

# Hurricane


# Julio

## A model for 3D printing

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**H**urricane Julio (2014) roamed through Eastern Pacific Ocean without ever posing a threat to land. But before it reached hurricane status, Julio became the first tropical storm known to have produced a powerful burst of radiation called a terrestrial gamma-ray flash (TGF), the highest-energy naturally-occurring light on Earth.<sup>1</sup> For this reason, Julio became the inspiration and prototype of an effort to develop simple 3D-printable storm models from satellite imagery.<sup>2</sup>



3D-printed model of Hurricane Julio in white PLA. As oriented here, north is at top.

The model represents Julio as it appeared on Aug. 7 at 2 p.m. PDT (2100 UTC), when maximum sustained winds of 105 mph (165 km/h) placed it firmly in Category 2 on the Saffir-Simpson Hurricane Scale. The storm's center was located at 17.1° N and 137.7° W, or 1155 miles (1855 km) east of Hilo, Hawaii.<sup>3</sup> To provide height to the model, a typical value for the tropopause at Julio's latitude (14-15 km) was used; the vertical scale is exaggerated by 10 times.

Two model files are provided, at different sizes and levels of detail, along with the blended visible/infrared satellite image used to create them and the printer settings used for the print shown above. Further details are provided below.

File	Description
Readme_Julio.pdf	This file
Julio.stl	Main model: 195 mm (7.7 in.) per side; scale is 1 mm = 12.06 km (7.49 mi.)
Julio_small.stl	Half-size model: 97.5 mm (3.8 in.) per side; scale is 1 mm = 24.1 km (15 mi.)
Julio_Vis_x_IR.jpg	Blended GOES 15 visible and infrared image, source for the model
ZYYX_PLA_process.fff	For ZYYX printers, this XML profile can be imported directly into the <a href="#">Simplify3D</a> printing software. Those with other printer types may find it helpful to review these process settings in a text editor.

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## Notes

1. Reddy, F., and Gutro, R. (Aug. 7, 2014) [NASA sees Hurricane Julio organize and emit a gamma-ray flash](#). NASA's Goddard Space Flight Center.
2. Reddy, F. (April 30, 2015). *3D printing with CLASS: Making models for education and outreach using satellite weather imagery*. Poster presented at the 2015 NOAA Satellite Conference, Greenbelt, MD.
3. Beven, J. (Aug. 7, 2014) [Hurricane Julio advisory number 16](#). National Hurricane Center.