WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

Research Board

Celeste Saulo, Deon Terblanche, and the Science & Innovation team

WMO OMM
World Meteorological Organization
Organisation météorologique mondiale

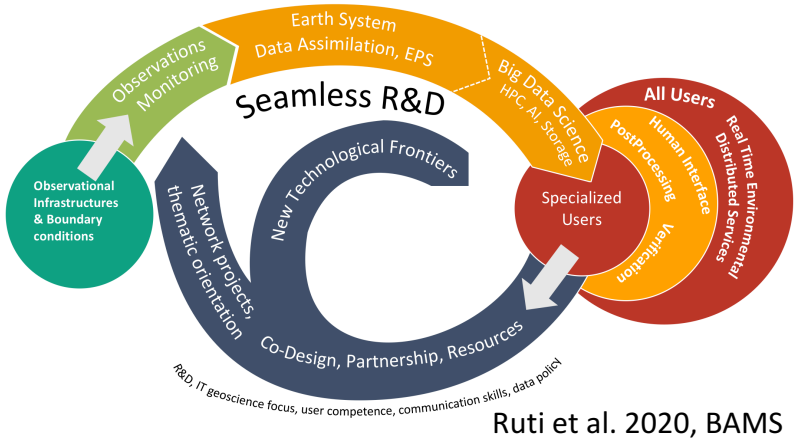
Research Board, Science for Services

- Executive Council Decisions: 2 **Technical Commissions** and the **Research Board**
- RB delivers the Long Term Goal 3 of the WMO Strategy "**Advance Targeted Research**"

  - Advance Scientific Knowledge of the **Earth System** (LTG 3.1)

  - Enhance the **science-for-service** value chain ensuring scientific and technological advances to improve predictive capabilities (LTG 3.2, RR done)

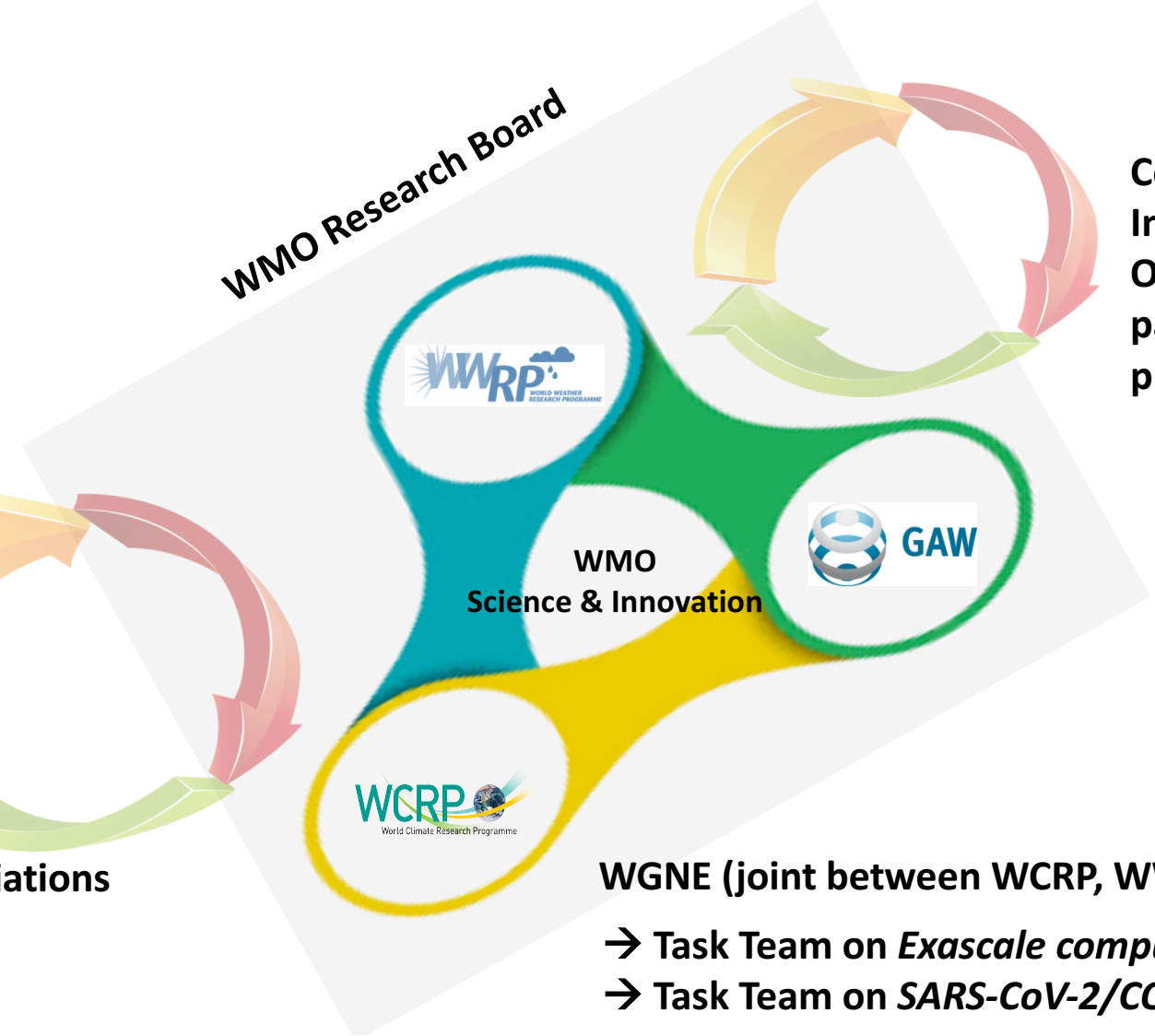
  - Advance **policy-relevant science** (LTG 3.3)



