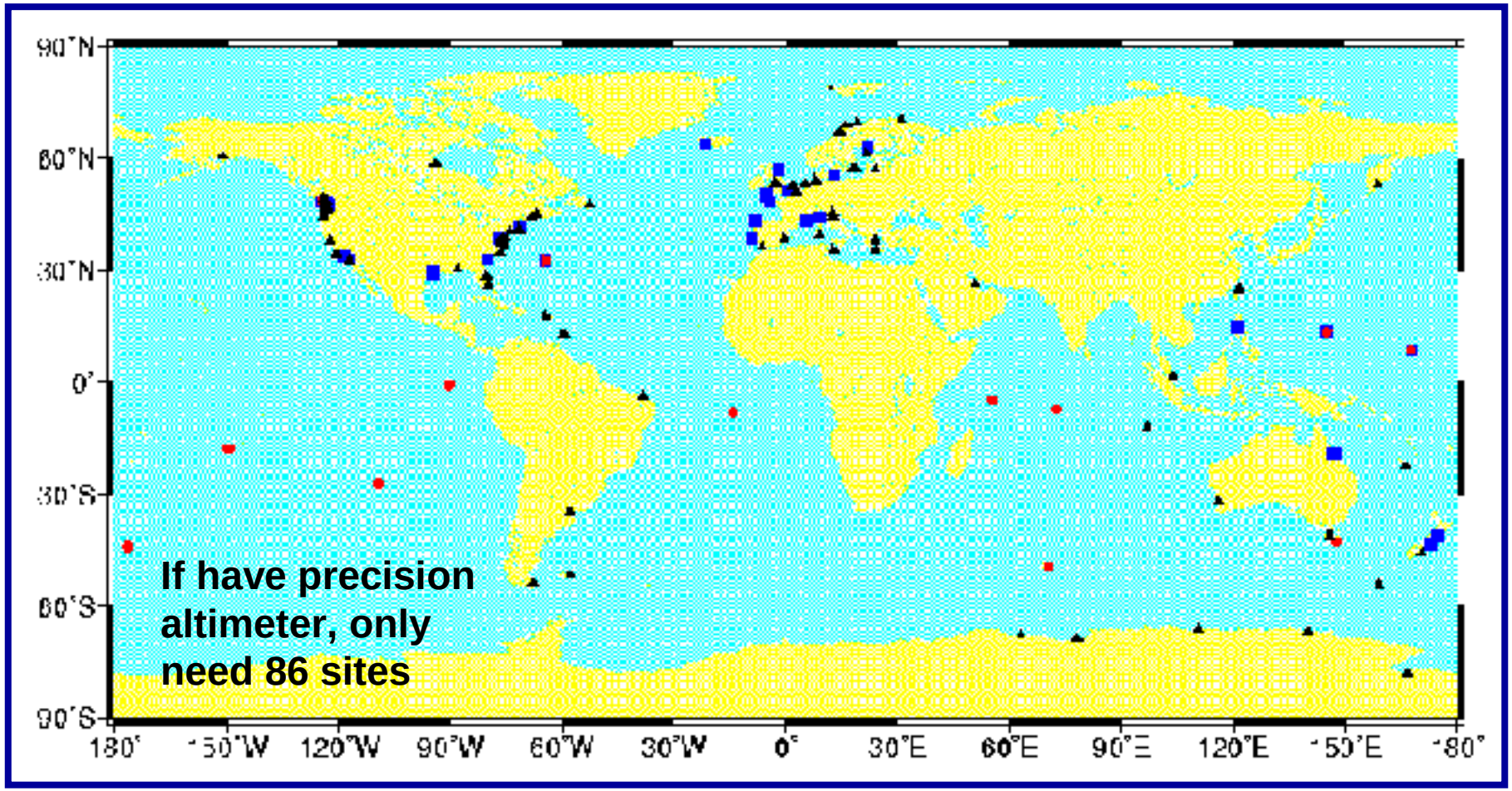


COLUMN OZONE NETWORK
IN 2003: Data since at least 1 Jan 1999



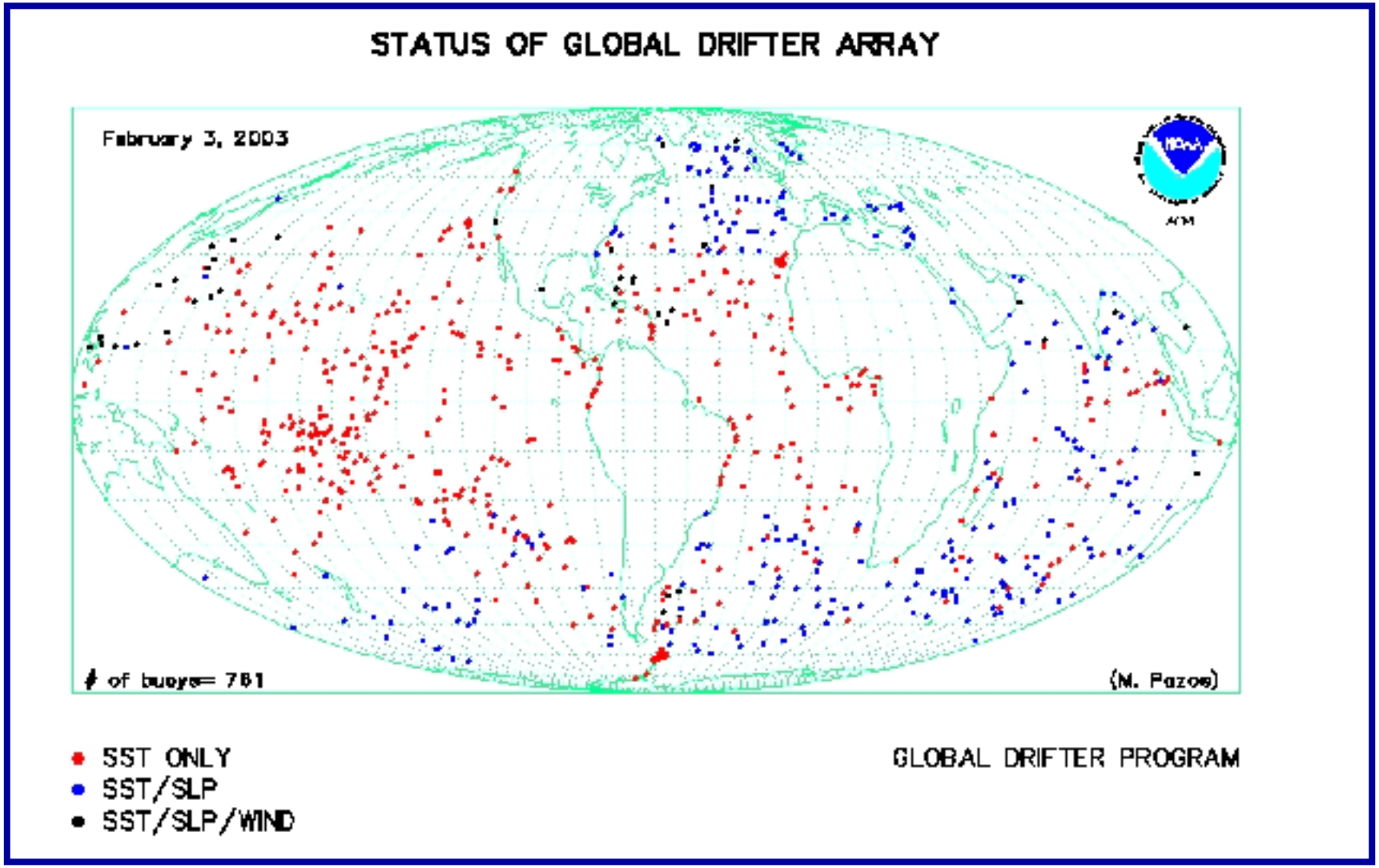
Compliments of GAW WOUDC, Toronto, Ed Hare, Manager

