World Meteorological Organization

Weather • Climate • Water

# World Weather Research Programme
# WWRP

**PM Ruti WMO**

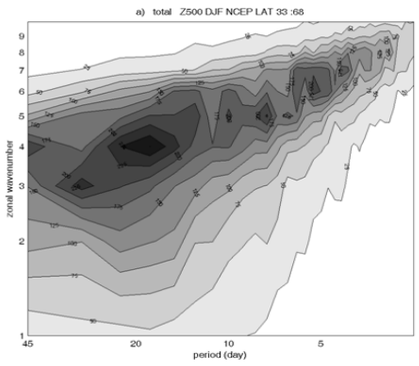
# Societal challenges: a 10y vision

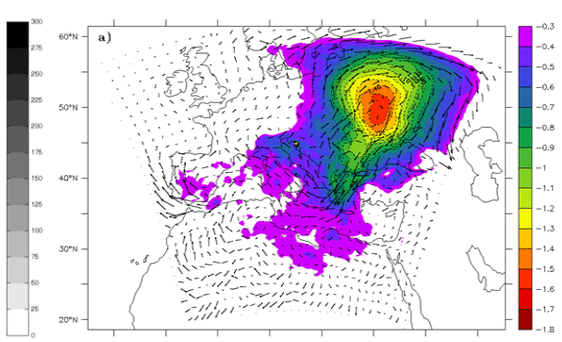
- **High Impact Weather and its socio-economic effects in the context of global change**
- **Water: Modelling and predicting the water cycle for improved Disaster Risk Reduction and resource management**
- **Urbanization: Research and services for megacities and large urban complexes**
- **Evolving Technologies: Their impact on science and its use**

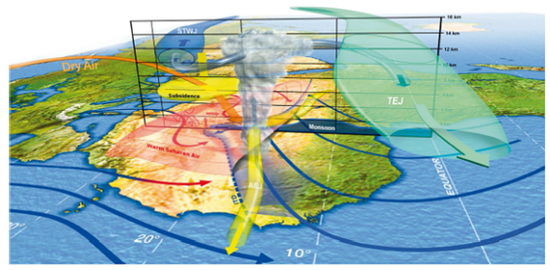
Technical Commission for Atmospheric Science

# WWRP vision

- **WWRP advances society's ability to cope with high impact weather through research focused on improving the accuracy, lead time and utilization of weather prediction, on fostering evaluation development and on engaging stakeholders and users with a bottom-up approach for a better communication.**
- **WCRP and WWRP promote a seamless approach favoring convergence between weather, climate and environmental communities**

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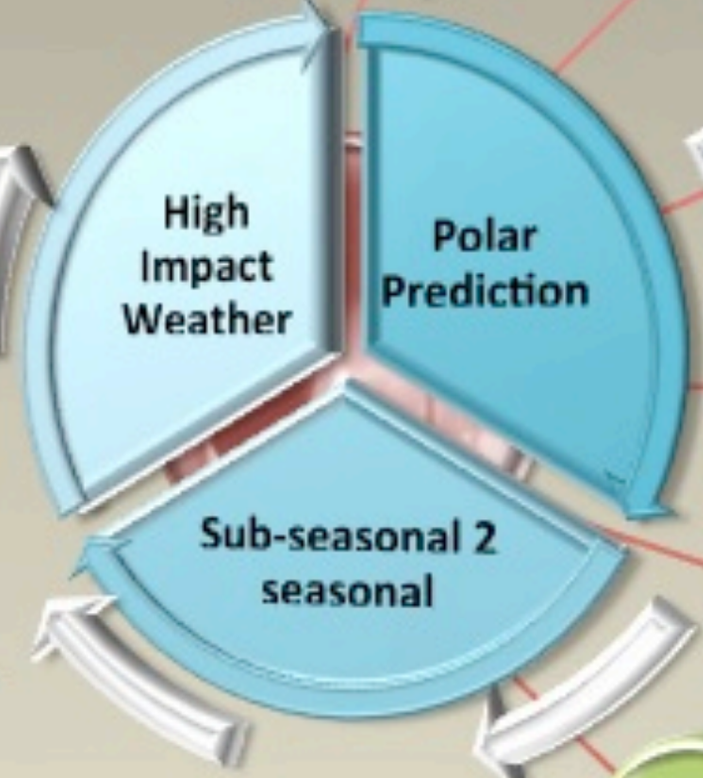
WWRP a seamless programme

