Measurement Challenges in WMO Integrated Global Observing System (WIGOS)

For the 10-year anniversary of the CIPM MRA

Wenjian ZHANG
Director, Observing and Information Systems Department
World Meteorological Organization
WMO in The United Nations System

- International Court of Justice
- General Assembly
- Economic and Social Council
- Security Council
- Secretariat
- Trusteeship Council

- Main and other sessional committees
- Standing committees and ad-hoc bodies
- Other subsidiary organs and related bodies

- UNRWA
- IAEA
- INSTRAW
- UNCHS
- UNCTAD
- UNDCP
- UNDP
- UNEP
- UNFPA
- UNHCR
- UNICEF
- UNIFEM
- UNITAR
- UNU
- WFC
- World Bank Group
  - IBRD
  - IDA
  - IFC
  - MIGA
- IMF
- ICAO
- UPU
- ITU
- WMO
  - World Meteorological Organization
- ILO
- FAO
- UNESCO
- WHO
- UN programmes and organs (representative list only)
  - UNTSO
  - UNMOGIP
  - UNFICYP
  - UNDOF
  - UNIFIL
  - UNIKOM
  - UNAVEM II
  - ONUSAL
  - MINURSO
  - UNPROFOR
  - UNOMIG
  - UNMIL
  - UNMIH
  - UNAMIR
  - UNMOT

- Military Staff Committee
- Standing committees and ad-hoc bodies

- Functional Commissions
- Regional Commissions
- Sessional and Standing Committees
- Expert, Ad-hoc and Related Bodies

- UN programmes and organs (representative list only)
  - Specialized agencies and other autonomous organizations within the system
  - Other commissions, committees and ad-hoc related bodies
Organizational Structure of WMO (188 Members)
World Meteorological Organization

• The UN system's authoritative voice on the state and behaviour of the Earth's atmosphere, its interaction with the oceans, the climate it produces and the resulting distribution of water resources.

• Among others, WMO:
  – Facilitates the establishment of networks of observing stations
  – Promotes the standardization of meteorological observations
  – Promotes systems for the rapid exchange of meteorological and related information
  – Furthers the application of meteorology to water problems, agriculture, aviation, shipping…

• WMO collaborates with BIPM and relies on its services

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One of the greatest achievements of WMO: Global Observing System

- For 60 years WMO through its Members has advanced the observing and monitoring of the Earth’s weather, water and climate systems.
- This has led to better understanding of the Earth’s environmental system and resulted in the delivery of improved and expanded services such as weather forecasts, climate outlooks and expanded advice and services to society.

- Surface & Ocean in situ observing networks
- Upper-air networks
- Surface remote sensing (Radar) networks
- Airborne and observations
- Satellite constellations
The Space-Based component of the Global Observing System (GOS)
Convergence of N.Hem and S.Hem Medium Range Forecast skill

Anomaly correlation of 500hPa height forecasts

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New Challenges: Climate Change and severe disaster under this background. Ever-complex society need improved services.
WCC-3 : a historic event

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The road to WCC-3

- **1st WCC (1979)**
- **2nd WCC (1990)**
- Climate variability/change impacts on all socioeconomic sectors
- A Global Framework for Climate Services (GFCS) required
- A Cg-XV decision (2007)
- A 2-year preparatory process
- International Organizing Committee
- Preparation with Members

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Conference opening

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Conference Experts Segment

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High-level Segment opening

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High-level Segment participation

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WCC-3 High-level Declaration  
(approved on 3 September 2009)

DO 1 We, Heads of State and Government, Ministers and Heads of Delegation present at the High-level Segment of the World Climate Conference-3 (WCC-3) in Geneva, noting the findings of the Expert Segment of the Conference;

OP 1 Decide to establish a Global Framework for Climate Services (hereafter referred to as “the Framework”) to strengthen production, availability, delivery and application of science-based climate prediction and services;

OP 2 Request the Secretary-General of WMO to convene within four months of the adoption of the Declaration an intergovernmental meeting of member states of the WMO to approve the terms of reference and to endorse the composition of a task force of high-level, independent advisors to be appointed by the Secretary-General of the WMO with due consideration to expertise, geographical and gender balance;

OP 3 Decide that the task force will, after wide consultation with governments, partner organizations and relevant stakeholders, prepare a report, including recommendations on proposed elements of the Framework, to the Secretary-General of WMO within 12 months of the task force being set up. The report should contain findings and proposed next steps for developing and implementing a Framework. In the development of their report, the taskforce will take into account the concepts outlined in the annexed Brief Note;

OP 4 Decide further that the report of the task force shall be circulated by the Secretary-General of WMO to Member States of the WMO for consideration at the next WMO Congress in 2011, with a view to the adoption of a Framework and a plan for its implementation; and

OP 5 Invite the Secretary-General of WMO to provide the report to relevant organizations, including the UN Secretary-General.

