Charles L. Chandler—"The Electromagnetic Nature of Tornadic Supercell Thunderstorms"

Key Points

1. Preface
Question: Are there electromagnetic or magnetohydrodynamic explanations for the development of tornadoes?
Answer: As far as scientists understand, tornadoes are formed and sustained by a purely thermodynamic process.

Author argues for electromagnetic explanations for tornadoes.

2. **Storms create charge separation**.

"Previous research showed that ohmic heating from the flow of an electric current through the tornado is more powerful than latent heating, but similarly, this energy is thermalized through the entire height of the vortex, leaving the extreme low pressure near the ground unexplained. The sustained current inside the tornado was confirmed by various methods to be greater than 100 amps. Inexplicably, evidence of such a current going into the ground has never been found."

3. Author discusses advantages of earlier warning of tornadoes since about 89 people are killed every year plus billions in property damage.

4. "It's possible that in a supercell, weak EM forces resolve into a large structure, and the sum of the effects of the weak forces

produces a new property set, while in the other 999 out of 1,000 cases, the weak forces never get organized into anything new."

"Since the existing meteorological data (from radar, anemometers, etc.) are not revealing the active ingredient in tornadogenesis, it goes without saying that we need to look at other types of data. And there is only one "other type" possible: electromagnetism.

The implication of that is that we need a new framework, since there isn't any place to put EM data within the existing thermodynamics-based theories. So we need to start over. This sounds like a Herculean task, but there is a way of approaching it that greatly increases the chance of success."

"Thermodynamic simulations fail to resolve into supercells, and the only other force present is electromagnetism, but modeling the subtle effects of near infinitesimal forces in such a complex system would take fine-grain data that we don't have, and processing the data would take a supercomputer that we can't afford. "

"All of this leads to the conclusion that there is simply nothing that is physically *possible* about the standard model of supercells."

"There is some sort of organizing principle in a mesocyclone that we just don't understand."

Fig. 21 "Toroidal flow with positive double-layer."

"The study of coupled electromagnetic and thermodynamic forces is a young discipline. Here is a quote from a recent work

that describes the types of problems that are being tackled with such interdisciplinary methods.[70]

Electro-Magneto-Hydro-Dynamics (EMHD) addresses all phenomena related to the interaction of electric and magnetic fields with electrically conducting or magnetic fluids."

Toroidal shape of airflow leads to mesocyclone, tornadoes

Supercells cannot be produced in a lab, scale-dependent pressure gradients.

The gap between the standard model and reality widens to an impassable chasm when we consider that 20% of all tornadoes descend from thunderstorms that don't even have detectable mesocyclonic rotation. [54]So the actual relationship between mesocyclones and tornadoes is indirect at best. If we are to understand tornadoes, we have to ignore any sort of vortex that may (or may not) be present inside the cloud, and study just the tornadoes themselves.

The slightly warmer air in the updraft will allow the electric current to flow more easily, meaning more electrons making it to the base of the updraft, where they can neutralize more positively charged air. The faster flow into the updraft means more frictional heating, which increases the buoyancy of the air, which means that once the charge is neutralized, it will rise more vigorously.

If the inflow is slightly asymmetrical, it will switch from a radial to a cyclonic inflow pattern, instantiating a vortex. The reduced pressure inside the vortex (due to the centrifugal force from the rotation) will further decrease the electrical resistance of the air,

resulting is a fully consolidated flow of electrons through the vortex. The increased current density then becomes capable of neutralizing even more positively charged air, and the vortex becomes robust.

Now we can consider how all of these factors interact in a real tornado. There is an updraft in the cloud pulling in air from all around. This will not create a vortex with the destructive power of a tornado on the ground. But it will open up a conduit for the flow of electricity. Ohmic heating then creates a channel of air below the cloud that rises faster. If the air flowing into this channel has any angular momentum, a vortex will form, which will project along the centerline of the inflow until it hits a boundary (i.e., the surface of the Earth). The reduced pressure inside the vortex consolidates the electric current, and the vortex becomes more robust.