High Impact Weather

Predicting Water Cycle

Urbanization

Emerging Technologies




WG • Nowcasting and Mesoscale

WG • Tropical Meteorology

WG • Predictability, dynamics and ensemble forecasting

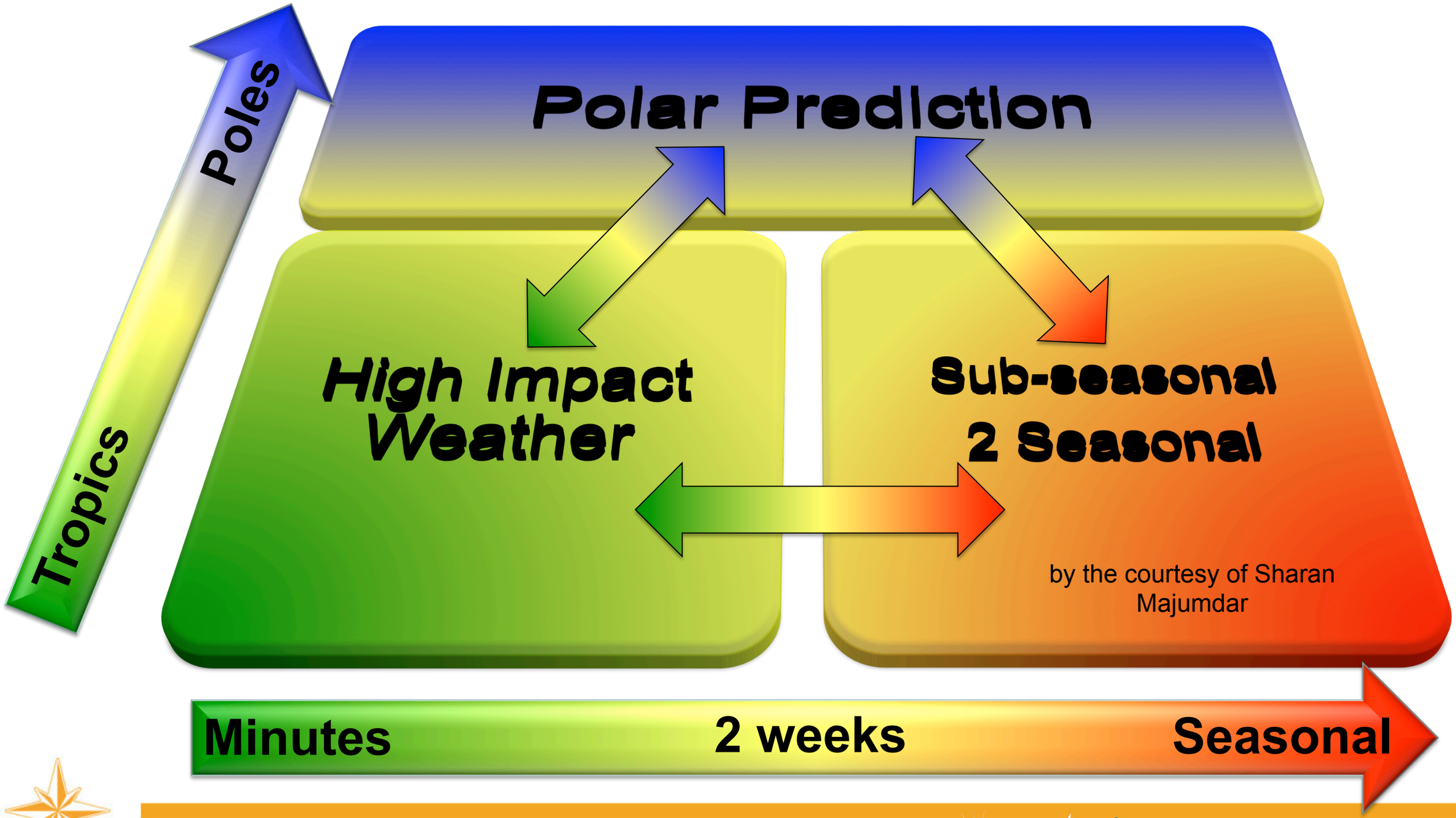
WG • Data assimilation and observing systems