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WCC-3 closure

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The way ahead

- Within 4 months, to convene an intergovernmental meeting to approve the terms of reference and to endorse the composition of a task force of high-level, independent advisors
- Within 4+12 = 16 months to receive the task force’s Report and recommendations on the proposed GFCS
- Before Cg-XVI (2011), to submit the Report to WMO Members
- To provide the Report to relevant organizations
- The beginning of a process!
Overview of Weather and Climate Models and the Required Observations

Mid-1970s  Mid-1980s  Early 1990s  Late 1990s  Present Day  Early 2000s?
Atmosphere  Atmosphere  Atmosphere  Atmosphere  Atmosphere  Atmosphere
Land Surface  Land Surface  Land Surface  Land Surface  Land Surface  Land Surface
Ocean & Sea Ice  Ocean & Sea Ice  Ocean & Sea Ice  Ocean & Sea Ice  Ocean & Sea Ice  Ocean & Sea Ice
Sulphate Aerosol  Sulphate Aerosol  Sulphate Aerosol  Sulphate Aerosol  Sulphate Aerosol  Sulphate Aerosol
Non-sulphate Aerosol  Non-sulphate Aerosol  Non-sulphate Aerosol  Non-sulphate Aerosol  Non-sulphate Aerosol  Non-sulphate Aerosol
Dynamic Vegetation  Atmospheric Chemistry

Need an Integrated Global Observing System Going Beyond the GOS
GCOS Progress Report 2004-2008

- Good commitment to GCOS climate monitoring principles, and some improvements in data exchange
- Developed Countries have improved their climate observation capabilities, but developing Countries have only made limited (in-situ) progress, and capacity building support remains small in relation to needs
- 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
**WMO INTEGRATED GLOBAL OBSERVING SYSTEM (WIGOS)**

- **Integration of WMO Observing Systems**: to address obs. requirements of all WMO Programmes; and ensure
  - Comprehensive
  - Coordinated
  - Sustained & Cost-effective

- **WIGOS Framework major components**:  
  - Global Observing System (GOS)
  - Global Atmospheric Watch (GAW)
  - WMO Hydrological Global Observing System (WHYGOS)

- **Framework facilitating standardization and interoperability** with co-sponsored systems (GCOS, GOOS and GTOS, etc) for improved:
  - Quality (accuracy, stability, traceability)
  - Availability & access
  - Utilization

of weather, climate & water information

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Selected GAW global observatories

Dr. Neil Trivett Global Atmosphere Watch Observatory, Alert, Canada

South Pole Atmospheric Research Observatory

WMO Integrated GAW Observing System
Three areas of Integrations/Standardizations

Instruments and methods of observation standards

Observations for Weather, Climate, Water, Ocean, ...

Data Processing and Forecasting

WIS Standards for Data & Metadata exchange & Discovery, Access and Retrieval (DAR) Services

Users

QMF Standards

Archiving

Active Quality Management
World Radiometric Reference (WRR)-Standard for Solar Irradiance

- Introduced by WMO in 1980 based on the comparison of 15 fully characterized instruments
- Maintained by PMOD in Davos through a group of instruments
- Disseminated worldwide by the means of intercomparisons held every 5 years
World Radiometric Reference to SI Comparison

• Collaboration with BIPM community allowed to verify the correspondence of WRR and cryogenic standards scale of NPL (UK) and METAS (Switzerland)

• Further collaboration (PMOD, METAS, NPL) undergoing for the development of a Cryogenic Solar Absolute Radiometer (CSAR)
In-Situ Ozone

- Atmospheric ozone is an important atmospheric gas affecting health, protecting from UV radiation and acting as a greenhouse gas.

- Since ~2000, NIST with BIPM have been maintaining the WMO-GAW Central Calibration Laboratory (CCL) for *in situ* ozone.

- The WMO-GAW World Calibration Centre (WCC) in Zürich relies upon this service to transfer this standard to global observatories.

- WMO/GAW appreciates this collaboration which marked the beginning of a decade of further cooperation.
Trace Gas Standards For Reactive Gases Important In Air Pollution, Ozone Depletion and Climate

GAP Filled By BIPM/WMO Collaboration

Establishment in 2009 of a Central Calibration Laboratory (CCL) for atmospheric Volatile Organic Compounds (VOCs) as part of the WMO Global Atmosphere Watch (GAW) observing system

Problem

Due to the large number of compounds involved, the task exceeds the capacities of a single laboratory or institution.

Solution

The responsibilities for several compounds are shared amongst several metrology laboratories. Four National Metrology Institutes (NMIs) kindly agreed to form the CCL.
The responsibilities for the individual compounds are shared among several laboratories (institutions).
Carbon Tracking Information Services using observations and inversion modelling will be needed by policy makers, industry, scientists, and the public to make informed decisions in implementing carbon mitigation measures in a post-Kyoto world.

Carbon Tracker courtesy of NOAA ESRL

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<table>
<thead>
<tr>
<th>Day I</th>
<th>Day II</th>
<th>Day II</th>
<th>Day III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plenary Session I</td>
<td>Working Group Session</td>
<td>Working Group Session A</td>
<td>Wrap-up and the way Forward</td>
</tr>
<tr>
<td>Requirements, key challenges and</td>
<td>Working Group A</td>
<td>Working Group Session B</td>
<td>Recommendation form WG-A</td>
</tr>
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<td>opportunities in Monitoring climate and</td>
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<td>Working Group Session C</td>
<td>Recommendation form WG-B</td>
</tr>
<tr>
<td>Environmental change Monitoring</td>
<td></td>
<td></td>
<td>Recommendation form WG-C</td>
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<tr>
<td>Current status of science and technology</td>
<td></td>
<td></td>
<td>Presentation of the Concept Paper for the</td>
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THANK YOU

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