

Upward Lightning

[Read more about Tom A Warner](#) >> [1]

Over the past few years Tom A Warner and colleagues have been filming lightning on high-speed cameras. In total they have captured 776 naturally occurring lightning flashes with recording speeds as high as 100,000 images per second. 41 of the flashes were upward flashes originating from tall towers in Rapid City. Recording at speeds this high allows a detailed examination of what actually happens during lightning strikes and Tom has done a lot of work on upward lightning.

Upward Lightning

The most important finding about upward lightning, is that it primarily occurs when there is a nearby positive cloud-to-ground flash. The electric field change caused by the preceding flash causes an upward positive leader to initiate from a tall object such as a building, tower or wind turbine. It is the shape of the tall object and the resulting enhancement in the electrical field that makes it possible for an upward leader to form following a nearby flash. Tom and his colleagues call this lightning-triggered upward lightning and the upward leader would not develop if the tall object was not present. This is shown below in a fascinating high-speed video.

[Downward Positive Cloud-to-Ground Lightning Flash Triggers Upward Positive Leaders from Towers](#) [2] from [ZT Research](#) [3] on [Vimeo](#) [4].

Both captures from [ZT Research](#) [5]

Another lightning series below

[Lightning captured at 7,207 images per second](#) [6] from [ZT Research](#) [3] on [Vimeo](#) [4].

During winter snow storms, Tom's research also shows that tall objects can initiate upward leaders without preceding triggering flashes. These findings are very important because there are a lot of tall structures being built, especially wind turbines. These structures are experiencing lightning currents from upward lightning at a much higher rate than they might experience from normal downward lightning, even up to 100 times more often. Therefore, there is a much greater chance for damage. Also, it is unclear what global atmospheric impacts (i.e. atmospheric chemistry) if any, may result from the increase in lightning (specifically upward lightning) due to man-made tall objects.

Tom's high speed captures use Vision Research Phantom cameras which can record over 100,000 images per second. The cameras are operated manually. Even with 16 GB of memory, the camera can only record about 2 secs video. Therefore, it continually records using a buffer loop. When a flash occurs, they trigger the camera system at the end of the flash and the system saves the preceding 2 sec of video. The captured flash is somewhere in the saved recording which they then download to hard drives. The video plays back on the computer at 30 images per second, so in order to watch a 1 sec flash recorded at 10,000 image per second, it would take 5 1/2 minutes. Likewise, a 1 sec flash recorded at 100,000 images per second would take over 55 min to watch. Tom and fellow students therefore, spend most of their winter looking at and analyzing the high-speed recordings.

What is really interesting is that upward lightning occurred at St Peter's Basilica [7] only hours after the pope resigned in February 2013

Tom and colleagues are currently working on the UPLIGHTS [8] project

Visit Tom's blog ZT Research >> [9]

See more of Tom's lightning videos on vimeo >> [10]

Source URL: <http://www.accsys.rmets.org/weather-and-climate/weather/upward-lightning>

Links

[1] <http://www.accsys.rmets.org/tom-warner-biography>

[2] <https://vimeo.com/45803576>

[3] <https://vimeo.com/ztresearch>

[4] <https://vimeo.com>

[5] <http://vimeo.com/ztresearch>

[6] <https://vimeo.com/28457062>

[7] <http://www.bbc.co.uk/news/world-europe-21421810>

[8] <http://ztresearch.wordpress.com/uplights/>

[9] <http://ztresearch.wordpress.com/>

[10] <http://vimeo.com/59586603>