Status of GPS/DORIS implementation at Tide Gauge Stations



- Long Term Trends Reference Stations (27 of 62)
- Altimeter Calibration Stations (13 of 30)
- Other Stations

47% complete



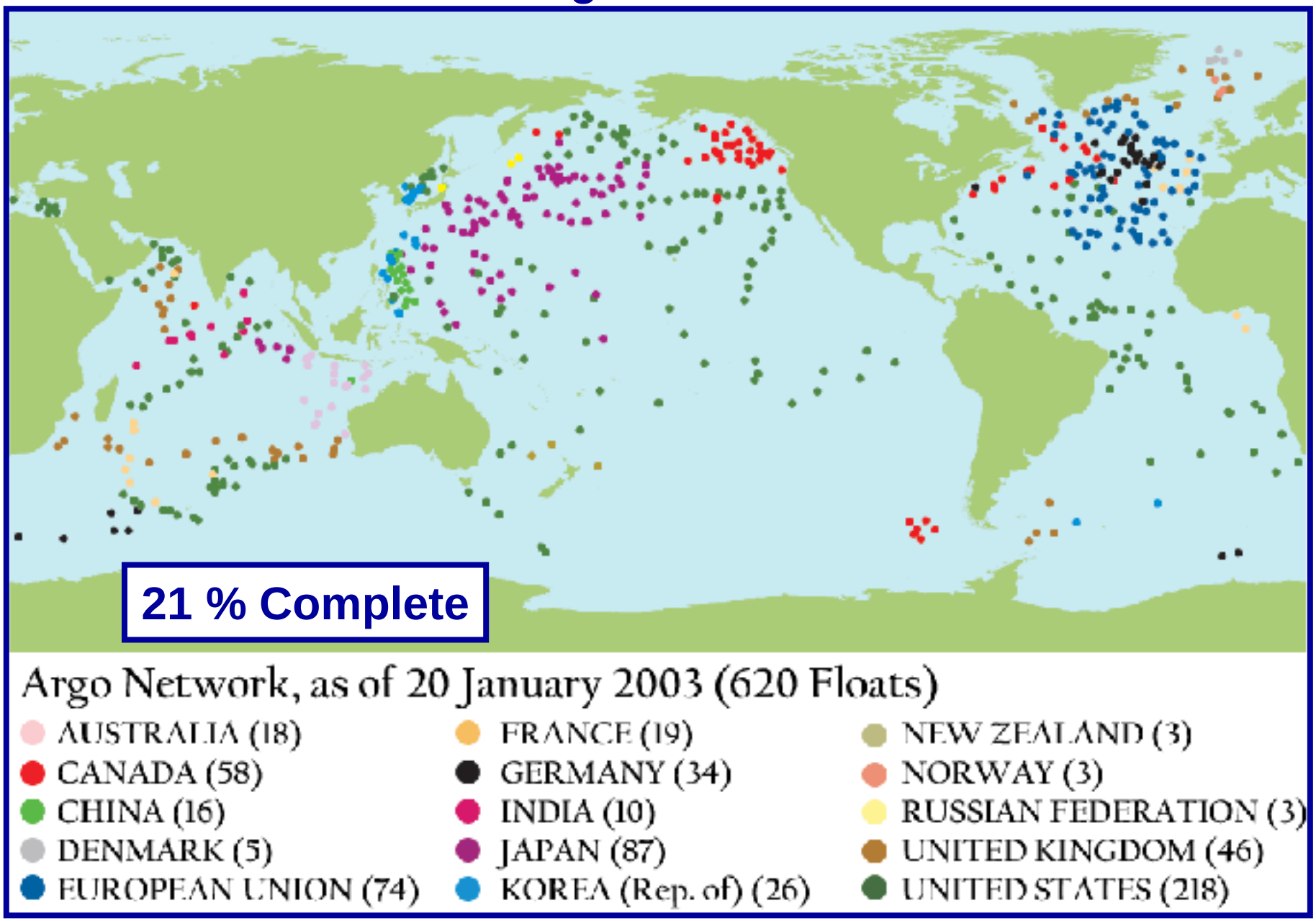
Want global 5x5 coverage – 1250

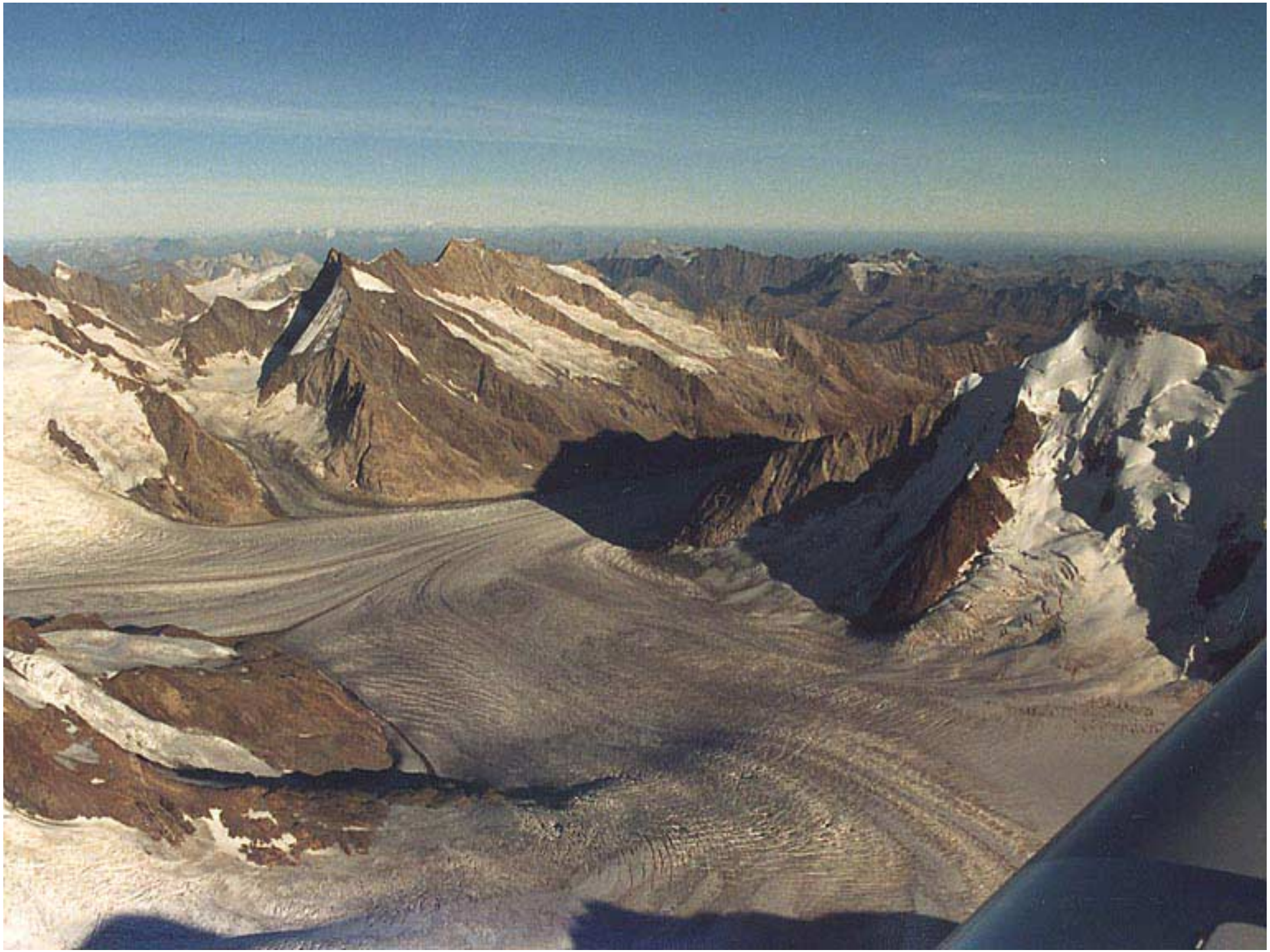
Big impact, esp. if reporting diurnally

37% complete

Want 3x3 coverage - 3000

Argo Status





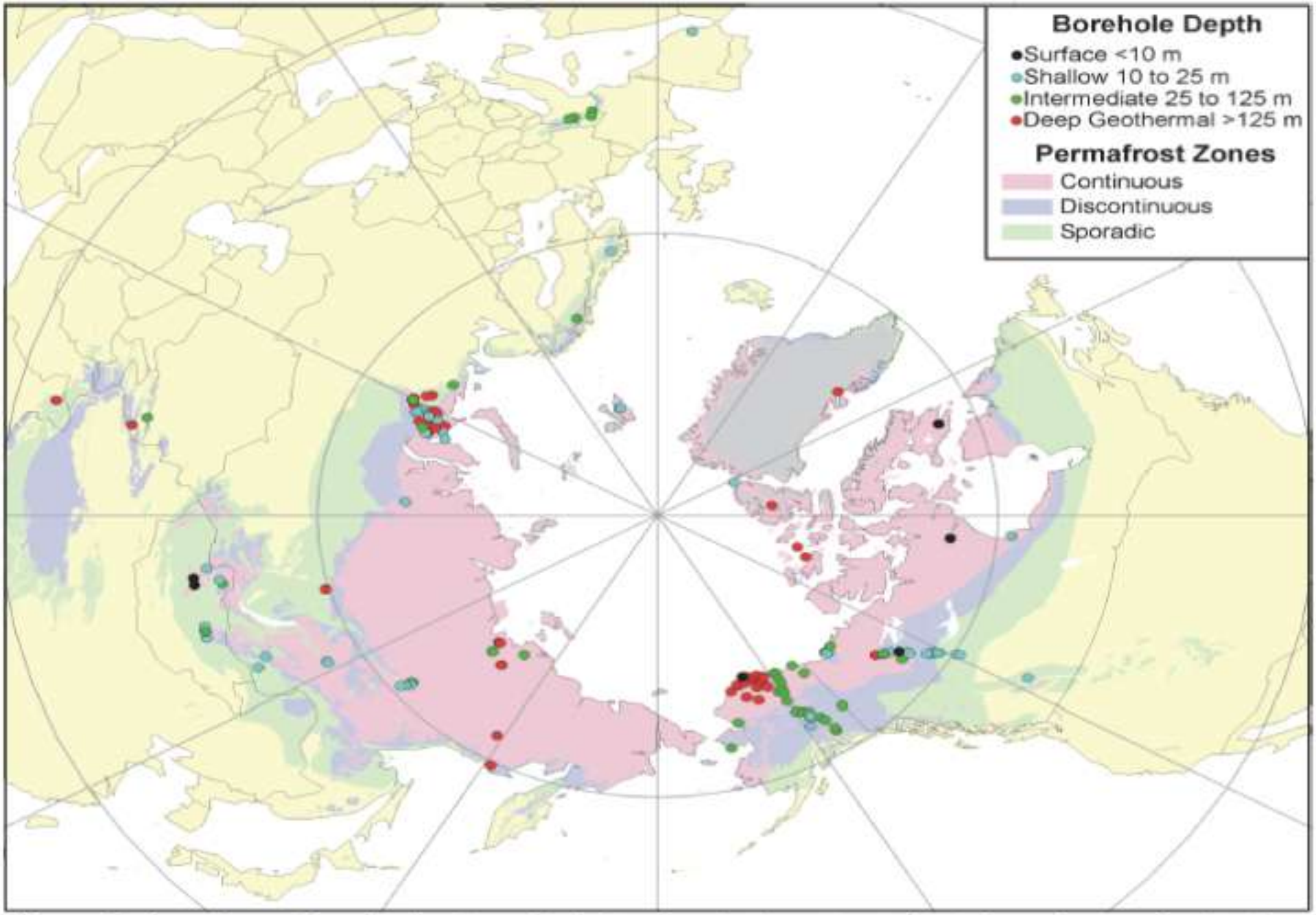


Figure 2. Location of boreholes for which site descriptions (metadata) have been submitted (compiled by S. Smith, Geological Survey of Canada, July 2003).

Effective Data Exchange and Access