Ruti et al. 2020, BAMS

→ Seamless Earth system modelling across weather, water, atmosphere/environment, ocean, climate; interoperable observation systems of Earth System components

Research Board, catalyzing Science and Innovation



Co-Sponsors, International Science Org., academia, key partners, private sector, etc.

Technical Commissions

Regional Associations

WGNE (joint between WCRP, WWRP and GAW)

→ Task Team on *Exascale computing/AI*

→ Task Team on *SARS-CoV-2/COVID-19*

Research Board Members

- Composed of ~ 30 scientific/technical experts from different fields and experts of its subsidiary bodies, ensuring geographical/gender balance, early career scientists, ensuring engagement from operational and academia

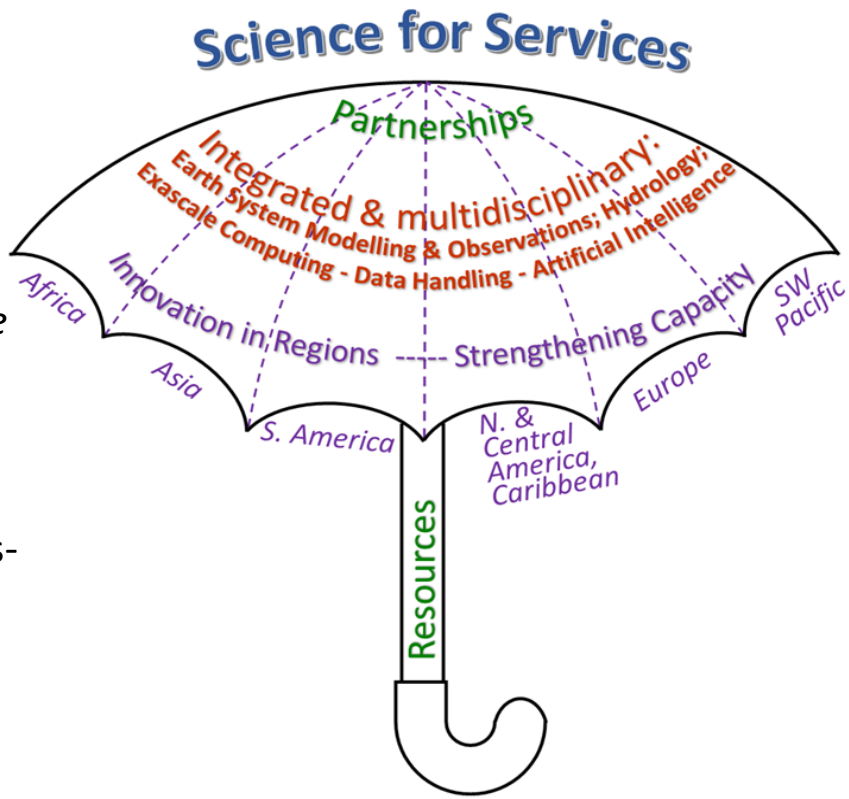
- Celeste Saulo (Chair), Deon Terblanche (Vice-Chair)

- Geographical distribution: Africa (6, including UNEP, one vacant); Asia (3); South America (3, one vacant); North/Central America and Caribb. (8, including GAW, WWRP, WGNE chairs, IOC Repr.); South West Pacific (4); Europe (5, including WCRP chair and ISC Repr.)

