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GAW

WMO Addressing Climate and Air Quality

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Atmospheric Environment Research (AER) Division
WMO Secretariat

GURME
The WMO GAW Urban Research Meteorology and Environment Project

WMO
OMM

World Meteorological Organization

Independent technical UN agency

189 Members manage through WMO Congress and Executive Council

Secretariat in Geneva (staff 280)

Technical Departments

Observing and Information Systems (OBS)
GCOS (co-sponsored)

Climate and Water (CLW)

Weather and Disaster Risk Reduction Services (WDS)

Research (RES)
World Climate Research Programme (WCRP, co-sponsored)
Atmospheric Environment Research Division (AER)
Global Atmosphere Watch (GAW)
GURME

Global Framework for Climate Services (GFCS)

Result of WCC-3 held in 2009

- Established to strengthen production, availability, delivery and application of science-based climate prediction and services.
- A High-Level Taskforce (HLTF) was established to design the framework in order to mainstream climate science into decision-making at all levels and to ensure that every country and every climate-sensitive sector of society is well equipped to access and apply relevant climate information.
- Based on their report Secretariat now proceeding with the planning.
- Extraordinary WMO Congress on GFCS to be held October 2012

Global Framework for Climate Services (GFCS)

Initial focus (2012-2017) on facilitating access to improved climate services in the following key areas:

- Agriculture and food security
- Water resources
- Disaster risk
- Human health

Implementation Plan

- User Interface Platform
- Climate Services Information System
- Observations and Monitoring
- Research, Modelling and Prediction
- Capacity Development

Observations

- Weather related observations (OBS)
- Climate observations (GCOS)
- Atmospheric chemistry and related physical parameters (GAW)

THE GAW MISSION

- Systematic long-term monitoring of atmospheric chemical and physical parameters globally
- Analysis and assessment
- Development of predictive capability

(GURME and Sand and Dust Storm Warning System)

GAW observations

- **Stratospheric Ozone**
- **Tropospheric Ozone**
- **Greenhouse Gases (CO_2, CH_4, N_2O, CFCs)**
- **Reactive Gases (CO, VOC, NO_y, SO_2)**
- **Precipitation Chemistry**
- **Aerosols (chemical, physical, AOD)**
- **UV Radiation**
- **(Natural Radionuclides, Rn^{222}, Be^{7}, ^{14}CO)**

GAW Global Stations

In addition there are about 800 regional and contributing stations

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GAW Station Information System

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GAWSIS Online - *comprehensive information on all GAW stations*

- ***Database***
- ***Search / Update***
- ***Inventory / Audit***

(Supported by Switzerland)

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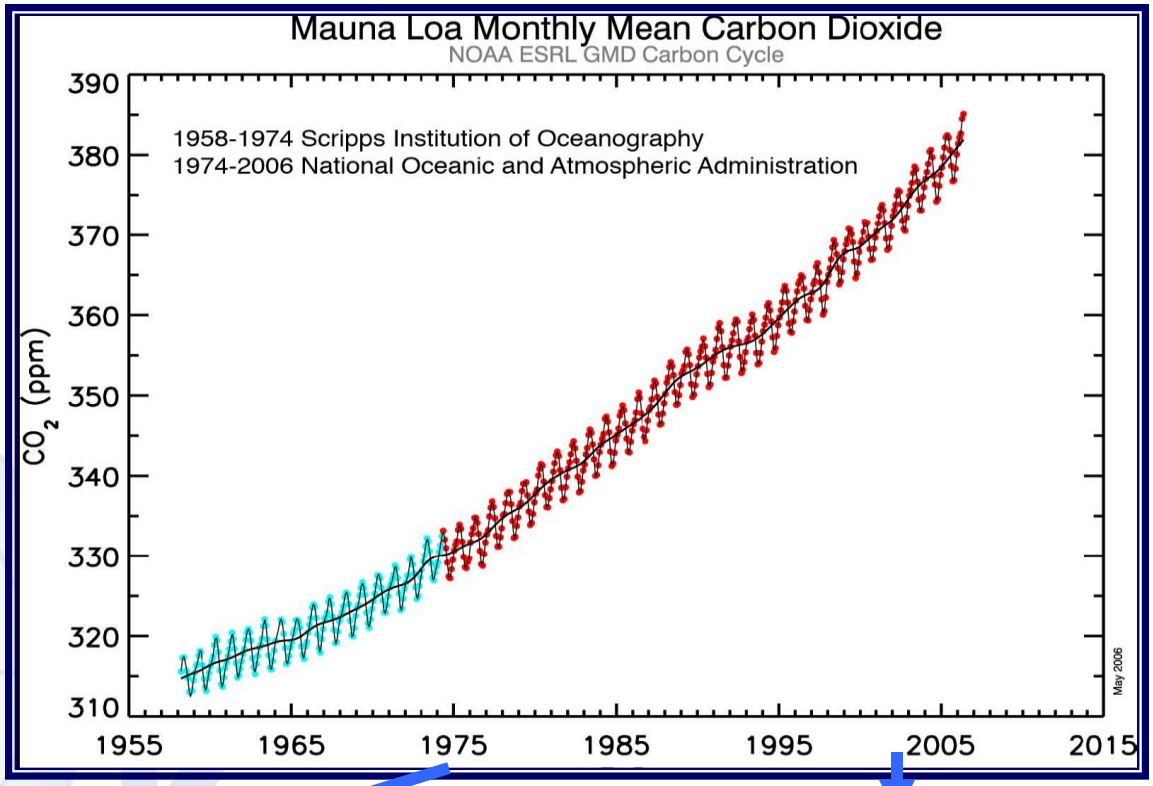
Quality assurance/Quality Control (QA/QC)

