

WMO Forecasting Infrastructure for Predicting Climate Variability and its Potential for Anticipating Changes in Extremes

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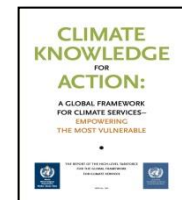
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*WMO Expert Team on Operational Predictions from Sub-seasonal to Longer
Time-Scales

Outline

- Defining weather and climate extremes
- Prediction of climate extremes
- WMO infrastructure for long-range forecasts

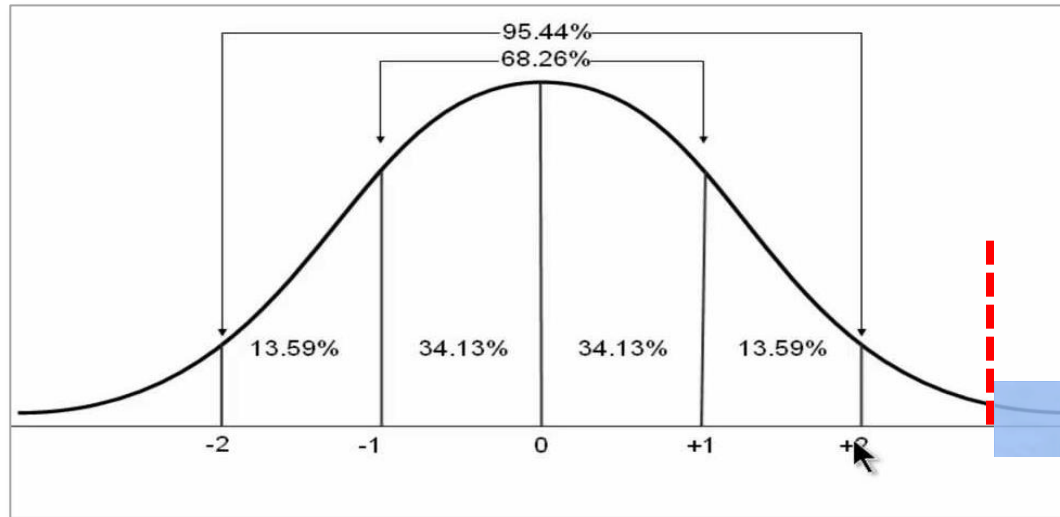


Defining extremes



- Variability is an inherent part of climate.
- A meteorological definition for extremes could be based on the events that occur on the tails of the frequency distribution of a variable; an impact independent definition.
- A societally relevant definition could be: climate extremes are events that stress various facets of society (risk human and livestock health, incur economic losses, cause damage to infrastructure etc.); extreme event + vulnerability
- Examples – heat/cold waves (health; energy), droughts (economic), floods (life and property).