Two-fluid simulations are sometimes used to study tornadic vortexes, as they have a couple of properties in common with tornadoes, and that are impossible to get otherwise. 136 First, the vortex only pulls in more fluid at the lower boundary, and second, the inflow travels along the lower boundary, even if it has to travel a long way. The reason why two-fluid simulations aren't considered to be realistic is that it shouldn't be possible to develop such substantial viscosity differences in the air. As there is no doubt that tornadoes exhibit two-fluid behaviors, and as temperature and humidity combined cannot account for the difference in viscosity, the only possibility is that the "lower fluid" is a layer of charged air.

Mechanistically speaking, the RFD (Rear Flanking Downdraft) is hard to explain, and it has proved difficult to simulate with thermodynamic modeling. 132 This means that other forces are present.

For meteorologists, thinking of the tornado as a condensation funnel inside a mesocyclonic vortex seems to be an adequate description. But this is fundamentally incorrect.

But both models then have an even tougher question to answer. How does condensation form as the air ascends? Tornadoes only pull in air at the surface, 151 so this is not evidence of a new source of moisture. The fastest wind speeds are nearest the surface, 152,153,154,155 so there isn't any increase in tangential velocity that could drop the pressure and cause condensation. The lowest pressure in a tornado is at the surface, 102,103,148,149 and from there the low pressure relaxes. If there isn't any condensation in the extreme low pressure at the surface, there shouldn't be any condensation anywhere in the tornado.

Only the EMHD model can explain this. If the tornadic inflow is positively charged, its water vapor will not condense until the charge is neutralized. There is certainly no absence of negative charge inside the cloud, and there is well-known direct evidence of an electric current inside tornadoes, which has been estimated at 100~250 amps. 30,112,113,114 The electrons in such a current will eliminate the electrostatic repulsion between positively charged water molecules, and make covalent bonding possible. This enables the condensation of the water vapor even as the low pressure relaxes.

So in the EMHD model, tornadoes are not low-pressure condensation funnels at all, but rather, low-pressure electrically neutralized condensation funnels. By fluid dynamic standards, we would expect condensation at the surface, if there is an extreme low pressure. But that expectation would only be legitimate if an extreme low pressure at the surface made sense in a purely fluid dynamic context, which it does not. Another force had to create the conditions necessary for a tornado. While that force is present, an absence of condensation in an extreme low pressure is possible. When that force expires, we revert to just fluid dynamics, and both the brief condensation at the surface and the immediate failure of tornado make sense.

One of the curious things about tornadoes is that the inflow in laminar, and the base of the tornado is laminar, but the vortex sometimes converts to a turbulent flow before entering the mesocyclone. This is anomalous because if the source of energy is the low pressure in the mesocyclone, we would expect a laminar flow all of the way into the mesocyclone. Turbulent flows only occur when air is decelerating, while air responding to a low pressure always accelerates toward the source of the low pressure. This is clear evidence of an extreme low pressure at the ground, and that the low pressure relaxes in the direction of the flow.

There is really only one possibility here, because there is only one other force present: electromagnetism. Since air is not responsive to the magnetic force, only the electric force could be powerful enough to accomplish such a feat in the atmosphere. If the tornadic inflow is electrically charged, and is therefore experiencing an electrostatic attraction to an induced charge in

the Earth, it will be subjected to much more skin friction, and it will not detach from the boundary when expected. This means much more frictional heating, and much more Rankine acceleration. When the charge is neutralized by an electric current inside the tornado, the air is released from its attraction to the ground. The net effect will be the same as if there was a big piece of plywood with a hole in it.

There is no question that a car can become airborne in crosswinds above 134.2 mph, which is in the EF2 range. 184 (See this video for an example.) Contrary to popular belief, it is not the Bernoulli Effect that can lift a car with low pressure above it. Rather, when air broadsides a car, some of it gets forced underneath, and the high pressure below the car is the force that lifts it up. But once off the ground, the car is then rapidly accelerated in the direction of the wind, and hits the ground (for the first time at least) 5.5 yards or more away. Furthermore, the car will be picked up at or before the peak wind speed has been achieved. Yet these vehicles were picked up after the winds had begun to subside, and once picked up, they hovered for a while before "settling back down." Lateral winds are not capable of such effects.

