Accomplishments and Achievements of the World Climate Research Programme: 2000-2019

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JSC 21 - 40
Ghassem R. Asrar
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Editors
Climate Science for Serving Society
Research, Modeling and Prediction Priorities

WCRP World Climate Research Programme

JSC Chairs 2000 - 2019

Larry Gates
1995 - 2000

Peter Lemke
2000 - 2006

John Church
2006 - 2008

Antonio Busalacchi
2008 - 2014

Guy Brasseur
2014 - 2019

Detlef Stammer
2019 -

Mission & Objectives

World Climate Research Programme supports **climate-related decision making** and planning **adaptation to climate change** by coordinating research required to improve

(1) climate predictions and

(2) our understanding of human influence on climate

"for use in an increasing range of practical applications of direct relevance, benefit and value to society"
(WCRP Strategic Framework 2005-2015).

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WCRP World Climate Research Programme

ESSP Partners

The Earth System Science Partnership is a partnership of four international global environmental change (GEC) research programme for the integrated study of the Earth System, the changes that are occurring to the system and the implications of these changes for global and regional sustainability.

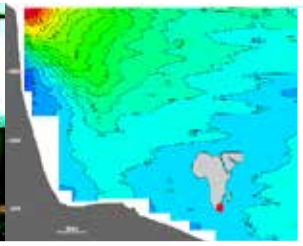
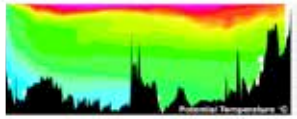
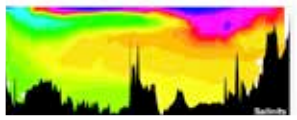
DIVERSITAS

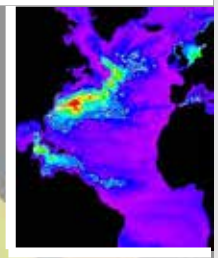
GLOBAL CHANGE
IGBP

WCRP World Climate Research Programme

IHDP

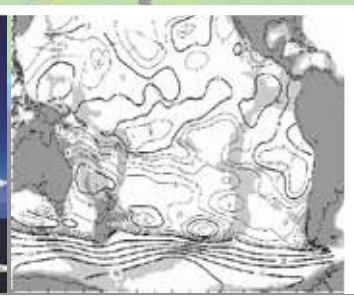
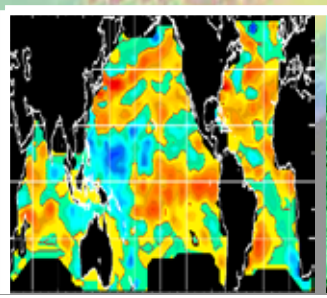
WMO IOC ICSU