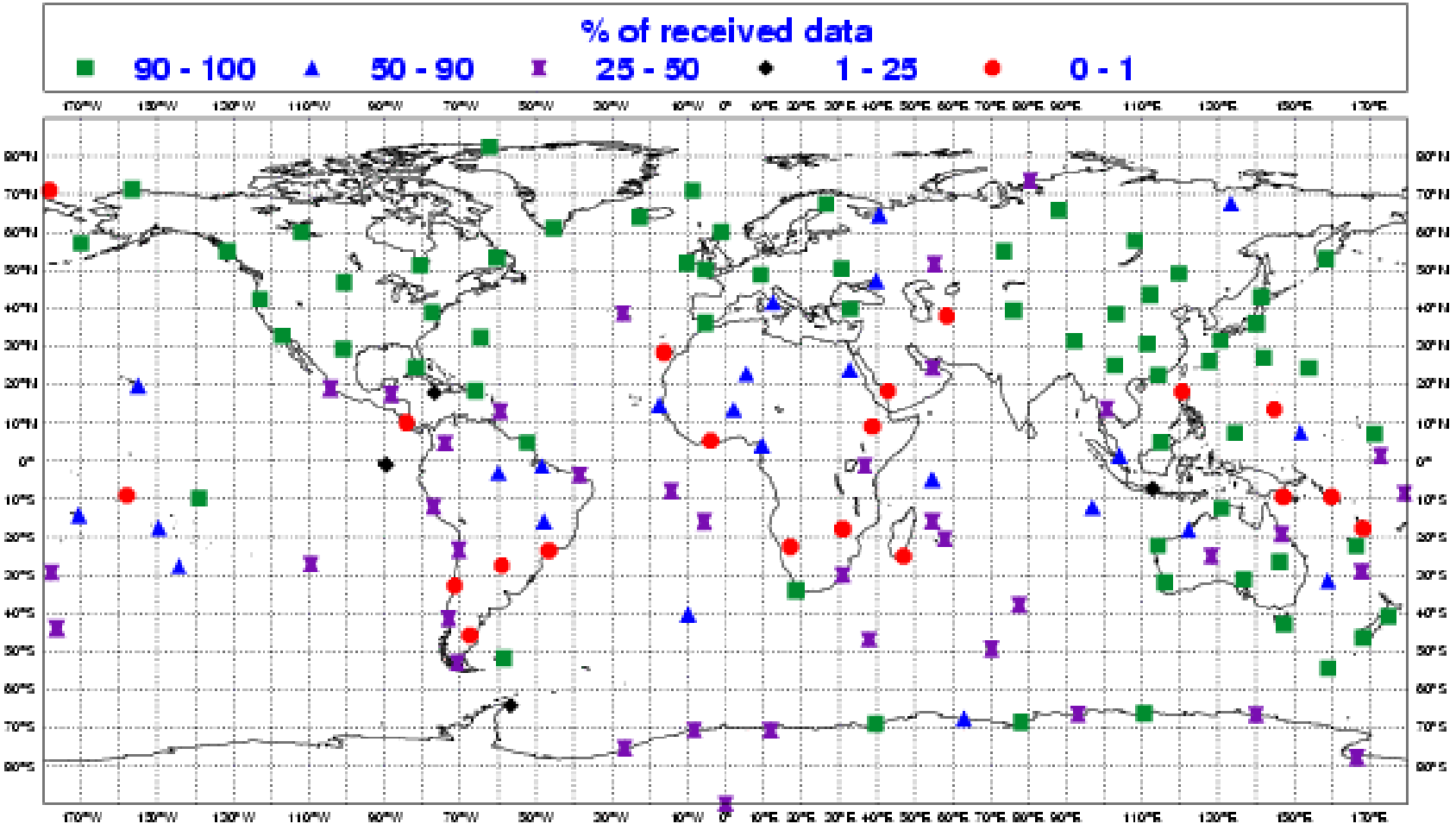
Essential for data use and UNFCCC needs

Conclusion:

2. Adherence by nations to the agreed policy of free and unrestricted exchange is urgently required for both *in situ* and satellite climate observations, particularly in respect of observations of the Essential Climate Variables listed in Table 1, as well as their associated climate products; and

3. Nations need to ensure that their observations and associated metadata for the Essential Climate Variables, including historical observations, are available at international data centres for application to climate analyses.