WG • Verification

WG • Social and economic research

**Challenges** **Projects** **Working Groups**

# The three WWRP strategic projects



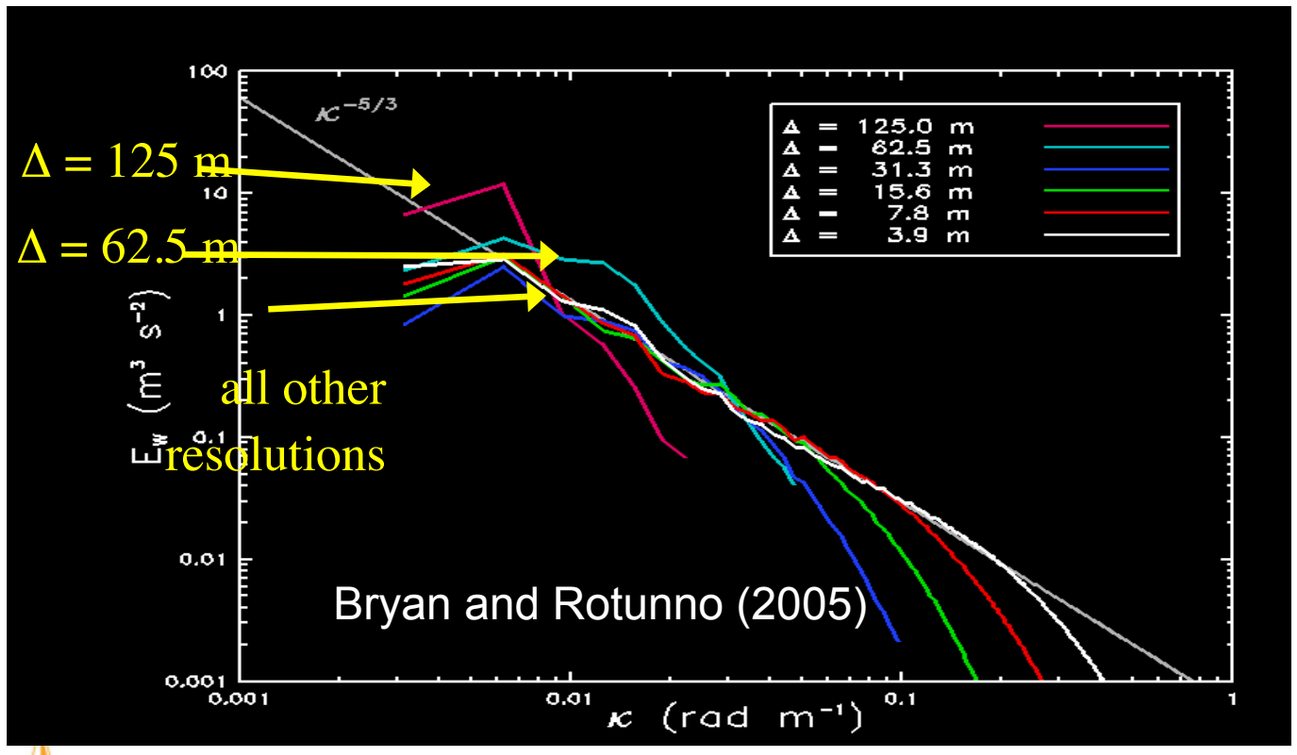
# WWRP.WGNE joint priorities

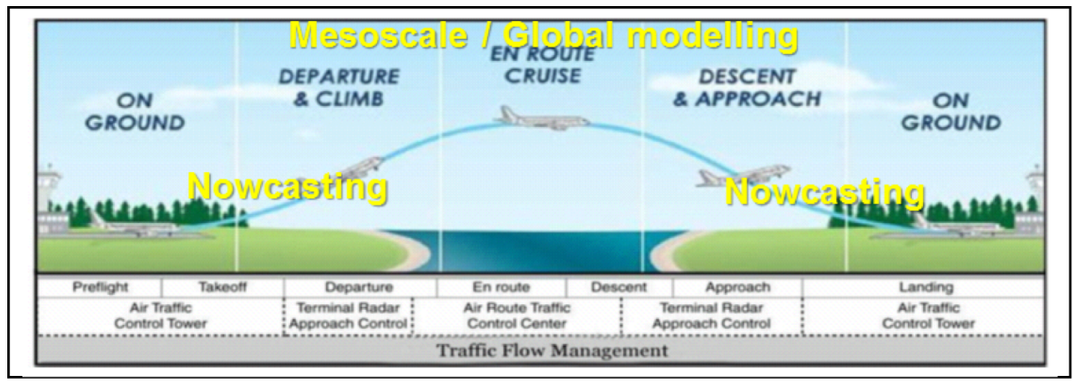
- **Towards 1-km scale operational forecast and more. Improving the prediction of continental convection and associated weather hazards**
- **Towards Environmental Prediction, integrating modeling components (hydrology, sea-ice, ocean, atmospheric composition, etc.) to better understand coupled processes and to improve forecasting methods.**
- **Towards a seamless predictive capability (Hoskins, 2012). Improving global weather forecasts on the weekly to monthly time scale.**

# Towards 1-km scale forecast and more

**Improving the prediction of continental convection and associated weather hazards:**

1. **Terra incognito (Wyngaard, 2004): resolving motions and processes tha are intended to not be resolved, but treated by boundary layer schemes.**