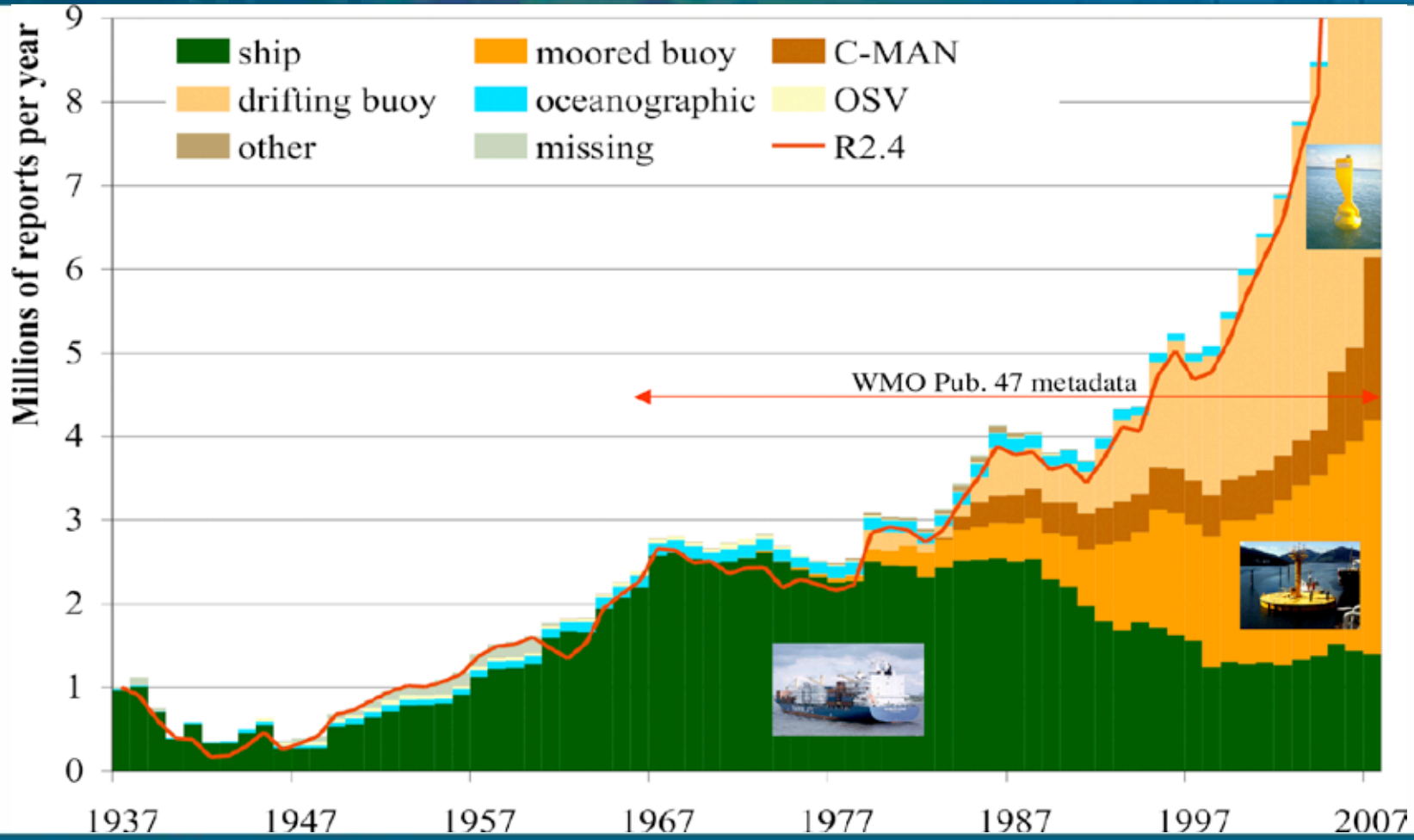





WOCE 1983-2002

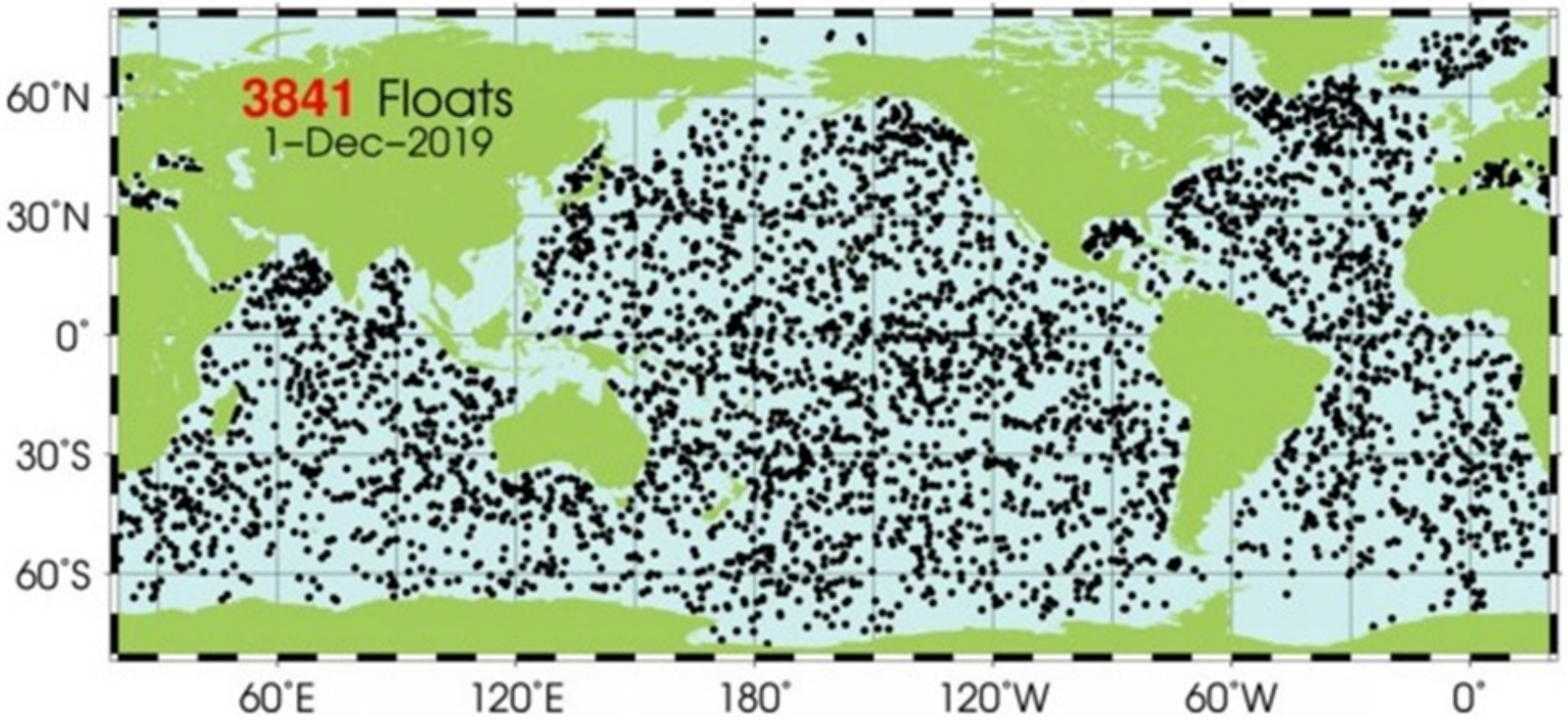
The Ocean Revolution

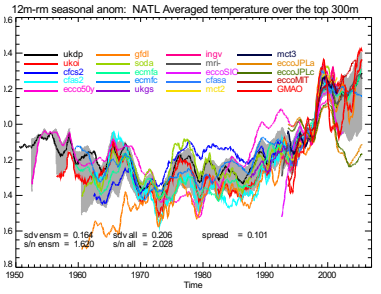
cf Worley et al., Snowden et al., 2009

The ocean observing system



CLIVAR GSOP: Ocean Synthesis Evaluation Workshops

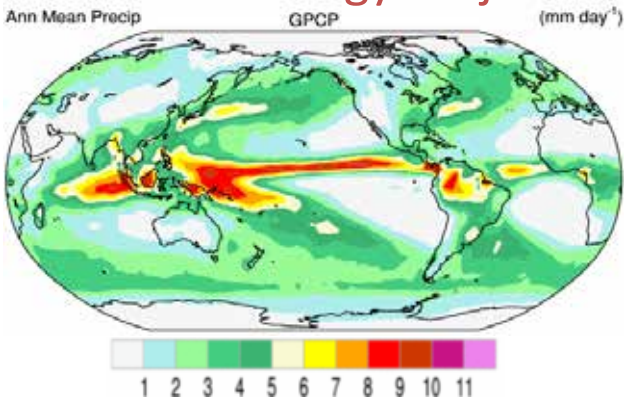
N. Atlantic Temp (0-300 m)



