Hurricane Suppression Using Salt

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Abstract

This paper is a short overview of why adding salt to the eye of a hurricane might be an effective method for suppressing a hurricane by disrupting its electric field which is known to exist in hurricanes. A salt powder absorbed into the moist atmosphere would add a measure of ionic conductivity and could significantly reduce the electric and electromagnetic fields build-up which would change a hurricane's pressure and ability to stay organized. There is a history of observed strong electric fields inside hurricanes, primarily in the eye. A hurricane's electric field role is not well understood. We hypothesize some physics of how the electric field's role can aid in reducing pressure; thus if fields can be discharged, pressure levels should then increase, weakening the hurricane. Considering the damage hurricanes create, and their increase threat due to global warming, rewards could overwhelm risks in a proper investigation of hurricane de-electrification.

1. Salt is a Natural Way to Suppress a Hurricane

Hurricanes have been observed to have large electric fields built-up (see discussion below) especially in the eye area. We hypothesize in the next paragraph some physics on how the fields act like the glue holding the hurricane together. Therefore, if these large fields can be discharged, the premise is that it will disrupt the hurricane's ability to organize its energy. The main method we propose to disrupt the electric field build-up is to increase the conductivity of the atmosphere. This is accomplished by salt seeding into the hurricane's eye. The centrifugal forces of the hurricane would disperse the concentrated salt powder into its moist atmosphere for absorption and thereby quickly increase conductivity. The salt like atmosphere then would act as an ionic electrolyte increasing the local conductivity and promoting discharging of the hurricane's electric fields. If done in a timely manner in the early stages of a hurricane's development, such a treatment may be manageable. A Salt powder or Salt like bomb would likely be the most compact and concentrated way to seed the hurricane eye area. Using concentrated ocean salt would be a natural way to treat a hurricane and maintain environmental integrity without harming the oceanic environment. Furthermore, a little salt can go a long way in increasing conductivity in a moist environment.

2. The Role of Electric Fields in Hurricanes - Hypothesis

Unfortunately, the role of electric fields in hurricanes appears not well understood. However, numerous references are provided below to its presence [1-3,6-8,11] and how other authors [1-5,12] have viewed electric fields as vital to a hurricane's structure. It might only be a consequence of cloud triboelectric effect. However, in this paper it is explained how it can play a role in hurricane pressure. Of course the thermodynamics aspects are complex regarding temperature and storm pressure. But basic thermodynamic variables alone perhaps cannot explain the full nature of hurricane turbulence. We hypothesize an overly simplistic explanation as to why electric charge may play a key role. In an analogy of an atom, we know that without the electric field atomic attraction, the orbital electrons would spiral outward and leave its orbital. Similarly, there is a history (see below) of observations of very strong electric fields inside hurricanes, primarily the eye [1-3,6-8,11]. We hypothesize that this acts as part of the hurricanes glue, the more it can be discharged, the less organized it should become, weakening its structure. The idea is that the charging produces strong electric and magnetic fields that hold the positive and negative cloud layers tighter together during rotation and help reduce atmospheric pressure near the eye. There is reasonable physics to support electromagnetic effects with favorable circular forces [1-5,12] and self attraction of cloud rotations. Such self attraction would reduce air pressure towards the eye. For example, one simple theory is that rotational movements of circular like charge current layers act like wires that have magnetic field attraction between each other when currents are flowing in the same direction. This in theory would compact cloud mass, decreasing storm pressure via attraction, intensifying the storm. The greater the charging and circular currents, the more mass that can be held together, the lower the atmospheric pressure in the eye (where charging is greatest), and the higher is the spin mass and

ocean funneling. In this theory, without the electric field, the centrifugal force should disperse the mass; eye pressure should increase, and allow the storm to spin apart from its center. On the other hand, charging could simply be a consequence of the triboelectric cloud motion, or it could play an important role in cloud pressure. Since the role of electric charging in Hurricanes is not well understood, Salt seeding could minimally help determine the importance of charging. Considering the damage hurricanes create, the rewards could overwhelm the risks in such an elaborate experimental investigation.