GUAN STATIONS APR 2003
Frequency of RECEPTION data at ECMWF
Level: 300 hPa Temperature SUMMARY 00/12 UTC



High-Quality Climate Data

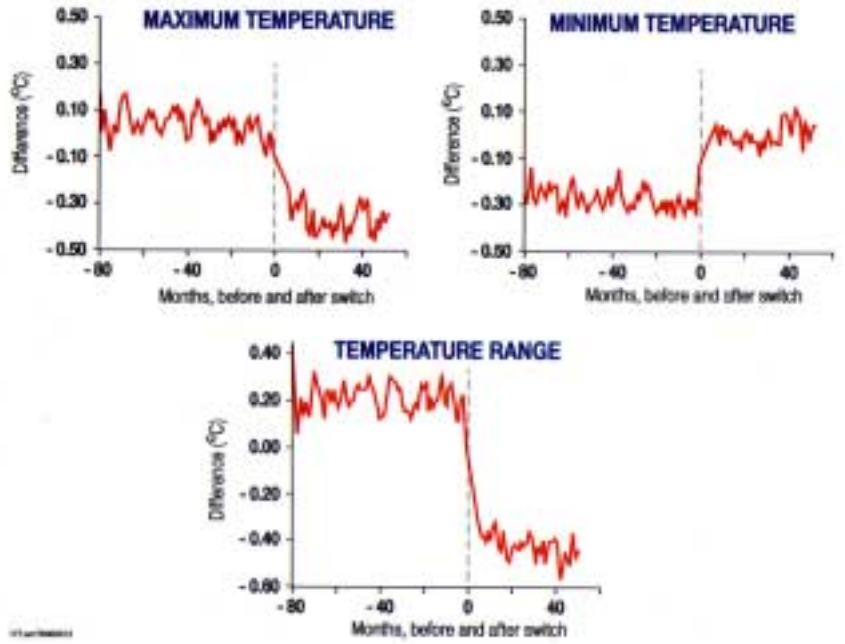
Good practice of wide benefit and essential for climate use

Conclusion:

4. Adherence by nations to the GCOS Climate Monitoring Principles for global climate observations from both *in situ* networks and satellites is required; and

5. GCOS and its partners need to monitor the performance of the individual networks to ensure their continued effectiveness and the timely identification and remediation of problems that may compromise the quality of climate products.

Estimated Bias Introduced by New Sensors in NOAA's 6000 Station Cooperative Network



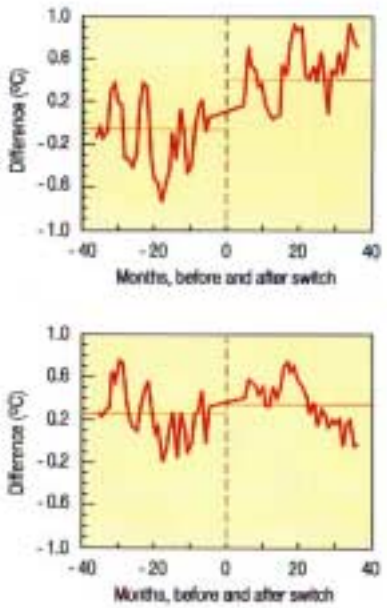
Effects of Changing Instruments from HO63 Series to HO83 Series

MAXIMUM TEMPERATURE

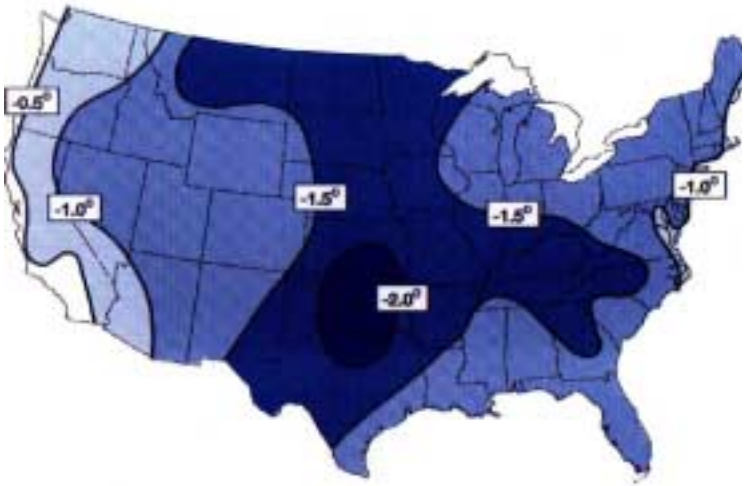
Average difference: + 0.50 °C

MINIMUM TEMPERATURE

Average difference: maybe + 0.10 °C



Change in the average March temperatures (°C) resulting from changing the time of observation from 5 P.M. to 7 A.M. local time.



Courtesy Tom Karl

Data for Impact Assessment

Some special needs

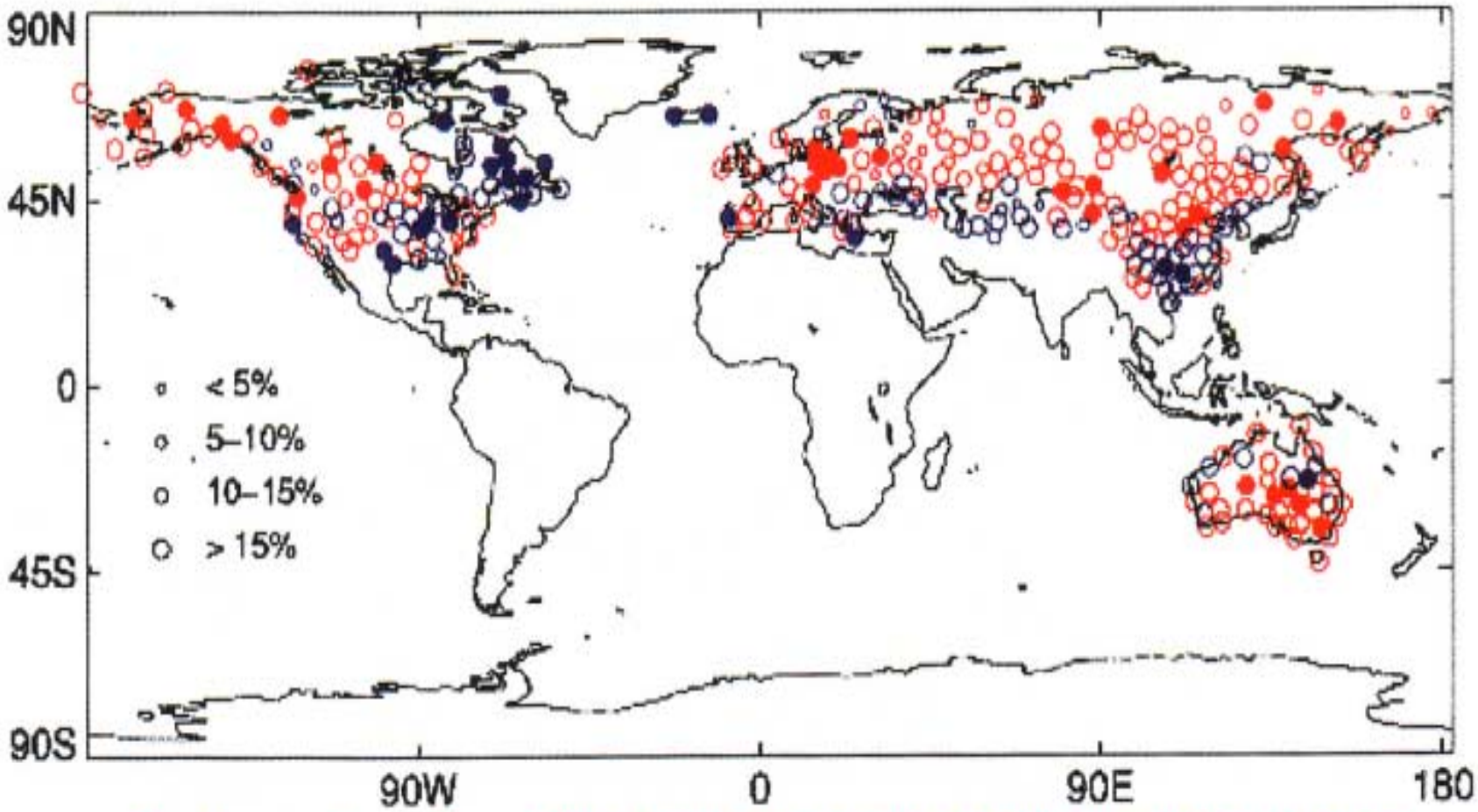
.

