Updating implementation plan for WWRP

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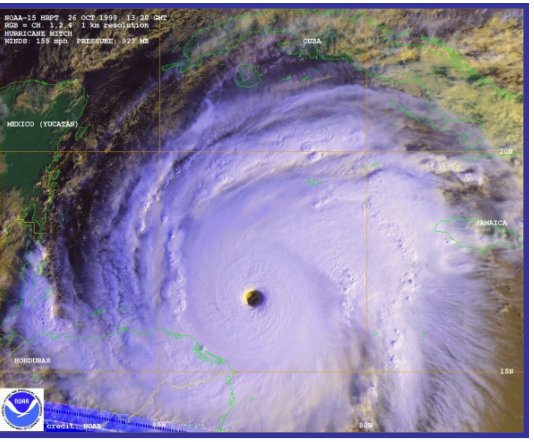
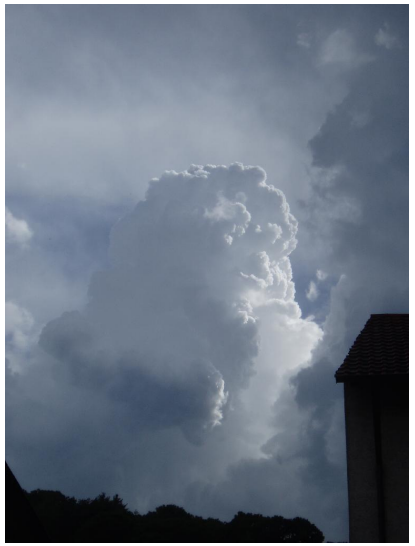
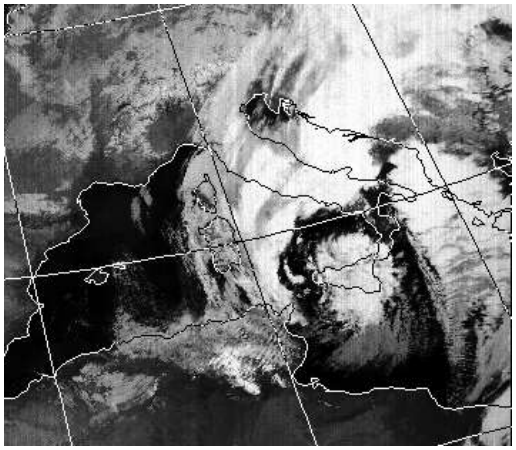
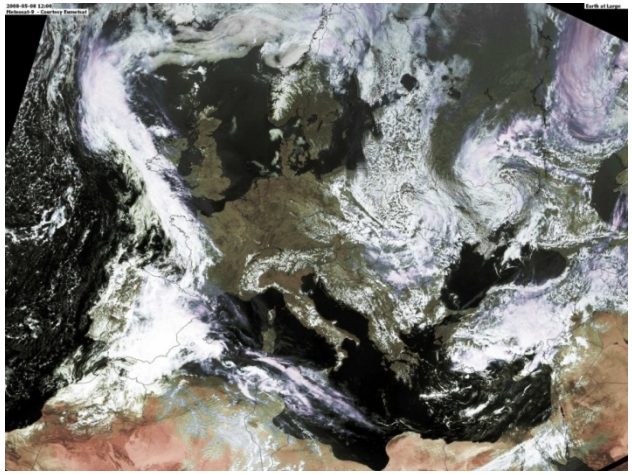
WWRP/SSC Chair
and
Sarah Jones
next WWRP/SSC Chair

