Year of Thunder and Lightning

ANNUAL LIGHTNING REPORT 2019

VAISALA

World’s Most Advanced Lightning Detection Networks

National Lightning Detection Network (NLDN)

Vaisala's U.S. National Lightning Detection Network® (NLDN) is the most scientifically accurate and reliable lightning information system, monitoring total lightning activity across the continental United States.

It has been proven to deliver unrivalled performance with excellent location accuracy and detection efficiency, and is the most capable network of both detecting cloud and cloud-to-ground lightning while, at the same time, correctly differentiating between the two.

NOAA's NLDN Data Is Regarded as a Foundational Data-Set

For more than 30 years, major government agencies, municipalities, private companies and universities have chosen NLDN data as their primary source for lightning information, including the National Weather Service, Federal Aviation Administration, U.S. Air Force, Army and Navy. The largest electric power utilities use the NLDN to help manage the reliability of their transmission and wind power assets.

The NLDN is unique in having sensors evenly distributed across the U.S. to ensure uniform performance, to guarantee that detected lightning trends reflect reality, allowing accurate year-on-year comparisons and providing a reliable climatological record.

Global Lightning Detection Network and Dataset GLD360

The data provided through Vaisala Global Lightning Dataset GLD360 is generated by a Vaisala-owned-and-operated, world-wide lightning detection sensor network.

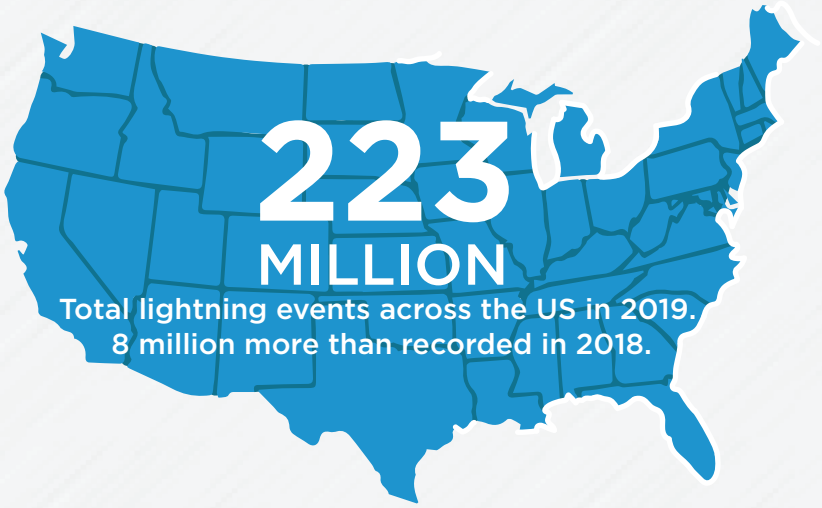
The global network has the ability to instantly detect lightning and convective activity anywhere over land and sea. The data is delivered as a dedicated data stream providing real-time lightning data for accurate, early detection and tracking of severe weather. GLD360 offers unbeatable long-range coverage and location accuracy. It detects thunderstorms outside the range of radars and satellites, tracks the trajectory and the intensity of the lightning discharges and is used to forecast the development of tropical cyclones and other potentially severe weather events.

Annual Lightning Report

The data are from the Vaisala NLDN U.S. National Lightning Detection Network and the Vaisala GLD360 Global Lightning Detection Network, that monitor total lightning activity, including both in-cloud (IC) and cloud-to-ground (CG) lightning, 24 hours a day, 365 days a year.

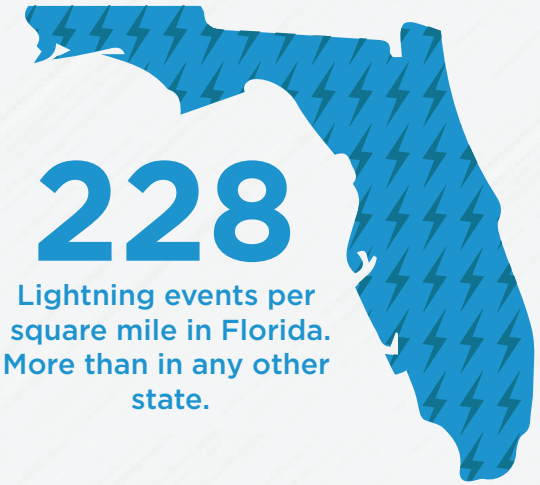
Data analysis provided by **Ronald Holle and Kelly Gassert.**

LIGHTNING ACTIVITY IN 2019



223 MILLION

Total lightning events across the US in 2019. 8 million more than recorded in 2018.



228

Lightning events per square mile in Florida. More than in any other state.

110mi

Distance from the North Pole to the nearest recorded lightning event. Vaisala's GLD360 lightning detection network now holds the Guinness World Record for detecting the "Most Northerly Lightning."

2.35 BILLION

Global lightning events recorded in 2019

Flash, Pulse and Stroke

Cloud Lightning

A cloud flash is a lightning discharge that connects regions with opposite polarity (+/-) within one cloud or between multiple clouds.

A cloud flash has one or more cloud pulses. Pulses are the components of flashes detected by the NLDN and GLD360.

