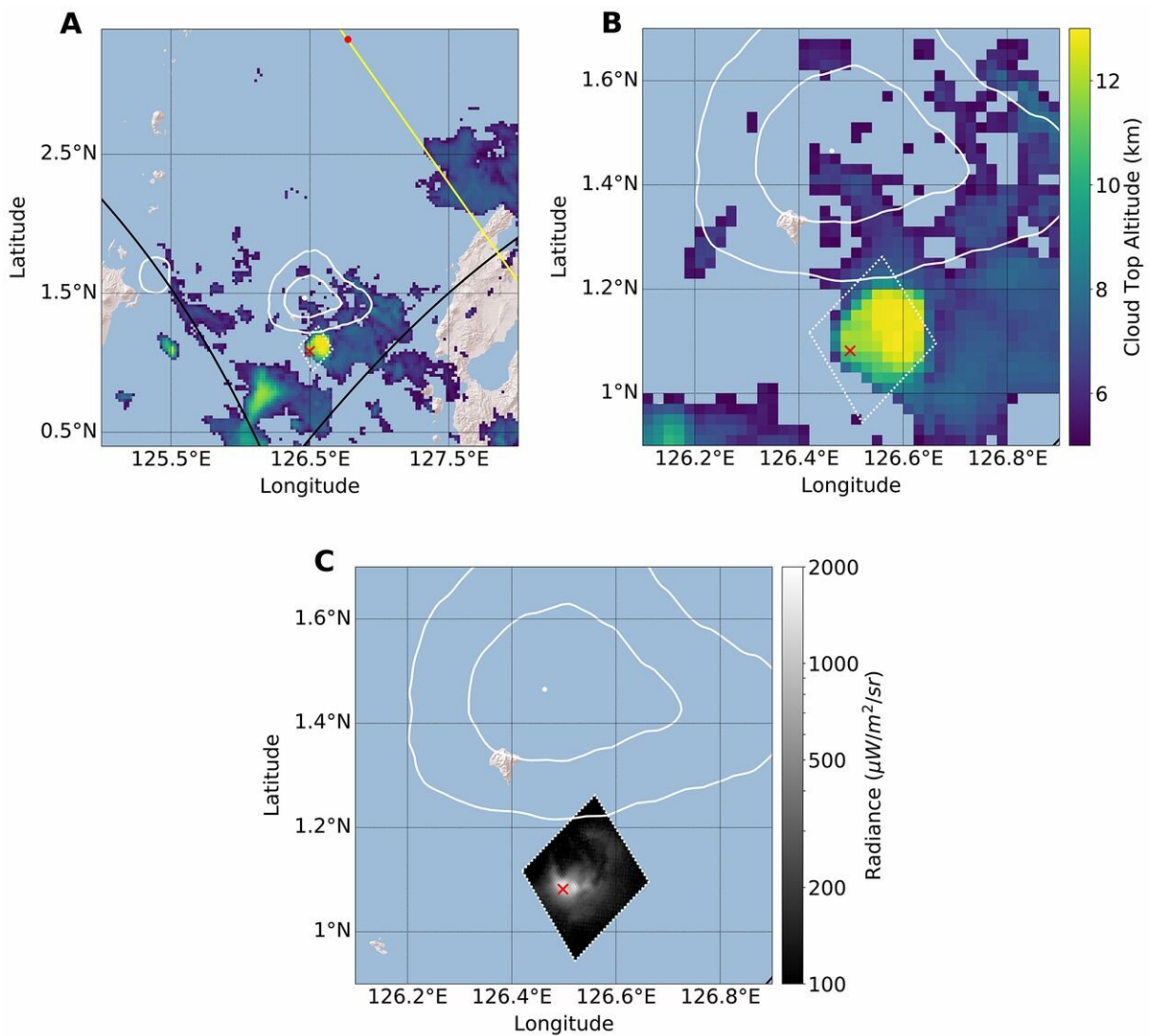


# ISS sensors show terrestrial gamma-ray flash and ionospheric UV emissions spurred by lightning

December 11 2019, by Bob Yirka



Location of the TGF event observed on 2018 October 10. (A) Cloud top

altitudes (15) are shown in color. The ISS orbit is shown by the yellow curve and the red dot marks its position at the onset time of the TGF at 13:01:33.100080 UTC. The white dot marks the most probable TGF location, with white contours outlining the 68% and 95.4% confidence regions. The black box is the full field of view of the optical instruments, and the white dash-lined box the cropped images downlinked from the ISS. (B) The same view zoomed in to the active cloud region. A single thundercloud partially overlaps with the TGF 95% confidence region. (C) The TGF position overlain with a projection of the ASIM camera image in the 337 nm filter, with 83 ms exposure. A coincident lightning event detected by the WWLLN (15) is shown with a red cross. The attitude of the ASIM instruments is calibrated to align the WWLLN lightning location with the maximum optical activity of the ASIM image. Credit: *Science* 10 Dec 2019: eaax3872

A team of researchers from Denmark, Norway, Spain and Italy has found that both terrestrial gamma-ray flashes and ionospheric ultraviolet emissions are spurred by lightning. In their paper published in the journal *Science*, the group describes their study of data from the Atmosphere-Space Interactions Monitor (ASIM) aboard the International Space Station (ISS), and what they found.

Prior research has shown that terrestrial gamma-ray flashes (TGFs) are created by thunderstorms. So, too, are ultraviolet and optical emissions (elves) found in the lower ionosphere during thunderstorms. But the process involved in the creation of each has not been clear. Prior research had shown that elves are set off by an [electromagnetic pulse](#) emanating from a bolt of lightning in a thunderstorm. It has not been clear what sets off TGFs.

To learn more about both types of flashes and how they may be related to lightning bolts, the researchers studied data from the ASIM, which is affixed to the exterior of the ISS. The device is able to capture X-ray

and gamma-ray data coming from thunderstorms. It also has cameras that can capture images and data in both visible and ultraviolet light.

The researchers chose a [time period](#) during which a thunderstorm was occurring just below the device. It captured information about lightning flashes, TGFs and Elves. In looking at the data, the researchers were able to see that a TGF was produced by a field of electricity just before a [lightning bolt](#) appeared in the same cloud. They were also able to see that the same bolt of lightning unleashed an electromagnetic pulse, which pushed an elve into existence above the thunderstorm. Thus, both types of flashes were found to be spurred into existence by bolts of lightning. They also noted that elve formation occurred when lightning struck something on the ground, and that event, the researchers suggest, led to changes in the lightning bolt, which somehow triggered the elve. But they also noted that in other instances, an elve could come into existence without [lightning](#) striking the ground, suggesting that there is still more to learn about their nature.

**More information:** A terrestrial gamma-ray flash and ionospheric ultraviolet emissions powered by lightning, *Science* 10 Dec 2019: eaax3872, [DOI: 10.1126/science.aax3872](https://doi.org/10.1126/science.aax3872) , [science.sciencemag.org/content ... 2/09/science.aax3872](https://www.science.org/doi/full/10.1126/science.aax3872)

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