Conclusion:

6. Nations will need to operate climate-observing networks with a denser distribution of stations and often more frequent observations, in addition to the GCOS baseline networks, for impact assessment and the development of adaptation strategies. These regional and national networks, to the greatest extent possible, should also be operated in accordance with the GCOS Climate Monitoring Principles.

Heat Wave Duration Index (144 HWDI)

Change (%) between two multi-decadal averages during 2nd half of 20th Century



Red is a positive change. Filled circles are significant at 95% level of confidence

Implementation Considerations

Call for action and a significant, but fractional, increase in resources

Conclusion:

7. Parties, both individually and through multilateral agreements and intergovernmental mechanisms, should commit to the full implementation of integrated global observing systems for climate, sustained on the basis of a mix of high-quality satellite and *in situ* measurements, dedicated infrastructure and targeted capacity-building.

Integrated Approach

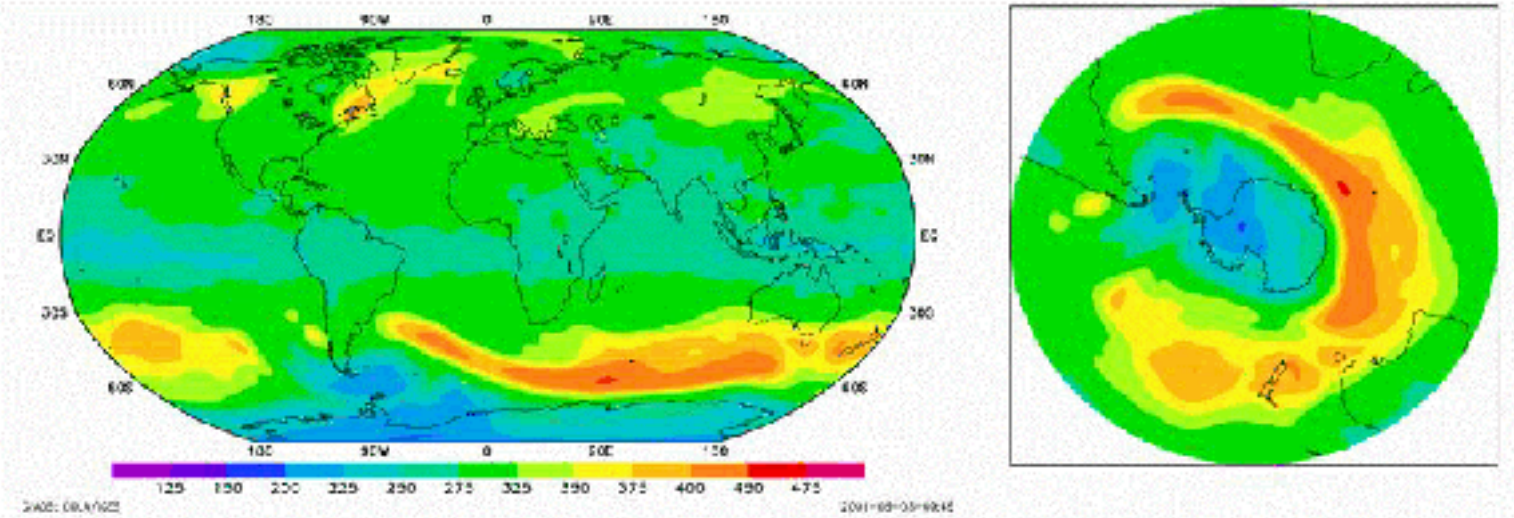
Full exploitation of all data

Conclusion:

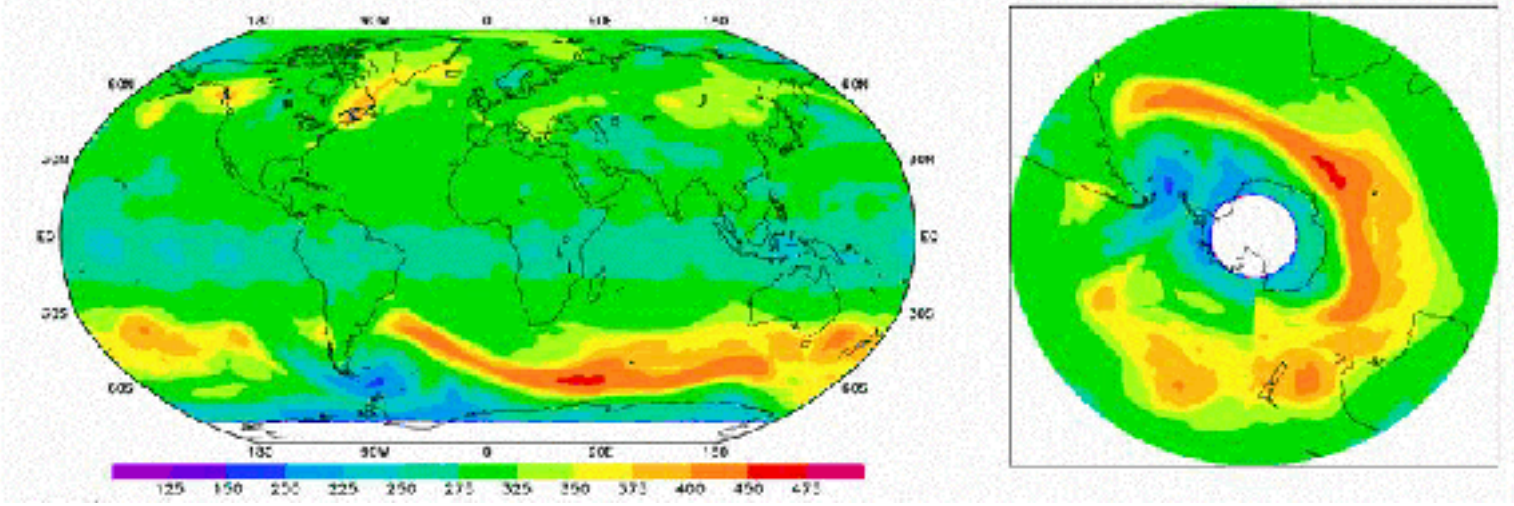
8. Internationally-coordinated re-analysis activities need to be enhanced and sustained by the involved Parties to meet the requirements for monitoring climate trends, to establish ocean re-analysis for the recent satellite era, and to include variables related to atmospheric composition and other aspects of climate forcing;

