World Meteorological Organization

Working together in weather, climate and water

Status Report on WWRP including THORPEX

CAS/WCRP WGNE

November 2012

Long-term objectives of the WWRP

- To improve public safety and economic productivity by accelerating research on the prediction of high-impact weather;

- To demonstrate improvements in the prediction of weather, with emphasis on high-impact events through the exploitation of advances in scientific understanding, observational network design, data assimilation and modelling techniques and information systems;

- To improve understanding of atmospheric processes of importance to weather forecasting through the organization of focused research programmes (e.g., WWRP Strategic Plan, RDPs);

- To encourage the utilization of relevant advances in weather prediction systems to the benefit of all WMO Programmes and all Members (e.g., FDPs)

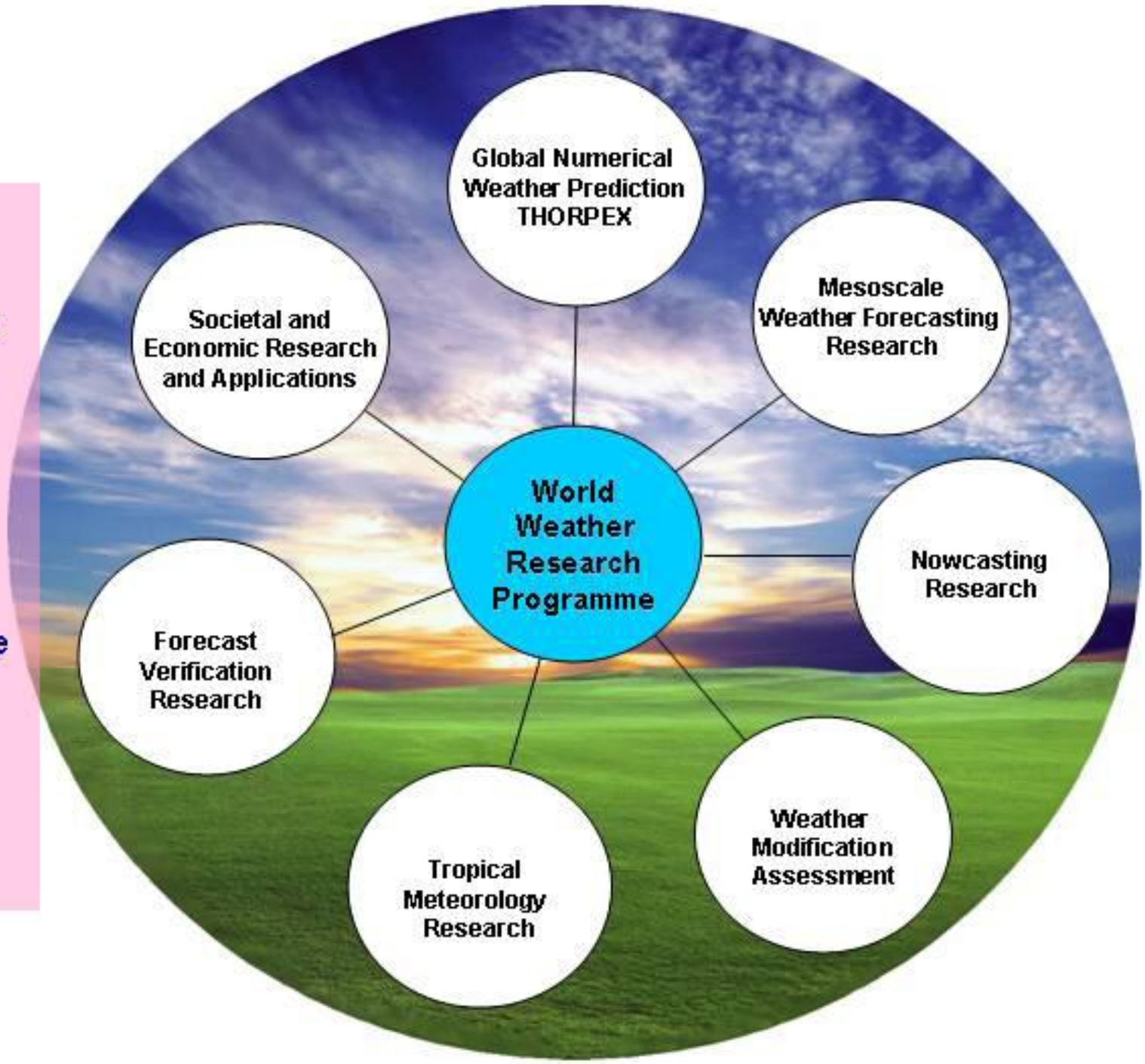
- To maintain a strong focus on training opportunities for young scientists, in particular from developing countries, so that as many countries as possible will be able to contribute to and benefit from the research advances.