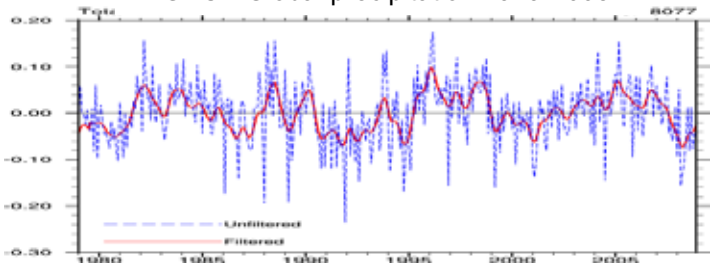
WCRP enabling initialized predictions

Atmospheric data sets

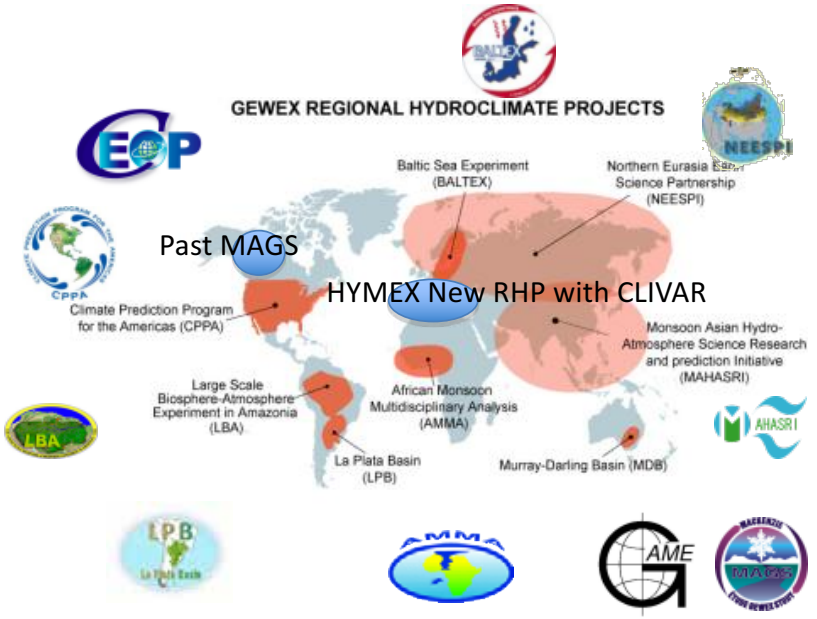
GEWEX Global Precipitation Climatology Project



GPCP Global precipitation 1979-2008



Regional Hydrology Data Sets



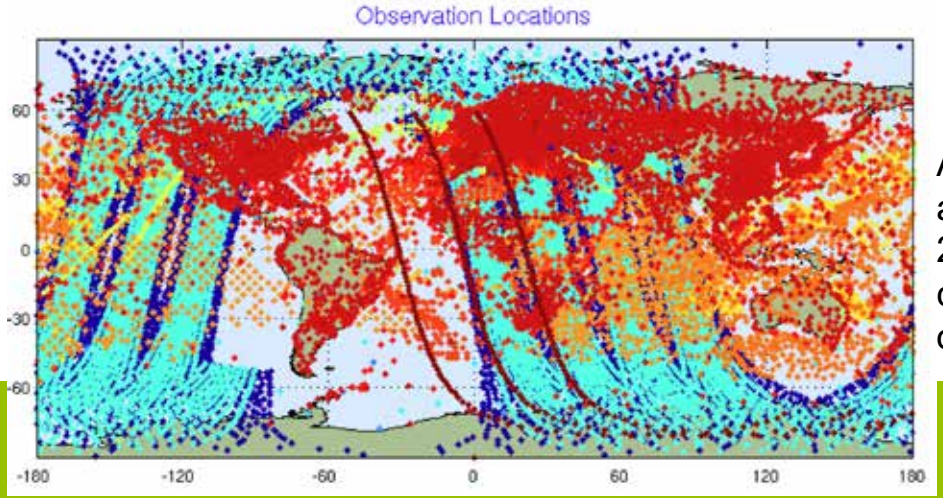
WCRP
World Climate Research Programme

WCRP 4th International Reanalysis Conference

7-11 May 2012

Silver Spring, Maryland USA

Agency Priorities: An Open Panel Discussion with Conference Participants



As many as four million observations are analyzed during 6-hours windows in the 2000s. More than 50 billion observations can be analyzed over 30 years (Courtesy of M. Bosilovich)

WMO IOC ICSU

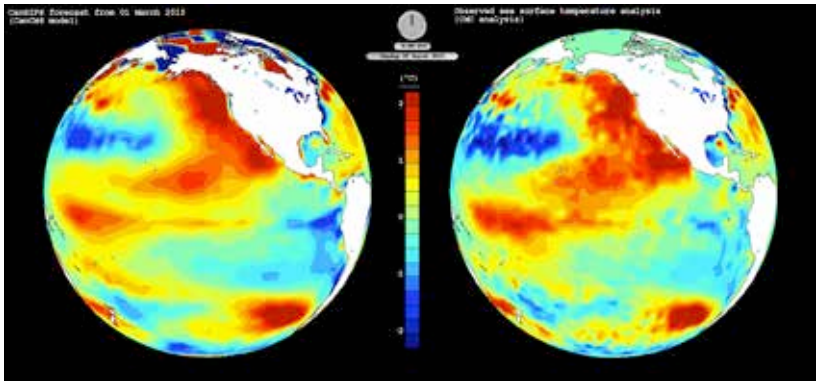
WGSIP *Working Group on Subseasonal to Interdecadal Prediction*