- Gender balance: 41% female members

Concept Notes (strong involvement of WCRP)

- *Science for Services* (final stage);
  - *Innovation in Regions* (final stage);
  - *Advancing Earth system observations* (in progress);
  - *Advancing Earth System Modelling* (in progress);
  - *Exascale Computing, Data Handling and Artificial Intelligence* (in progress)
  - *Identification & development of specific steps to implement, research priorities advancing operational hydrology mission of the WMO* (to be started)
- articulate the high-level scientific priorities & key activities to the scientific community and partners, including funding agencies and stakeholders
- enable the research programmes to work more effectively on cross-cutting aspects
- facilitate interactions within WMO
- provide an inclusive framework for partners of WMO including Regional Associations
- To be finalised by end of January 2021
- should initiates future activities and potentially attracts funding agencies



Activities in Task Teams

Task Team on COVID-19, Meteorological, & Air Quality Factors

Aim

To respond to the real-time challenge of **providing decision support relevant knowledge on climate-weather-air pollution drivers and determinants of the SARS-CoV-2/COVID-19 pandemic**, by providing a platform to discuss and share science-based insights, and to form functional partnerships.

Priority and Plans

- Reviewing peer reviewed and pre-print literature
- Open review period and living statement with regular updates

* **Publish First State of the Science Statement early 2021**

- Make recommendations for NMHS and other audiences
- Coordinate with the SERCOM Health Study Group

Chairs

Ben Zaitchik (Johns Hopkins, USA)
Judy Omumbo (African Academy Science, Kenya)

Established for an 18 months period (June 2020-December 2021).

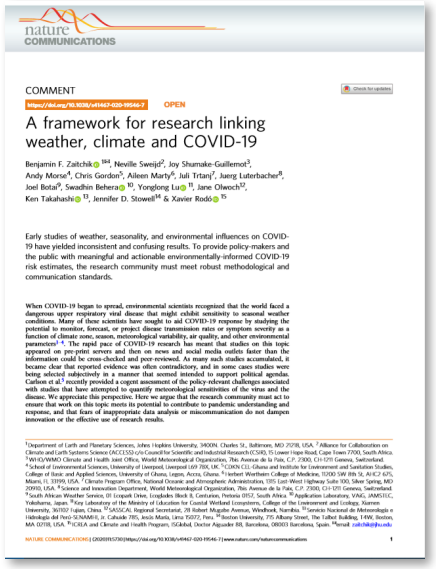
Status

- Active team meets every 2 weeks
- Research Assistant being recruited
- In active drafting phase

Challenge: Massive volume of rapidly evolving literature

Highlights and Achievements of COVID TT

Supported Online Conference with 400 participants
Recommendations paper in *Nature Communications*
Conducted decision needs validation with key stakeholders



nature COMMUNICATIONS

COMMENT

OPEN

A framework for research linking weather, climate and COVID-19

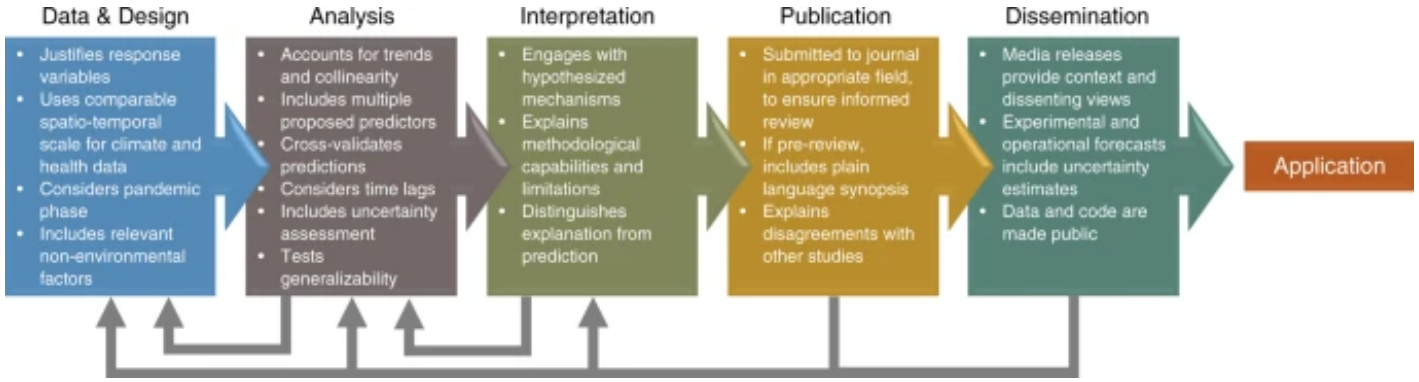
Benjamin F. Zaitchik[1✉], Neville Sweijd[2], Joy Shumake-Guillemot[3], Andy Morse[4], Chris Gordon[5], Aileen Marty[6], Juli Trtanj[7], Juerg Luterbacher[8], Joel Botai[9], Swadhin Behera[10], Yongfong Lu[11], Jane Olwoch[12], Ken Takahashi[13], Jennifer D. Stowell[14] & Xavier Rodó[15]

Early studies of weather, seasonality, and environmental influences on COVID-19 have yielded inconsistent and confusing results. To provide policy-makers and the public with meaningful and actionable environmentally-informed COVID-19 risk estimates, the research community must meet robust methodological and communication standards.