Defining extremes



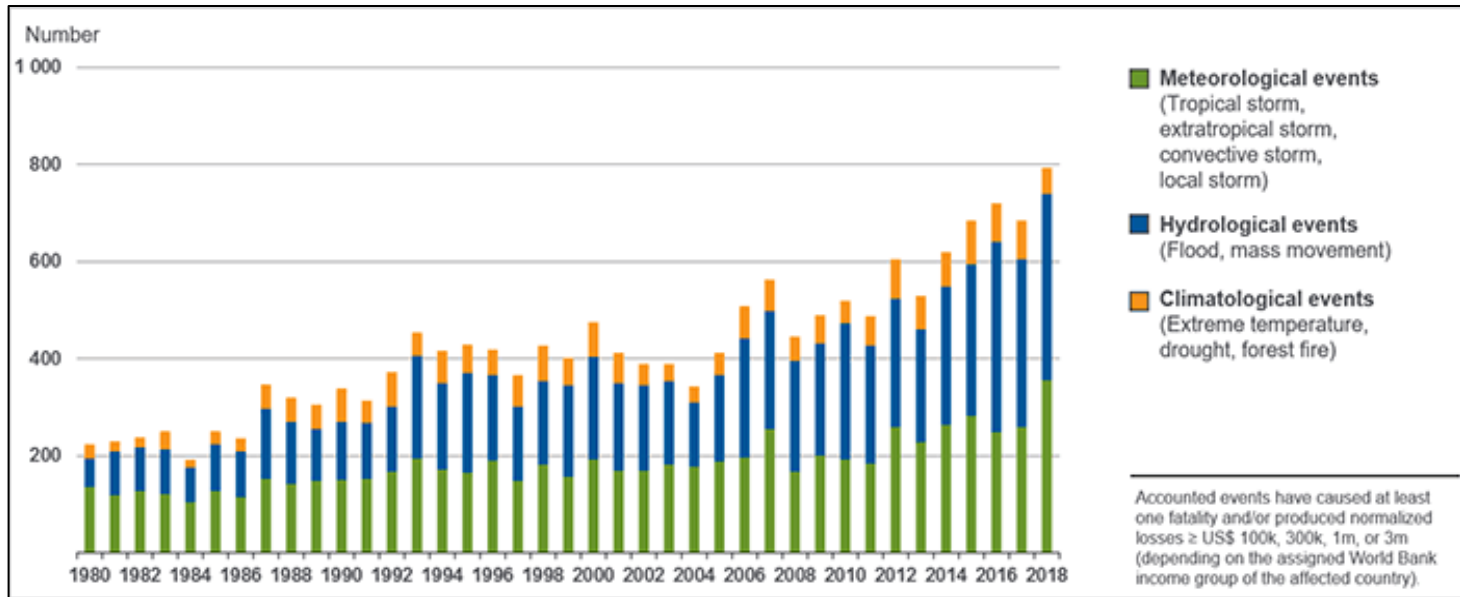
Frequency distribution of temperature at a location
(daily, monthly, seasonal, ...)

Types of extremes

- Correlated (or compound) extremes
 - Hot, dry, windy → fire danger;
 - Hot, moist, stagnant → health danger;
 - Sea level rise, astronomical tides, storm surge → coastal erosion.
- Correlated extremes can worsen chances of societal stresses.
- The societal impact of extreme events also depends on the characteristics of local climate (e.g., onset of rainy season).

Losses from extremes are increasing

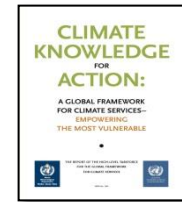
Weather-Related Natural Catastrophes across the world (by type) 1980-2018
(based on insured losses)



<https://www.iii.org/fact-statistic/facts-statistics-global-catastrophes>

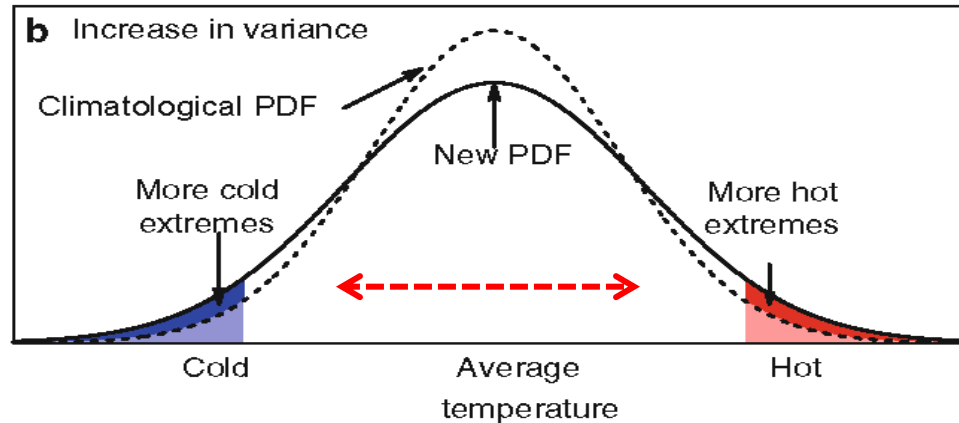
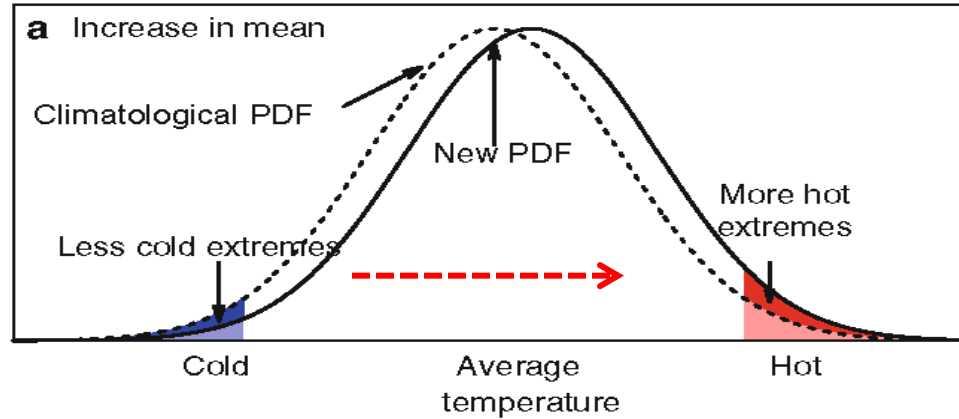
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Influence of changes in climate variability on extremes

