Climate Extremes: The Science, Impacts and Policy Relevance

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Background

- Climate extremes (e.g., heat waves and storms or regional warming and rainfall) are projected to become more intense and frequent in the 21st century (IPCC, AR4).
- Potential impacts on food security, water resources, disease spread, hazards, humanitarian aid and migration need to be understood along with uncertainties.
- Challenges from multiple perspectives
  - Accuracy, resolution and credibility of projections
  - Massive multi-source data and nonlinear processes
  - Focus on tail behavior and complex dependence
  - Cascading uncertainty propagation
  - Complex interacting systems: Natural, built, human
- An urgent societal priority with complex trade-offs
- Regional preparedness and mitigation policies

Objectives and Research Framework

- Quantifying the uncertainty of climate extreme by incorporating both the observation and simulation.
- Investigating the consistency (or inconsistency) among multiple climate projections in non-stationary environments
- Risk-based impact assessment

Temperature Extremes

- Higher trends but larger uncertainty of temperature extremes in the 21st century

Uncertainty on Regional Hydrology

- Unlike temperature, precipitation errors cannot be modeled by a Gaussian distribution alone.
- Bias adjustment uses observations and simulations

Complex Network for Uncertainty Reduction

- Complex networks can unify data-guided descriptive analysis and predictive modeling for climate
- Descriptive oceanic clusters may predict land extremes

Point of Contact

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References

- Ganguly et al. (2009), Uncertainties in the Assessment of Climate Change Impacts on Regional Hydrology and Water Resources, invited submission, under double-blind review.
- Ganguly et al. (2009), Higher trends but larger uncertainty and geographic variability in 21st century temperature and heat waves, PNAS, 106(37).
- Increase over time, the increment is not spatially uniform.
- Droughts projected over regions already experiencing or beginning to experience drought-like conditions.

Intensiﬁed Rainfall Extreme

- More intense rainfall extremes are expected in the 21st century on the average: This can be inferred from both observations and climate models with extreme value theory.

Droughts

- While the total global precipitation is expected to increase over time, the increment is not spatially uniform.
- Droughts projected over regions already experiencing or beginning to experience drought-like conditions.

http://blogs.nature.com/news/blog/events/climate_war_game/
http://www.ornl.gov/sci/knowledgediscovery/QDR/
http://www.cornell.edu/cic/knowledgediscovery/CDR/