## Aviation Research Development Project

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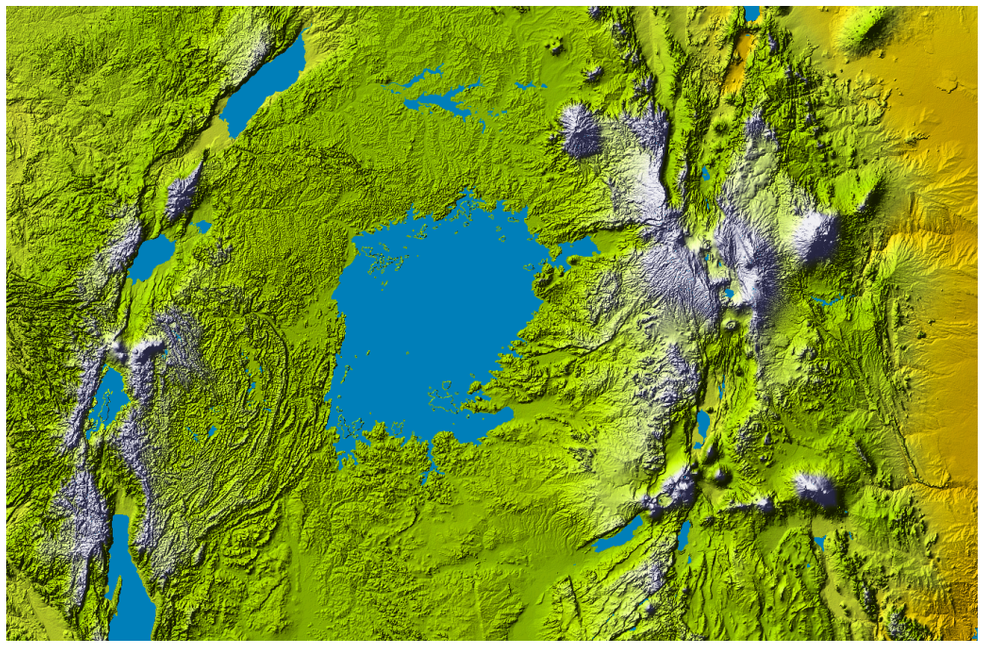
# Towards 1-km scale forecasts and more

2. « Grey zone », where horizontal grid spacing too large to represent deep convection, but small enough to switch off the convective schemes.

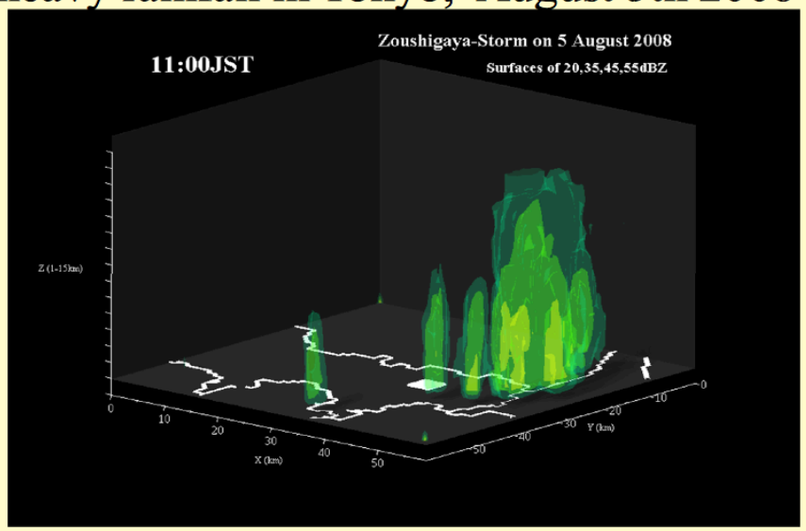
3. Upscaling of coupled land surface hydrological processes for heterogeneous landscape → High Impact Weather and link to WCRP Grand Challenge on Extremes

- Urban extremes (HIW)

- Land surface heterogeneity (Lake Victoria)



Convections of thunderstorm causing local heavy rainfall in Tokyo, August 5th 2008