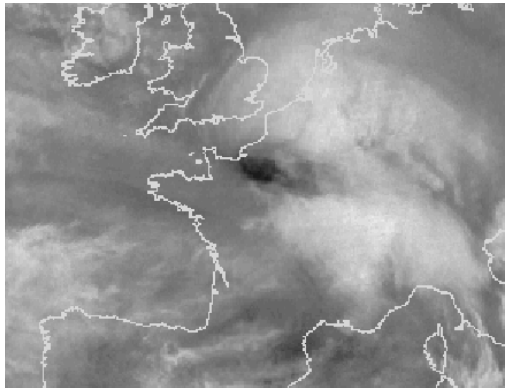
WCRP JSC, 2014





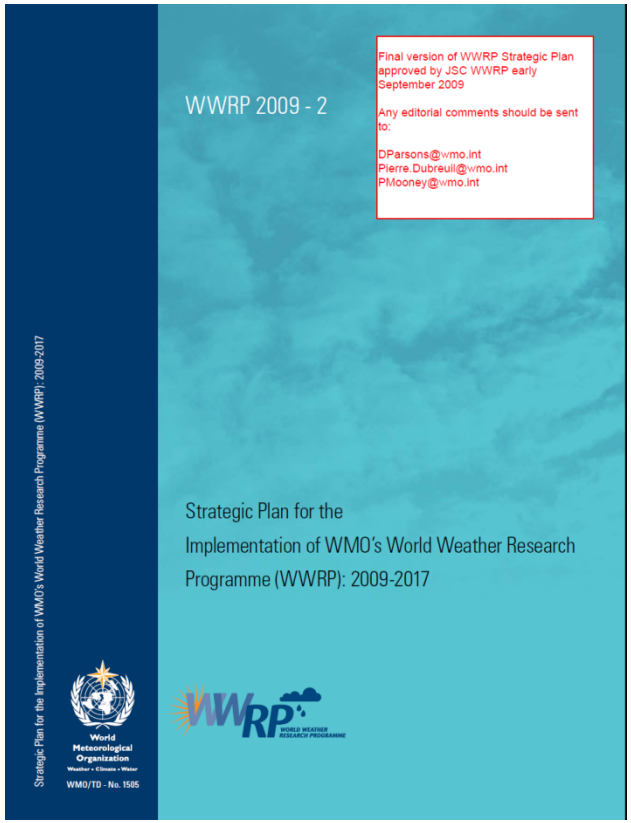






WWRP Strategic Plan

- The first Strategic Plan for the Implementation of WMO's World Weather Research Programme (WWRP): 2009 – 2017 (WMO/TD-No. 1505).
- The WWRP strategic plan integrates WMO Member activities in THORPEX, tropical meteorology, mesoscale weather forecasting, nowcasting, verification and societal and economic applications.
- The plan maintains and reinforces the traditional strong links with GAW, the World Climate Research Programme (WCRP) and other WMO activities.



NB: GARP and Charney`s dream: weather impacts and climate

WWRP Strategic Plan

The WWRP has already produced very tangible research results, many of which have been successfully transferred to operations. …….. …… Nevertheless, an unacceptably large number of people are still killed, injured, suffer from disease, or are displaced as a direct or indirect result of weather-related events, especially in developing nations.




WWRP Strategic Plan

Challenges:

- Be international focal point for weather research, especially for high impact weather
- Bring together research and operational communities
- Enhance research collaboration in environmental prediction: EPAC, Chy, WCRP
- Maintain and enhance focus on prority operational needs and operational demonstration and implementation of research advances
- Maintain strong focus on training for young scientists, in particular from developing countries

WWRP Strategic Plan

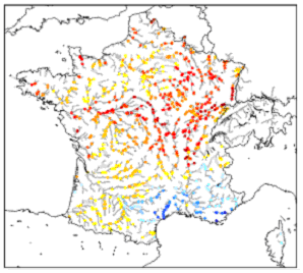
WWRP will promote, initiate, coordinate, manage:

- Field campaigns, long-term research projects & programmes
- Establishment of international data sets
- End-to-end research demonstration projects (RDP)

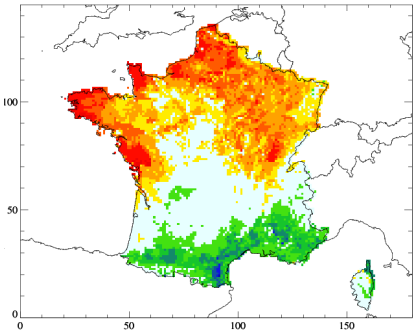
  Advance understanding – improve forecast techniques – increase utility of forecast info.
- Forecast demonstration projects (FDPs) to evaluate research techniques, tools and concepts in operational setting

Water: modelling and predicting the water cycle for improved DRR and resource management

• Growing improvements in the quality of coupled weather hydrological prediction systems;
• CAUTION: none can claim to be in operation and to close the water cycle budget with sufficient accuracy for reliable automation, but next five years are promising;
• Seamless: developing the climate tool of the future
• Increasing requirement for the employment (e.g. population growth) of nowcast to sub-seasonal to seasonal predictions for a wide range of hydrological applications which include:



(River Flow)