When COVID-19 began to spread, environmental scientists recognized that the world faced a dangerous upper respiratory viral disease that might exhibit sensitivity to seasonal weather conditions. Many of these scientists have sought to aid COVID-19 response by studying the potential to monitor, forecast, or project disease transmission rates or symptom severity as a function of climate zone, season, meteorological variability, air quality, and other environmental parameters[1–4]. The rapid pace of COVID-19 research has meant that studies on this topic appeared on pre-print servers and then on news and social media outlets faster than the information could be cross-checked and peer-reviewed. As many such studies accumulated, it became clear that reported evidence was often contradictory, and in some cases studies were being selected subjectively in a manner that seemed intended to support political agendas. Carlson et al.[5] recently provided a cogent assessment of the policy-relevant challenges associated with studies that have attempted to quantify meteorological sensitivities of the virus and the disease. We appreciate this perspective. Here we argue that the research community must act to ensure that work on this topic meets its potential to contribute to pandemic understanding and response, and that fears of inappropriate data analysis or miscommunication do not dampen innovation or the effective use of research results.

[1] Department of Earth and Planetary Sciences, Johns Hopkins University, 34000 N. Charles St., Baltimore, MD 21218, USA. [2] Alliance for Collaboration on Climate and Earth Systems Science (ACCESS) c/o Council for Scientific and Industrial Research (CSIR), 15 Lower Hope Road, Cape Town 7700, South Africa. [3] WHO/WMO Climate and Health Joint Office, World Meteorological Organization, 7bis Avenue de la Paix, C.P. 2300, CH-1211 Geneva, Switzerland. [4] School of Environmental Sciences, University of Liverpool, Liverpool L69 7ZX, UK. [5] CIDEN CCI, Ghana and Institute for Environment and Sanitation Studies, College of Basic and Applied Sciences, University of Ghana, Legon, Accra, Ghana. [6] Herbert Wertheim College of Medicine, 11200 SW 8th St, AHC2 675, Miami, FL 33199, USA. [7] Climate Program Office, National Oceanic and Atmospheric Administration, 1315 East-West Highway Suite 100, Silver Spring, MD 20910, USA. [8] Science and Innovation Department, World Meteorological Organization, 7bis Avenue de la Paix, C.P. 2300, CH-1211 Geneva, Switzerland. [9] South African Weather Service, 01 Lynpark Drive, Lynpark Block B, Centurion, Pretoria 0157, South Africa. [10] Application Laboratory, VALC, JAMSTEC, Yokohama, Japan. [11] Key Laboratory of the Ministry of Education for Coastal Wetland Ecosystems, College of the Environment and Ecology, Xiamen University, 361102 Fujian, China. [12] SASSCAL Regional Secretariat, 28 Robert Mugabe Avenue, Windhoek, Namibia. [13] Servicio Nacional de Meteorología e Hidrología del Perú-SENAMHI, Jr. Cahuide 785, Jesús María, Lima 15072, Perú. [14] Boston University, 775 Albany Street, The Talbot Building, 114W, Boston, MA 02118, USA. [15] ICREA and Climate and Health Program, ISGlobal, Doctor Aiguader 88, Barcelona, 08003 Barcelona, Spain. ✉email: zaitchik@jhu.edu

NATURE COMMUNICATIONS | (2020)11:5701 | https://doi.org/10.1038/s41467-020-19546-7 | www.nature.com/naturecommunications 1



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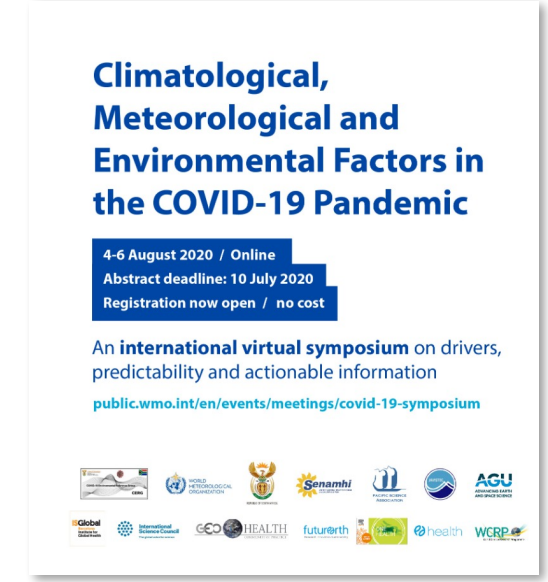

Task Team on Exascale Computing, Data handling and Artificial Intelligence

Background*:*

- Officially effective from mid 2020 following the recommendation by the Research Board (RB) meeting in Apr 2020
- Representatives from including the Research Programmes (WWRP, WCRP, GAW), WGNE, INFCOM, SERCOM, Ocean, National MET Services and academic.