Advancing research in subseasonal to interdecadal prediction and its societal applications

- Developing a programme of ***numerical experimentation*** for climate variability and predictability over a range of time scales, with an emphasis on ***assessing and improving predictions***
- Evaluating data assimilation, model initialization and forecasting procedures for ***initialized climate predictions***

Predicted daily SST anomalies 1 Mar 2015 – 28 Feb 2016 (CanCM4 model)

Observed daily SST anomalies 1 Mar 2015 – 6 Nov 2015 (CMC analysis)



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World Climate Conference-3

Better Climate Information for a Better Future

A Global Framework for Climate Services

WCC · 3

World Meteorological Organization
Weather • Climate • Water

Geneva, Switzerland

31 August–4 September 2009

UN SYSTEM
DELIVERING AS ONE ON
CLIMATE KNOWLEDGE

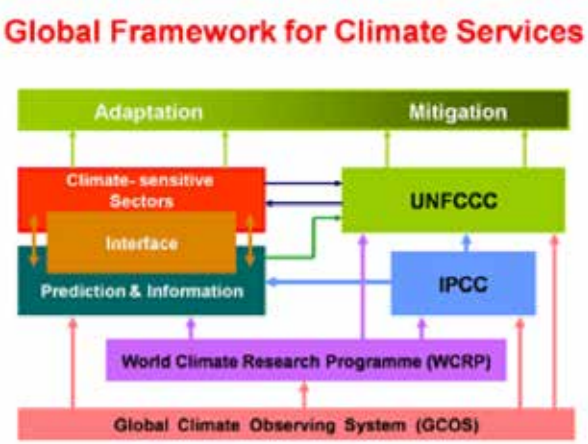
W

CMWF

WCC-3 Conference Statement

- Great recognition of scientific progress made through WCRP and its associated activities
- Call for major strengthening of observations and research

Support the development of the Global Framework for Climate Services



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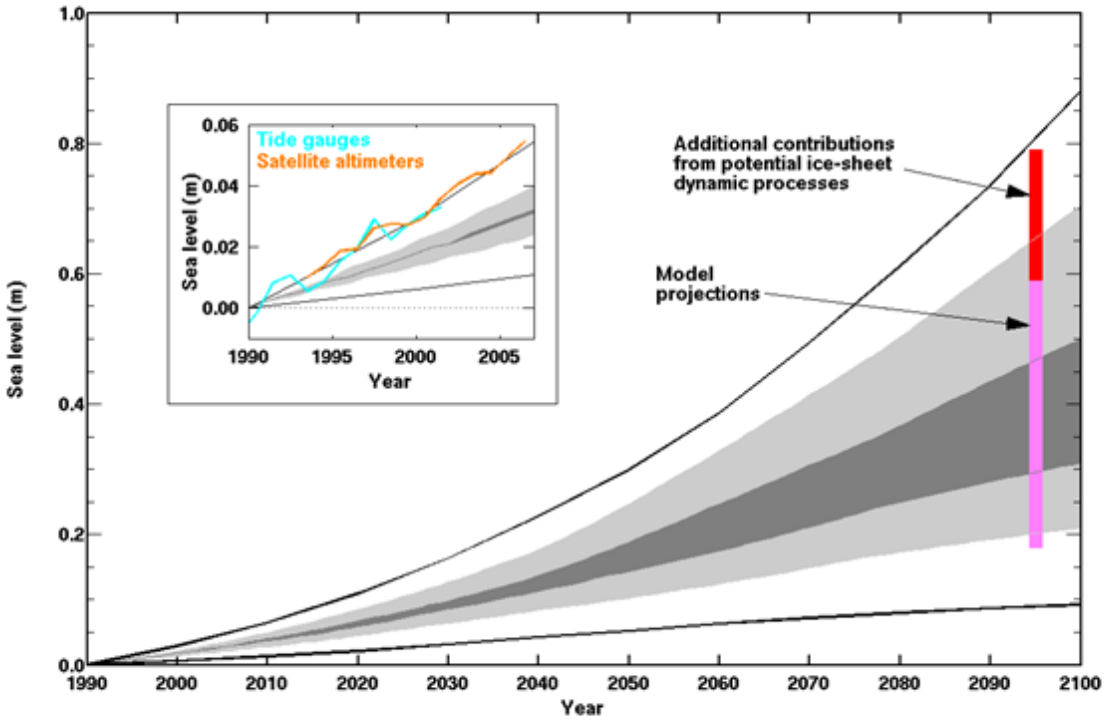
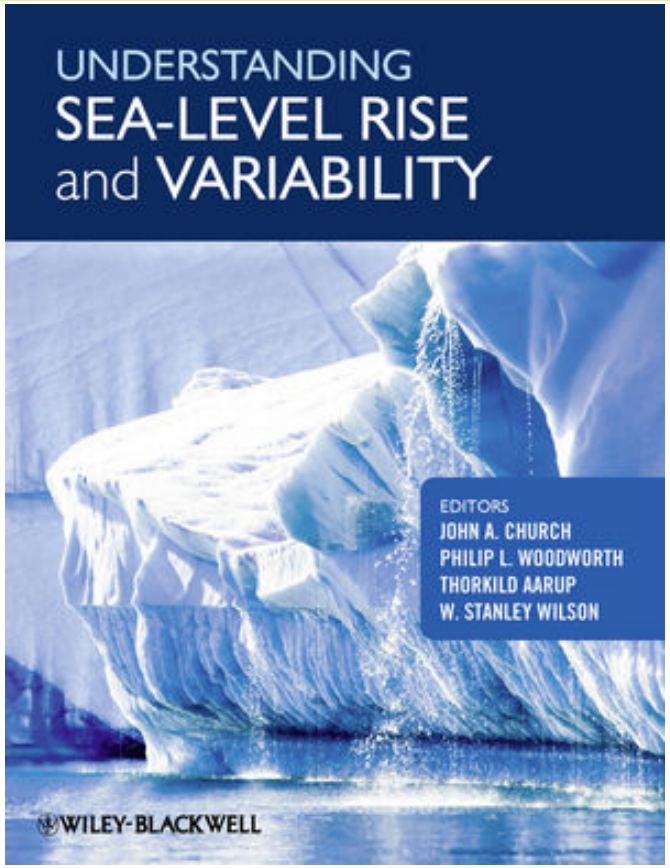
Major Publications