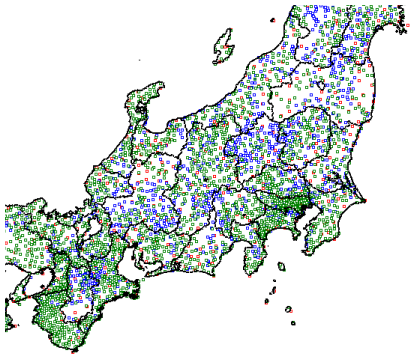
SWI
(Soil Wetness Index)

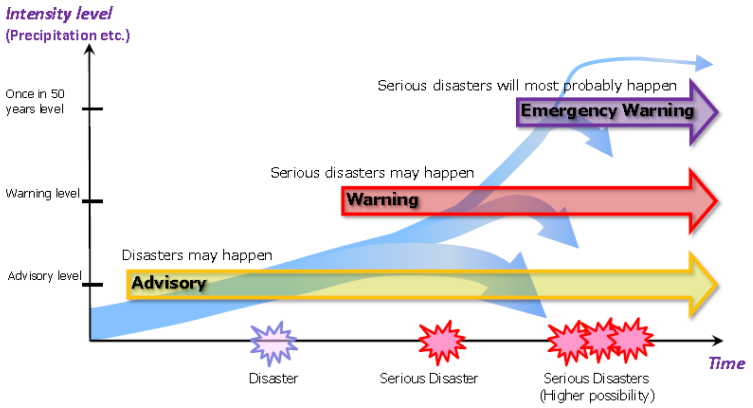
- **River-flow** for flood prediction and hydroelectric power generation;
- **Warnings** of the likelihood of severe hydrological impact weather (droughts, flooding, etc.) to help protect life and property;
- **Water management (**e.g. agriculture)
- **Hydrological climate information** at the regional (e.g. reservoir) level for long term planning and regulatory framework;
- **Urban flood**, including flooding from the sea, rivers and directly from rainfall, with particular emphasis on flood impacts in the growing megacities.

Water: nowcasting to sub-seasonal to seasonal forecasts and climate applications

Comments and Questions:

- How to communicate the information in a seamless manner (e.g. warnings from two weeks to a few hours)?
- How hydrological forecast information, including uncertainty, connects with decision-making?
- A closer relationship between the users and providers of forecast information is needed.
- There is also a great need for much easier access to forecast and climate information by the user community, especially for countries with no NWP and climate modelling technology (including HPC).
- What are the emerging observation opportunities?
- How to improve synergies between the international Hydrology and Weather communities, including inside WMO?

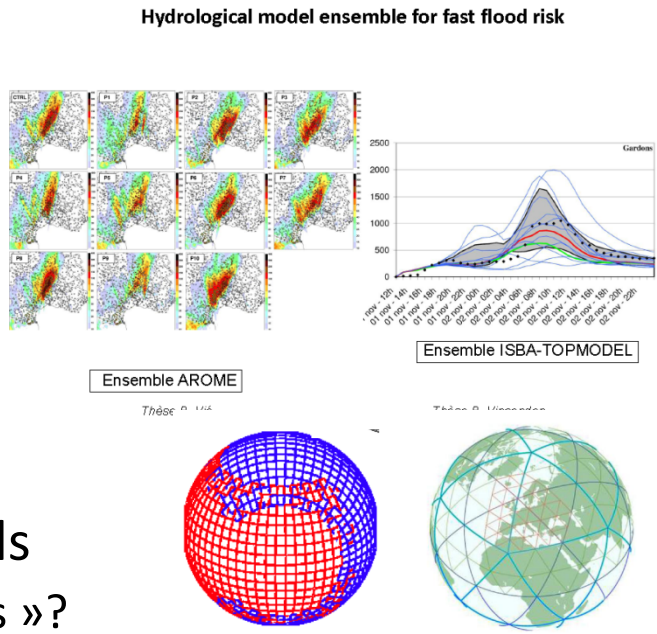




Current challenges for WWRP and WGNE

- Improve the accuracy of short-range high resolution forecasts for security of people and properties, health, transport, defense and the energy market;
- Extend probabilistic verification; use new sources of data; evaluate responses to forecasts & warnings and their value in user decision making
- Develop climate services, i.e. improve seasonal prediction and assess decadal prediction including developing the capability to produce realistic high resolution representations of the impacts.