Structure of the World Weather Research Programme (WWRP)

WWRP
WORLD WEATHER RESEARCH PROGRAMME

Major Partners

- Joint Working Group on Numerical Experimentation (WGNE)
- World Climate Research Programme (WCRP)
- WMO Weather and Disaster Risk Reduction Services
- Global Atmosphere Watch (GAW)
- WMO Integrated Global Observing System (WIGOS) and Information System (WIS)
- The International Council for Science (ICSU): Integrated Research on Disaster Risk (IRDR)
- Hydrological Research Community
- Ocean Observations and Modelling Research Community



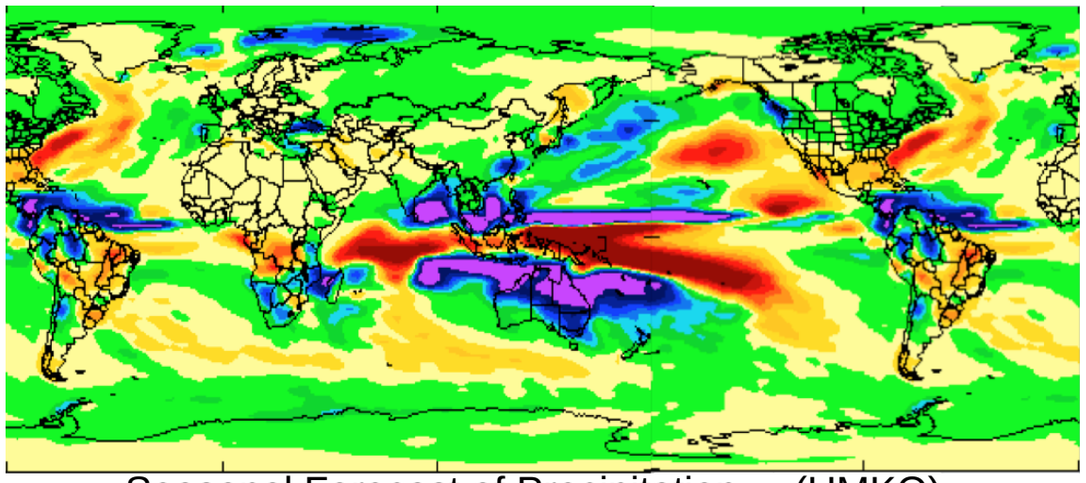
WWRP including THORPEX

WWRP and the legacy of THORPEX to ensure relevance in changing world in which weather-related disasters remain a significant threat