- Positive change in the mean
- More hot extremes; less cold extremes



- No change in mean; increase in spread
- More hot and cold extremes

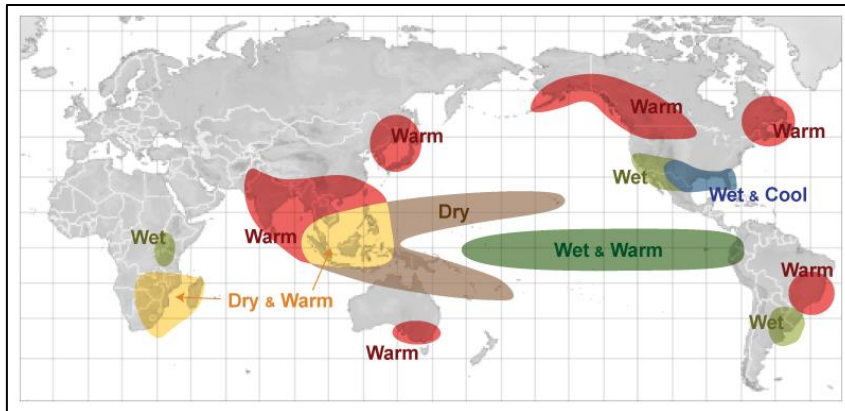
Examples of extremes and interactions across time-scales

- El Niño and extreme rainfall/mudslides in Peru.
- El Niño and extreme fire season in Indonesia.
- North Atlantic Oscillation (NAO) and extreme cold over eastern US.

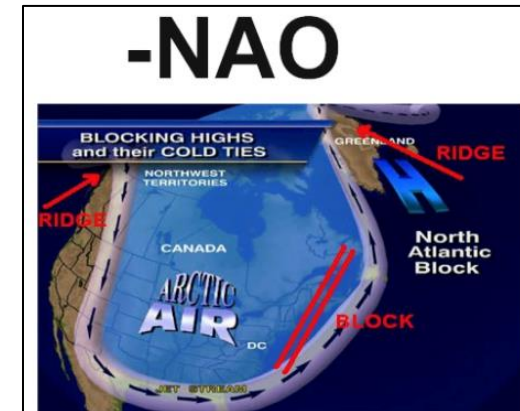


Predicting climate extremes

- Links between modes of climate variability and local extremes can be used for the prediction of extremes.



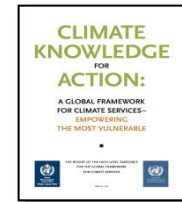
El Niño and its effect – December to February



Effect of negative phase of NAO on surface temperature

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Current status of operational sub-seasonal to decadal (S2D) infrastructure within WMO

- Global Producing Centers for Long-Range Forecasts (GPC-LRFs) – Seasonal.
- Global Producing Centers for Annual to Decadal Climate Predictions (GPC-ADCPs).
- Regional Climate Centers (RCCs).
- Regional Climate Outlook Forums (RCOFs).
- These “operational” entities provide support for the infrastructure for various components of WMO’s Climate Services.