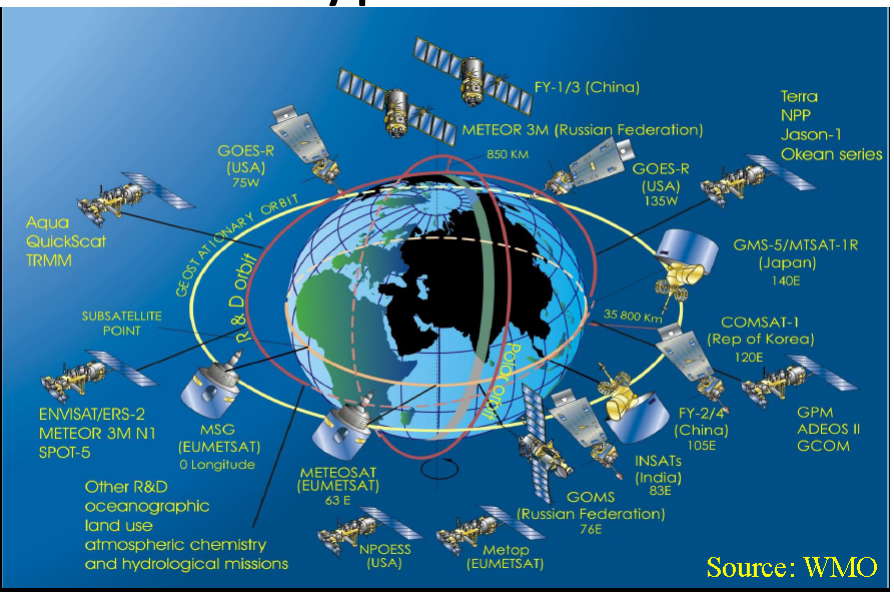
Trends for NWP systems

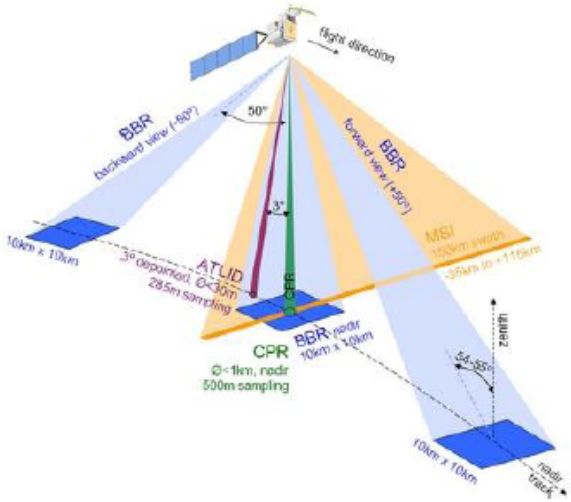


- Integrated NWP systems (for efficiency)
- Seamless forecasts: from minutes to months and beyond to climate
- Continued trend in increased resolution
- Generalization of ensembles to impact models
  - Towards the end of the « deterministic forecasts »?
- Revisiting the basic equations for non-hydrostatic dynamics
- More scalable dynamical cores, optimizing the data flux between processor
- Towards unstructured grids to better represent steep orography (like in ocean models)
- Toward coupled NWP with ocean, sea-ice, waves, chemistry and hydrology