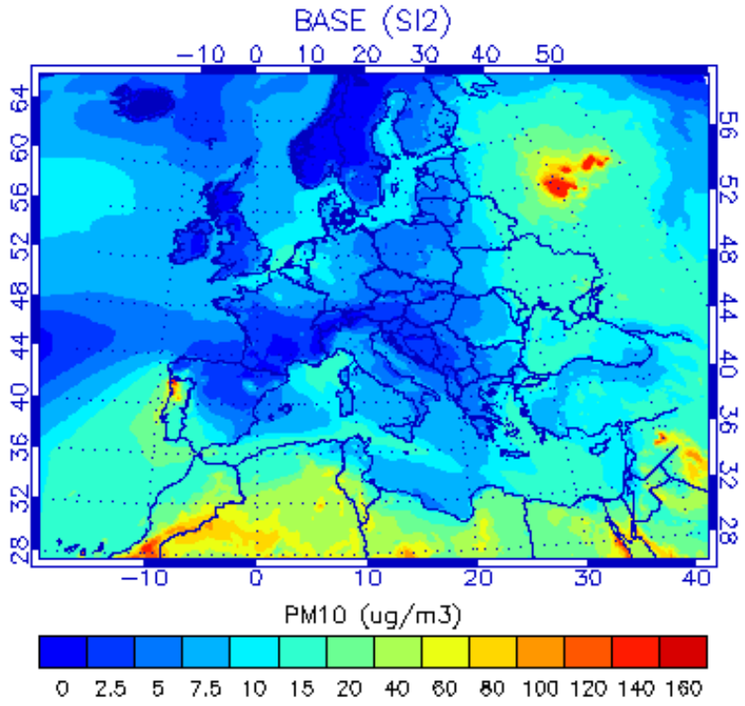


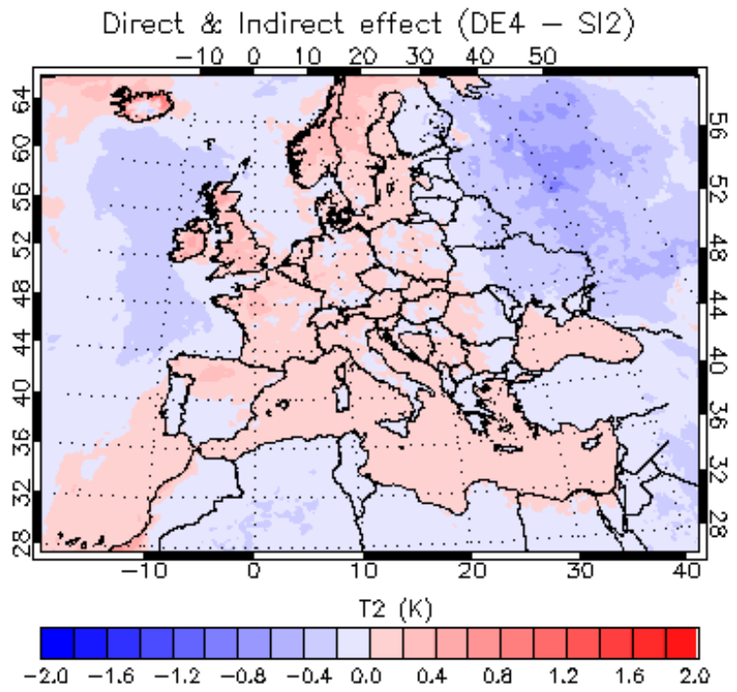

Time evolution of the thunderstorm from 1100 to 1330

# Towards Environmental Prediction

1. What are the advantages of integrating meteorological and chemical/aerosol processes in coupled models for meteorology and climate?

2. Need some specifically defined experiment that looks at chemistry-cloud-microphysics at different scales → Urban.




- Significant aerosol direct effects on meteorology (and loop back on chemistry).
- Reduced downward short wave radiation and surface temperature, and also reduced PBL height. It in turn reduced photolysis rate for O3