3. Observations of High Electric and Electromagnetic Fields in Hurricanes

An overview of some references is provided here describing the presence of high electric and electromagnetic fields in cyclones, Hurricanes as well as Tornados:

1. In 2005 NASA (see reference) a team of scientists explored Hurricane Emily using NASA's ER-2 aircraft, flying high above the storm; they noted frequent lightning in the cylindrical wall of clouds surrounding the hurricane's eye. Both cloud-to-cloud and cloud-to-ground lightning were present. The electric fields above Emily were among the strongest ever measured by the aircraft's sensors over any storm, in excess of 8 kilovolts per meter. This measured at sea not near tribo-electric charging land masses.
2. In 2005 NASA comparison have been made between, Emily, a Category 4 storm, Rita and Katrina were Category 5; All three were over water when their lightning was detected; and in each case, the lightning was located around the eye-wall.
3. The role of electric fields is not well understood since other equally intense storms often do not produce as much lightning. This of course does not mean that high electric fields did not exist. They just were not observed to produce as frequent lightning discharges.
4. Hare [1837], 160 years ago pointed out the possible role of effects connected with a strong electric field in the formation of a tornado.
5. Numerous researchers have studied both hurricanes and tornadoes and found they were accompanied by frequent and strong lightning [Chalmers, 1967; Ziegler and MacGorman, 1994; Molinari et all., 1994]
6. Measurements in tornados of electric and magnetic files, have also been made. [Vonnegut and Weyer, 1966; Brook, 1967; Chalmers, 1967; Watkins et al., 1978; Ziegler and MacGorman, 1994].
7. Krasilnikov [1997, 2002], stated electric forces play a cardinal role in supporting hurricanes. Based on this conjecture, he proposed a method for electric charge neutralization which differs from the approach in this paper. Krasilnikov also formulated at least three conditions for tropical cyclone activity. First, it is necessary that the initial cyclonic disturbance could emerge in a powerful enough cumulus containing layers of charged particles of high volume electric charge density. The second condition is that the initial cyclonic disturbance should be localized in the middle troposphere at an altitude where the negatively charged layer is, since this is the area in which the Electromagnetohydrodynamic mechanism is maximum. Note that this has been confirmed [e .g., Miller, 1967]. Third, the initial cyclonic disturbance should not be too weak.

4. Ways to Reduce Electric Fields in Hurricanes

There may be other ways to reduce an electric field as suggested by Krasilnikov 2002. The salt method suggested here would be benign in that it would not harm the environment. There are two main ways broken-up atmospheric aqueous salt ions Na+ and Cl- can dissipate charges:

1) The first is that it adds ions to combine with the positive and negative cloud charges to neutralize existing charges.

2) The second effect is likely more significant. Here the salt ion absorption could turn the insulating atmosphere into a conductive electrolyte atmosphere so the electric cloud build up can self discharge.

5. Some Cloud Seeding Precedence

Cloud seeding using salt spray to tame hurricanes was described but for a different reason [see Wall, 2011]. In the Wall article, it was reported that the basic idea was to brighten marine clouds above the tropical Atlantic Ocean by pumping tiny salt particles into them. Brighter clouds would then reflect more sunlight into space, so the geoengineering effort could lower ocean temperatures. Lower temperature waters would reduce the probability of hurricane occurrences. Although proposed years ago, the author has not seen the follow-up effort. Computer simulations were thought to help reduce hurricane categories. This method was also thought to help somewhat against global warming.

Another type of cloud seeding with silver iodide has been attempted by China in 2008 for different reasons. The China seeding was used to prevent rain during the opening of the Beijing Olympics [see Thompson 2008].

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Biography

Alec Feinberg is the founder of DfRSoft. He has a Ph.D. in Physics and is the principal author of the books, Design for Reliability and Thermodynamic Degradation Science: Physics of Failure, Accelerated Testing, Fatigue, and Reliability Applications. DfRSoft provides consulting in reliability and shock and vibration, training classes and DfRSoftware. Please contact us if you need help. Alec has provided reliability engineering services in diverse industries (AT&T Bell Labs, Tyco Electronics, HP, NASA, etc) for over 35 years in aerospace, automotive and electrical and mechanical systems. He has provided training classes in Design for Reliability & Quality, Shock and Vibration, HALT and ESD. Alec has presented numerous technical papers and won the 2003 RAMS best tutorial award for the topic, “Thermodynamic Reliability Engineering.”