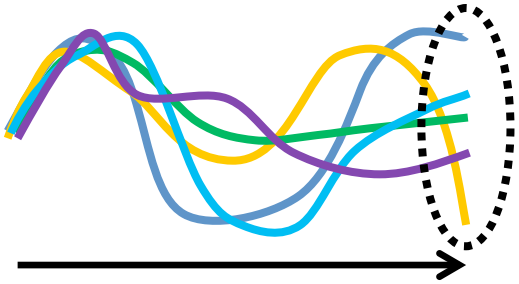
New Observations

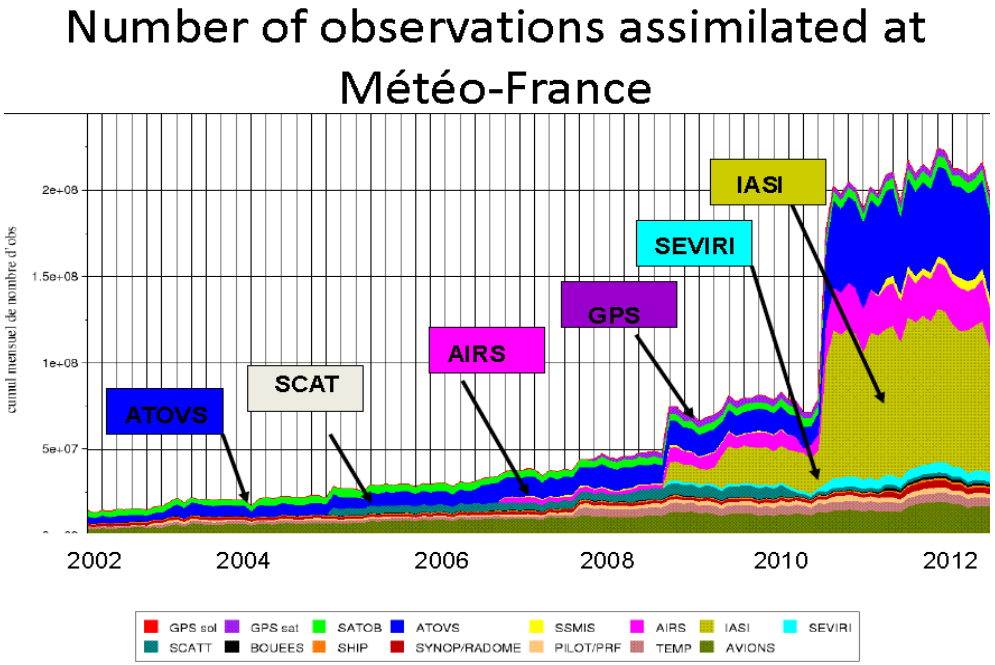
- High spectral resolution IR sounders on geostationary satellites (MTG in 2020)
- Space wind lidars (Aeolus in 2015)
- Advanced usage of met radars; ground based remote sensing
- New types of observations (e.g EarthCare)





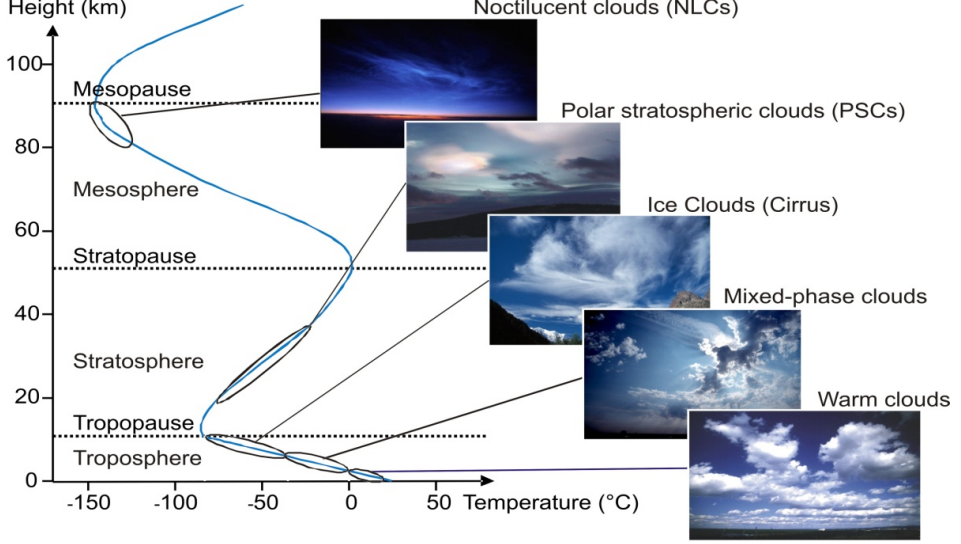
Ensemble and Data assimilation techniques





- Evolution driven by both progress in science and constraints from massively parallel machine architectures
- Increasingly hybrid methods (ensembles-variational)
- Work on improving description of model uncertainty
- Develop suitable verification techniques (deterministic, probabilistic, ensemble and high-resolution)

Model physics



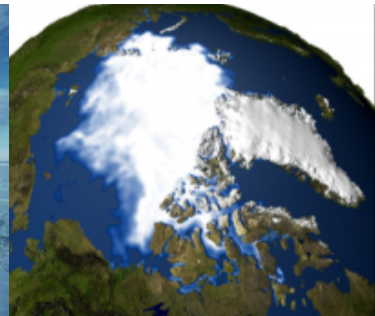
- Towards more conservative variables (e.g. chemistry)
- More advanced microphysics
- Accounting for horizontal exchanges by turbulence and radiation for grid cells < 1km (e.g. urban NWP)
- Parametrization of convection remains a difficult problem for grid cells > 5km
- Better representation of land surface – atmosphere interaction
- More « grey zone » problems as the integrated forecasts systems will be used at various resolutions

Accelerating the Weather Science agenda: international and cross-cutting collaboration

- International opportunities to advance the science of seamless prediction
  - the Sub-seasonal TO Seasonal (S2S) project (jointly with WCRP);
  - Polar Prediction Project (PPP) with joint WCRP activities (reanalyses, predictability, model error)
  - High-Impact Weather (HIWeather) project;







The High Impact Weather Project

Timely!