*Kong et al, AE, 2014*

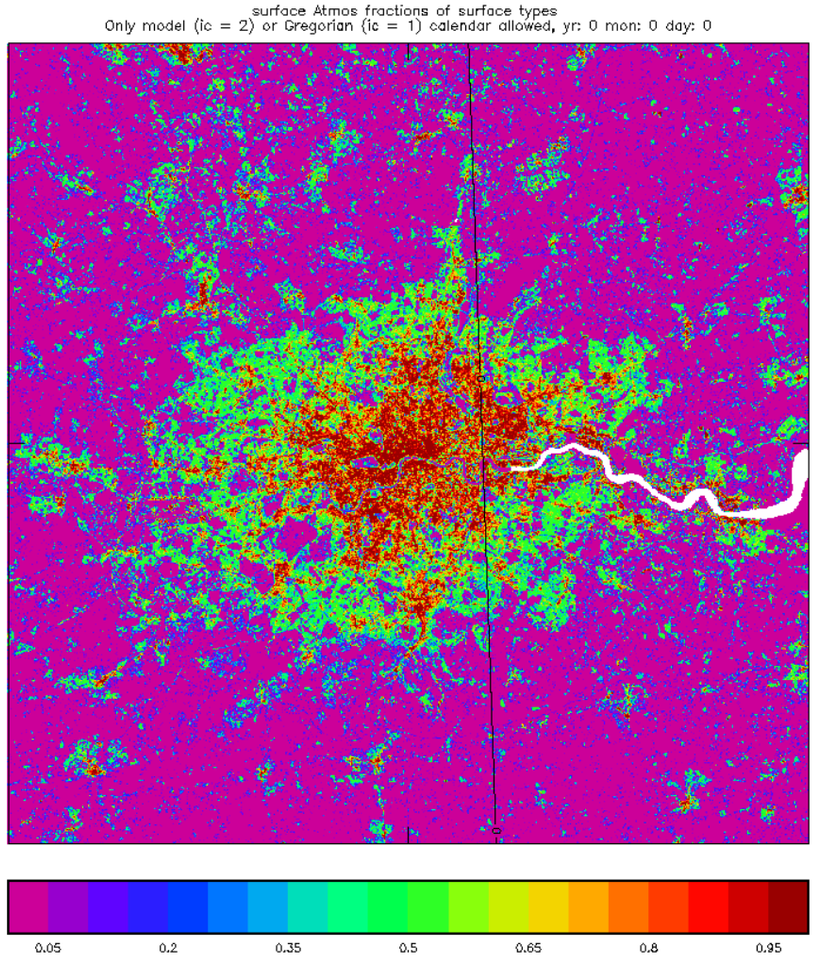
# Towards Environmental Prediction

## 3. Re-solving the catchment problem, how to integrate atmospheric, hydrological, rivers, ocean/lake models → water quality forecast