Serves both developed and developing countries

The GAW QA/QC system impacts all aspects of atmospheric chemistry observations, including

- training of station personnel;
- assessment of infrastructures, operations and the quality of observations at the sites;
- documentation of data submitted to the WDCs;
- improvement of the quality and documentation of legacy data at the WDCs.

The *primary objectives* of the GAW QA/QC system are to ensure that the data in the WDCs are **consistent, of known and adequate quality**, supported by comprehensive metadata, and sufficiently complete to describe global atmospheric states with respect to spatial and temporal distribution.


Mauna Loa Monthly Mean Carbon Dioxide
NOAA ESRL GMD Carbon Cycle
1958-1974 Scripps Institution of Oceanography
1974-2006 National Oceanic and Atmospheric Administration
CO2 (ppm)
390
380
370
360
350
340
330
320
310
1955
1965
1975
1985
1995
2005
2015
May 2006


The 13th WMO/IAEA Meeting of Experts on
CO2 Concentration and Related Tracer Measurement Techniques
Boulder, Colorado USA - September 19-22, 2005

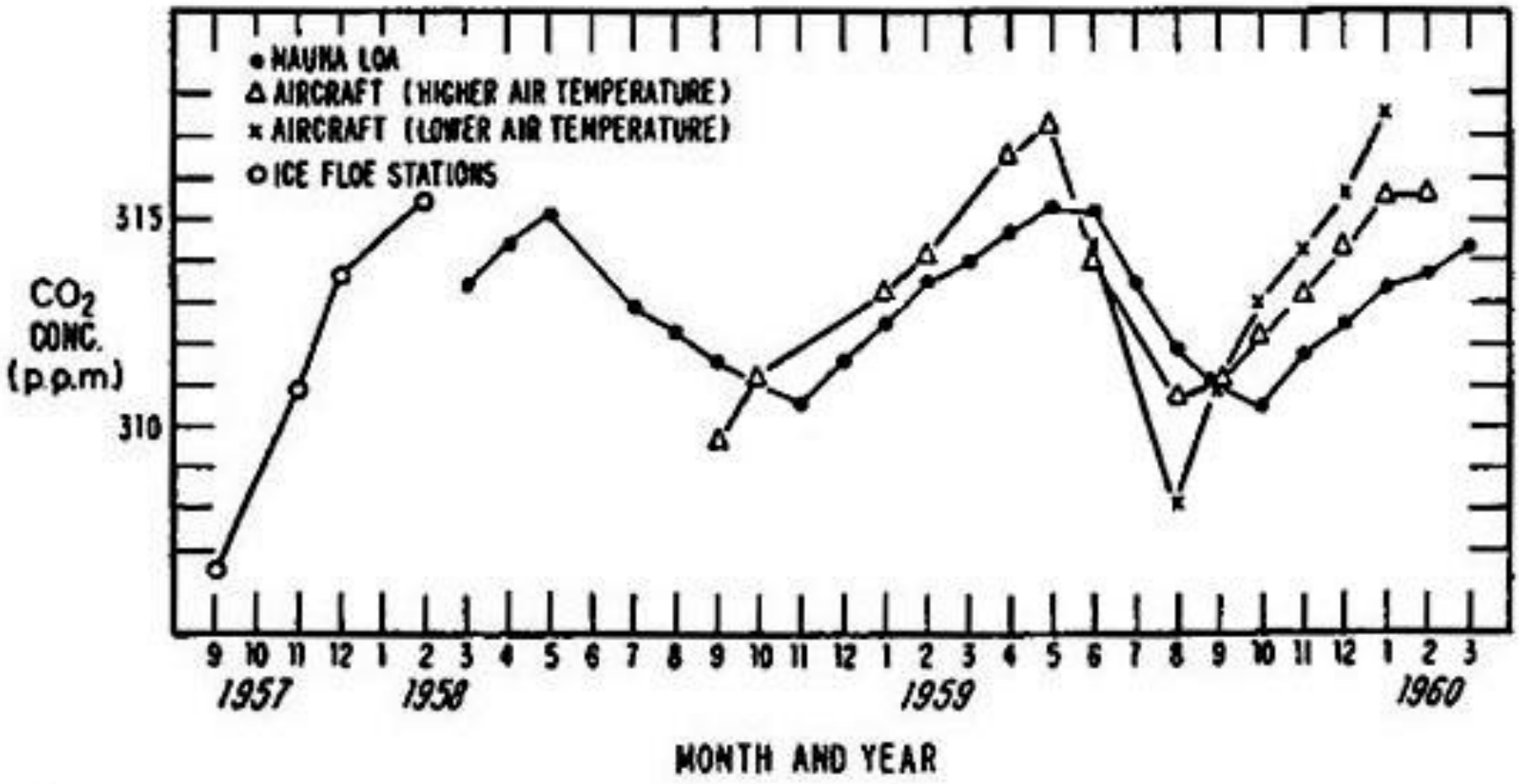


Fig. 1. Variation in concentration of atmospheric carbon dioxide in the Northern Hemisphere.

C. D. Keeling

Tellus XII (1960), 2

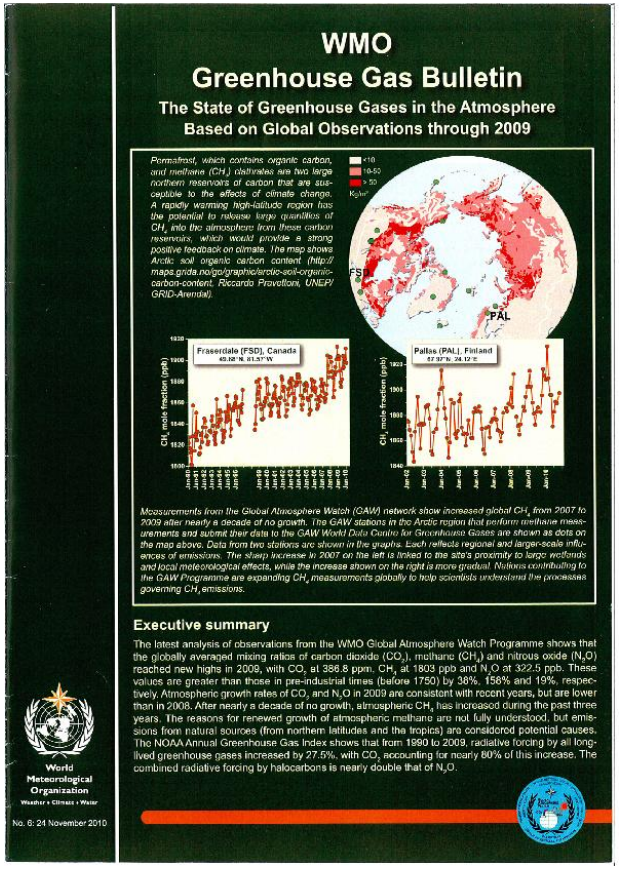
Annual Greenhouse Gas Bulletins

Published in time for COP (Conference of Parties to UNFCCC) meetings

6th Bulletin:

Potential methane releases from northern permafrost and wetlands, under future climate change, is of great concern and is becoming a focus of intensive research and observations.

Prepared by WDCGHG and Scientific Advisory Group GHG



(available from GAW website)

CAS FUTURE ORIENTATIONS

CAS President Question:
What are the significant technical, social and environmental stressors which will drive the demand for more accurate and user friendly environmental assessments and predictions?