Priorities:

- Coordinate with the Research Programmes, WGNE, SERCOM, INFCOM and partners to identify priorities and key activities on Exascale and AI for weather, climate, water and the environment, considering the ongoing and planned relevant activities
- Develop a proposal to the Research Board (RB) for concrete next steps including mechanisms for coordinating with the Research Programmes, INFCOM, SERCOM
- Support the Drafting Team to finalize the Exascale & AI Concept Note that serves as a guideline for the RB to plan its future activities on this topic

Highlights:

- Coordinate and interact within WMO and with partners
- Engage with the Public Private Engagement (PPE) and private sector
- Coordinate with other concept notes especially the Science for Services and Innovations in Regions to ensure the proper links

Task Team on Exascale Computing, Data handling and Artificial Intelligence

Achievements:

- Coordinated inputs for an overview of existing initiatives/projects on this topic from the research community and within some WMO programs (draft)
- Identified critical gaps and challenges and the ways to address them through Task Team group discussions and individual interactions (draft)
- Identified priority activities and developed a draft proposal for next steps to implement these priorities (draft)

Plans:

- Conduct consultations with the three Research Programmes, SERCOM, INFCOM, private sector, etc., for comments/inputs on the Concept Note
- Ensure the links of the Concept Note with other concept notes especially the Science for Services and Innovations in Regions
- Work with the Drafting Team to finalize the Concept Note by Jan 2021

Key events and activities to be advanced by the RB 2021/2022, some examples

Research Board meeting 28/29 January 2021 (online)

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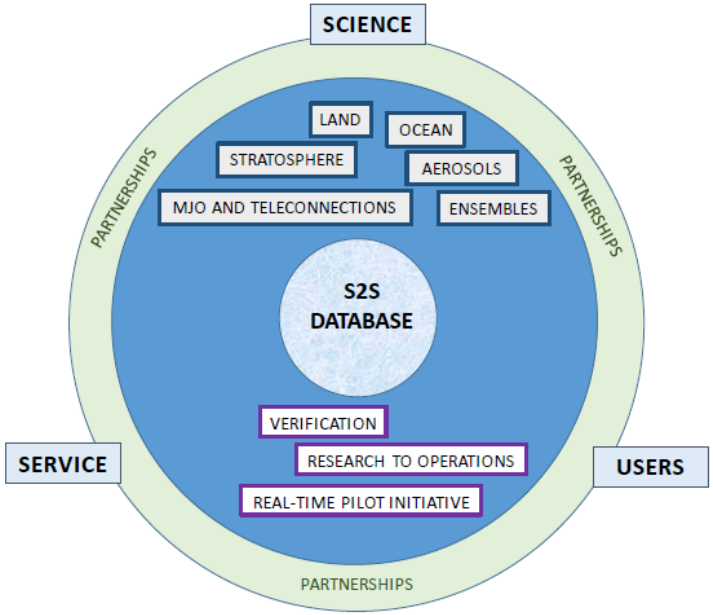
WWRP and WCRP –
Sub-seasonal to Seasonal *and beyond*

***Aim**: Identify sophisticated methods (AI/Machine learning, etc.) to produce and evaluate application-orientated forecasts in support of NMHSs to pull-through S2S research into operations and to explore synergies on longer timescale*

Challenges/Opportunities:

- Open competition to explore new services based on AI and applied to the WWRP/WCRP S2S project data
- The winning entry will push the frontiers of weather and climate science within the WMO framework
- Supports the UN Sustainable Development Goals
- Exploring how this should be done in the future across all timescale (e.g. Digital Earths)
- Close collaboration with the Task Team on Exascale computing/AI under the Research Board