- New capabilities in short range forecasting (new observations, convective-scale probabilistic NWP)
- Advances in coupling prediction models
- Better understanding of the challenges to achieving effective responses to warnings

Time is ripe to capitalise on these advances!

Mission: "Promote cooperative international research to achieve a dramatic increase in resilience to high impact weather, worldwide, through improving forecasts for timescales of minutes to two weeks and enhancing their communication and utility in social, economic and environmental applications"

Christof Stache/AFP/ Getty Images

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Alexandros Vlachos/EPA

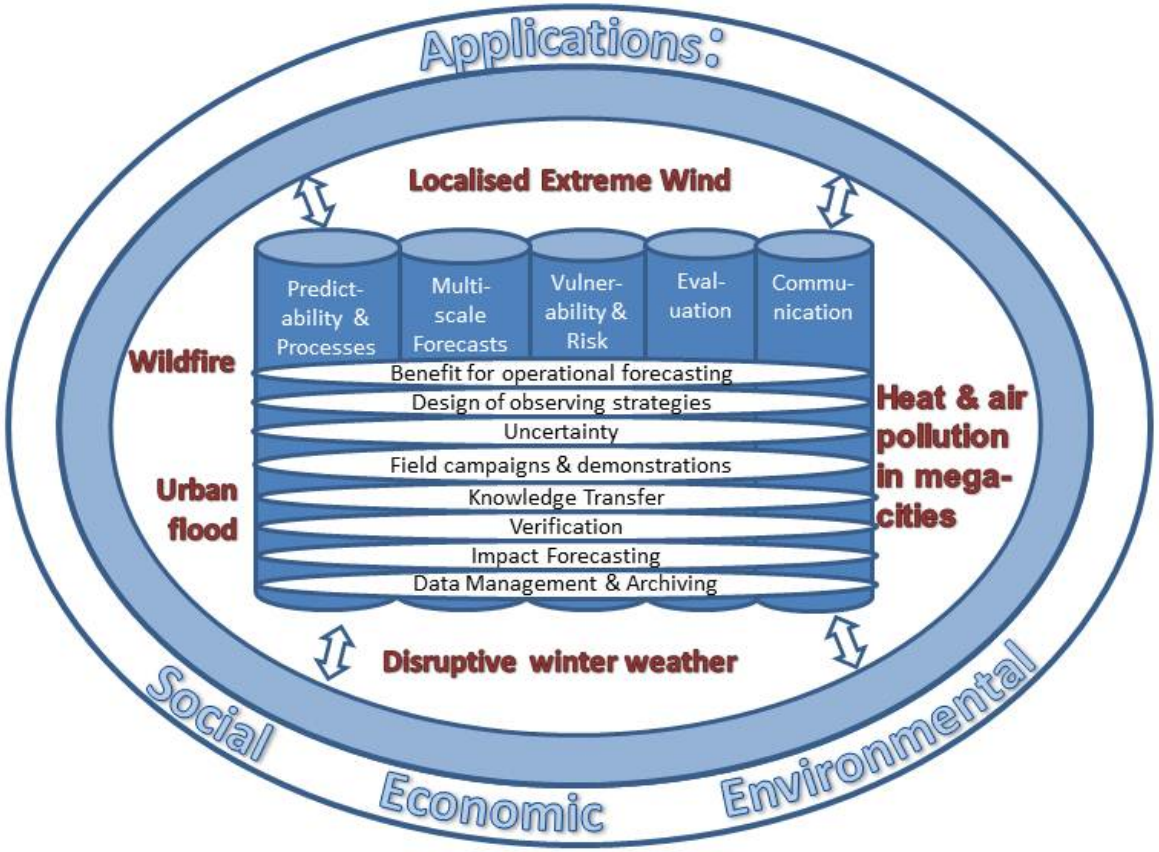
NOAA NWS

NOAA NWS

The High Impact Weather Project

- Shaped by needs for applications, assessed through communication and interaction with stakeholders
- Scope and limits defined by a set of weather related hazards
- Focus on predictive time scales of minutes to two-weeks

