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IT'S ALL CONNECTED

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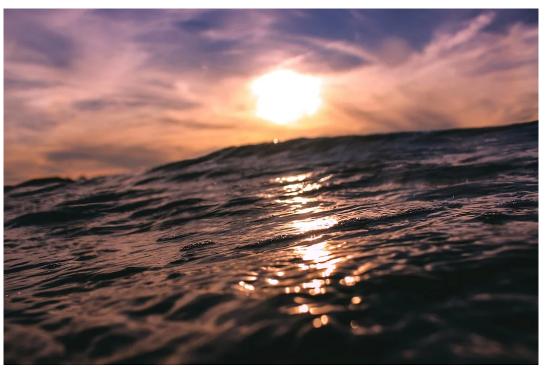


Waterworld

What do increasingly severe storms, bomb cyclones, atmospheric rivers, and even earthquakes and slowing rotation of the Earth have in common? Hint: 70% of the Earth's surface is covered by the element at play here.

Yes, water, and the water cycle have profound effects on many planetary features. Let's take a closer look at some of the far reaching effects that the water cycle, now combined with climate change, has on us and the planet.

When ocean water warms, increased evaporation occurs creating more intense and frequent precipitation. The amount of total rainfall may not be much different, but the pattern in which it falls does change…very often dropping a year's worth of precipitation in a single event. These changes are being observed more regularly in events such as bomb cyclones, hurricanes, and atmospheric rivers.

A **bomb cyclone**, also known as explosive cyclogenesis, is a rapidly intensifying storm system characterized by a significant drop (at least 24 millibars within 24 hours) in atmospheric pressure. The term "bomb" refers to the sudden and explosive nature of its intensification.

Bomb cyclones typically form in the mid-latitudes, where cold polar air meets warm air from the tropics. While they can occur in various parts of the world, bomb cyclones are most common off the East Coast of the United States, particularly during the fall and winter months.

Bomb cyclones can bring heavy snowfall, strong winds, and severe weather, including blizzards in winter. In coastal areas, they can lead to storm surges and flooding. Two notable bomb cyclones include the "Storm of the Century" in March 1993 and the "Bomb Cyclone" that struck the U.S. Midwest and Northeast in March 2019.

Atmospheric rivers are narrow corridors of concentrated moisture in the atmosphere that transport large amounts of water vapor from the tropics to mid-latitudes and higher latitudes. They are key features in the global water cycle and can have significant impacts on weather and climate, particularly in regions they affect.

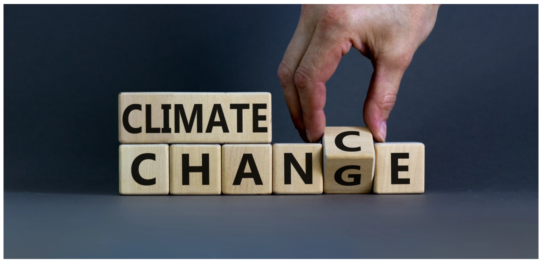
Atmospheric rivers are typically 250-375 miles (400-600 km) wide but can stretch thousands of miles long. They carry water vapor equivalent to the average flow of water at the mouth of the Mississippi River. These rivers form when moisture from the ocean is lifted into the atmosphere by evaporation and then transported by strong winds, often within the jet stream. When this moisture-laden air encounters mountainous regions, it rises, cools, and condenses, leading to heavy precipitation.

Atmospheric rivers can produce intense rainfall and snowfall and can last for several days. AR's are relatively common phenomena, with around 30-50 atmospheric river events occurring each year on the West Coast of the United States alone. With the added effects of climate change, meteorologist Dr. Daniel Swain illustrated how some AR's carry excessive water vapor and drop their content in spectacular fashion when they make landfall, sometimes causing extreme flooding and landslides.

The "Pineapple Express" is a well-known atmospheric river that brings moisture from the tropical Pacific near Hawaii to the West Coast of North America. Atmospheric rivers play a crucial role in the distribution of global precipitation and can account for a substantial portion of the annual rainfall in some regions.

In recent years meteorologists have noticed that **hurricanes** have become more likely to experience "hyper-intensification." Just last year, a tropical storm named Otis rapidly turned into the strongest hurricane ever to make landfall in Mexico, with maximum sustained winds increasing from 55 mph to 160 mph in just 21 hours. A major factor in these cases is anomalously warm sea surface temperatures that contribute to a "heat engine" feedback loop. Dr. Marshall Shepherd discussed this phenomenon on a recent Nature's Archive podcast episode. As sea surface temperatures warm, these dangerous hyper-intensification scenarios are more and more likely to occur.

With current climate change and the accelerated melting of glaciers in Greenland, Antarctica, and other regions, the process of "glacial isostatic adjustment" (GIA), also referred to as "post-glacial rebound" may increase. GIA potentially leads to changes in **seismic activity** because these glaciers are massive bodies of ice that exert substantial pressure on the Earth's crust.