- WCRP Implementation Plan and Accomplishment Report were Published in 2009.

ICSU

Sea Level Rise





Church et al., 2010

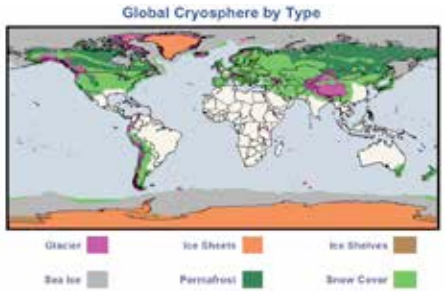
Accomplishments

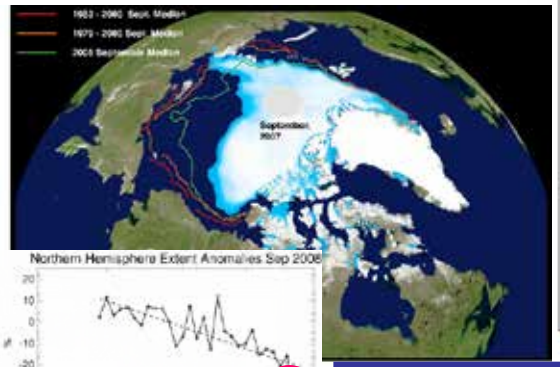
Climate Science Awareness

Assessments

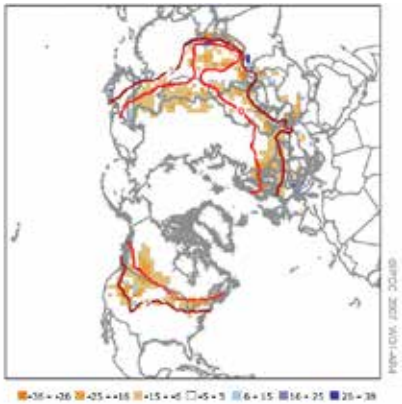
IPCC

CliC: Cryosphere chapter



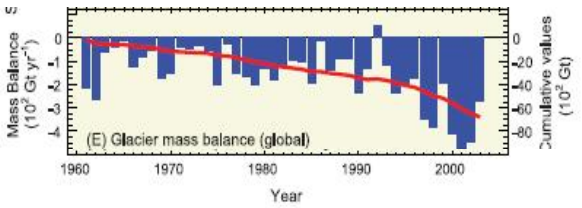


2007: 38% below average
2008: 34% below average



1941 **Alaska**

1900 **Austria**



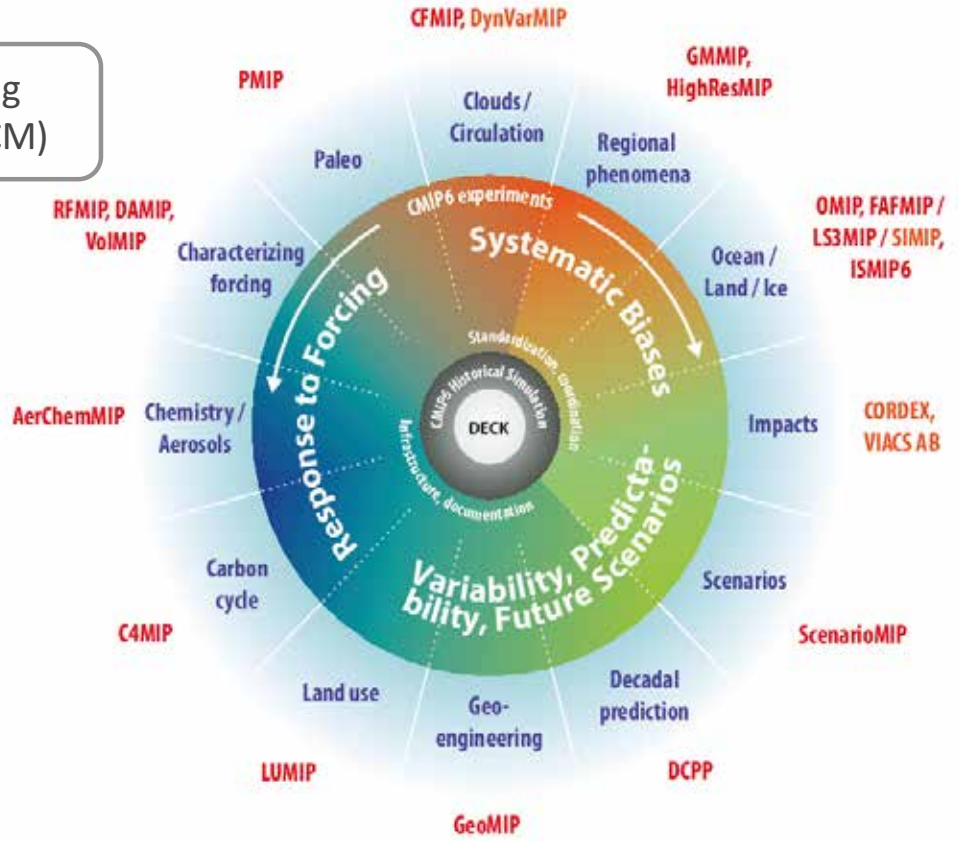
CMIP
The World Climate Research Programme's Coupled Model Intercomparison Project

Coupled Model Intercomparison Project

CMIP is a project of WCRP's Working Group on Coupled Modelling (WGCM)

CMIP has led to an improved understanding of past, present and future climate change and variability in a multi-model framework

CMIP defines common experiment protocols, forcings and output



21 CMIP6-Endorsed MIPs

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VAMOS: MONSOON EXPERIMENT SOUTH AMERICA (MESA)

HYPOTHESIS:
The SAMS provides a physical basis for determining the degree of predictability on short- and long timescales over the region.

YEAR (2001+)	01	02	03	04	05	06	07	08 …
SALLJEX Planning	…-------|							
SALLJEX Preparations	----------|							
SALLJEX Data Collection	----------|							
SALLJEX Post-field activities	----------|							
PLATEX Planning	----------|							
PLATEX Preparation	----------|							
PLATEX Data Collection	---------…							
MESA Principal Research	… ----------…							
MESA Data Management	----------…							

MESA PRIORITY RESEARCH AREAS (PRA):

Better understanding and simulation of:

- **diurnal and mesoscale processes (PRA-I);**
- **intraseasonal variability (PRA-II)**
- **response to oceanic and continental boundary conditions (PRA-III);**
- **monsoon evolution and variability (PRAs-I, II, III).**

WCRP Open Science Conference

24-28 October 2011

Denver, Colorado, USA

http://conference2011.wcrp-climate.org

Climate Research in Service to Society

Registered Participants:

- **1907 from 86 countries**
- **541 Early Career Scientists & Students**
- **332 from Developing Countries**

Stakeholders and User Perspective

- Urgent need for **actionable climate information** based on sound science

- The need for **"symbiotic" relationship between providers and users of climate information** to ensure climate information is timely, accessible, easy to understand

- Urgent need for **training and development of next generation of scientists and decision makers** who pursue and promote the use of actionable climate/environmental information

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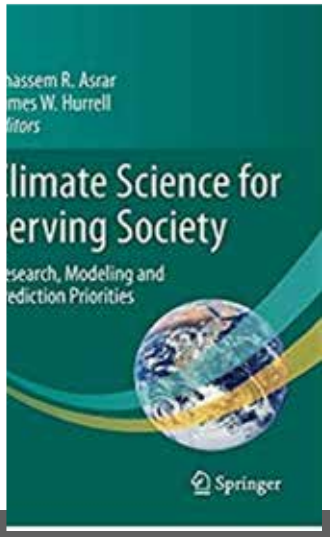
Future Directions: Actionable Science

Defined as: data, analysis, and forecasts that are sufficiently predictive, accepted and understandable to support decision-making, including capital investment decision-making.

- World Climate Conference-3, OceanObs '09, ICSU Review and Visioning, acknowledge WCRP past contributions and identify future challenges and opportunities.

- Need for more flexibility/agility to respond to expanding users needs, that includes climate information, products & services:

    - At regional scale
    - For key sectors of global economy
    - For adaptation, mitigation and risk management
    - Research on frontiers of climate/Earth system



WCRP Grand Challenges

- A Grand Challenge is both highly specific and highly focused identifying a specific barrier preventing progress in a critical area of climate science.

- This focus enables the development of targeted research efforts with the likelihood of significant progress over 5-10 years, even if its ultimate success is uncertain.

- It should thus enable the implementation of effective and measurable performance metrics.

- By being transformative, a Grand Challenge should bring the best minds to the table (voluntarily), building and strengthening communities of innovators that are collaborative, perhaps also extending beyond “in-house expertise”.

- It can capture the public’s imagination: teams of world-leading scientists working to solve pressing challenges can offer compelling storylines to capture the interest of media and the public.

WCRP Grand Challenges

- Regional Climate Information
- Regional Sea-Level Rise
- Cryosphere in a Changing Climate
- Clouds, Circulation, and Climate Sensitivity
- Changes in Water Availability
- Prediction and Attribution of Extreme Events

WCRP Grand Challenges

- Near Term Climate Prediction
- Regional Sea Level Change and Coastal Impacts
- Melting Ice and Global Consequences
- Clouds, Circulation, and Climate Sensitivity
- Water for the Food Baskets of the World
- Understanding and Predicting Weather and Climate Extremes
- Carbon Feedbacks in the Climate System

WCRP/WWRP International Prize for model development

- Make Model Development More Attractive to New Researchers
- Provide Recognition and Prestige for model improvements
- Awarded Annually for outstanding contribution to weather and climate model development by an early- to mid-career research
- Consist of a certificate signed by the chairs of WCRP JSC and WWRP SSC + funding to attend a major conference or meeting

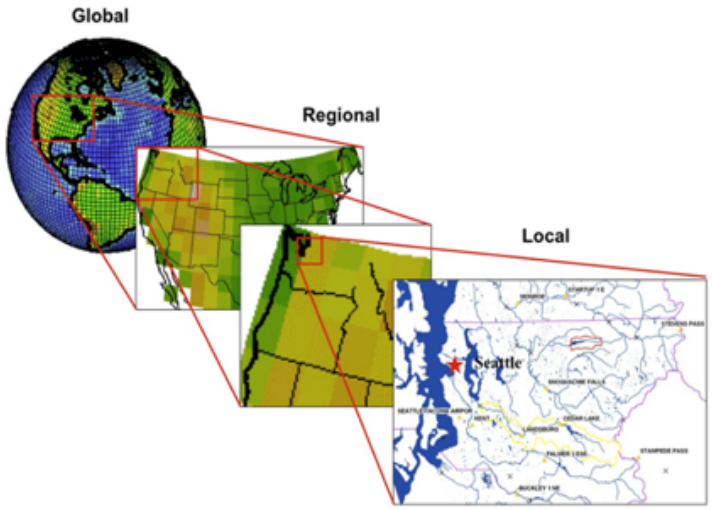
CORDEX

COordinated Regional climate Downscaling Experiment

Advancing the science and application of regional climate downscaling, for improved regional climate information

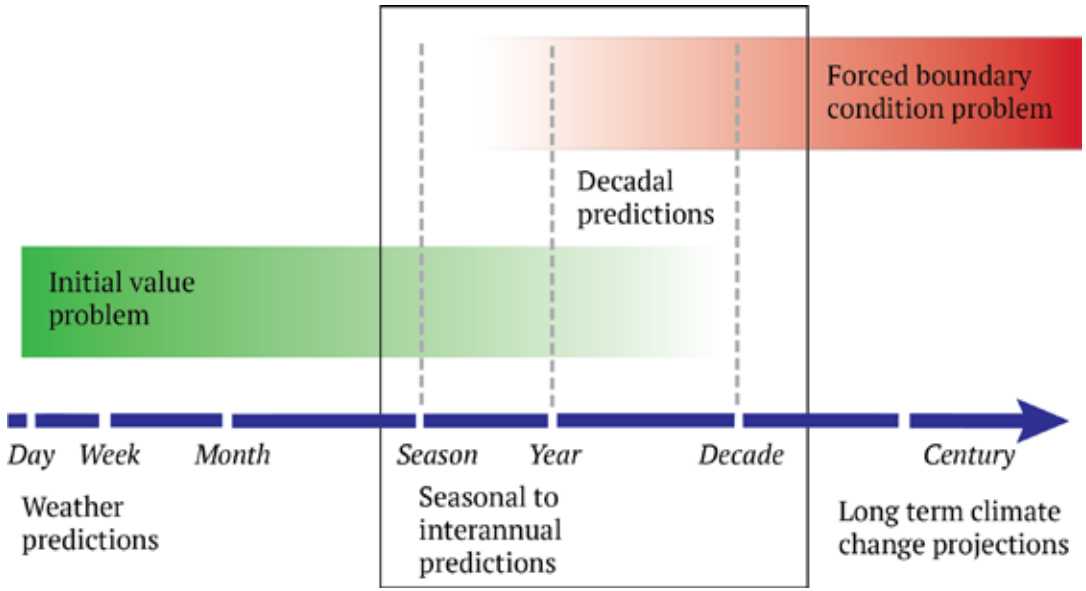
CORDEX scientific challenges:

- **Added value** of downscaling, scales, bias and uncertainties, user-oriented metrics
- Understanding and simulating **human elements**, e.g. land use, urban development, climate and coastal cities
- Coordination of regional **coupled modeling**
- Precipitation, e.g. convective systems, monsoon
- Local wind systems



Model downscaling. NCAR dr. Andrew Wood

Near Term Prediction



How can we enhance the understanding of sources of decadal predictability?

How can we serve decadal prediction information as is already done for seasonal prediction?

ESSP DIVERSITAS IGBP IHDP WCRP

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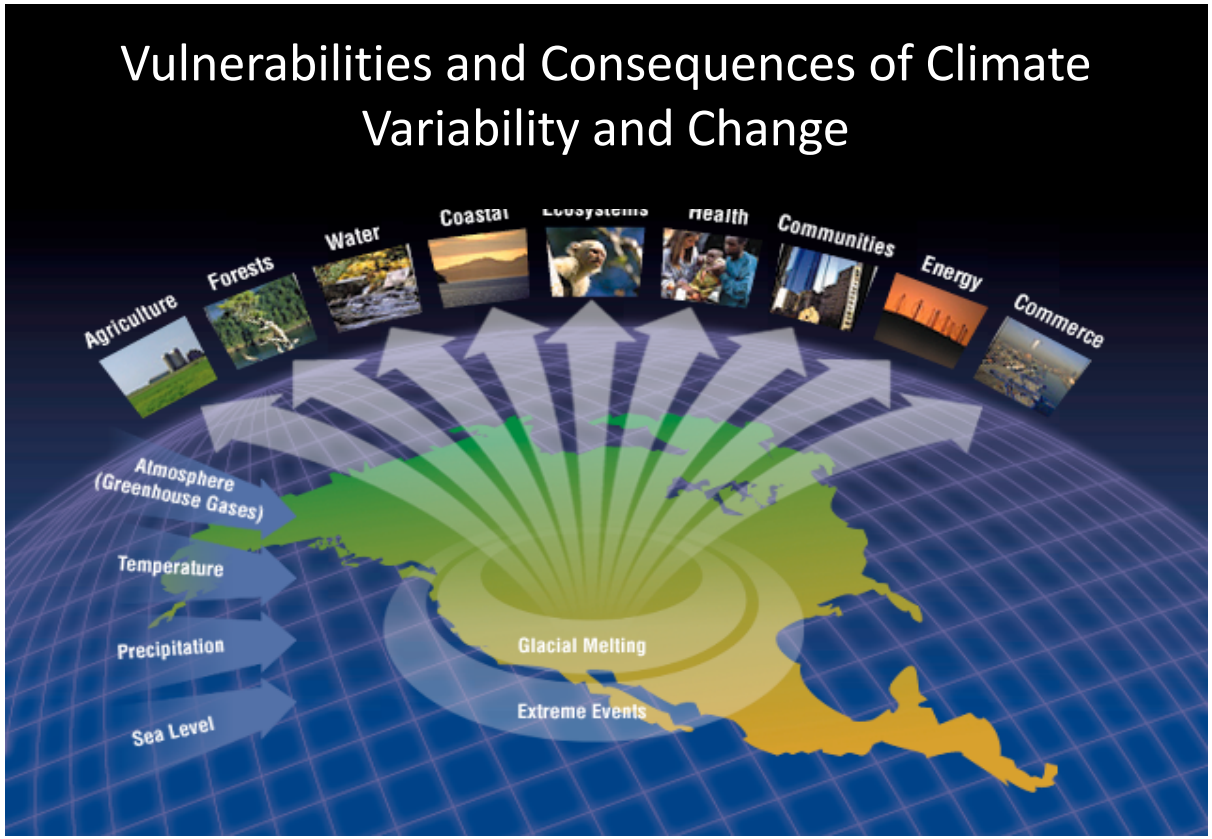
Grandest of Grand Challenges: Prediction of the Earth System

