

Let's Talk Water – Natural Disasters Part 1: Hurricanes

By Dr. Mike Strobel

Normally, I probably wouldn't be addressing hurricanes to a reader audience in eastern Nevada. However, because hurricanes have played such a big role in the news this year, I thought it was worth discussing the definition of hurricanes, why they cause so much damage, and how this relates to hydrology.

According to the National Oceanic and Atmospheric Administration (NOAA), where much of the information for this article was derived, a hurricane is a severe tropical storm that forms in the southern Atlantic Ocean, Caribbean Sea, Gulf of Mexico, or in the eastern Pacific Ocean (<http://hurricanes.noaa.gov/>). Hurricanes are part of meteorological phenomenon known as tropical cyclones, where hurricanes represent the most severe of these types of weather.

A hurricane is a low pressure system with associated warm, moist conditions and thunderstorm activity that rotates around an "eye" in a counterclockwise direction. A tropical cyclone becomes a tropical storm when its winds reach 39-73 mph, and is defined as a hurricane when the winds exceed 74 mph. Once defined as a hurricane, there are categories from 1 to 5, with 5 being most severe. Category 1 hurricanes have winds between 74-95 mph and category 5 hurricanes have winds in excess of 155 mph. Keep in mind that the category rating of a hurricane does not directly relate to the damage it will cause. The category is simply wind speed, and damage may depend on numerous factors.

Hurricanes can vary in size and may reach as large as 300 miles across. The center of the hurricane is the eye and this area, typically 20-40 miles across, can be relatively calm. Associated with the hurricane are bands of dense clouds full of moisture and with high potential for thunderstorms.

Although the winds are a major cause of damage during a hurricane, often water damage due to surging seas and heavy downpours with related flooding can be responsible for much of the damage costs and loss of life. In looking at rating hurricanes as a factor of damage costs, the results often can be misleading. For example, a lower category hurricane may result in more damage costs than a category 5 hurricane with extremely high winds simply because of the population density and building types in the storm's path. As pointed out by NOAA, Hurricane Andrew in 1992 alone caused \$25 billion in damage in South Florida and Louisiana, but this would have been much higher had the storm hit Miami directly.

I was living in North Carolina soon after Hurricane Floyd had hit and done so much damage along the coast and for hundreds of miles inland. Much of the damage was related to heavy rains and flash floods. Floyd neared category 5 as it neared the Bahamas, but had fallen to a category 2 hurricane as it hit the Carolina coast and declined to a tropical storm as it moved north from Virginia.

The reason Floyd was so damaging was, in part, the winds, but also the heavy rainfall. As much as 15-20 inches of rain fell in portions of eastern North Carolina, and a 24-hour record of 15.06 inches at Wilmington. By contrast, Nevada receives an average of 9 inches of precipitation a year. Throughout much of the eastern US, new 1-day records for rainfall were set in numerous locations.

The heavy rainfall and related flooding were responsible for 57 deaths and billions of dollars in damage. It is often a bad combination to have heavy rains and high winds. Rains can saturate the soils, softening the foundation around trees and structures. Once weakened, the winds can do much greater damage to the landscape. Often, it is the storms that precede a high-category hurricane that really are responsible for much of the damage. If the soils are already saturated prior to a hurricane reaching the coast, then the damage from winds and flooding have the potential to be much larger.

This summer, there were a series of damaging hurricanes to hit the US. Hurricane Alex (July 31 to August 6) had winds near 100 mph as it passed within 10 miles of the North Carolina coast. Hurricane Charley (August 9 to 14) hit the southwest coast of Florida with winds of 145 mph. It caused 10 deaths in the US. Hurricane Frances (August 24 to September 9) hit Florida's east coast as a category 2 and weakened to a tropical storm over Florida. It moved up through the eastern US and dissipated over southeastern Canada. Frances was responsible for 23 deaths. Hurricane Ivan (September 2 to 24) reached category 5 at several times, but was a category 3 when it hit the US coast at Alabama. Ivan was responsible for 90 deaths, mostly on Grand Cayman Island and Cuba. Finally, Hurricane Jeanne (September 13 to 29) made landfall on the east coast of Florida as a category 3 hurricane, near the same location that Hurricane Jeanne came ashore. Death tolls in the Dominican Republic and Haiti are not yet known, but estimates are over 2000 deaths due to inland flooding.

This will probably be remembered as the year of the hurricane. According to NOAA, in an average 3-year period, roughly 5 hurricanes hit the US coastline, killing approximately 50 to 100 people anywhere from Texas to Maine. Of these, two are typically major hurricanes (winds in excess of 100 mph). This year has been exceptional for hurricane activity to reach the coast and the related damage and deaths associated with large hurricanes.

So, this is all very interesting, but you may ask what this has to do with Nevada. Actually, much of the weather patterns related to storms in the Atlantic can affect Nevada. During the "monsoon" season of July and August, warm, moist weather from the Gulf of Mexico can bring heavy rainfalls in the southwestern US, including Nevada. These are responsible for a number of the large, often damaging downpours recorded in Las Vegas and other cities. Tropical storms and hurricanes can affect weather patterns and precipitation amounts for great distances inland. Therefore, all of the US should watch hurricane activity with some level of interest.

I hope this provides a general overview of hurricanes. If you have questions, please send them to me at the Ely Times or email me at mstrobels@usgs.gov. Next week, we continue with natural disasters and discuss the hydrology related to volcanoes.