When glaciers melt, the weight exerted on the crust is reduced. The Earth's crust begins to slowly rise or rebound once the ice melts and flows off. This rebound is not immediate; it occurs over thousands of years as the mantle, which behaves like a very viscous fluid, slowly readjusts to the reduced pressure. As the crust rebounds, this adjustment can lead to the reactivation of pre-existing faults or the creation of new faults, resulting in seismic activity, or earthquakes.

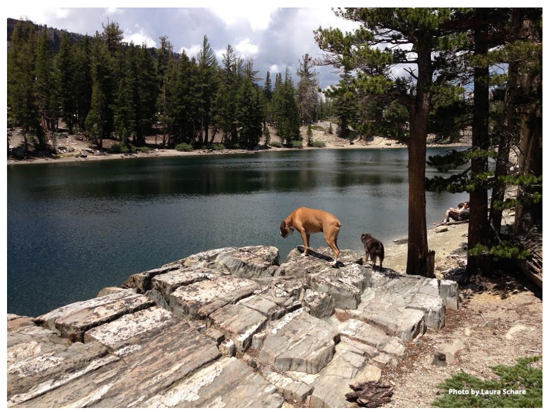
Regions that were heavily glaciated during the last Ice Age, such as parts of Scandinavia, Canada, and the northern United States, experience increased seismic activity due to this rebounding process. Understanding the relationship between melting glaciers and earthquakes is crucial for assessing seismic risks in regions experiencing significant glacial melt and post-glacial rebound.

Another effect of melting glaciers is sea level rise. Surprisingly, this does not occur evenly. In fact, melted glacial water has contributed to more water accumulation around the equator which has actually resulted in an extremely small slowing of **Earth's rotation**.

In the last 30 years, worldwide ocean levels have risen about 4 inches and could rise another 24 inches by the end of the century if we don't make substantive changes to carbon pollution from fossil fuel use. Because ocean levels are higher around the equator, the planet is wider which slows Earth's rotation just a tiny bit. On a human scale, we cannot fathom the miniscule change, but our technology is highly sensitive to fractions of a second.

These are just some of the changes we see in our water cycles due to climate change. Whether it is increased storm severity resulting in infrastructure damage, earthquakes from redistributed water weight, or adjustments to our technology because climate change contributes to slowing of the Earth. The fact is, we need to understand the potential for continued effects and prepare. Better yet, we need to address our contributions to climate change and make adjustments to our everyday lives on an individual as well as corporate and governmental level.

Dogs, Hiking, and Heatstroke



Every summer emergency calls come in from frightened owners because their dog fell ill while out hiking. Invariably, these dogs are suffering from heatstroke and many do not make it. While it's wonderful to share the trails with your furry best friend, it's important to remember that dogs don't handle heat the same way humans do. Dogs don't have sweat glands to help regulate body temperature. That means higher temperatures combined with exercise may create an ideal environment for hyperthermia and heat stroke.

Of course, carrying plenty of extra water is important, but knowing the signs of heatstroke is invaluable: excessive panting, trouble breathing, glazed eyes, drooling/salivating, rapid heartbeat, agitation/restlessness, bright red tongue and gums, vomiting/diarrhea (maybe with blood), weakness/collapse, seizures, elevated temperature (103+), limbs that are hot/warm to the touch, or unconsciousness.

Watch your pet carefully while out on the trails, choose places with plenty of shade to cool off and rest, pay attention to the ground temperature…if it's too hot for you to walk barefoot, it's too hot for your dog, and be prepared to abort your hike if any signs of heat illness are showing.

Did you know that skin destruction begins in 60 seconds at a temperature of 125°F? Keep in mind that in direct sun:

- If air temperature is 77°F, asphalt temperature can reach 125°F
- If air temperature is 86°F, asphalt temperature can reach 135°F
- If air temperature is 87°F, asphalt temperature can reach 143°F

Asphalt is not the only substrate to heat up, many trails have hot surfaces as well, such as sand or ground rock that absorbs heat much like pavement.

Quick Connections

Books, websites, documentaries, podcasts, events, quotes, and more

Native Plant Ideas

Level up your container gardening efforts with help from Christian Cooper and Homegrown National Park.

Quote we're pondering

"Start where you are. Use what you have. Do what you can." - **Arthur Ashe**

When you think National Park, the iconic views of **Yosemite** come to mind. This series of short videos highlight the plants, animals, geology, and history of the park.

Free ID Guide

Sparrows are tricky to identify at times and Cornell Lab has your back with these free field guides.

Community Connections

We want to connect with you. Are you a National Park geek? Which parks are your favorites and where are you headed this summer?

We read each and every response and will share selected reader stories in upcoming newsletters.

Share With Us

Your feedback is important. Tell us how we are doing and what you would like to see covered in future newsletters.

Every connection counts! Please help grow our community of everyday heroes by sharing this newsletter with a friend or colleague.

Thank you,

Laura Schare, Editor

Michael Hawk, Founder

Jumpstart Nature

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