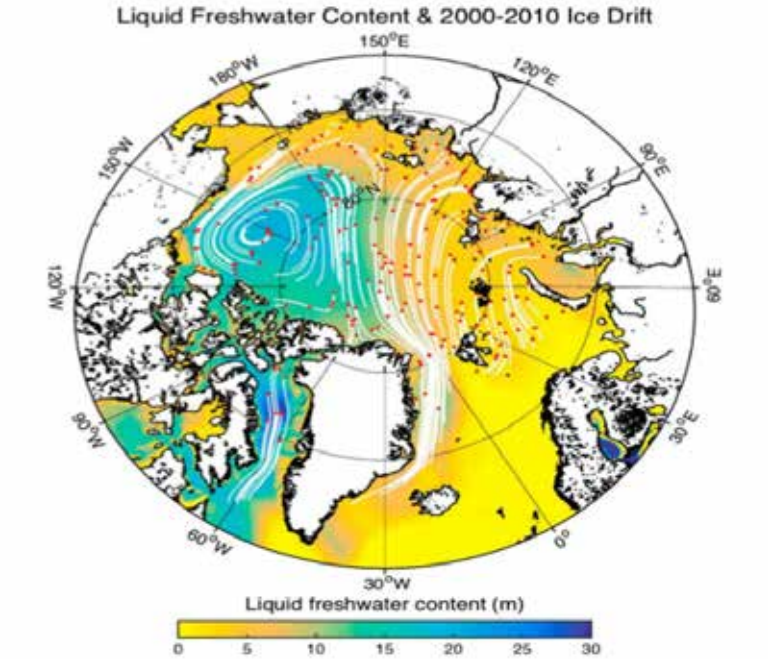
GOALS:

- Deliver knowledge to respond to global change
- Engage a new generation of researchers across physical climate and biogeochemistry
- Transition to the full range of sciences and humanities



WCRP Science Findings *Arctic freshwater*

Arctic freshwater is expanding and changing



- Arctic freshwater domain expanded, both for the oceans and land
- New freshwater regimes developed
- An un-quantified moisture flux detected, due to the loss of Arctic freshwater ice cover
- Increase of the benefits of freshwater-based resource activities

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CliC Climate and Cryosphere

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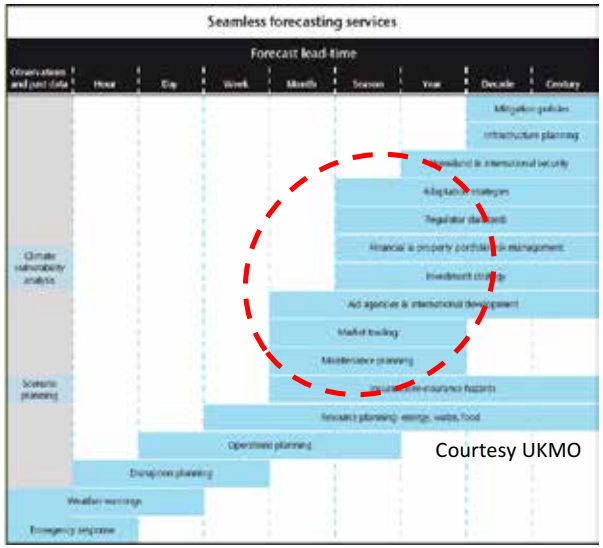
Subseasonal to Seasonal (S2S) Project



Courtesy UKMO

Courtesy IRI

❑**Objectives:**

- To improve forecast skill and understanding on the S2S timescale with emphasis on HIW
- To promote uptake by operational centres and exploitation by the applications community
- To capitalize on the expertise of the weather and climate research communities to address GFCS priorities

❑**Implementation underway**: TIGGE-like multi-model data base being established

❑**Demonstration projects on extreme events**(e.g. 2010 Russian heatwave, floods in Pakistan in 2010 and Australia in 2011, and 2012 European cold spell)

❑**Project Office**: NIMR, KMA, Jeju, Korea (official ceremony at EC-65)

❑**Trust fund**: we expect and welcome support and contributions by Members.

WMO IOC ICSU