Total Ozone, 1 September 1991

ERA-40



TOMS



Integrated Approach

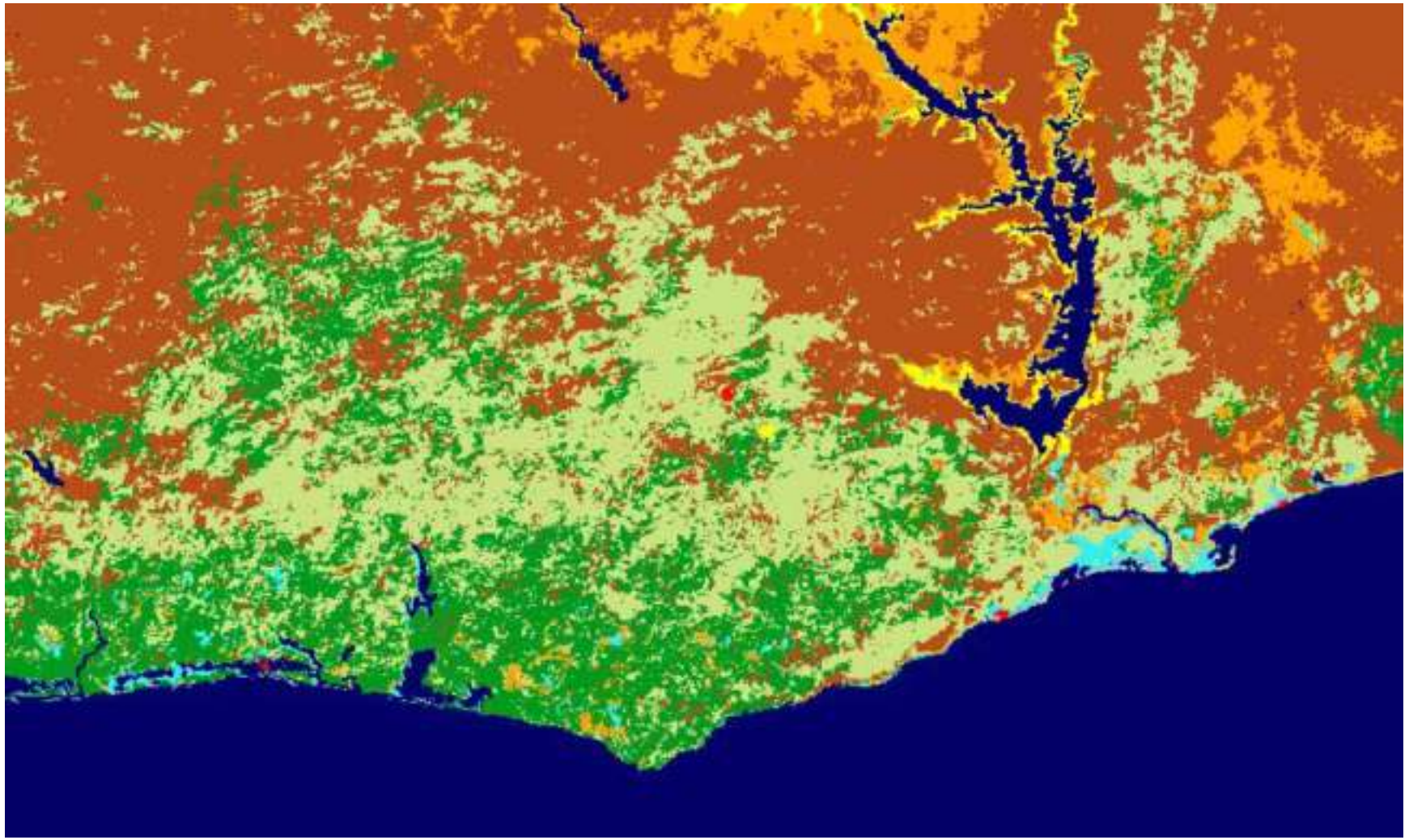
Promising demonstrations need to be institutionalized

Conclusion:

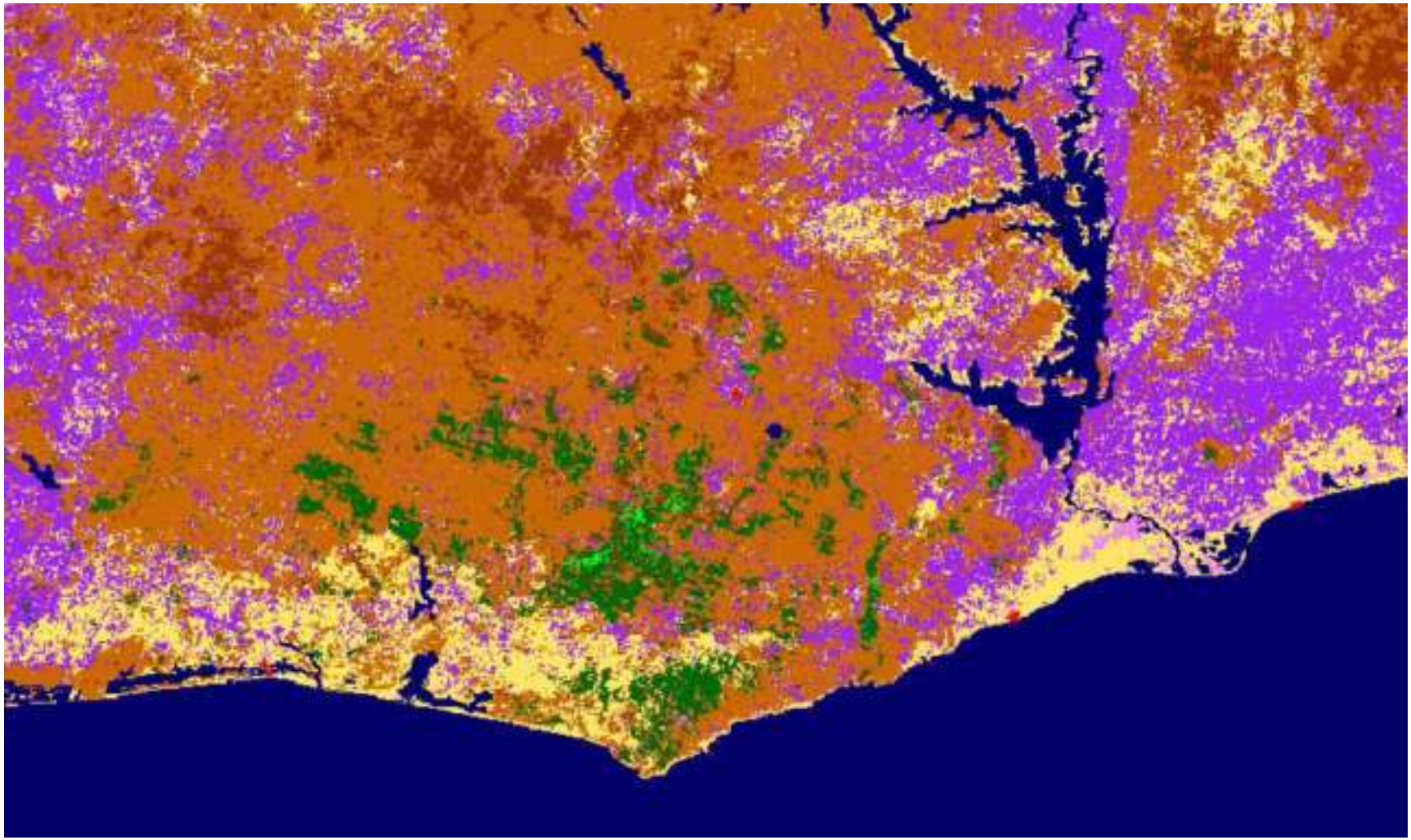
9. Parties with responsibility for space agencies should support the long-term operation of Earth observation satellites; ensure that homogeneous climate data and integrated products are produced; and strive to make them available to all Parties; and

