Grand Challenge – Weather and Climate Extremes

41st Session of the WCRP Joint Scientific Committee

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Online

WORLD METEOROLOGICAL ORGANIZATION
United Nations Educational, Scientific and Cultural Organization
Intergovernmental Oceanographic Commission
International Science Council
WCRP World Climate Research Programme

Progress and achievements

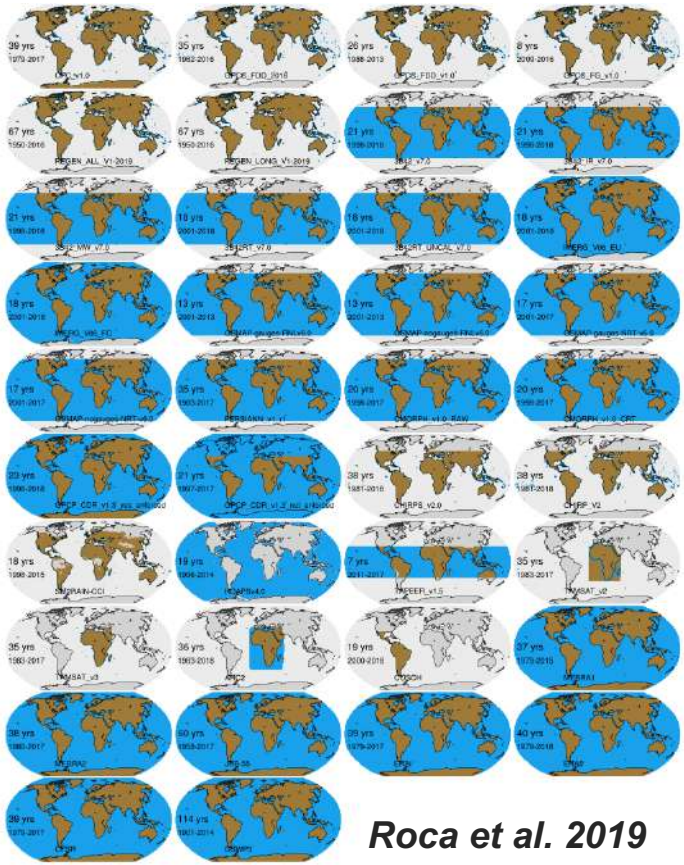
- WCRP Institute of Advanced Studies in Climate Extremes and Risk Management (Nanjing, 2019):
  - WCRP contribution to RISK-KAN
  - Supported by Nanjing University of Information Science and Technology, APN, IRDR.
  - 29 international (from all continents) plus 10 local students at PhD level (senior PhD student and recent PhDs); three student-led papers are in the work and will be submitted for peer reviewed publication
  - Six lecturers from WGI/II community (5 IPCC lead authors)

Progress and achievements

- Contribution to IPCC AR6
  - Coordinated key analyses on past and future changes in extremes, and detection and attribution studies to provide timely publications for the AR6 assessment. Most of key figures in the Chapter 11 (dedicated to extremes) of IPCC AR6 WGI report come from GC coordinated analyses.
  - The GC-extreme team contributes to AR6 assessment including 3 coordinating lead authors, 3 lead authors, one review editor, and several contributing authors
- Participation in CMIP6
  - coordinating in multiple MIPs including LUMIP (Sonia Senevirante), VolMIP (Gabi Hegerl), LS3MIP, and providing inputs to other MIPs that pays particular attention to extremes such as DAMIP, highresMIP, and HAPPI.
- Dataset development
  - Creation of unique global-scale daily and sub-daily precipitation datasets and a dataset of climate extremes indices and associated web portal along with the co-development with GEWEX of the Frequent Rainfall on Grids (FROGs) database containing consistently formatted in situ, satellite and reanalysis precipitation datasets and associated Special Issue in Environmental Research Letters.

Document theme example

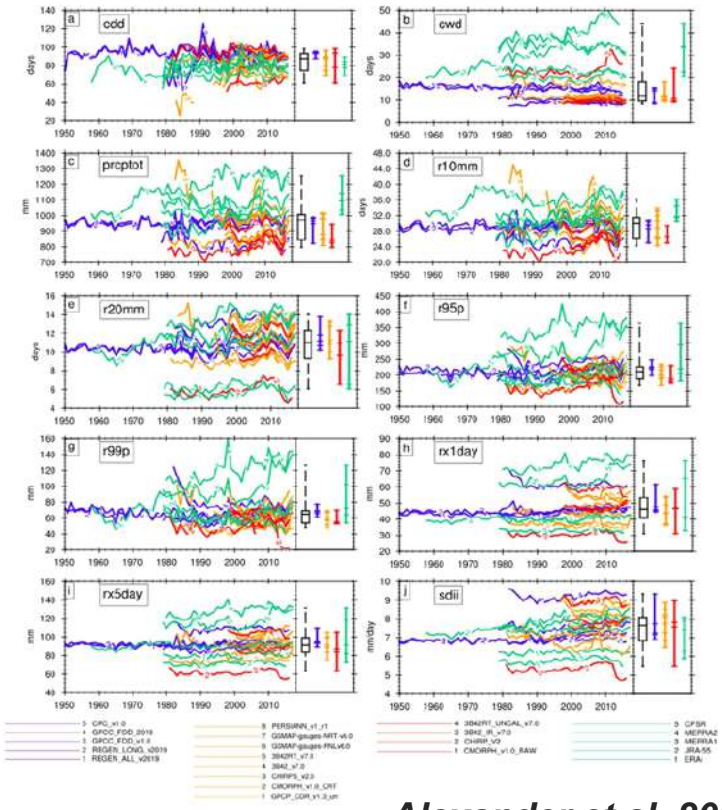
FROGs database



Roca et al. 2019

40 products (continually updated) of daily precipitation observations on a 1◦x1◦ grid
http://frogs.ipsl.fr/

Intercomparison of extreme indices



Alexander et al. 2020

Future plans

- Scoping and development of global extremes project
- Document theme:
  - Workshop/hackathon using FROGs
  - Guidance document on how to use precipitation datasets for model evaluation

Links to the WCRP Strategic and Implementation Plans

Extremes: Scientifically challenging and great societal needs

- **Strategic Plan:**
  - Fundamental Understanding of the climate system: *'understanding…the ways in which extreme events are manifest in a non-stationary climate'*
  - Prediction of the near-term evolution of the climate system: '*attention on societally relevant outcomes such as meteorological, oceanic, and hydrological extremes, including compound events*'
  - Bridging Climate and Society '*The timescales on which society requires this information range from near-term extreme events to long-range planning horizons, while spatial scales range from local to global.'*
  - Critical Infrastructure *'Sustained observations and reference datasets'*
- **Implementation priorities:**
  - Quantify climate risk and opportunities
  - Co-produce regional climate info for decision support and adaptation
  - Inform and evaluate mitigation
  - Advance understanding of multi-scale dynamics

Emerging issues

A case for a Global Extremes Project:

- a consensus about the importance of extremes from both science and service perspectives
- a need for a true partnership between climate science and its users
- a key role and opportunity across most of the proposed lighthouse activities; requiring coordination

Initial activities could included:

- Global and regional monitoring and global stocktake (ETCCDI)
- Annual updates on the status of extremes and attribution
- Cross-WCRP coordination and integration of extreme-related activities; identification of evolving new science questions and developments on mechanism, modelling, attribution and prediction of extremes including compound events
- Capacity building for proper applications and developing true partnership with users