Journal of Earth and Environmental Sciences
Goldschmidt-Clermont PJ and Goldschmidt AJP. J Earth Environ Sci 6: 199.
www.doi.org/10.29011/2577-0640.100099
www.gavinpublishers.com

Research Article

Universal Gravity, Hurricane Clouds, Ocean Geoid Low, and the Ocean Surges and Dimples

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Citation: Goldschmidt-Clermont PJ, Goldschmidt AJP (2023) Universal Gravity, Hurricane Clouds, Ocean Geoid Low, and the Ocean Surges and Dimples. J Earth Environ Sci 6: 199. DOI:10.29011/2577-0640.100099

Received: 01 December 2023; **Accepted:** 05 December 2023; **Published:** 07 December 2023

Abstract

Here we propose that hurricane-induced displacements of ocean waters, surges and dimples (even large local emptying), are induced by Newton's universal gravity force created by the massive amount of water suspended in the sky within the hurricane cloud, and proximal to the ocean surface. These clouds have been estimated to contain trillion liters of water or more. The winds moving cyclonically are essential to maintaining such mass of water suspended in the sky like a giant spinning top. As hurricane clouds have become larger with global warming, our calculations support the hypothesis that hurricane clouds exert sufficient gravity force to displace ocean surface waters across large regions to cause surges and dimples.

Keywords: Weather Extremes; Hurricane Clouds; Global Warming; Ocean Geoid Low; Gravity; Ocean Surges

Introduction

It is usually believed that violent winds are the most damaging impact of hurricanes, however, in the past 20 years, we have come to realize that storm surges are the most devastating impact of a hurricane. Indeed, storm surges destroy coastal regions and are assumed to be the product of rain and ocean water being pushed toward the shore by the force of the winds moving cyclonically around the storm. There is no question that coastal winds can affect the size of ocean waves [1-5].

However, what winds alone do not explain is the massive displacement of ocean surface water, with consequent regions of water surges, akin to giant tides, but also with very large regions of ocean water emptying, or dimples (Figure 1), often at a considerable distance from surges. Such ocean water dimples represent another indication of the substantial amount of displaced ocean water, unlikely to result from hurricane winds alone.

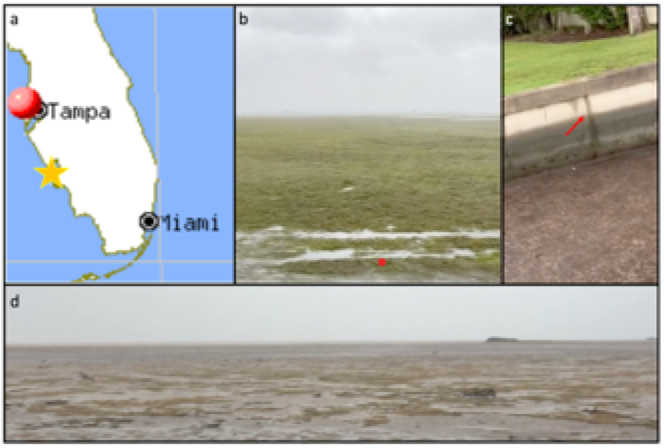

Figure 1: a) Map with location of 2022 hurricane Ian' landfall in Cayo Costa next to Fort Myers, Florida (yellow star), where the surge took place; the orange dot shows the area of ocean emptying next to Palm Harbor in Florida, just West of Tampa, 106 miles away from Cayo Costa. b) Emptied ocean coast next to Palm Harbor. c) Mark of the usual water level (red arrow) on the Palm Harbor wall against the ocean. d) Emptied ocean coast in the Bahamas following the passage of 2017 hurricane Irma

Hypothesis and Facts

Such displacements of ocean water resemble the tides that we are familiar with and are induced by our Earth's moon via gravity force (and by the sun to a lesser extent due to the distance between sun and Earth). The gravity force exerted by the moon mass is capable of displacing ocean surface water across large oceans.

We propose that a hurricane surge is also induced by gravity force according to the formula [6]:

Gravity force F = G x [mass of surface ocean water) x (mass of hurricane water cloud] divided by (distance between the hurricane cloud and the surface of the ocean)^2

The eye of the hurricane is like a lower pressure chimney that helps propel moist water to the top of the hurricane cloud (Figure 2), which is supported by rain bands, allowing for a gigantic mass of water to be suspended in the sky. As any gigantic object, the hurricane cloud exerts a gravity force proportional to its mass and inversely proportional to the square of the distance between the cloud and the surface of the ocean which is relatively short (assumed to be approximately one kilometer).

