The World Climate Research Programme

1990
- Global Energy and Water Exchanges (GEWEX)
- Stratosphere-Troposphere Processes and their Role in Climate (SPARC)

1992
- Coordinated Regional Climate Downscaling Experiment (CORDEX)

1994
- Climate and Ocean Variability, Predictability and Change (CLIVAR)

1995
- Montreal Protocol on Substances that Deplete the Ozone Layer
- Tropical Ocean and Global Atmosphere (TOGA)

1988-1994
- World Ocean Circulation Experiment (WOCE)

1980
- WCRP Established

1990-2002
- World Ocean Circulation Experiment (WOCE)

1996
- Climate and Ocean Variability, Predictability and Change (CLIVAR)

1998
- IPCC Second Assessment Report (SAR): Climate Change

2001
- IPCC Third Assessment Report (TAR): Climate Change

2004
- IPCC Fourth Assessment Report (AR4): Climate Change

2007
- IPCC Fourth Assessment Report (AR4): Climate Change

2007-2008
- International Polar Year

2010
- WCRP Strategic Plan

2012
- Subseasonal-to-Seasonal Prediction Project (S2S)

2013
- CMIP5

2014
- IPCC Fifth Assessment Report (AR5): Climate Change

2018
- IPCC Report on Global Warming of 1.5°C

2020
- 2019 IPCC Sixth Assessment Report (AR6): Climate Change

2021
- WCRP

World Climate Research Programme
Climate Science for Society

Major WCRP Programmes
Scientific Contributions
Release dates of Coupled Model Intercomparison Project (CMIP) phases**
The World Climate Research Programme

Joint Scientific Committee (JSC)

- WCRP Modelling Advisory Council (WMAC)
- WCRP Data Advisory Council (WDAC)

Working Groups on:
- Subseasonal to Interdecadal Prediction (WGSP)
- Numerical Experimentation (WGNE)
- Coupled Modelling (WGCM)
- Regional Climate (WGRC)

- CliC
  - Cryosphere-Climate
- CLIVAR
  - Ocean-Atmosphere
- GEWEX
  - Land-Atmosphere
- SPARC
  - Troposphere-Stratosphere
- CORDEX
  - Regional Climate Downscaling

Grand Challenges
WCRP-leading climate science

CMIP is a project of WCRP’s Working Group on Coupled Modeling (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
WCRP addresses key science questions...

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
WCRP addresses key science questions...

Change in Ocean Temperature in North Atlantic
Predicting the warming event in 1990s

→ Initialised decadal predictions for ocean warming show good skill

→ Higher predictability for hurricanes than for rainfall
Comparing the observed sea level to the sum of contributions: ocean thermal expansion, glacier and ice sheet mass balance, land water storage change.
WCRP addresses key science questions...

(Seneviratne et al. 2016, Nature)
WCRP addresses key science questions...

(Credit: Modathir Zaroug, Univ. Cape Town)
Disagreement between reported (bottom-up) and calculated (top-down) CCl₄ emissions since 1999

Multi-disciplinary activity using innovative analysis techniques and new observations

Total lifetime of CCl₄ updated

New emissions estimates (reported + unreported inadvertent industrial emissions) agree within the uncertainty range

**Policy Relevant:** Direct response to stakeholder needs (Parties to the Montreal Protocol)
WCRP addresses key science questions...

von Schuckmann et. al, 2016a: Nature Climate Change 6, 138–144, doi:10.1038/nclimate2876
Evolving Context and Challenges

Research is pulled into a new and broader “operational/service/policy” landscape

- IPCC Assessment Reports
- UNFCCC Paris Agreement and Global Stocktake
- Global Framework for Climate Services
- Sendai Framework for Disaster Risk Reduction
Evolving Context and Challenges

Research is pulled into a new and broader "operational/service/policy" landscape

- A new Strategic Plan, under development for a 10-year time horizon (2019-2029)
- 10-year accompanying Implementation Plan (2019-2029)
**Overarching Objectives**
Focuses on the far horizon - the scientific research required to address current and future challenges and take advantage of opportunities.

**Emphases**
Highlights the bedrock science that must be supported and nurtured as communities form and re-form around evolving scientific foci in support of the Objectives.

**Imperatives**
WCRP tools and capabilities, including those focused on technical capacity and those relating to human capacity driven activities.
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The Next Decade

WCRP Coordinates international climate research to develop, share and apply the climate knowledge that contributes to societal well-being.
The Next Decade

WCRP Coordinates international climate research to develop, share and apply the climate knowledge that contributes to societal well-being.