Reply:

CLIMATE CHANGE
POPULATION GROWTH
AND URBANIZATION

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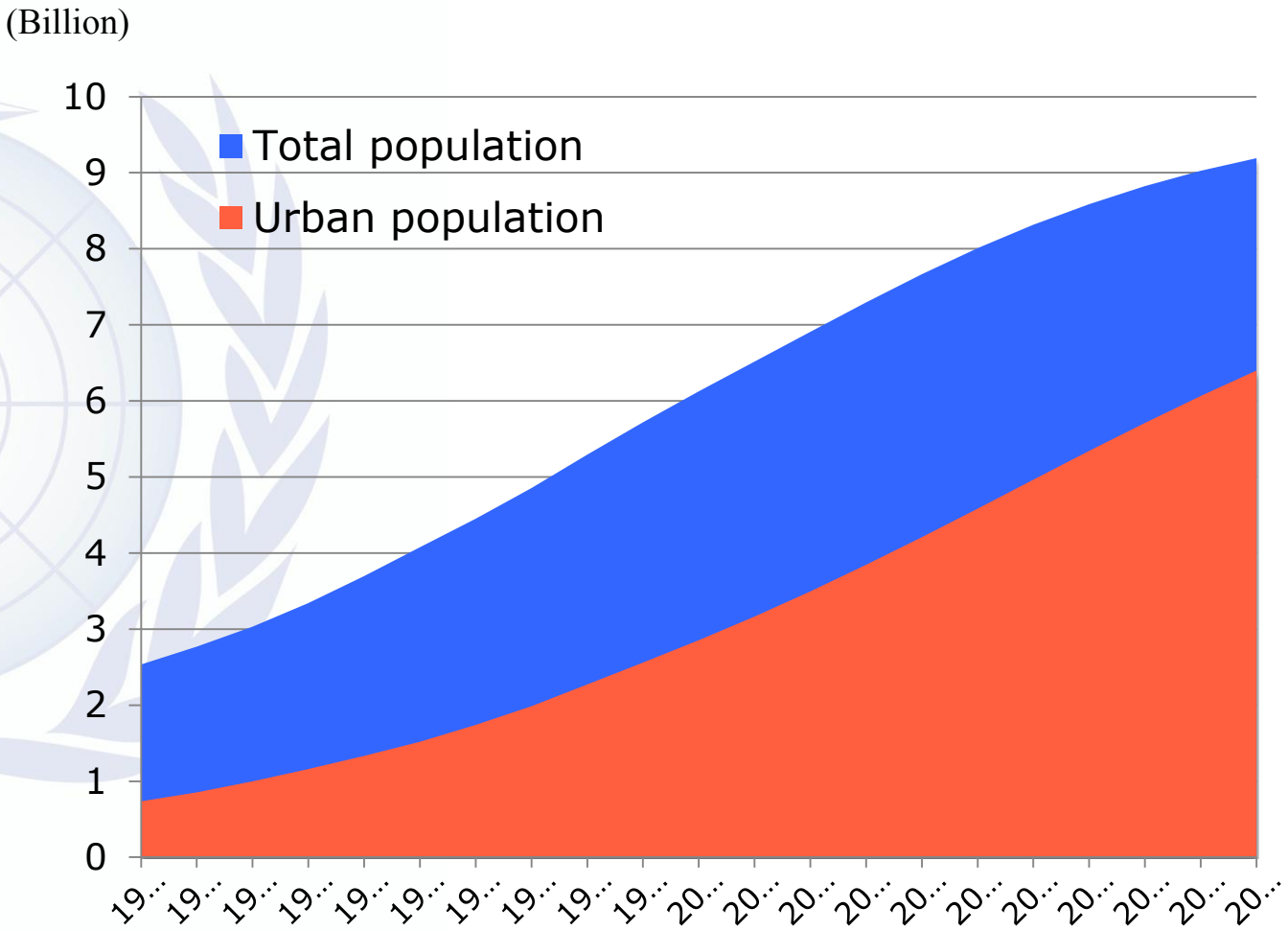
Growing Urban Population



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WMO increasing focus: Megacities