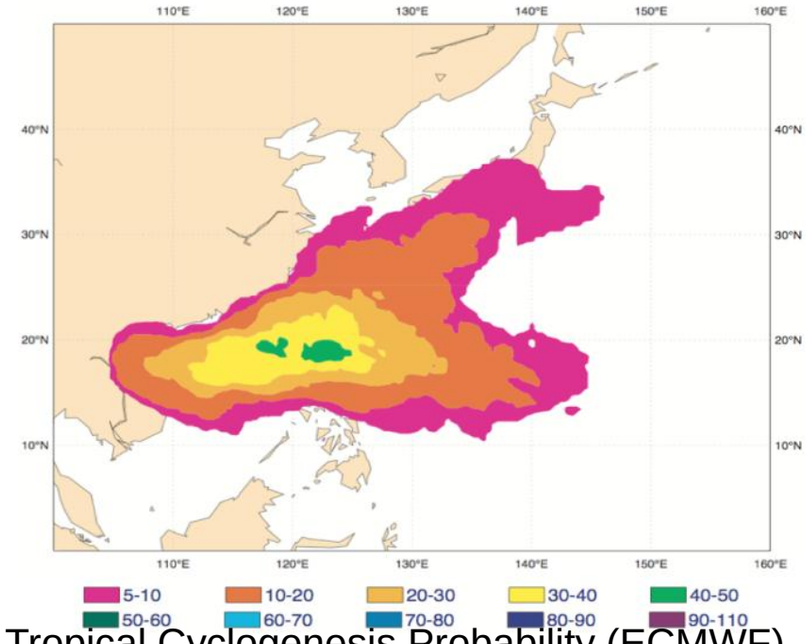
- **WWRP**
  - Four New FDPs/RDPs, endorsed in the WWRP JSC in April 2012
  - WWRP Open Science Conference - 15-21 Aug 2014, Montreal, Canada
  - Summer School for Earth System Prediction - Summer 2013 or 2014 in US
  - Ongoing capacity development in cooperation with ETR
- **THORPEX**
  - THORPEX review completed, publication end 2012 – lesson learnt
  - Ongoing discussion on Legacy of THORPEX
  - Special emphasis in supporting effective contribution by THORPEX-Africa
- **Cooperation with WCRP in support of GFCS**
  - Implementation Plan for sub-seasonal to seasonal prediction
  - Implementation Plan for polar prediction research
  - Geo-engineering
  - Grey Zone (with GASS)
  - YOTC/MJO TF

WWRP and WCRP Cooperation

- Proposed WWRP/THORPEX and WCRP joint research Projects:
  - **Sub-seasonal to Seasonal Prediction**
    - A new research frontier aimed at addressing specific user needs on a time scale of particular socio-economic importance
    - Benefits of bringing the weather and climate research communities together
    - Discussion requested for Draft Resolution 4.5/2 (EC-64)
    - More info in the flyer



Seasonal Forecast of Precipitation (UMKO)



Tropical Cyclogenesis Probability (ECMWF)

WWRP and WCRP Cooperation

- Proposed WWRP/THORPEX Project with strong link with WCRP:
  - **Polar Prediction**
- Emerging user needs in areas of rapid change
- Benefits to predictions beyond the polar regions
- Discussion requested for the Draft Resolution 4.5/2 (EC-64)
- More info in the flyer

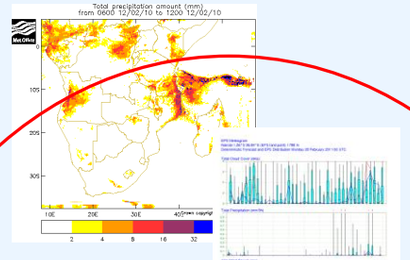
SWFDP links and synergies

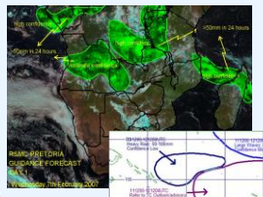
Flash Flood Guidance

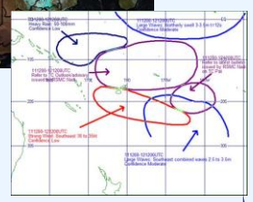
HWR

AgM, MMO, AeM, etc.

Tailored Forecasting Products for Specialized Applications







Global Centres

Global NWP/EPS and Sat-based products

RSMCs-TC

TC

Regional Centre

Guidance Products (risk/probability)

National Met Centres

(Forecast D / D+5; Bulletins)

GDPFS

PWS

Specific Comm. Systems

SMS; Weather Radio Systems; Public Web; etc.

E-mail; etc.

Media

Radio; TV

General Public and spec. users (Agriculture, Fisheries, Marine Safety, Aviation, etc.)