There are also confirmed reports of people being picked up by tornadoes, and sometimes carried for some distance, and then set back down gently enough that they were relatively unharmed. The longest confirmed distance that a tornado carried a person who survived was 437.4 yards. 185 The person suffered no injuries when hitting the ground. A critical analysis reveals that a fluid dynamic explanation is just not possible. A human body simply isn't an aerodynamic shape, and even at the maximum near-ground wind speeds in a tornado (~223.7 mph), it will not

generate lift in excess of the force of gravity. So like cars, the only way that a human body can be lifted by wind is if there is a small gap between the object and the ground into which high-pressure air can be forced. But once the object is lifted, the high pressure is relieved, and the object falls back down. Near the ground, it is slightly cushioned by air flowing under it, but as the drag force accelerates the object, asymptotically approaching the speed of the air, the cushioning effect diminishes, and the object hits the ground. On bouncing, the process repeats, as the gap is filled with high-pressure air that lifts the object again. This is a well-known process called saltation, resulting in the object "skipping" across the ground. There are no statistics for the skipping distance of a saltating human body, but since objects such as cars, with shapes more prone to it than human bodies, typically travel no more than 5.5 yards before hitting the ground, we can use that as an upper limit. In a distance of 437.4 yards, hitting the ground every 5.5 yards would mean 80 bounces. Yet in the case cited above, the person was airborne for the entire 437.4 yards, which is way out of range for saltation.

And then there have been cases where entire houses have been picked up and carried, and then set back down, damaged but still relatively intact. The anomalous aspect of this is not that an object as big as a house could be picked up. Houses are mainly empty space, with plenty of surface area upon which the winds can exert force. But houses simply are not built in such a way that they can be picked up, except from underneath, without falling apart. Without being able to get underneath the house to pick it up, the only other way to generate the necessary uplift without destroying the house is with a force that can act upon the that can

act upon the entire mass at once. There are only two such forces in nature operative at this scale — gravity and electromagnetism. It's not gravity, because the houses were picked up. That leaves electromagnetism.

It's possible that the house lost its roof in the EF2 winds, but it was not the lateral winds that picked up the house and moved it. Rather, the house was subjected to triboelectric charging as the tornado passed overhead, and then after the winds subsided, the house was picked up and set back down 20 yards away by the electric force. The car inside the garage was shielded from triboelectric charging during the strongest winds, so it did not experience the same uplifting force later.

In addition to the effects of an updraft in or near the vortex, there is another type of "levitation" that sometimes occurs at some distance from the vortex. Scientists have not applied any critical scrutiny to these reports, and the common "explanation" is flatly absurd. A tornado was nearby; tornadoes are suction vortexes; things were picked up; any questions? Yet outside of the vortex, the lines of motion are parallel to the ground. So the vertical motion in or near the vortex would be irrelevant, even if the conventional framework could explain it. A critical treatment of the topic requires that we explain how objects are picked up just with horizontal air motion.

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182 houses simply are not built in such a way that they can be picked up, except from underneath, without falling apart. Without being able to get underneath the house to pick it up, the only other way to generate the necessary uplift without destroying the house is with a force that can act upon the entire mass at once. There are only two such forces in nature operative at this scale — gravity and electromagnetism. It's not gravity, because the houses were picked up. That leaves electromagnetism.

The EMHD model asserts that the tornadic inflow is positively charged, and the surface of the Earth has an induced negative charge. This means that particulate matter from the surface that is getting blown in the wind will be negatively charged. Objects exposed to the tornadic inflow (such as people, cars, etc.) will be sandblasted with this particulate matter, and will therefore develop a net negative charge. The objects will then be attracted by the electric force to the positively charged air around them. Since there is more air above them than below them, the net force will be upward. And since electromagnetism is 39 orders of magnitude more powerful than gravity, even an extremely small EM force can be the determining factor. Also, if the strongest positive charge in the storm is in the RFD, objects will be subjected to the most powerful uplifting force after the tornado passes.