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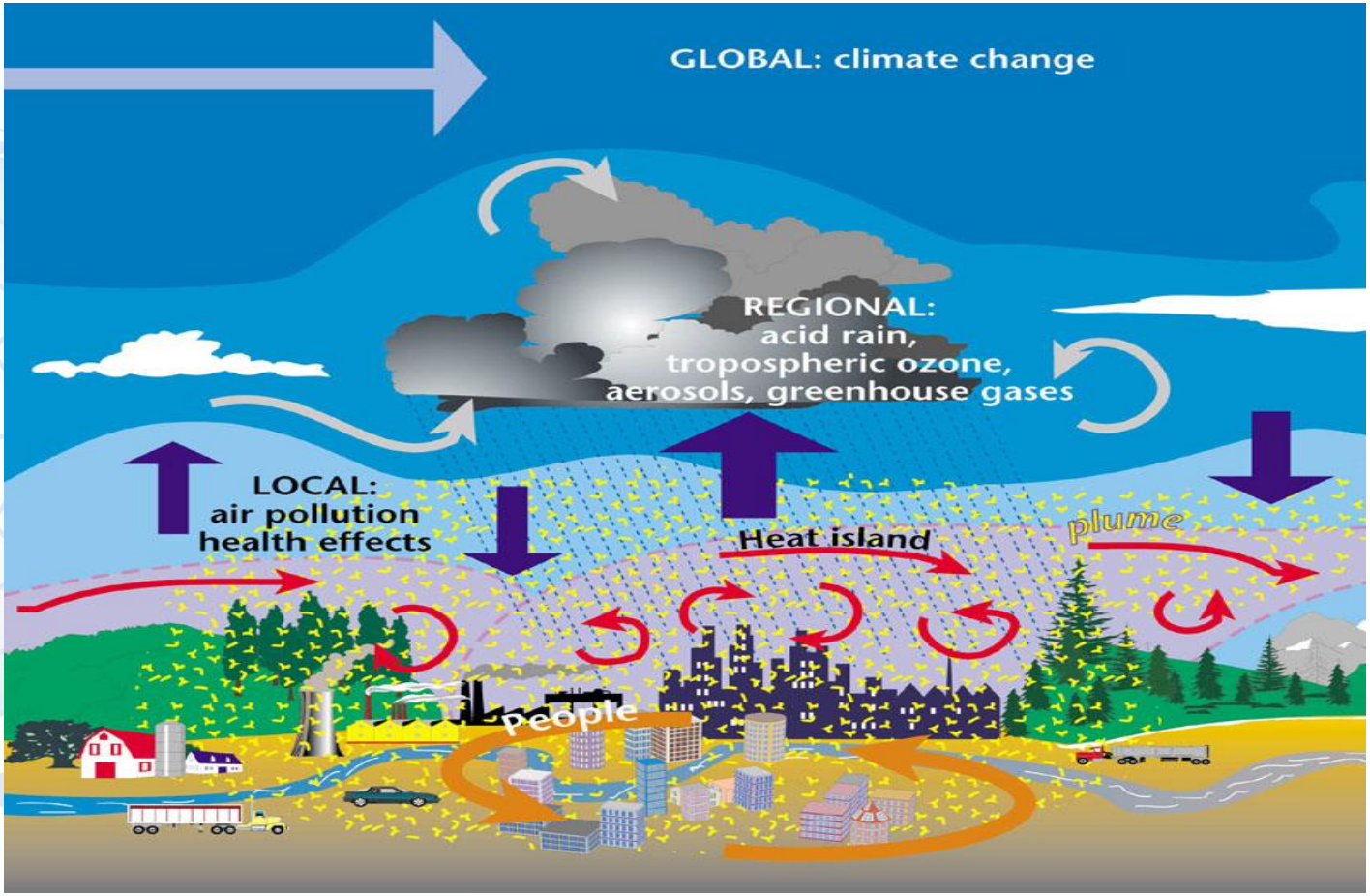
Need to consider all scales



Climate change air pollution interactions

GURME Tasks For The Strategic Planning Period 2008-2015

Observational Needs
- Chemical
- Meteorological

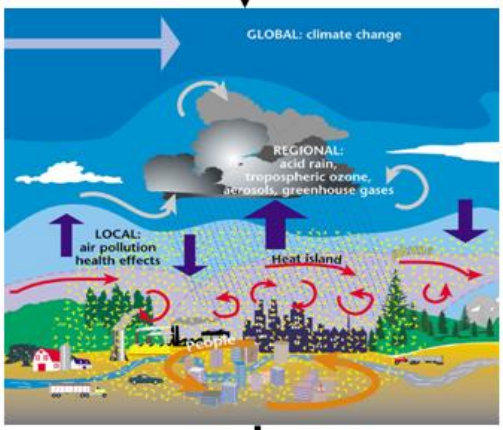
(Tasks: 3,6,17)

Assimilation

Modeling Needs
- Weather prediction
- Chemical weather and air quality prediction

(Tasks: 8,11,13,15)

Demonstration



Coordination

Capacity Building
- Workshops
- Training

(Tasks: 2,4)

Users
- Health
- Agriculture
- Environmental
- Public
- Emergency Response

(Tasks: 9,14,16,18)

Education

Air Quality & Related Products
- Improved Forecasts
- Guidelines
- Pilot Projects

(Tasks: 1,5,7,12)

Dissemination

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GURME FOCUS: Air Quality Modelling and Forecasting (AQF) Workshops and Training

- Basic AQF for Latin American Countries, July 2006, Lima, Peru
- Air Quality Forecasting for South Asia, December 2008, Pune, India
- Air Quality Modeling for Latin America, August 2009, Mexico City
- IWAQFR, Nov 2010, Quebec
- Modelling Training Workshop, with EANET, January 2011, Niigata
- NRT in AQF, March 2011, Hangzhou
- UAQCC, Hamburg 16-18 Aug 2011

Planned:

With NASA and EPA, AQF, Central America, Costa Rica, October 2011

GURME Latin America Cities Pilot Project, Mexico City Aug. 2009

Key AQF topics covered:

Meteorology, chemistry, emissions

Forecasting approaches

Forecasting operations & communication and use of products

Observing systems (met & chem), including the use of satellites

Model training (e.g., WRF & WRF/Chem)

Impact prediction/analysis (health, heat wave, agriculture)

Case studies

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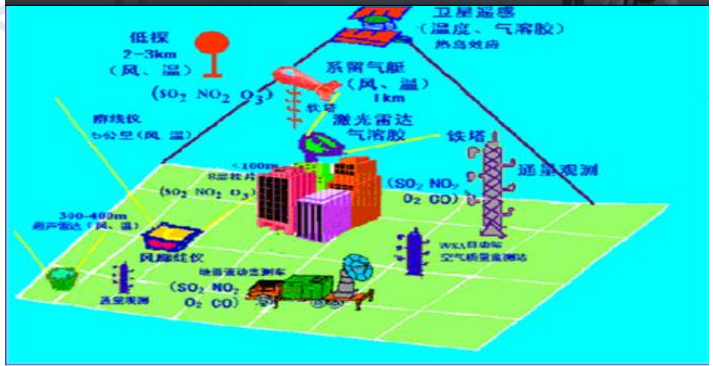
GURME Pilot Project Example: MHEWS Shanghai (EXPO-2010)



- ✓Enhanced observing system
- ✓Enhanced air quality & weather forecasting (& heat waves)
- ✓Field experiment (joint with NCAR)
- ✓Workshop activities

Operation ozone prediction and warning based on WRF-CHEM modified version and one hour refresh assimilation and 3km resolution technique based on WRF3.0

(1) Information system

- Forecast dynamics (NCEP)
- Emissions of air pollutants
- Initial and boundary conditions
  - (Meteorology - NCEP)
  - (Chemistry - MOZART)
- Land surface data
- Pre-process system (WRF-SI)
  - (integrating data)

(2) Physical and chemical system

- Dynamical model (WRF) – forecast dynamical parameters
  - winds, temperature, clouds, rain, PBL….
- Chemical/aerosol model (Chem) – forecast O3, NOx, aerosols…….
- Radiation model (TUV) – forecast UV, Photolysis ……
- On-line coupled dynamics-chemistry-aerosols-radiation (WRF-Chem)

(3) Products

- Data analysis system
  - Visual display
  - Ozone analysis
- Impact model
  - Effect of O3 on health
  - Effect of O3 on vegetation
- Alert system
  - Distribute the early warning results
- Reduction strategy
  - Providing possible methods to reduce O3

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UNEP/WMO Integrated Assessment of Tropospheric Ozone and Black Carbon

