



Spotlight on Climate

Climate Change: Rainfall, Droughts, and Floods

At this point everyone can see that the Earth is getting warmer. It's not some distant, uncertain, theoretical future anymore. In Phoenix, people regularly swelter in temperatures over 110°F (=43°C), and in Flagstaff, people are beginning to wonder if they should install cooling systems in their homes. Science has long told us that as we thicken the layer of greenhouse gases, Earth will trap more of the Sun's heat energy, and we now see the results of this every day. Temperatures have been rising so steadily, scientists can easily predict with high certainty how it will continue to rise. Other climate variables are a little more complicated. How does the added heat energy in our atmosphere affect rainfall, drought, and floods? Are the recent floods in Flagstaff related to climate change?

We've all heard that hot air holds more water than cold air. So, does that mean we'll get more clouds and rainfall now? To answer that, we have to back up for a minute and look at the basics of climate: the long-term pattern of weather in a given region. In a nutshell, climate is powered by the heat energy in the atmosphere and oceans. Heat energy powers the wind, it powers ocean currents, it powers rain, and it can also dry the land.

So, as our CO₂ and other greenhouse gas emissions continue to trap more heat energy in the atmosphere, what do we expect will happen? More warming, of course, but also more extremes of every sort. To put it one way, if we give "old man wind" more energy, he'll be able to howl up bigger storms. "Last week's IPCC Report pointed out that we have already seen a significant increase in the number and strength of tropical storms or 'cyclones' around the world over the last four decades," says Dr. Darrell Kaufman, NAU Regents Professor and IPCC Lead Author, "the report also found a significant increase in heavy rainfall events since the 1950s and that this increase was most likely caused by climate change." A 2019 study in southern Arizona showed that "the intensity of monsoon storms has increased since the mid-1970s", said lead author Dr. Eleonora Demaria, Principal Hydrologist of the Pima County Regional Flood Control District.

Many parts of the world now see storms several times per year that are only supposed to happen once in 100 years. Last Tuesday's flooding in many Flagstaff neighborhoods came from an extreme downpour over the Museum Fire Scar that was estimated by the County to be a 200-to-500-year storm. Last month, an extreme downpour on nearby areas of Mount Elden caused similar flooding that even floated cars down the street. Perhaps these downpours are part of the same pattern of increased monsoon rainfall intensity that Dr. Demaria documented in southern Arizona.

While the world has seen this increase in extreme storms, we are also seeing additional extreme drought. Currently, and for the last 20 years, the Southwest and, really, most of the Western United States has been in what is now recognized as a megadrought. How can we be having more storms and at the same time more droughts? Well, again, heat energy drives both outcomes. Heat can not only change rainfall patterns, but also heat leads to greater evaporation. Evaporative loss can dry out plants, bake soils, and kill crops. Dry lands that have seen lower rainfall and greater evaporation are more susceptible to wildfire. It's not surprising then that we have seen more flooding and more wildfires as climate change turns up

the heat. And it's not just Arizona. We're now seeing these same patterns across the US West, Canada, across Europe, northern Africa, and India. Even Russian Siberia is burning.

What can you do to fight climate change? Lower your carbon footprint in every way possible. Encourage your City Council to implement the Flagstaff Climate Action and Adaptation Plan as soon as possible and in the strongest possible way. Join citizen groups like the Northern Arizona Climate Change Alliance to help educate and empower your fellow community members. Join the ShoeStrike for Climate Justice on Saturday 28 August and the Fridays For Future Global Climate Strike on Friday 24 September. Please visit www.NAZCCA.org to learn more and sign up to volunteer by visiting <https://www.nazcca.org/volunteer>.

Dr. Stefan Sommer, Stefan.Sommer@nau.edu
Center for Adaptable Western Landscapes
at Northern Arizona University
and the
Northern Arizona Climate Change Alliance (NAZCCA.org)

Larger logo:

