

How does the sea 'disappear' when a hurricane passes by?

September 13 2017, by Darrell Strauss

You may have seen the [media images](#) of bays and coastlines along Hurricane Irma's track, in which the ocean has eerily "disappeared", leaving locals amazed and [wildlife stranded](#). What exactly was happening?

These coastlines were experiencing a "negative storm surge" – one in which the storm pushes water away from the land, rather than towards it.

Most people are familiar with the idea that the sea is not at the same level everywhere at the same time. It is an uneven surface, pulled around by gravity, such as the tidal effects of the Moon and Sun. This is why we see tides rise and fall at any given location.

At the same time, Earth's atmosphere has regions where the air pressure is higher or lower than average, in ever-shifting patterns as weather systems move around. Areas of high [atmospheric pressure](#) actually push down on the ocean surface, lowering sea level, while low pressure allows the sea to rise slightly.

This is known as the "[inverse barometer effect](#)". Roughly speaking, a 1 hectopascal change in atmospheric pressure (the global average pressure is 1,010hPa) causes the sea level to move by 1cm.

When a low-pressure system forms over warm tropical oceans [under the right conditions](#), it can intensify to become a tropical depression, then a tropical storm, and ultimately a tropical cyclone – known as a hurricane

in the North Atlantic or a typhoon in the northwest Pacific.

As this process unfolds, the atmospheric pressure drops ever lower and wind strength increases, because the pressure difference with surrounding areas causes more air to flow towards the storm.

I am in disbelief right now... This is Long Island, Bahamas and the ocean water is missing!!! That's as far as they see [#HurricaneIrma](#) wtf pic.twitter.com/AhPAonjO6s

— #ForeverFlourish (@Kaydi_K) [September 9, 2017](#)

In the northern hemisphere tropical cyclones rotate anticlockwise and officially become hurricanes once they reach a maximum sustained wind speed of around 120km per hour. If sustained wind speeds reach 178km per hour the storm is classed as a major hurricane.

Surging waters

A "normal" storm surge happens when a tropical cyclone reaches shallow coastal waters. In places where the wind is blowing onshore, water is pushed up against the land. At the same time the cyclone's incredibly low air pressure allows the water to rise higher than normal. On top of all this, the high waves whipped up by the [wind](#) mean that even more water inundates the coast.

The anticlockwise rotation of Atlantic hurricanes means that the storm's northern side produces winds blowing from the east, and its southern side brings westerly winds. In the case of Hurricane Irma, which tracked almost directly up the Florida panhandle, this meant that as it approached, the east coast of the Florida peninsula experienced easterly onshore winds and suffered a storm surge that caused severe inundation and flooding in areas such as [Miami](#).

The negative surge

In contrast, these same easterly winds had the opposite effect on Florida's west coast (the Gulf Coast), where water was pushed offshore, leading to a negative storm surge. This was most pronounced in areas such as Fort Myers and Tampa Bay, which normally has a relatively low tide range of less than 1m.

Manatee rescued: More pics of [#Irma](#) storm survivors helping a manatee stranded when storm surge pulled water out.

[@ActionNewsJax pic.twitter.com/RWf6cUslEn](#)

— Paige Kelton (@PaigeANjax) [September 10, 2017](#)

The negative surge developed over a period of about 12 hours and resulted in a water level up to 1.5m below the predicted low tide level. Combined with the fact that the sea is shallow in these areas anyway, it looked as if the sea had simply disappeared.

As [tropical cyclones](#) rapidly lose energy when moving over land, the unusually low [water](#) level was expected to rapidly rise, which prompted authorities to issue a [flash flood warning](#) to alert onlookers to the potential danger. The negative surge was replaced by a [storm](#) surge of a similar magnitude within about 6 hours at Fort Myers and 12 hours later at Tampa Bay.

Rising waters are the deadliest aspect of hurricanes – even more than the ferocious winds. So while it may be tempting to explore the uncovered seabed, it's certainly not wise to be there when the sea comes rushing back.

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