



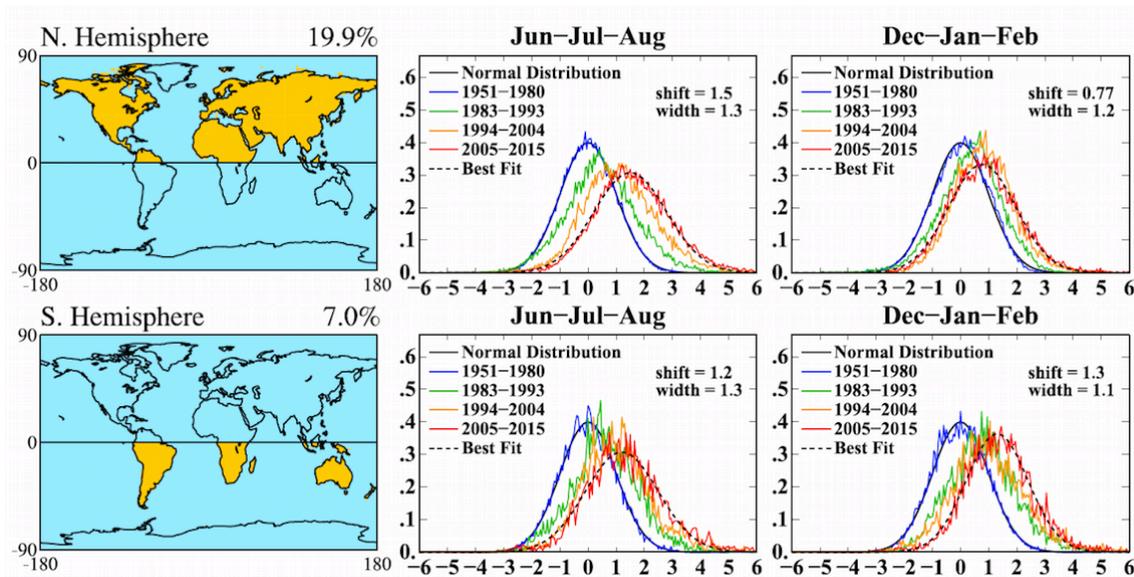
Aspen Global Change Institute Energy Project

March 2016 Quarterly Research Review

REGIONAL IMPACTS OF CLIMATE CHANGE ARE INCONGRUOUS WITH RESPONSIBILITY

In an ambitious new article, Hansen and Sato (2016) not only examine the regional variation of climate change impacts, but also identify responsibilities and viable climate policies to address the causes of global warming in an equitable way.

The paper starts off by comparing the last 66 years of climate data (seasonal mean temperatures) to a base period of 1951-1980, confirming findings of significant global warming and increasing extreme climate events. They note that, due to the more variable nature of winter climate conditions, warming was more easily detected during summers in both the Northern and Southern Hemispheres (see figure below). They also detail the incredible variability of warming observed across different regions around the world and the obvious difference in land area between the hemispheres the figure illustrates.



While the United States exhibited summer warming in the last decade on the order of 1 standard deviation higher than base period temperatures, this trend is accentuated in Europe, China, and India where warming was 1.5 standard deviations higher. These trends are further accentuated in the lower latitudes. The Sahara, the Sahel, and Southeast Asia all had summer warming over 2 standard deviations higher, and the Mediterranean, Middle East, and African Rainforest had warming closer to 2.5 standard deviations higher than the base period temperatures. All of these observed trends, however, pale in comparison to the impact of 6 standard deviations in temperature rise that would be associated with a 2°C increase in those regions.

The implications of these warming trends are global and serious – from new human health threats, to diminished economic productivity, to potential increases in human conflicts and associated migration patterns. Human health will face magnified challenges with the increase in the numbers of droughts, storms, floods, and heat waves. The ranges of vector-borne diseases are also expected to broaden as mosquitos and ticks are able to survive in broader ranges.

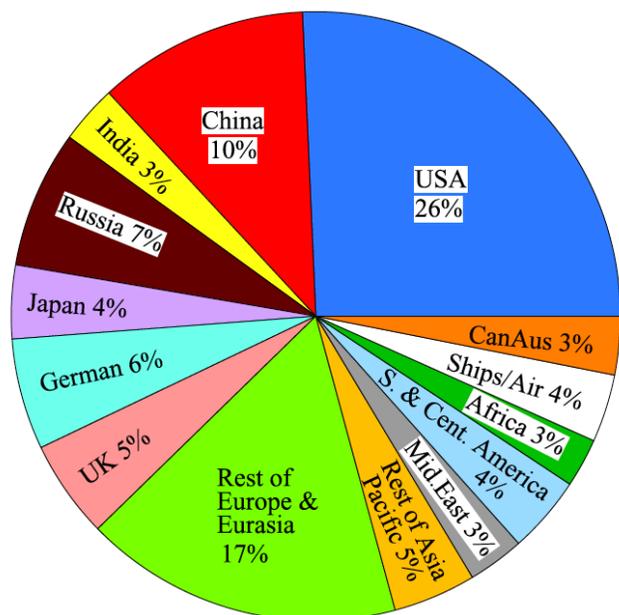
Outdoor livelihoods and even basic residence may be compromised in regions with amplified warming. For instance, certain areas in the Middle East are expected to exceed the habitable range of humans – with wet bulb temperatures projected to exceed the level at which the human body can cool itself. Productivity in the southern U.S., southern China, Indonesia, India, and Nigeria are likewise expected to be significantly compromised.

And past research indicates that increases in temperature increase the likelihood of both interpersonal and inter-group conflict. Conflict coupled with extended drought, as in the case of Syria in recent years, can result in migration. The same can be said for populations who in the future will be displaced by sea level rise (which threatens many of the planet’s major cities).

Hansen and Sato (2016) then go on to point out that many of the regions projected to be most impacted by climate change, such as Southeast Asia, the Sahara, and the Sahel are not those that generated greenhouse gases. Some regions are projected to see severe warming, like the Mediterranean and the Middle East, which do have per capita emissions far above average (even greater than the U.S.). But ultimately, the majority of the responsibility for climate change rests on the United States, Europe, and Eurasia (see figure to the right).

In order to stabilize the climate, Hansen and Sato (2016) argue for the implementation of a price on carbon

1751–2014 Cumulative Emissions (396 GtC)



accounting for the 'external' costs to society posed by fossil fuels. This tactic would rely upon international cooperation, with economically strong countries implementing the carbon fee along with border duties to ensure that the carbon footprint of goods made in non-participating countries would also be accounted for. With the true costs of fossil fuels incorporated into their prices, the rise of carbon-free energy technologies would be greatly accelerated. This approach, they argue, would ultimately stabilize the climate with the fewest economic hardships.

Hansen, J., and M. Sato. 2016. Regional climate change and national responsibilities. *Environmental Research Letters* (11) 1-9.