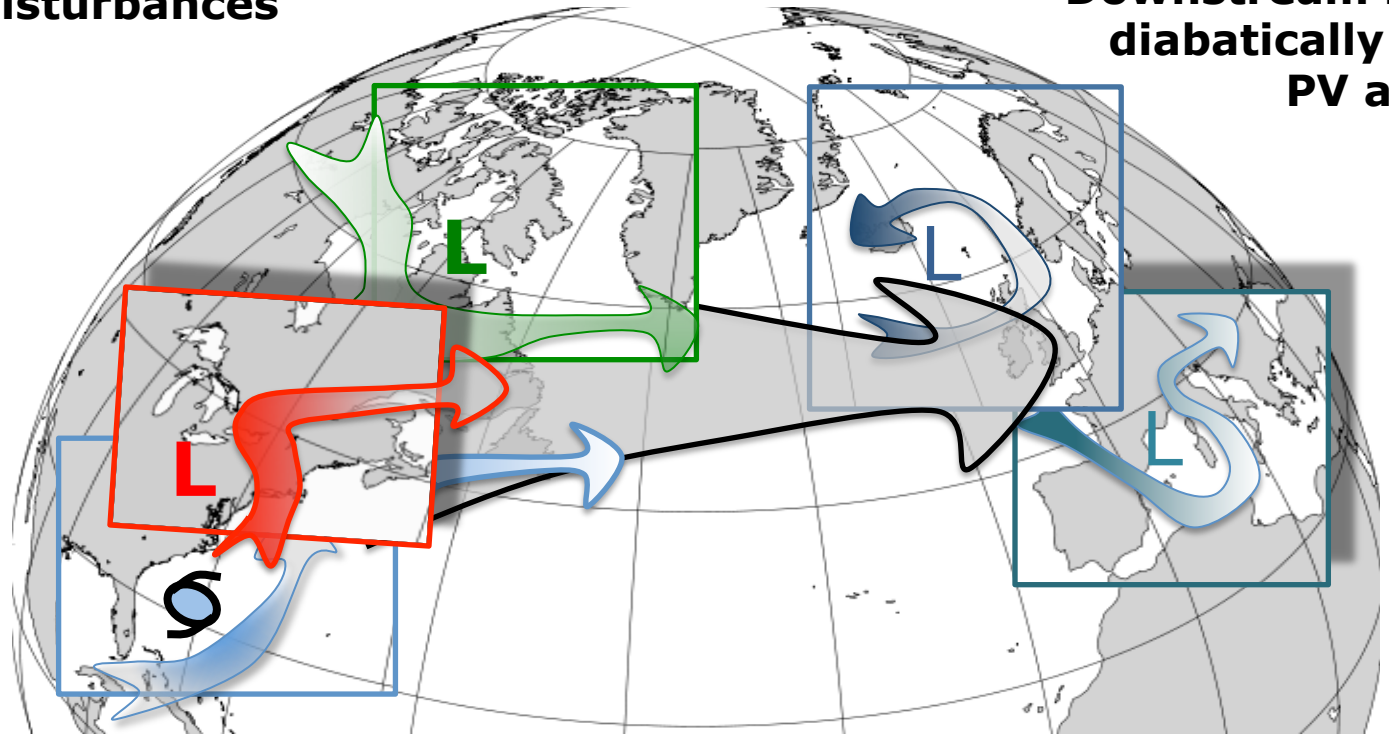
- Links to WCRP & GFCS for response to High Impact Weather in a changing climate