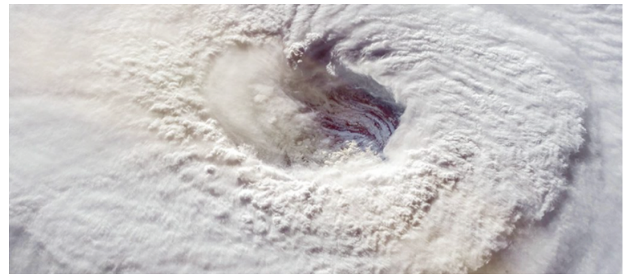

Figure 2: Satellite picture of a hurricane cloud and eye, demonstrating the massive amount of water suspended in the sky by the hurricane.

According to our calculations, to displace an amount of ocean water equivalent to that displaced by the moon with the tides and considering the much shorter distance between the epicenter of the hurricane and the surface of the ocean, compared to the distance separating Earth from its moon, then a hurricane cloud should contain approximately 500 billion liters of water, or more, suspended in the air in proximity to the ocean surface.

Recent hurricanes have been characterized by the gigantic size of their cloud. For example, the diameter of 2022 hurricane Ian was greater than the width of Florida (Figure 3). With global warming, we are likely to be confronted with ever larger hurricane clouds in the future. Furthermore, the hurricane tide is more local than the moon tide, such that the amount of water displaced by a hurricane is probably less than that displaced by the moon. But it is enough to empty ocean regions, and enough to create huge surges in their landing track.

Figure 3: Meteorological picture of hurricane Ian with the map of Florida superimposed, demonstrating the massive size of the dense hurricane cloud.

It is tempting to speculate that tornedos, with a cloud that is also highly water dense but much smaller than that of a hurricane (yet suspended in the air like a spin top by powerful winds), are also able to pull ocean waters, their content (fish, as example), or other objects depending on where they strike. Such pulling power could be the result of a very large mass of water even closer to the surface of Earth than hurricanes.

Instructively, other ocean water "emptying(s)" have been observed as massive "dimples" on the surface of oceans. Indeed, the Earth's lowest geoid, the Indian Ocean geoid low (IOGL) situated just south of the Indian peninsula, is assumed, using current tomography models, to be due to mid to upper mantle hot anomalies believed to cause such IOGL. In other words, a gravity hole below the Indian ocean weakens Earth's gravity pull because its density is lower than the surrounding mantle of Earth. Such a gravity hole results in a dip in ocean water level greater than 300 feet [7]. Such a finding is further evidence that surface ocean waters are exquisitely susceptible to gravity pulls (Figure 4).

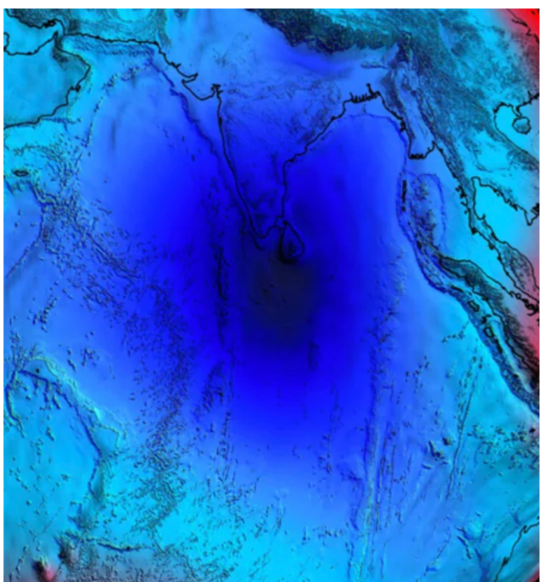

Figure 4: The Indian Ocean geoid low (IOGL) situated just south of the Indian peninsula. The darker blue indicates a region where gravity exerted by the earth is insufficient to maintain the same amount of ocean water as for the lighter blue adjacent regions.

Conclusion

We believe that this novel explanation for hurricane-induced ocean surges, is an important one because space satellites' measurements of the cloud size and its water content could help us predict the size and severity of the resulting surge wherever the hurricane hits the coast in its trajectory. Such information could be of great value to coastal regions in preparedness for, and dealing with, the effects of weather extremes. With the global warming of our planet, likely that we have not seen the end of hurricane growth and their massive clouds.

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