10. Such Parties should support an internationally-coordinated approach to the development of an initial set of integrated global climate products, related to the variables in Table 2, and make them accessible to all Parties. Developing a strategy for implementing these global products could be an important role for the Integrated Global Observing Strategy (IGOS) partners, of which GCOS is a member

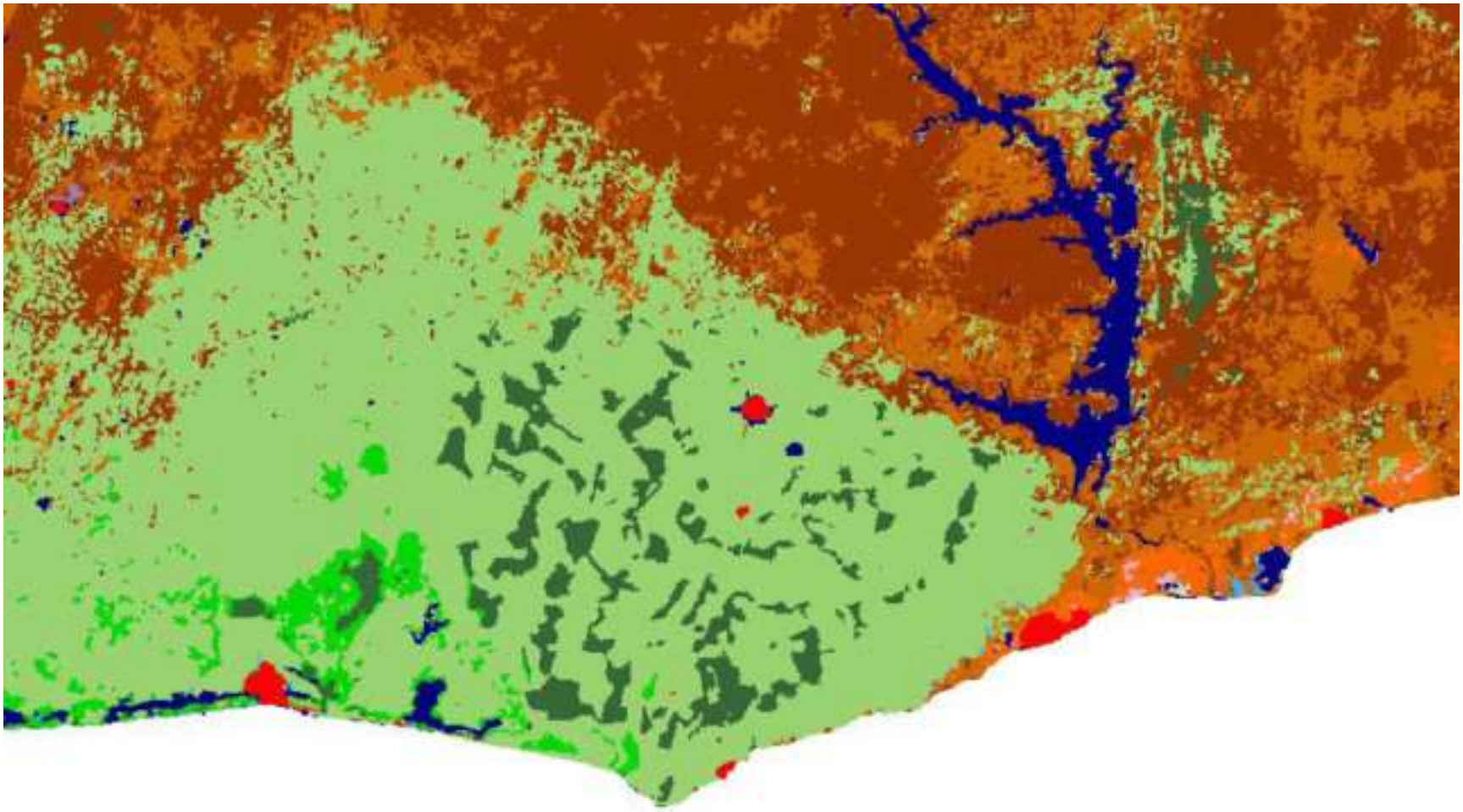
Domain	Variables largely dependent upon satellite observations
Atmospheric (over land, sea and ice)	Precipitation, Earth radiation budget (including solar irradiance), Upper-air temperature (including MSU radiances), Wind speed and direction (especially over the oceans), Water vapour, Cloud properties, Carbon dioxide, Ozone, Aerosol properties.
Oceanic	Sea-surface temperature, Sea level, Sea ice, Ocean colour (for biological activity).
Terrestrial	Snow cover, Glaciers and ice caps, Albedo, Land cover (including vegetation type), Fraction of absorbed photosynthetically active radiation (FAPAR), Fire disturbance.



Cote d’ Ivoire, Ghana and Togo: IGBP database



Cote d’ Ivoire, Ghana and Togo: University of Maryland database



Cote d’ Ivoire, Ghana and Togo:Global Land Cover 2000 database

Common Standards

Much in-situ terrestrial data lacks adherence to consistent standards

Conclusion:

12. The GCOS Sponsors, in consultation with other international or intergovernmental agencies, as appropriate, should consider the establishment of an international mechanism that would prepare and issue regulatory and guidance material relating to terrestrial observing systems and management of their data and associated products.

Participation by All Parties

Some of the most vulnerable countries have limited monitoring

Conclusion:

11.Annex 1 Parties, in conjunction with GCOS and its Sponsors, should explore the establishment of a voluntary funding mechanism for undertaking priority climate-observing-system improvements and related capacity-building with least-developed countries and small-island developing states as well as with some of those countries with economies in transition.

GCOS Cooperation Mechanism

Established pre COP9:

- Under the common action of Member countries of the GCOS sponsoring agencies

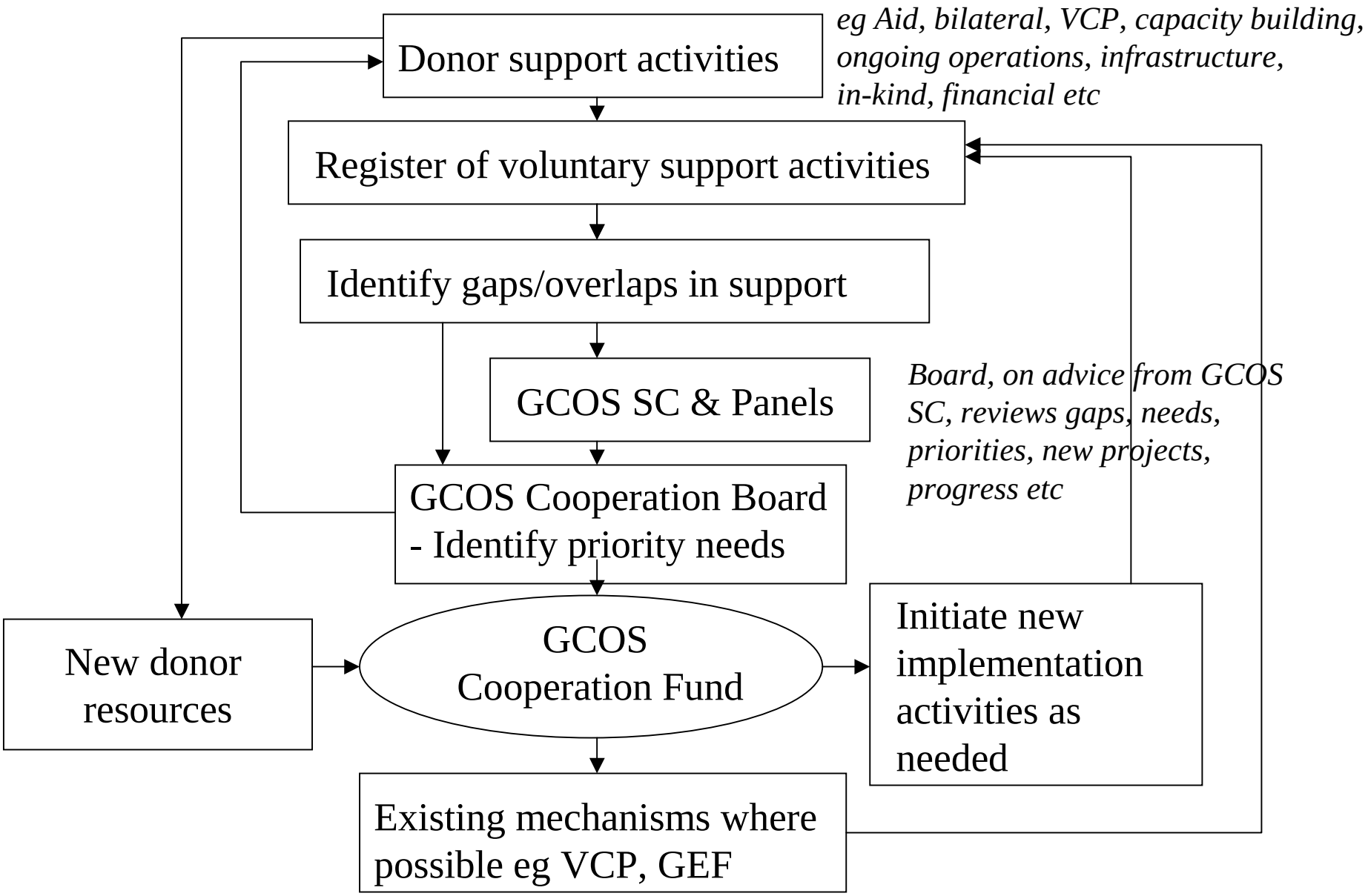
Aim:

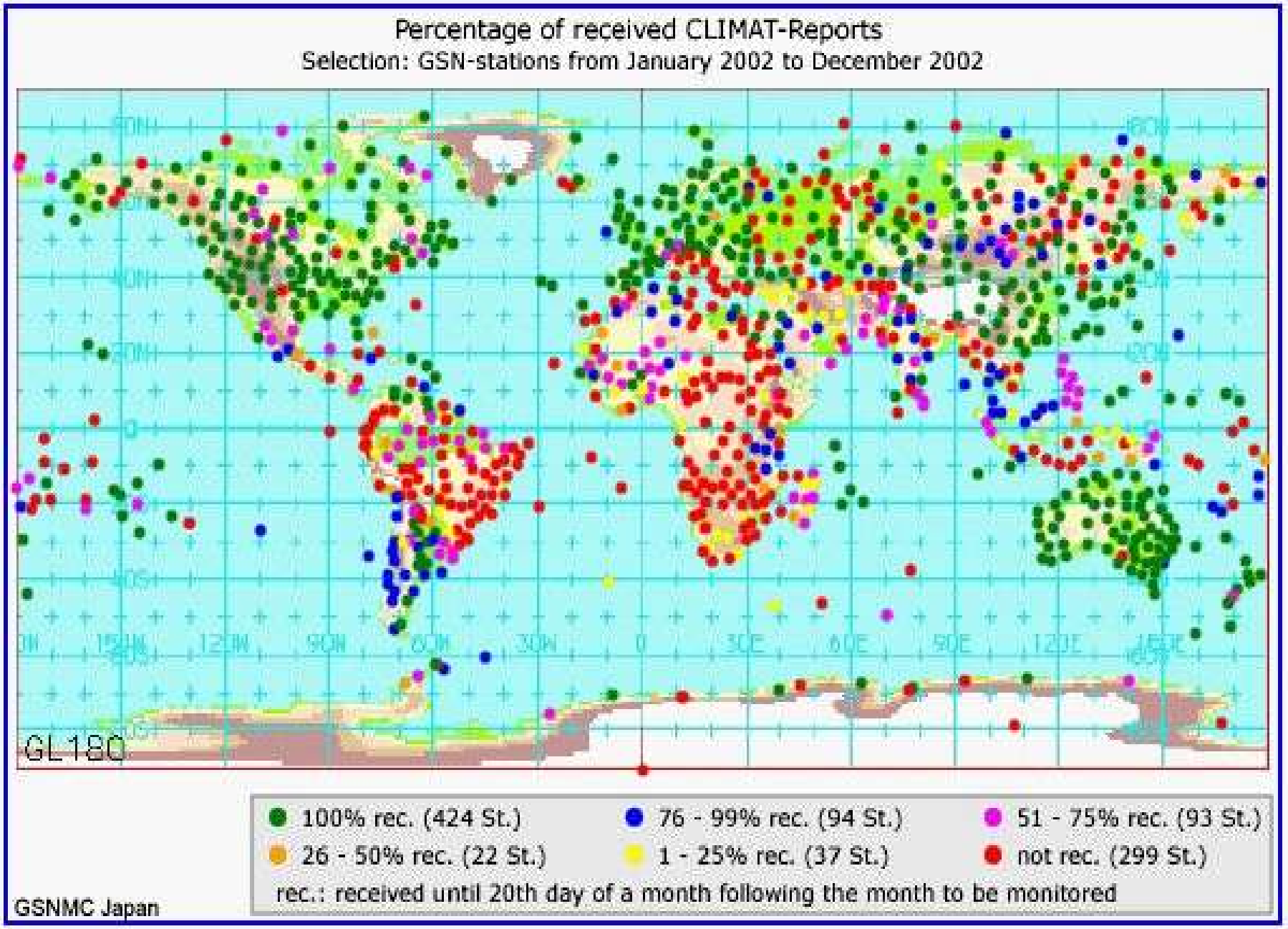
- Funding and facilitation
- Make the most effective use of resources available to support improvements in global observations for climate in developing countries – within framework of GCOS
- Cooperate & collaborate with other mechanism
- Address breadth of need for sustained global climate data

Comprising:

- Register of in-kind and financial support activities
- Board of donors
- Scientific guidance on gaps, deficiencies
- Voluntary fund

GCOS Cooperation Mechanism




Percentage of received CLIMAT-Reports
Selection: GSN-stations from January 2002 to December 2002
GL180
100% rec. (424 St.)
76 - 99% rec. (94 St.)
51 - 75% rec. (93 St.)
26 - 50% rec. (22 St.)
1 - 25% rec. (37 St.)
not rec. (299 St.)
rec.: received until 20th day of a month following the month to be monitored
GSNMC Japan

Planning and Reporting

National planning and reporting has proved valuable

Conclusion:

13. Nations are encouraged to adopt a systematic approach to implementing global observing systems for climate involving active national and regional coordination and planning processes and a commitment to systematic climate observation;

14. All Parties are strongly urged to submit information on their systematic observations as part of their national communications to the UNFCCC; and

Planning and Reporting

Many parties are unaware of the status of their data and systems

Conclusion:

15. The SBSTA, in consultation with the GCOS Secretariat, is urged to review the guidelines for National Communications by the Parties on research and systematic observation to include, *inter alia*, a specific requirement to report on the exchange of observations of the Essential Climate Variables and on the submission of current and historical observations and metadata to the international data centres.

Developing Future Capabilities

Need to continue to seek more effective approaches

Conclusion:

16 Further research and development is required to improve the comprehensiveness, accuracy and efficiency with which the global climate system can be characterized.

Thank you