T-NAWDEX/DOWNSTREAM 2016

Factors modifying waveguide disturbances

Downstream impact of diabatically modified PV anomalies



Evolution of Rossby waves along the waveguide

Ideal operation period in **Sep/Oct 2016:**

- strongest storm activity
- Tropical Cyclones
- Polar Vortices

GV: HALO

US: GV

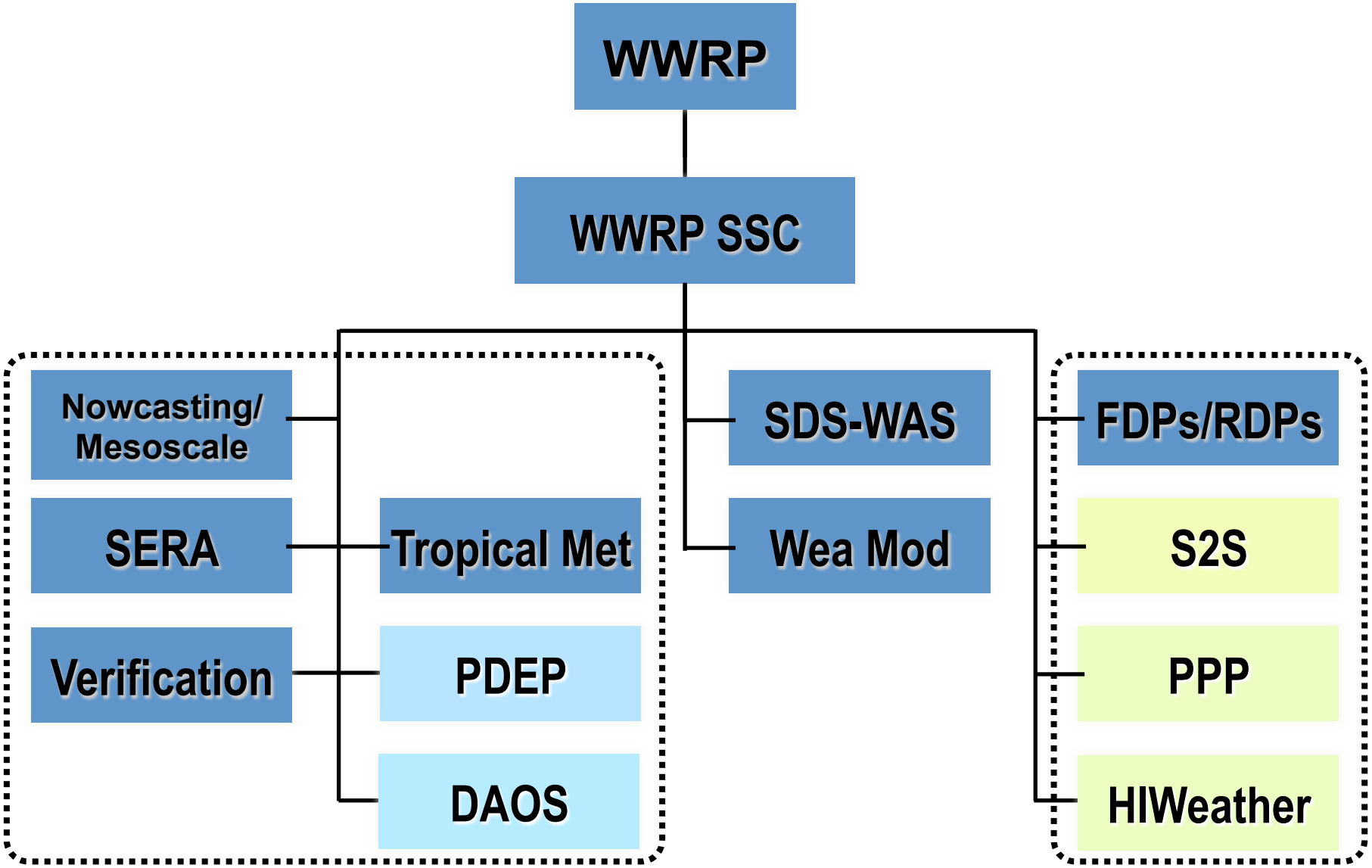
UK: BAE 146

CAN: NRC Convair 580

Partners

- Germany: DLR IPA, FX, KIT Karlsruhe, Univ. Mainz
- ETH Zürich
- US: NPS, NCAR, OU, Princeton, MIT, NOAA
- French, UK, CAN contributions envisaged
- Links to national weather services: DWD, ECMWF

Future WWRP Structure



WMO/WWRP/THORPEX
World Weather Open Science Conference

Saturday 16 – Thursday 21 August 2014, Montréal, Canada

Scientific Programme

The overarching theme of the OSC is ***Seamless Prediction of the Earth System: from minutes to months***. The science presented at the conference will range from basic research that extends our knowledge of processes and methods to the applied research required to put the prediction system together and assess the impacts of weather and climate events.

World Weather Open Science Conference
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The **scientific program** will be organized around five science themes:

- Data Assimilation and Observations;
- Predictability and Dynamical/Physical/Chemical Processes;
- Interactions between sub-systems;
- Prediction of the Earth system: putting it all together;
- Weather related hazards and impacts

Post-conference: the white papers will guide the future of WWRP and future collaborations (e.g. GAW).

The **User, Application and Social Science** Program has three focal areas:

- Individual, collective, and institutional behaviour in response to the communication, interpretation, and application of weather-related information in decision-making;
- Understanding, measuring, and predicting the societal impacts of weather and the costs, benefits, and other impacts of weather-related information; and
- Better practices and guidance for designing, implementing, evaluating and sustaining decision support systems and tools

WWRP
WORLD WEATHER RESEARCH PROGRAMME

Thank you!
Merci!
Vielen Dank!

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