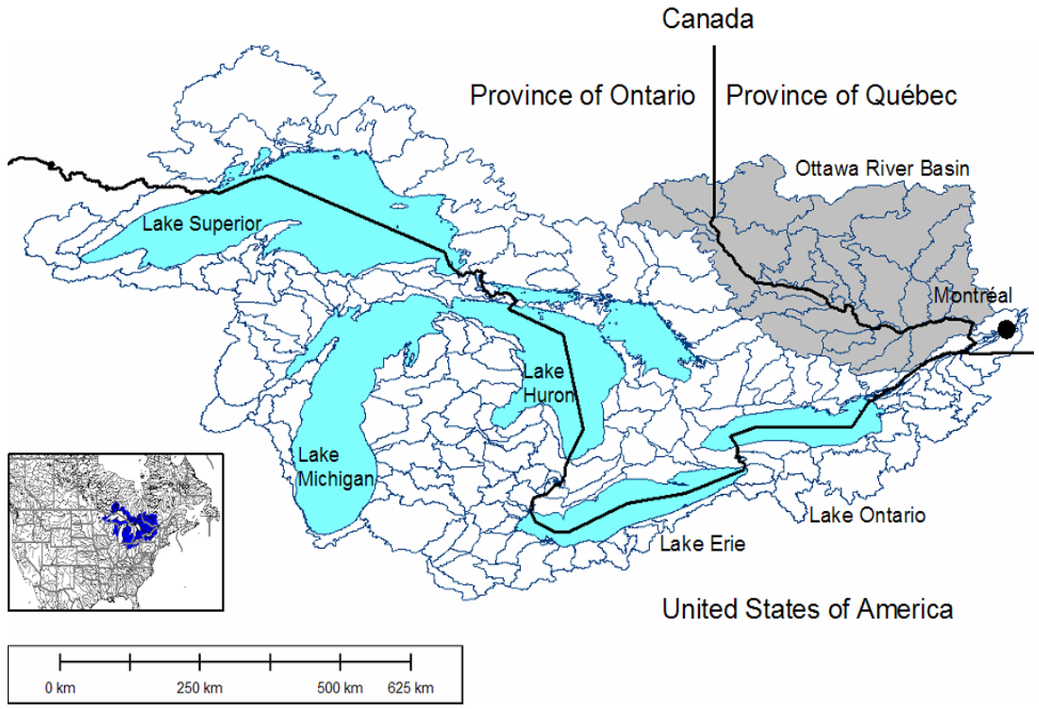
80x80km

Nested in UKV

And 500m




Urban fraction



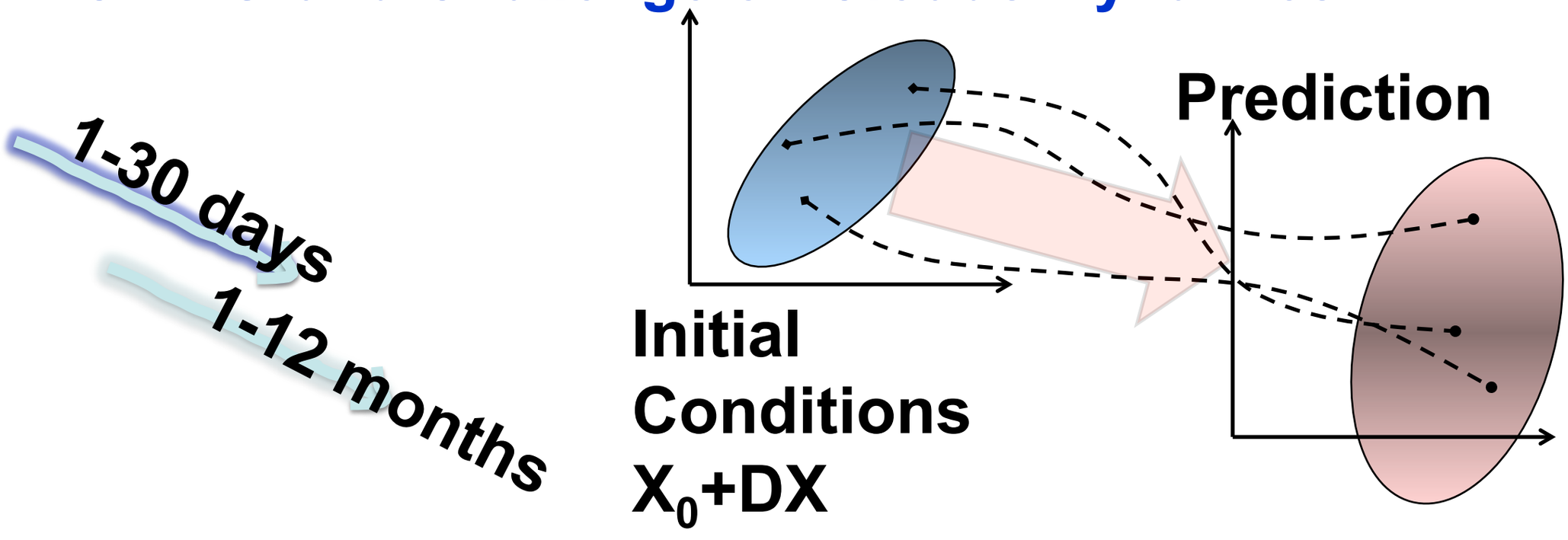

CHAMP project …

# Towards a seamless predictive capability

1. The role of coupling processes in the predictability of intra-seasonal variability. Systematic error, fast and slow components, what are the links (spectral energy transfer).