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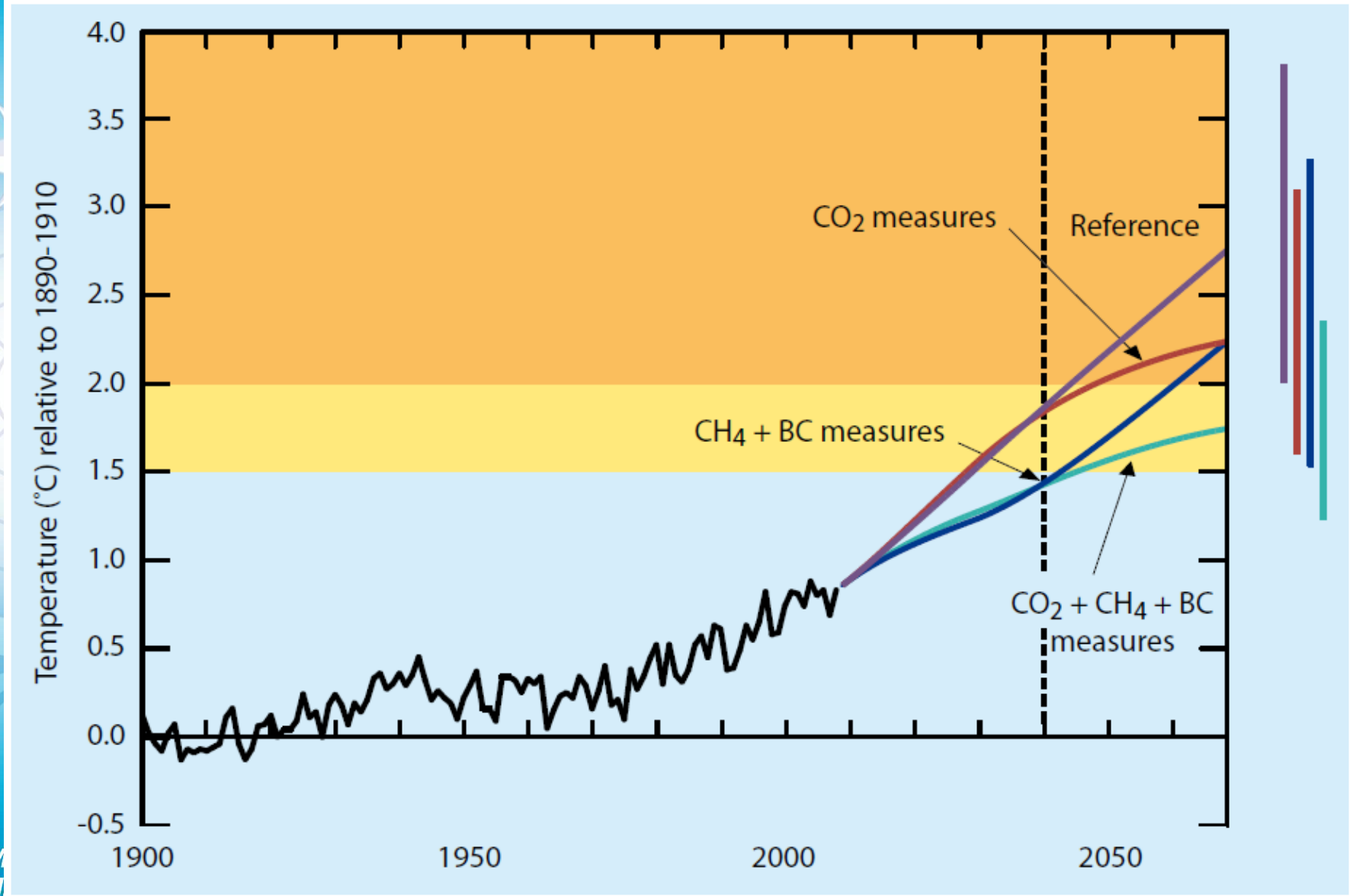
Result for Global Temperature Change (hybrid of results from GISS and ECHAM models informed by the literature) added to the historical record



Collaboration critical for success!

Heat waves cause excess deaths, large portion due to air pollution

Heat wave in Europe summer 2003:

70 000 extra deaths, about 20 – 38 % due to air pollution

More ozone:

- High T favors production of O_3
- Low RH reduces destruction of O_3
- Less dry removal through vegetation (T, no precipitation)
- Biogenic precursor emissions higher (isoprene)
- Stable meteorological situation with no clouds (containment of pollutants and favorable for photochemistry)

AQ forecasts and Heat Health Early Warnings (HHEW)