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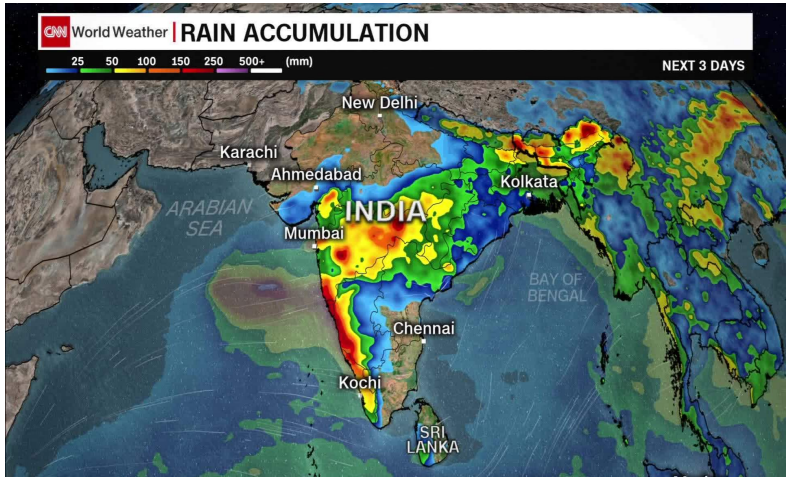
WWRP and WCRP – Monsoon Office in India

***Aim**: Establishing a joint WWRP and WCRP Office at the Indian Institute of Tropical Meteorology (IITM) to significantly enhance international monsoon research over different timescales*

Challenges/Opportunities:

- IITM as focal point for monsoon activities brings other monsoon work together (globally)
- IITM has strong international linkages, state-of-the art infrastructural facilities, long experience in hosting events and programmes
- Improving the monsoon forecast skill through a collective effort
- Logistical help for training, meetings, education



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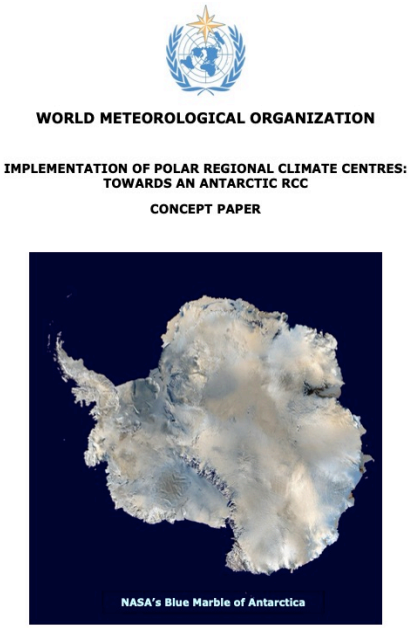
WCRP – SERCOM/INFCOM

Enhancing services to WMO members via new WCRP activities

Aim: *Links WCRP more effectively to WMO LTGs with regard to regional requirements & the science to services value chain*

Challenges/Opportunities:

- Build on WMO Decadal Outlook to enhance WMO State of the Climate & WMO Decadal Outlook via Earth System Change
- Enhance WMO regional climate services via My Climate Risk building on e.g. cooperation with WMO RCCs
- Push boundaries of development of Earth System Models and AI across programmes via Digital Earths
- Enhance WMO input to UNFCCC processes including SDGs via Safe Landing Climates
- Provide capacity building to WMO Members and Early Career Scientists in climate science



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Merci -Thank you

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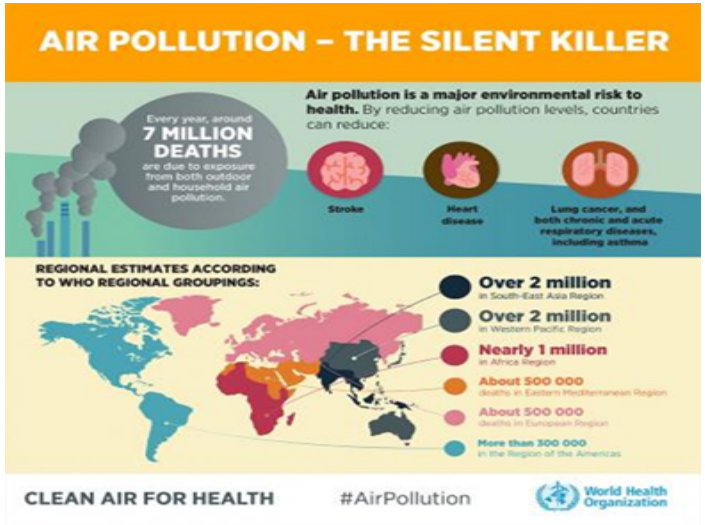
Collaboration across WMO Departments/Technical Commissions/ Regional Associations, current and future plans

Cooperation with Study Group on Integrated Health Services

***Aim**: Support the implementation of Resolution 33 (Cg-18) - Advancing Integrated Health Services, vis-à-vis the WHO-WMO Health Environment and Climate Science to Services Master Plan*

Challenges/Opportunities:

- Identify and map air pollution and its sources and health impacts to enable impactful actions
- Provide guidance for exposure of outdoor workers to health risks (air quality, solar radiation, extreme heath
- Identify regional and national strategies to integrate Clim Change & increased UV radiation
- Study group closely collaborates with the Task Team on COVID under the Research Board