Operational infrastructure for seasonal forecasts

- 13 Global Producing Centers for Long-Range Forecasts (GPC-LRFs).

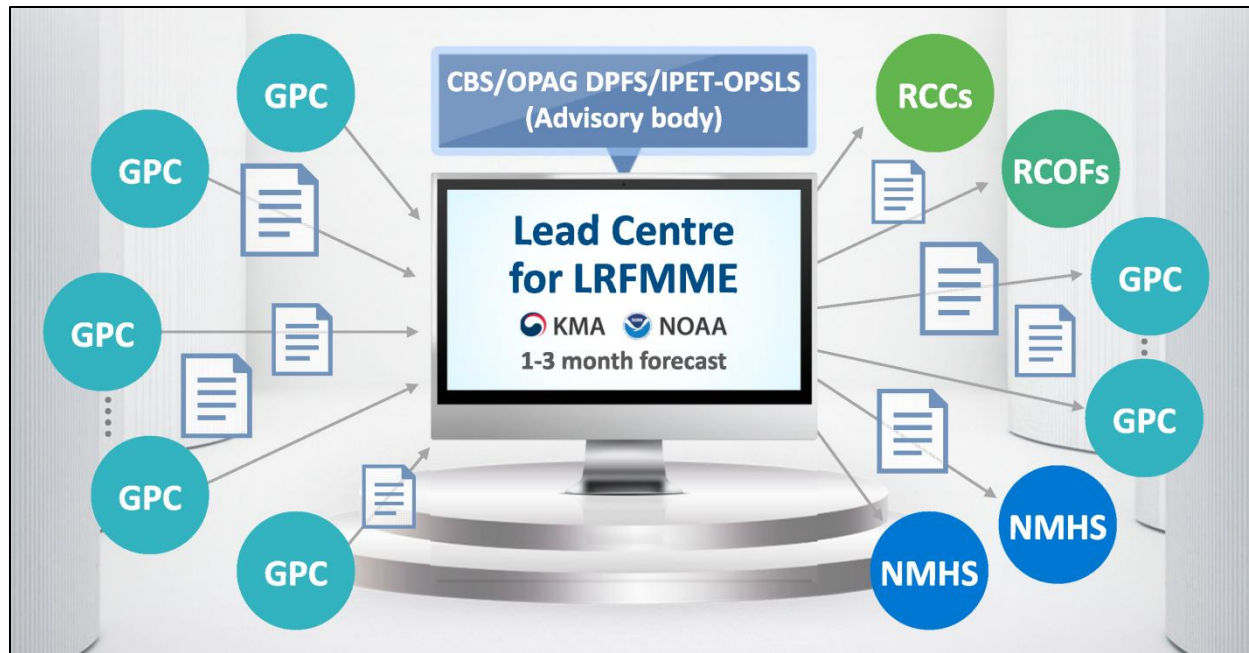


- On a monthly basis, seasonal forecast data is provided to the WMO Lead Center for Long-Range Forecast Multi Model-Ensembles (LC-LRFMME) hosted by the Korean Meteorological Administration (KMA).