Specific Communication Systems

Disaster Management and Civil Protection

WWRP

WMO SP

Research Projects

Satellite Imagery and Tools

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THORPEX Legacy and Options for a Follow on Programme

CAS/WCRP WGNE

November 2012

THORPEX
A World Weather Research Programme

- **Eight Core Research Objectives**
  - Increase knowledge of global-to-regional influences on the initiation, evolution and predictability of high-impact weather.
  - Contribute to the design and demonstration of interactive forecasting systems
  - Contribute to the development of advanced data assimilation and ensemble prediction systems.
  - Develop and apply new methods that enhance the utility and value of weather forecasts to society, economies and environment stewardship.
  - Carry out THORPEX Observing-System Tests and THORPEX Regional field Campaigns.
  - Demonstrate all aspects of THORPEX interactive forecasting systems, over the globe for a season to one year, to assess the utility of improved weather forecasts and user products.
  - Coordinate THORPEX research with the World Climate Research Programme Coordinated Observation and Prediction of the Earth System (WCRP/COPES) and the mesoscale/microscale community to address the observational and modeling requirements for the prediction of weather and climate for two weeks and beyond.
  - Facilitate the transfer of the results of THORPEX weather prediction research and its operational applications to developing countries through the WMO

THORPEX
A World Weather Research Programme

- **Three Research Priorities**
  - Global-to-regional influences on the evolution and predictability of weather systems (by **Predictability and Dynamic Processes WG**)
  - Global observing-system design and demonstration, Targeting and assimilation of observations (by **Data Assimilation and Observing System WG**)
  - Developing and testing global multi-model ensemble prediction systems and developing prototype multi-model ensemble products (by **GIFS-TIGGE WG**)
- **Governance and Structure**
  - The Programme is overseen by an International Core Steering Committee (ICSC) and receives scientific guidance and direction from the WWRP Joint Scientific Committee (JSC)
  - The Programme is supported by a Trust Fund to which nations are invited to contribute
  - International Programme Office - focal point for the day to day operation
  - Three WGs
  - Societal and Economic Research Application WG is now under the WWRP
  - Five Regional Committees
    - established for Asia, Africa, Europe, North America, and Southern Hemisphere

THORPEX
A World Weather Research Programme

- **Major Achievements(Cont.)**
  - The THORPEX **International Polar Year (IPY) cluster of projects** have made a major contribution to observing and NWP in Polar Regions.
    - The cluster of 10 projects were very successful and have demonstrated that improvements in NWP for Polar Regions are possible and significantly increased our understanding on how to improve models and the use of data in the Arctic, as well as providing a much deeper understanding of the physical processes involved
  - **AMMA** in the area of prediction of hazardous weather.
    - The two most fruitful examples of the collaboration were THORPEX support for additional radiosondes for AMMA and the evaluation of AMMA observational data through Observing System Experiments and co-operative efforts between AMMA and the THORPEX African Regional Committee, in particular for the development of the Forecasters Handbook for High Impact Weather
  - **The Year of Tropical Convection (YOTC) programme** has been initiated in conjunction with the WCRP and a Project Office established.
    - The YOTC Science Plan has been completed, and the YOTC Implementation Plan is a living web document (www.ucar.edu/yotc). It includes links to data, science items, documents, meeting reports, and general information. In addition a YOTC Task Force to focus on understanding and modelling the MJO has been set up.
  - **Comprehensive Reports** on the effectiveness of **data-targeting** (adaptive observations) in NWP have been completed.
    - The impact of observations on short range forecasts is found to be very similar across major NWP centres. The largest impacts are now from AMSU-A, satellite winds etc., although the global radiosonde network and data from aircraft remain very important.

THORPEX
A World Weather Research Programme

- **Major Achievements(Cont.)**
  - **Data Assimilation research** has made major contributions to the development of the observing system through the use of operational data and THORPEX field experiments.
    - New data assimilation systems including 4D-VAR with different options of inferring the background errors and the new EnKF systems are being contrasted and compared.AMMA in the area of prediction of hazardous weather.
  - **Predictability and Dynamical Processes** studies
    - have contributed to the preparation and evaluation of international field experiments, raised the awareness in the PDP community of the research objectives of THORPEX and the availability of THORPEX data sets (notably TIGGE, T-PARC, YOTC), supported the development of research projects dedicated to THORPEX PDP research, established a linkage to WGNE on the issue of model uncertainties and promoted THORPEX through the organisation of summer schools.
  - **Three major International Symposia on THORPEX** science, workshops and summer schools
    - have been organised at which numerous papers related to THORPEX topics were presented along with comprehensive poster sessions.
  - **Three GEO tasks** (in climate, ensemble-prediction and high impact weather in Africa) as now the main elements of the GEO weather prediction activity