Cooperation with Study Group on Integrated Urban Services

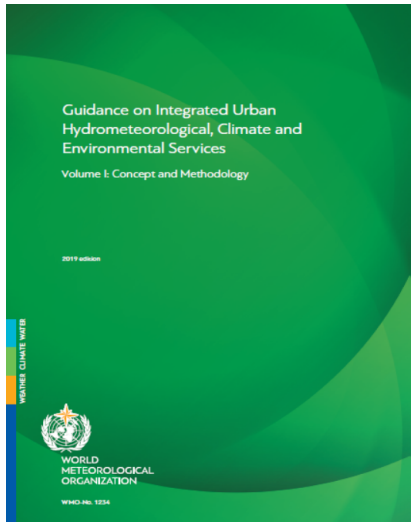
***Aim**: Implement the WMO Strategic Plan under the guidance of SERCOM in close collaboration with the RB and INFCOM (supported by GURME)*

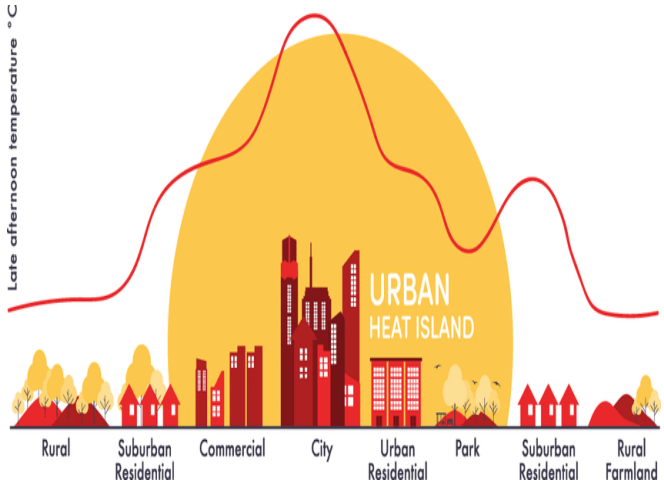
Priority activities of the Study Group:

- Analytical report on stakeholder mapping and roadmap on stakeholder engagement
- Implementation plan for working arrangements, impact-based forecasting and warning systems
- Good practices document related to high-resolution forecasting, predictions & warning systems

Urban Heat Island Guidance Task Team:

- Guidance for Urban Heat Island is under development supported by GAW & WWRP experts





SDS-WAS: Sand and Dust Storm - Warning Advisory and Assessment System

***Aim**: SDS-WAS enhances the ability of countries to deliver sand and dust storm forecasts, observations, information and knowledge through an international partnership of research and operational communities (research to operation)*

Opportunities:

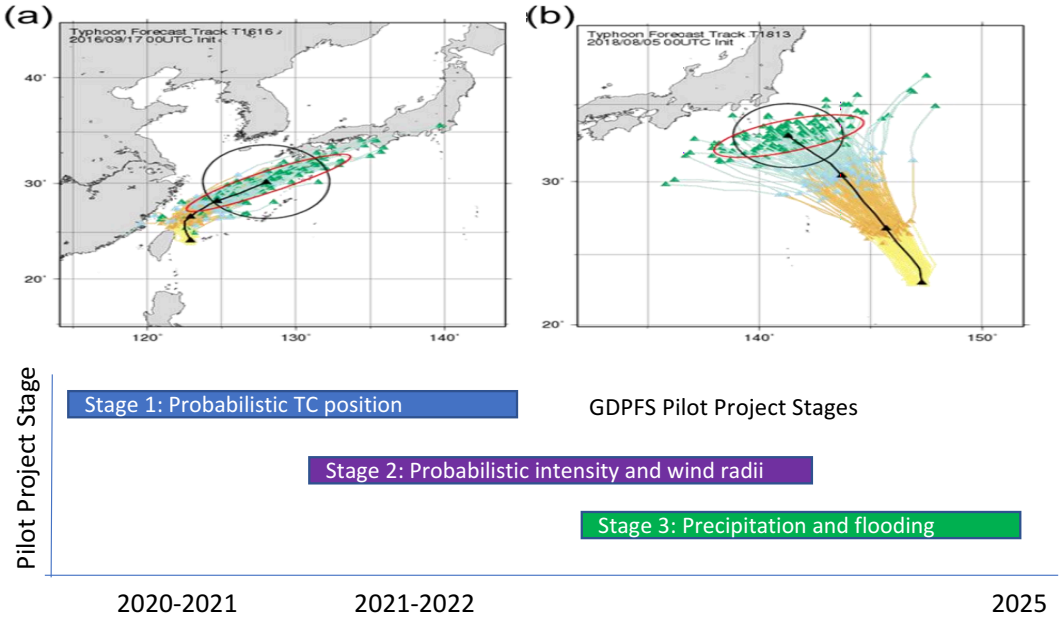
- WMO is the first UN Agency building SDS-WAS and leading Forecasting and Early Warning in the UN SDS Coalition
- Lack of dust observation: promote a protocol for exchanging and arrange access to dust data internationally
- Focus on impact based forecast health, agriculture, aviation, land transport, energy, industry, urban sector
- The "last mile“ to better reach end-users: closer collaboration with TCs and RAs