2. How to prioritise the work on predictability, dynamics and data assimilation to better support WGNE activities?

## WCRP Grand Challenge on Clouds-Dynamics

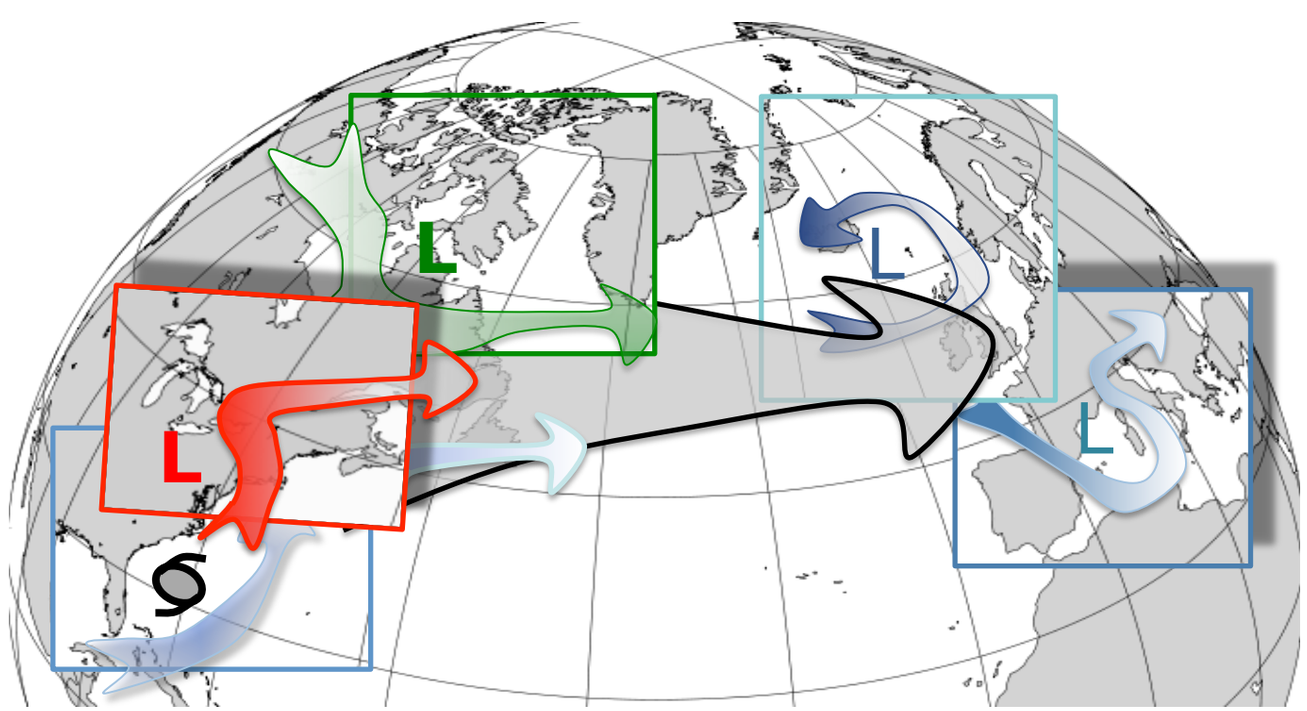


# Towards a seamless predictive capability

3. Transpose AMIP and CMIP, how to support Sub-seasonal 2 Seasonal and Polar Prediction projects (Transpose CMIP).

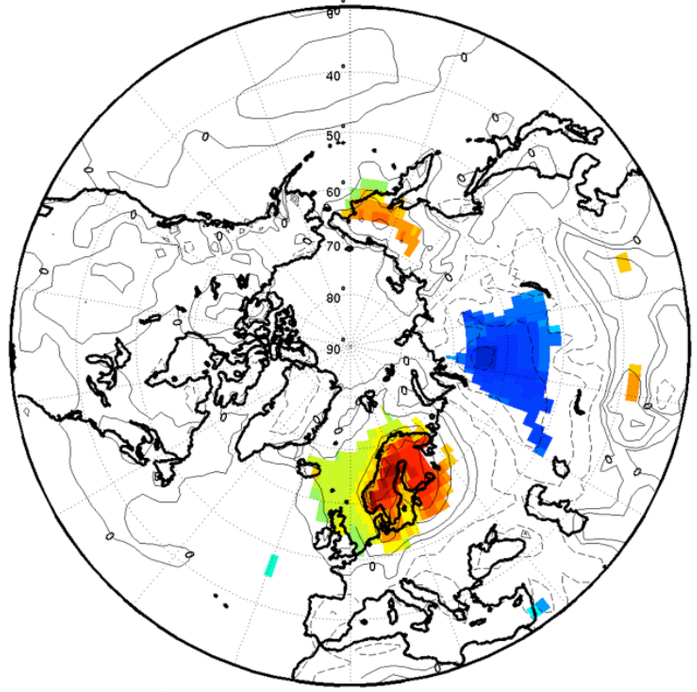
4. Key elements: MJO,  wave-guide, Rossby waves, blocking

…




Evolution of Rossby waves along the waveguide. Courtesy of S Jones

NCEP; Anomalies T2m JJA Blocked days 1961-2010



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# Thanks

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# WWRP Structure

**WMO secretariat**

**WWRP- Scientific Steering Committee**

**Working Group Numerical Experimentation**

**Working Groups**

- Nowcasting/ Mesoscale
- Predictabiliy, dynamics and Ensemble Forecasting
- Tropical Meteorology
- Data Assimilation & Observational Systems
- Verification
- Socio & Economic Research

**Projects**

- High Impact Weather
- Sub seasonal 2 Seasonal
- Polar Prediction Project
- Research (Forecast) Development (Demonstration) Project
- Sand Dust Storm – Warning Advisory System

WWRP WORLD WEATHER RESEARCH PROGRAMME

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WWRP a seamless programme

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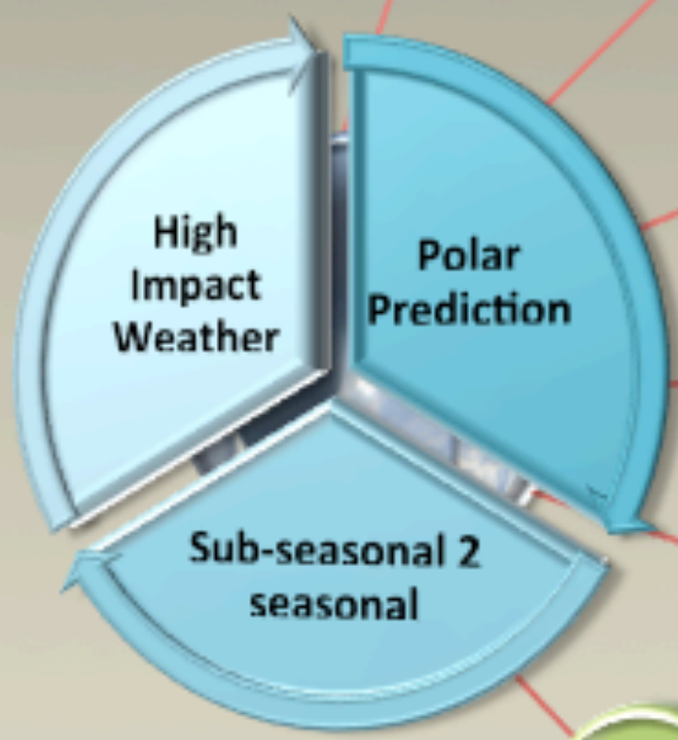


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# Conclusions

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- ...