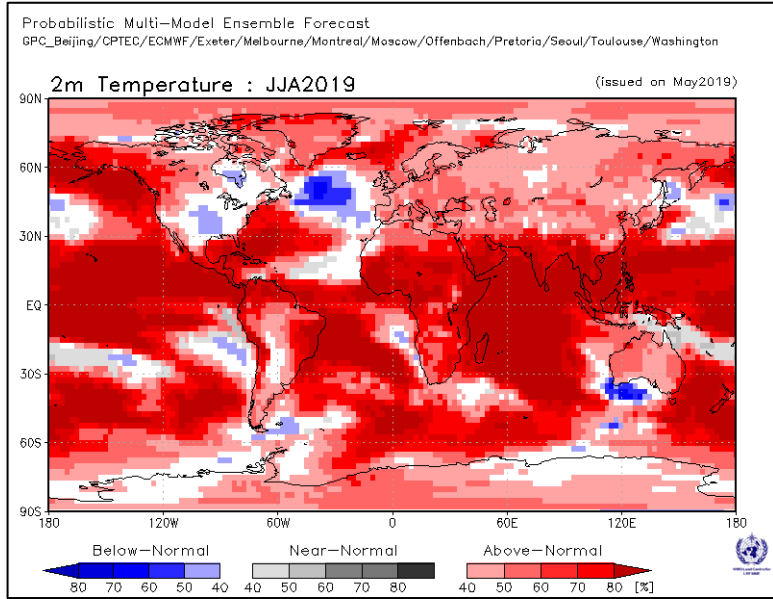
Lead Center for Long-Range Forecast Multi Model Ensembles (LC-LRFMME)

<https://www.wmolc.org/>

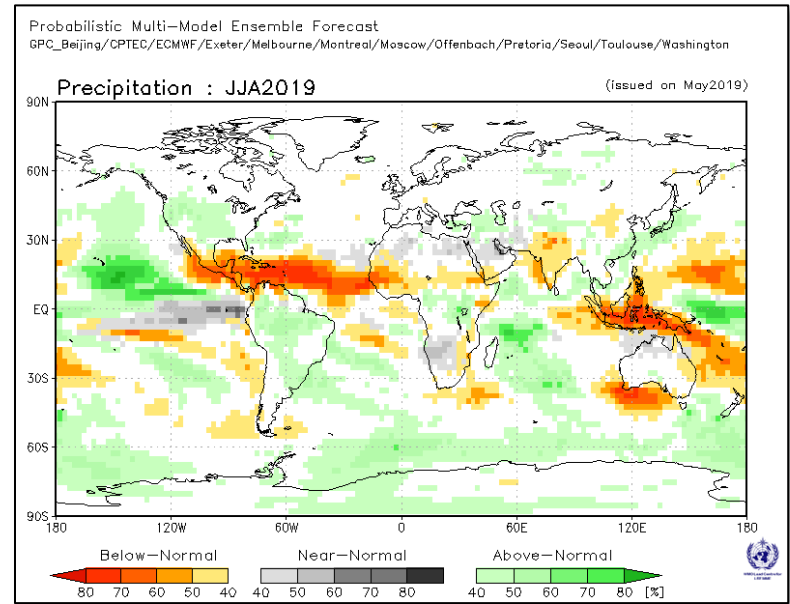
- LC-LRFMME provides a conduit for dissemination of seasonal forecast information between GPCs-LRF and NMHSs, RCCs etc.



Lead Centre – Long-Range Forecasts Multi-Model Ensembles



Temperature



Precipitation

Infrastructure for Annual to Decadal Climate Predictions (ADCP)

- An effort led by the UK Met Office.
- Outlooks updated once a year.
- Outlooks for year 1 and years 2-5 average.
- Plans to release “Global Annual to Decadal Climate Update (GA2DCU)”.
- <https://www.wmolc-adcp.org>

WMO Lead Centre for Annual-to-Decadal Climate Prediction

The Met Office is a designated Lead Centre for Annual-to-Decadal Climate Prediction (LC-ADCP). The LC-ADCP collects and provides hindcasts, forecasts and verification data from a number contributing centres worldwide.