GDPFS Pilot Project on Tropical Cyclones dynamic product

Aim: *Elucidate and coordinate best practices for a co-design approach on tropical cyclone products and services to communicate risk, its certainty and incorporate different hazards*

Challenges/Opportunities:

- Tropical cyclones affect urban coastal regions of developing and developed countries
- Better coordination across RSMCs to adopt best practices of a value-cycle approach to probabilistic tropical cyclone impacts forecasts and new services
- Forecasts of impacts from storm surge, fresh-water flooding, and extreme wind are uncertain to which stakeholders are sensitive



Concept Note: Science for Services (final stage)

- **Lead authors**: J. Ungaro and D. Terblanche with contributions from Research Programmes, WGNE, INFCOM, SERCOM, academia and others
- **Highlights** a number of critical elements that require focused research attention in the short to medium term to meet the global needs
  - The Value Cycle (network) Approach
  - Interaction with Users
  - Generation of Information and New Knowledge
  - Priorities for Engagement
- **Builds** upon the WMO Scientific Programmes (sponsored and co-sponsored), seeking for optimizing dedicated resources and efforts
- **Ensures** that science and technology better link & engage society in order to bring users, stakeholders, research and development together in a value added, inclusive network

Concept Note: Innovation in the Regions (final stage)

- **Lead authors**: A. Laing with contributions from Research Programmes, regional associations, INFCOM, SERCOM, academia and others

- **Key points addressed**:
  - Activities and Critical Gaps of research in regions
  - Engaging with a larger community in the WMO regions
  - Developing and sustaining effective partnerships to foster innovation
  - Examples of Research Partnerships and Programmes
  - Recommendations for initiating or improving Research Partnerships
  - Generation of Information and Knowledge for Research to Services
  - Mechanisms for funding research
  - Proposed Pilot Mechanisms for Enhanced Innovation
  - Key Research Priorities in Regions
  - Recommendations to improve innovative R&D in Developing Countries

Concept Note: Advancing Earth system observations (in progress)

- **Lead authors**: M. N. Rajeevan, C. McLean, A. Busalacchi, V. Lehmann, et al
- **Key context**: WIGOS (Global Observing System, Global Atmosphere Watch, Global Cryosphere Watch, WMO Hydrology Observing System)

- **Review of challenges and opportunities**:
  - Atmosphere and land
  - Ocean (link to IOC, ISC)
  - Cryosphere
  - Earth Observations (link to Coordination Group for Meteorological Satellites and Committee on Earth Observation Satellites)
  - Coupled data assimilation
  - Observations impacts
  - Observing systems: leveraging emerging technologies

- **Actions**
  - Near-term: COVID-19 impact, ensure resilience and fill urgent gaps
  - Medium-term: innovation towards scalability, autonomy, low maintenance, taking full advantage of Internet of Things, 5G, Artificial Intelligence and Machine Learning (AI/ML)

- **Next steps**
  - Comments/inputs from the Research Programmes, SERCOM, INFCOM, academia
  - Finalize and present the Concept Note to the RB meeting in Jan 2021

Concept Note on Exascale Computing, Data Handling and Artificial Intelligence (in progress)

Leading authors and contributors:

- C. Muroi, V. Bouchet, P. Bauer, K. Williams, with major contributors from the Research Programmes, WGNE, INFCOM, SERCOM, Ocean, National MET agencies and academic

Goals:

- Identify scientific priorities and activities on Exascale and AI for weather, climate, water and the environment and make recommendations to the Research Board
- Serve as a guideline for the RB to plan its follow up activities and facilitate collaboration and interactions within WMO and with partners

Key points addressed:

- Developed an overview of existing major activities on this topic in the research community and within some parts of WMO research programs (draft)
- Identified critical gaps and potential ways to address them and its linkages to other concept notes especially the Science for Services and Innovation in Regions (draft)
- Identified priorities activities and developed some recommendations for the RB (draft)
- Identified concrete next steps to implement the identified priorities (draft)

Next steps:

- Comments/inputs from the Research Programmes, SERCOM, INFCOM, academia, private sector
- Finalize and present the Concept Note to the RB meeting in Jan 2021