CLIMATE CENTRAL

SHIFTING CITIES: WINTER LOSES ITS COOL

SUMMARY

Hearing about climate change may bring heat waves and sweltering summers to mind, but in most regions in the U.S., winter temperatures are also on the rise. In spite of last year's East Coast blizzard and polar vortex, winters have, on average, been getting warmer since the 1970s. One of the starkest examples of this is the overall drop in nights below freezing in most cities.

For many Americans the idea of fewer freezing nights is a welcome prospect. But warmer winters can have negative impacts: ski resorts need freezing temperatures for snow, some crops rely on a chill period, and pests can flourish year-round if winter temperatures aren't cold-enough for them to die off.

Climate models project that freezing temperatures will become even less frequent as greenhouse gas emissions further increase global temperatures. What will these warming winters feel like? For our Winter Loses Its Cool interactive we have projected the number of nights below freezing for the end of this century for 697 cities, and then showed which U.S. city currently experiences that number of freezing nights. Several striking examples are highlighted below, but explore the interactive to find out how the cold season will be affected in your city.

By the end of the century, assuming current CO2 emissions trends continue until the end of the century, Helena, Mont., will see about 85 fewer freezing nights, which is comparable to Lubbock, Texas, today. Buffalo, N.Y., which currently experience about 124 freezing nights each year, will only see about 57 a year in 2100, making it more like Charlotte, N.C. Ann Arbor, Mich., will see less than half its current number of nights below freezing (131), more like Huntsville, Ala. (60).

In fact, more than 80 percent of the cities we analyzed – 593 of the 697 – could see at least a 50 percent reduction in number of nights below freezing, and more than 20 percent – 145 of the 697 – could see at least a 75 percent reduction. There are even 28 cities, mostly those that currently experience between 10 and 20 nights below freezing, that may see at least a 90 percent reduction. For these cities, freezing nights will become rare events that occur about once a year, comparable to the current conditions in Brownsville at the southern tip of Texas.

This analysis only accounts for daily minimum temperatures, which typically occur at night, and doesn't incorporate windchill, which contributes to how winters feel. This projected warming also assumes greenhouse gas emissions keep increasing through 2080 as they have been for the past few decades.

Click here to see a similar analysis of how summers may feel by the end of the century.

METHODOLOGY

Average annual number of nights below freezing for 1,001 major U.S. cities was calculated based on daily minimum temperature data from Daymet[1], which uses data from the Oak Ridge National Laboratory Distributed Active Archive Center and provides gridded estimates of daily weather parameters at 1km x 1km resolution (http://daymet.ornl.gov/index.html). The current average annual number of nights below freezing was calculated as the annual average from 1986-2005, rounded to the nearest whole number. For this analysis, only cities that currently average at least 10 nights below freezing were included, reducing the number of eligible cities to 697 compared to our previous summer analysis.

The projected temperature change from the present to 2100 was calculated by comparing the average minimum temperature from 1986-2005 to the average minimum temperature from 2080-2099 based on the RCP8.5 emissions scenario from a downscaled multi-model ensemble approach (Downscaled CMIP5 Climate Projections archive at http://gdo-dcp.ucllnl.org/downscaled_cmip_projections/). The projected temperature change was then added to the current daily minimum temperatures for 1986-2005 from Daymet, and the average annual number of nights below freezing for 2080-2099 was calculated. In order to adopt a more conservative approach for these future projections, the projected number of future nights was rounded up, to the nearest integer greater-than or equal- to the average projected number of nights below freezing.

To find a destination city, the projected number of nights below freezing in each city was compared to the current number of nights below freezing in all other cities. A destination city was then chosen among the cities that currently experience a number of nights below freezing that is within 5 percent of the projected number of nights. When multiple cities matched this criterion, the top three cities with the southernmost bearing relative to the origin city were identified (to minimize east-west movement), and the city with the most southern latitude was chosen among these. Since many cities are projected to have fewer than 10 nights below freezing by 2100, the possible list of destination cities included all 1,001 original cities.

Analysis by Regina Wang and Alyson Kenward.

(1) Thornton, P.E., M.M. Thornton, B.W. Mayer, N. Wilhelmi, Y. Wei, R. Devarakonda, and R.B. Cook. 2014. Daymet: Daily Surface Weather Data on a 1-km Grid for North America, Version 2. Data set. Available on-line [http://daac.ornl.gov] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, USA. Date accessed: 2015/01/13. Temporal range: 1986/01/01-2005/12/31. Spatial range: N=48.74, S=25.67, E=-69.77, W=-123.28. http://dx.doi.org/10.3334/ORNLDAAC/1219.

One Palmer Square, Suite 330 Princeton, NJ 08542
Phone: +1 609 924-3800
Toll Free: +1 877 4-CLI-SCI / +1 (877 425-4724)
www.climatecentral.org