WORLD CLIMATE RESEARCH PROGRAMME

Lighthouse Activity on Explaining and Predicting Earth System Change

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WCRP Lighthouse Activity on Explaining and Predicting Earth System Change

Motivation

- The formulation of robust policies for mitigation of, and adaptation to, climate change requires quantitative understanding of how and why specific changes are unfolding in the Earth system.
- Quantitative process-based explanation (attribution) of observed changes is essential for quantifying current risks and fundamental to confidence in climate predictions and projections.

WCRP Lighthouse Activity on Explaining and Predicting Earth System Change

Overarching objective

- ***To design, and take major steps toward delivery of, an integrated capability for quantitative observation, explanation, early warning and prediction of Earth System Change on <u>global and regional scales</u> and <u>multi-annual to decadal timescales.</u>***

- *Examples: "hiatus", changes in IPO phase, changes in AMOC, rapid regional ocean warming, persistent drought.*

- *Changes in ocean and atmosphere circulation and their influence on hazards is a specific focus – key issue for adaptation.*

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Science Plan Structure

Theme 1: Monitoring and modelling Earth System Change

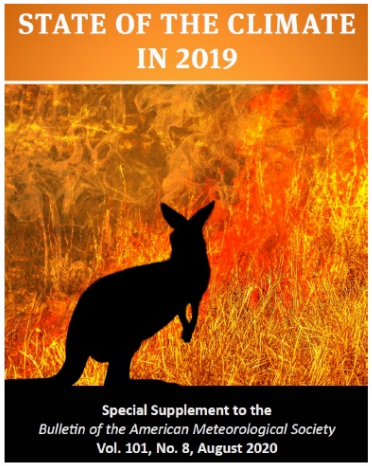
- Observational and modelling requirements to monitor, explain and predict earth system change
- Convergence between climate modelling and Earth system data assimilation & reanalysis

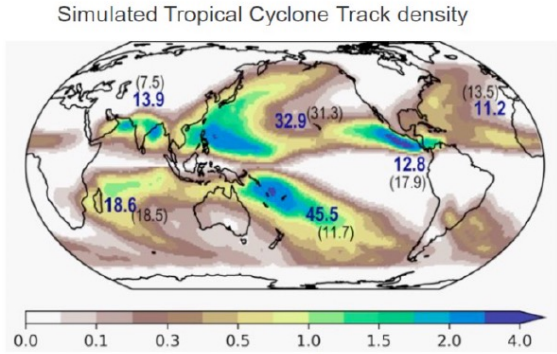
Theme 2: Integrated attribution, prediction, projection and early warning

- Quantitative process-based attribution of Earth System Change
- Integrated attribution, prediction and projection (building on GC in NTCP) including signal-to-noise "paradox"
- Contribute to WMO State of Global Climate & Annual to Decadal Climate Update reports
- Early warning of major changes – collaboration with SLC

Theme 3: Assessment of Current and Future hazards

- Focus on classes of events rather than individual events
- Understanding the natural and anthropogenic drivers of changing hazards in different regions; extending "event attribution" methodologies
- Collaboration with My Climate Risk & RifS





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Cross-cutting approaches / activities

Integrated use of observations and models

- Characterization and quantification of uncertainties - fundamental to attribution
- To what extent are models and observing systems adequate for the tasks?

Case studies of significant changes and multi-annual-to-decadal events

- Targeted research to quantify, explain and assess the predictability of carefully selected recent events
- Integrating insights of all three Themes.

Large ensembles

- Large ensemble single forcing experiments necessary for quantitative explanation of Earth System change
- High resolution ensembles necessary to understand circulation change and modulation of hazards
- Collaboration with Digital Earths

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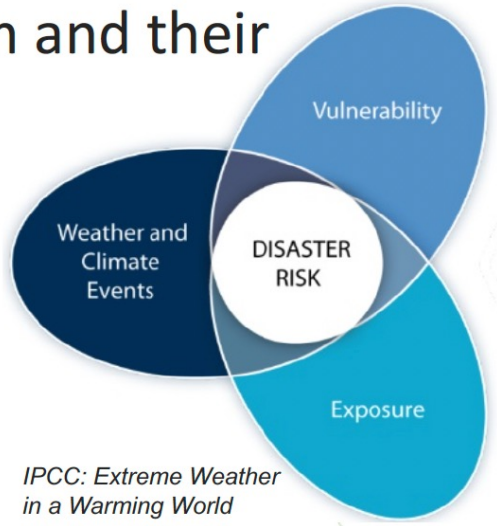
Longer term deliverables

Within the first five years we aim to have:

- Established methodologies for novel case study application;
- An international open-access multi-model archive of seasonal-to-decadal hindcast and forecast data;
- Improved capabilities for prediction of multi-annual to decadal changes in the climate system and their impacts on hazards; and
- Quantitative assessments of the current risk of specific hazards and future risk under defined scenarios.



IPCC: Extreme Weather in a Warming World

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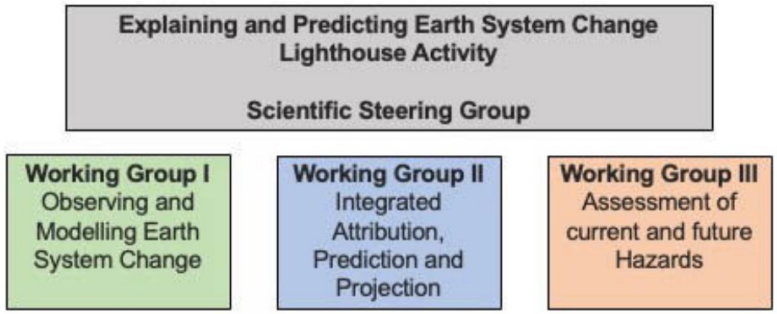

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Kirsten Findell	EPESC Co-chair	GFDL/NOAA	USA	GEWEX
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Doug Smith	Co-lead WG2	UK MetOffice	UK	
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Jochem Marotzke		Max Planck Institute for Meteorology	Germany	
Lijing Cheng		Institute of Atmospheric Physics, Chinese Academy of Sciences	China	CLIVAR
Markus Donat		Barcelona Supercomputing Center	Spain	ESMO
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