THORPEX
A World Weather Research Programme

- **New Initiatives**
  - ***Polar Prediction Research Project***
    - to improve understanding of the impact of polar processes on polar weather, the assimilation of data in Polar Regions, and the prediction of high impact weather over Polar Regions.
    - The new project will provide a framework for cooperative international research and development efforts to improve high impact weather, climate, and environmental prediction capabilities for the Polar Regions. The implementation plan is well advanced and EC-64 (June 2012) approved the initiative, including setting up a project office and establishing a trust fund for its support.
  - ***Sub-seasonal to seasonal prediction project***
    - The main goal of the WWRP/THORPEX-WCRP joint research project is to improve forecast skill and understanding on the subseasonal to seasonal timescale, and promote its uptake by operational centres and exploitation by the applications community. Specific attention will be paid to the risk of extreme weather, including tropical cyclones, droughts, floods, heat waves and the waxing and waning of monsoon precipitation.
    - The new project will provide a framework for cooperative international research and development efforts between WWRP, THORPEX and WCRP to improve the accuracy, spatial and temporal information and applications of prediction in the sub-seasonal to seasonal time range in close cooperation with centres that provide such services operationally.

3 (+1) Options for Post THORPEX

- Option A
  - Ends in 2014
- Option B
  - Continues with minor adjustments
- Option C
  - Establish a new Programme with embedded Projects
- Option D
  - All Projects under WWRP without a new separate Programme

Comments received

- 18 comments received
  - 4 JSC members
  - 1 ICSC member
  - 4 THORPEX WGs and WG member
  - 2 RCs
  - 5 Op Centers, including US THORPEX EC
  - 2 Int. Programmes

Some Issues Discussed at ICSC

- Need a New WCRP/WWRP Programme as a time-limited project?
  - Environmental Prediction Initiative
  - Predicting Weather and Climate Extremes
  - What time ranges do we cover in the Programme?
- Need a HIW project in addition to PPP, S2S?
  - High-impact Weather Prediction Project?
- Agree with the concept of “standing WG and time-limited project” in WWRP?
- Agree to establish two new standing WGs, supported by the WWRP regular budget?
  - DAOS
  - Predictability and Ensembles
- Agree to replace the RCs with regional initiatives/projects?

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WMO

The Evolution of the WWRP Structure: Addressing Changing Research Needs

- CAS/WCRP WGNE
- November 2012

Background (1)

Any Structural changes to WWRP should:

- Ensure more effective global coordination of weather research,
- Facilitate pushing the boundaries of predictive skill,
- Building links with other research programmes and bodies,
- Make better use of the limited resources available,
- Be better aligned to user needs,
- Ensure a smooth transition post-THORPEX,
- Better distinguish between Working Groups / Expert Teams and Projects and their support mechanisms.

Background (2)

Process that will inform structural changes to WWRP:

- Recommendations of 2012 THORPEX ICSC-10 on the post-THORPEX arrangements,
- CAS MG meetings in Sep 2012 (teleconf) and first half of 2013
- The (joint) ICSC-11 and WWRP JSC-6 meetings in mid 2013,
- CAS-16 in Nov 2013,
- Manageable and step-wise changes:
- New WGs / ETs building on strengths of THORPEX
- Nowcasting and Mesoscale Research – joint working group

Minute, Hour, Day, Week,Month, sub-seasonal, season, interannua…climate

WWRP

GAW

WCRP

Working Group/Expert Team Data Assimilation and Observation Systems

Working Group/Expert Team Numerical Experimentation

Working Group/Expert Team Predictabilit and Ensemble Prediction

Working Group/Expert Team Verification

Working Group/Expert Team SERA

WG Nowcasting and Mesoscale Meteorology

WG Tropical Meteorological Research

RDPs

FDPs

Polar Prediction Project

Subseasonal to seasonal Project

High Impact Weather Project

THORPEX Legacy Projects under WWRP

Thanks