The persistence of debris clouds outside the vortexes clearly demonstrates that tornadoes only pull in air at the ground, in

spite of the skin friction, thereby defying the principles of fluid dynamics. This is yet another proof that something is binding the inflow to the ground. This can only be evidence of an electrostatic attraction between the inflow and the surface of the Earth.

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We should now take an even closer look at the most anomalous cases — the ones in which the objects actually hovered. The reports are consistent in asserting that the fastest winds had already passed, and the eyewitnesses guessed the wind speeds at something like 30 m/s when the objects started "floating." Such winds are clearly insufficient to levitate the objects, and this section presents the more plausible explanation, that the electric force was at work. Yet even in 30 m/s winds, we still wouldn't expect objects to hover — the drag force should have accelerated the objects in the direction of the wind. For example, when Dr. Tracton's car was picked up at least two feet off the driveway, there shouldn't have been a way for it to "settle back down" onto the same driveway. (Watch the videos of cars being picked up by high wind speeds.) The car should have hit (first) at least 5 m off the driveway, and Dr. Tracton probably wouldn't have lived to tell the story.

If we consider the conditions in which this will happen, we find the answer. The objects were subjected to triboelectric charging as the tornado passed by. Then they were levitated. This means that they were then between the RFD and the tornado. There the winds will be traveling from the RFD toward the tornado, and we expect any object levitated in that air to be accelerated in the direction of the winds, toward the tornado. This proves that there has to be a force pushing the objects away from the tornado and/or pulling them toward the RFD. And that force can only be the electric force.

One of the implications of a positively charged house is that it will be structurally weaker. Ionization loosens the covalent bonds that give solids their strength. So the factors acting on the house might include all of the following:

- lateral and/or vertical aerodynamic force,

- electrostatic repulsion, and

- weakened structural beams, posts, and fasteners.

This might also help explain why building materials (such as lumber) seem to "disintegrate" under the force of a tornado, to a degree that cannot be explained simply by the force of the winds. Some damage assessments have explicitly mentioned the

surprisingly small size to which everything was reduced. This would make more sense if all of it had a strong positive charge, and therefore did not have its normal strength.

Another observation that might be related comes from the "Thunderstorm Project" (1946-1949), in which pilots flew WWII fighters fitted with weather instruments into thunderstorms. One pilot reported that the interior of the storm suddenly changed from jet black to bright yellow, accompanied by constant electrical activity. At the same time, personnel on the ground observed a tornado descending from the wall cloud that had formed. When the pilot returned to base and the plane was inspected, it was found that rivet heads had been peeled off of the wings. Interestingly, the pilot did not report experiencing G forces sufficient to cause such damage.187,188

Doppler radar studies have clearly shown that tornadoes can have eccentric sub-vortexes. 151 (See Figure 128.) Some researchers believe that the most extreme damage is done by the sub-vortexes. This would explain why a tornado might totally destroy one house, and spare the house next to it, even though both houses were definitely fully inside the same funnel cloud.

If the sub-vortex is more powerful than the main vortex, then we have a non-continuous pressure gradient inside another pressure gradient, which doesn't make sense. This constitutes rigorous proof that there are two sets of factors producing these vortexes. So what are they?

The "lightning hole" was mentioned earlier, and an example is clearly visible in Figure 72. While the "hole" is not absolute, and lightning does occur within this region, there is typically a

50~70% reduction in lightning strikes. 117,118,119,120 Figure 129 shows the typical time frame in which the reduction occurs.

On page 237 author notes that electrical activity associated with tornadoes has been incorrectly seen as simply “folklore” with no basis in evidence. However, he notes there is plenty of modern evidence for electrical changes and anomalies around tornadoes.

There has been no funding in the last 40 years for electromagnetic nature of tornadoes, only thermodynamics explanations.

p. 242 Volcanoes, with no cyclonic thermodynamic activity, are associated with tornadoes.

p. 246 77% of all tornado warnings are false alarms, while 27% of all tornadoes occur without warning. And in none of the cases do we have the ability to predict the strength of the tornado that might form. Obviously, we're missing something.

p. 250 Author suggests teams of people in cities to launch rockets into the thunderstorms to disperse electricity and prevent tornado formation.

p. 255 et al. Review of past and existing EM ideas about tornadoes.