Science for Understanding
Science for Impact
The Next Decade

- Imbalances in the fluxes of energy, water, carbon and other climate-relevant compounds
- Understanding and pushing limits to predictability of the climate system
- Understanding and predicting sensitivities of climate stresses
- ...

Importance of bedrock science
The World Climate Research Programme

The Next Decade

• seamless approach in time & space
• “Earth System” modelling
• Research-to-operations
• ...

Deliver actionable, accessible, inclusive and authoritative scientific information on the Earth system
Scientific partnerships across science communities are critical:

- Capacity and infrastructure development
- Consistent support for critical work e.g. CMIP

Wider partnerships – social sciences, governments, industry, civil society – are critical for climate science to service society.

- Co-production of knowledge, co-design of solutions
- Connecting global to local scales for adaptation
### Overarching Objectives

<table>
<thead>
<tr>
<th>Fundamental understanding of the climate system</th>
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<tbody>
<tr>
<td>Advance predictive skill on timescales up to a decade</td>
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<tr>
<td>Connecting climate science with policy and services</td>
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</tbody>
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#### Bedrock Science (Emphases)

#### Tools and Capabilities (Imperatives)

#### Partnerships
Emerging issue:

Public-Private Partnership
Global Weather Enterprise

(supported by WMO, WB GFDRR, HMEI, IAMAS...)

WMO OMM
Drivers

Agenda 2030 for Sustainable Development

Paris Agreement

Sendai Framework for Disaster Risk Reduction

Engagement of non-state actors

There is a need for the public and private sectors and civil society organizations, as well as academia and scientific and research institutions, to work more closely together and to create opportunities for collaboration ...”
• ... encompasses all business areas of WMO, including weather, climate and water.

• ... a description of the multitude of systems and entities participating in the production and provision of meteorological, climatological, hydrological, marine and related environmental information and services.
  – Public-sector entities (NMHSs, governmental agencies)
  – Private-sector entities (such as equipment manufacturers, data and service-provider companies, private media companies, etc.)
  – Academia
  – Civil society (community-based entities, NGOs, NMSs, etc.)
  – Users
- Public-sector entities (NMHSs, governmental agencies)
- Private-sector entities (such as equipment manufacturers, data and service-provider companies, private media companies, etc.)
- Academia
- Civil society (community-based entities, NGOs, NMSs, etc.)
- Users
Challenges

- Multiple sources for information and services (competition, markets) - How to know which source is credible
- How to demonstrate the quality of information
- National legal frameworks – large variety from country to country
• ... encompasses all business areas of WMO, including weather, climate and water.
• A description of the multitude of systems and entities participating in the production and provision of meteorological, climatological, hydrological, marine and related environmental information and services.

Opportunities

– Building trust
– Business models, Smart investment
– Making more data, metadata available
– Technology impact (big data, IoT, AI, etc.)
– Education and training
Thank You
WCRP SWOT Summary

STRENGTHS
- Active global science community collaborating toward common goals
- Excellent reputation and legitimacy (long history of global leadership) and strong co-sponsor backing
- Global research products
- Participation of leading scientists – strong scientific expertise

WEAKNESSES
- Overly complex structure
- Lack of clarity of focus/vision and boundaries
- Insufficient funding – complex and competitive
- Ineffective communication, successes not well showcased
- Not well connected to National Research Programmes, funding agencies, services etc. – requires global travel
- Reliance on voluntary efforts

OPPORTUNITIES
- Climate important to societal questions, particularly climate change
- Benefits (funding, in kind) associated with closer collaboration with operational agencies, international programs, etc. (stakeholders)
- Leadership needed to capitalize on new technologies
- Many emerging areas of research

THREATS
- Budget cuts and inefficient funding - leading to demotivation of volunteers/community
- Organizations with overlapping or perceived as overlapping mandates
- Fast-changing and reactive political landscape
- Perception that fundamental climate science is 'done' - reduction in support for fundamental science - perceived as irrelevant

26 September to 12 November 2017, 49 responses
Vision and Mission

- **Vision**
  
  *A world that uses relevant and authoritative climate science to ensure a resilient present and sustainable future for humankind.*

- **Mission**
  
  The World Climate Research Programme (WCRP) coordinates and guides international climate research to develop, share and apply the climate knowledge that contributes to societal well-being.

WCRP addresses aspects of climate science that are too large and too complex to be tackled by a single nation, agency or scientific discipline. Through international science coordination and successful partnerships, WCRP leads the way in understanding the fundamentals of the climate system and in determining its interactions with human activities. WCRP research provides the climate science that underpins the United Nations Framework Convention on Climate Change and contributes to the 2030 Agenda for Sustainable Development and the Sendai Framework for Disaster Risk Reduction.