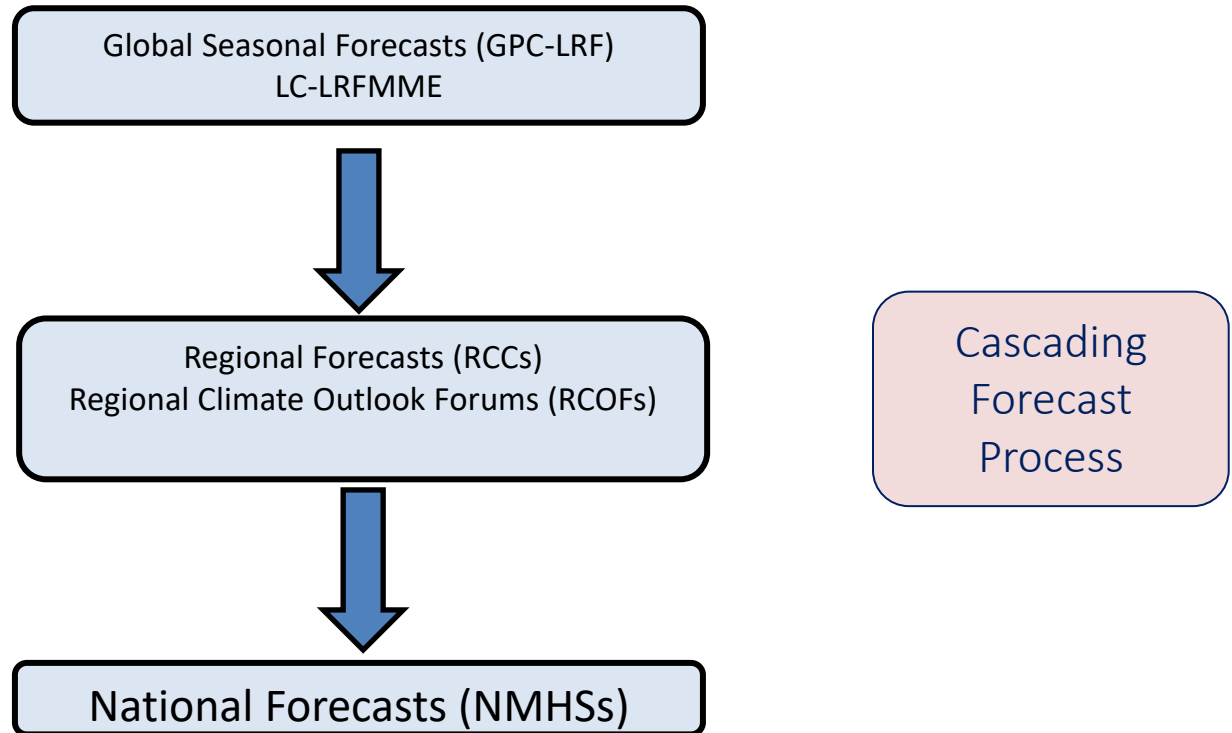
Sub-Seasonal to Seasonal (S2S) Project

- Currently a joint WWRP/WCRP research project.
- Collects hindcast and (delayed) real-time sub-seasonal forecast data.
- Efforts are under way to develop a formal operational infrastructure (similar to LRF and ADCP) within WMO.
- <http://s2sprediction.net/>



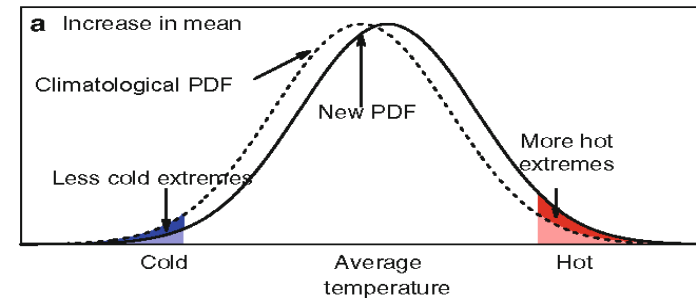
WMO Infrastructure for LRF

- WMO long-range forecast infrastructure for LRF is a tiered concept.



Utilizing WMO operational infrastructure for the prediction of extremes

- In the context of long-range forecasts, currently the most readily available information is
 - change in the time-mean average, and
 - the probability of its occurrence.



- Based on historical data, this information can also be utilized to develop an outlook for the changes in local extremes.

A photograph showing two firefighters in silhouette against a large, intense fire at night. The fire is bright orange and yellow, with thick smoke rising into the dark sky. The firefighters are wearing helmets and gear, and their forms are dark against the bright light of the flames. The word "Thanks!" is written in a large, elegant, cursive font in the center of the image.

Thanks!