



Extreme weather and climate change

November 20, 2013



Introduction

Extreme weather events, from hurricanes to heat waves, seem to be in the news with increasing regularity. But are extreme events actually increasing in frequency? And do they have a connection to our changing climate? Ethan will begin the lecture with an overview of some recent extreme weather events, and their impact on humans, whether due to flooding, extreme heat, or drought. Next, Karen will discuss observed changes in heavy precipitation events, and the connection between a warming atmosphere and increased heavy precipitation. Finally, Andy will explain the physical causes of heat waves, and how extremely hot temperatures are expected to change as the average temperature increases. Following the lecture, the speakers will give a short workshop on accessing and visualizing climate data on the internet.

Speakers



Ethan Butler is a sixth year PhD student at Harvard in Earth and Planetary Science. Originally from Minneapolis, Minnesota, Ethan studied Physics and the College of Letters at Wesleyan University and taught at the University of Liberal Arts Bangladesh in Dhaka before returning to New England. He works with Peter Huybers on how crop yields are affected by climate variation. His focus has been on how maize in the United States will be affected by extreme temperatures and how adaptation can reduce damages from a warming environment.



Karen McKinnon is a third year PhD student at Harvard in Earth and Planetary Sciences. She works with Peter Huybers on questions of surface temperature variability and change, including analyzing the statistics and physical causes of North American heat waves. Originally from Boulder, Colorado, Karen has been interested in atmospheric science since she was a child, and received her undergraduate degree in Earth and Planetary Sciences at Harvard. When not doing research, she enjoys running, backpacking, bread baking, and ceramics.



Andy Rhines is a sixth year PhD student at Harvard in Applied Mathematics, where he works with Peter Huybers. Andy is originally from Seattle, and enjoys rain. This is fitting of his research, which is primarily on moisture transport in the atmosphere and the effect that it has on climate variability. His other research interests include paleoclimate and high performance computing. Andy studied physics as an undergraduate at Reed College, and can be found outdoors in summer clothing most of the year.

Glossary of Important Terms

Anomaly: A value expressed as the difference from normal conditions. For example, the July temperature anomaly is the amount by which the temperature differs from the average July.

Heat dome: A meteorological condition where hot air builds up over a large region, blocking the inflow of colder air and suppressing precipitation. Heat domes are common in the Southwest during summer, but also occasionally occur for extended periods elsewhere.

Heat Index: A measure of the physiological effect of temperature and humidity.

Heat wave: A period of high levels of heat stress. Heat waves are measured in different ways depending on their location and timing.

Hurricane: A large tropical cyclone in the Atlantic or Caribbean with average surface winds, which are greater than 72 miles per hour. Hurricanes are called “Typhoons” in the Pacific Ocean.

Mean: The expected value from a range of values. In common use, mean and average are synonyms.

Palmer Drought Severity Index: A standardized measure of dryness, which is based on temperature and precipitation data.

Probability distribution: A probability distribution assigns a probability to each possible outcome under some set of circumstances. For example the probability distribution for flipping a fair coin would assign 50% to heads and 50% to tails while the probability distribution for rolling any value on a 6-sided die would be 16.666%.

Saturation vapor pressure: When the pressure of gaseous water vapor is in equilibrium with liquid water and thus the highest attainable vapor pressure at a given temperature.

Soil moisture: The fraction of soil volume made up by water.

Solar radiation: Incoming sunlight that constantly puts energy into the earth system.

Statistically significant: When a relationship is thought to arise from some source other than random chance.

Variance: A formal measure of spread among measurements or a probability distribution.

Water cycle: The movement of water between the ocean, atmosphere, land, and ice of the earth system through evaporation, precipitation as snow or rain, flow as surface water in lakes, rivers, and streams, and percolation into soil.

Resources to learn more

Links to climate resources on the internet: <http://tinyurl.com/n57eqn2>

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