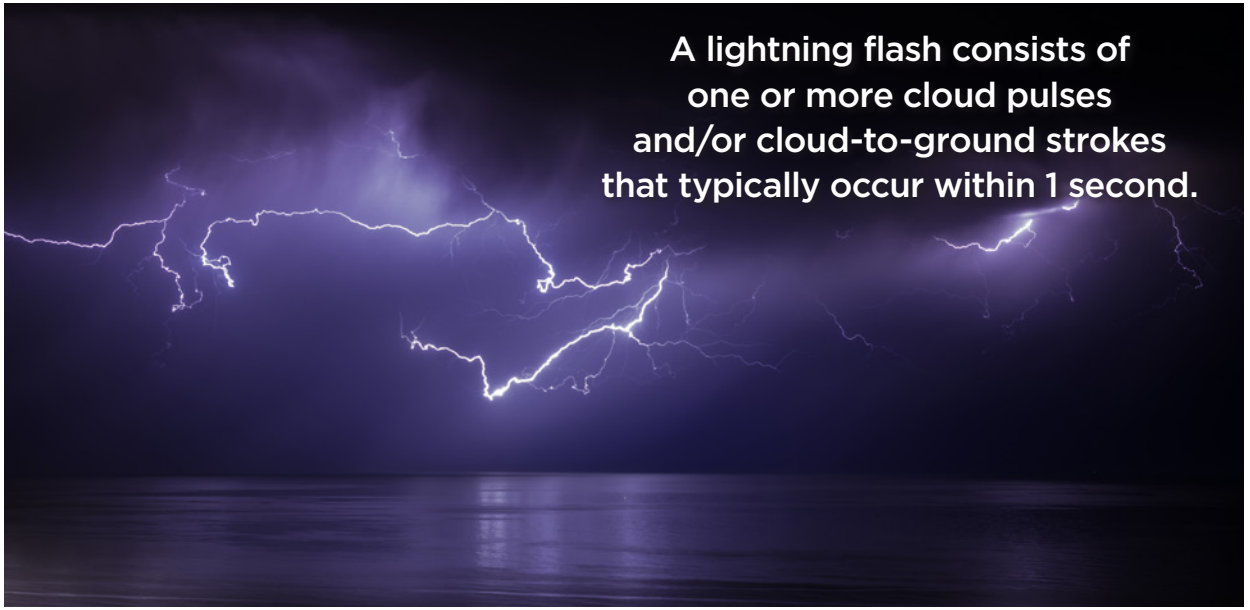
Cloud-to-Ground Lightning

A cloud-to-ground flash consists of at least one cloud-to-ground stroke and is dangerous to lives and property.

A stroke or cloud-to-ground stroke is a lightning discharge that connects a charge region in a cloud to the ground and is the bright, high current, visible part that touches the ground or an object.

Total Lightning

Both the NLDN and GLD360 detect cloud lightning and cloud -to-ground lightning, which together are called total lightning.



Top 10 States With the Most Total Lightning

Cloud-to-Ground Strokes Plus Cloud Pulses

TOP TEN TOTAL LIGHTNING COUNTS BY STATE IN 2019		
1	Texas	47,397,975
2	Oklahoma	14,772,145
3	Kansas	13,804,461
4	Missouri	13,415,285
5	Florida	13,049,687
6	Illinois	8,138,020
7	Louisiana	8,102,341
8	Nebraska	7,950,231
9	Arkansas	7,442,101
10	Mississippi	5,879,270

Texas Leads the Nation — Again

Texas leads the nation with the most total lightning events, checking in with more than 47 million, tripling up northern neighbor Oklahoma's second place finish with 14.7 million.

A number of factors, including latitude, relative humidity and proximity to large bodies of water — as well as the sheer land mass of 696,200 km^2 — align to make Texas an annual contender for the top of this list. The two states north of Texas, Oklahoma and Kansas, also have large total lightning counts due to active storm systems that often form there.

Lightning states are tornado states

Data from the Storm Prediction Center recorded an above-average number of tornadoes in 2019.

Texas, Mississippi, Kansas, Oklahoma, and Missouri had the most reported tornadoes and are all also top 10 states for lightning total lightning density in 2019.

Total Lightning Counts per State in 2019

Cloud-to-Ground Strokes Plus Cloud Pulse

1	Texas	47,397,975
2	Oklahoma	14,772,145
3	Kansas	13,804,461
4	Missouri	13,415,285
5	Florida	13,049,687
6	Illinois	8,138,020
7	Louisiana	8,102,341
8	Nebraska	7,950,231
9	Arkansas	7,442,101
10	Mississippi	5,879,270
11	Iowa	5,847,072
12	New Mexico	5,124,315
13	South Dakota	5,049,342
14	Georgia	5,027,333
15	Montana	4,615,334
16	Tennessee	4,564,958
17	Kentucky	4,128,159
18	Alabama	3,970,233
19	Minnesota	3,851,896
20	Colorado	3,704,799
21	North Carolina	3,641,417
22	Wyoming	3,383,728
23	North Dakota	3,188,018
24	South Carolina	3,168,624
25	Virginia	2,924,380
26	Indiana	2,867,912
27	Ohio	2,656,035
28	Pennsylvania	2,235,310
29	Wisconsin	2,081,049
30	Michigan	1,911,278
31	Arizona	1,841,300
32	West Virginia	1,140,587
33	New York	888,031
34	Maryland	874,327
35	Utah	801,457
36	Nevada	721,732
37	Idaho	635,686
38	Oregon	438,082
39	California	432,207
40	New Jersey	425,948
41	Washington	258,368
42	Delaware	180,209
43	Maine	136,335
44	Connecticut	87,830
45	Massachusetts	81,569
46	Vermont	66,240
47	New Hampshire	65,903
48	Rhode Island	12,364
49	District of Columbia	8,005

Top 10 States by Total Lightning Density

Cloud-to-Ground Strokes Plus Cloud Pulses

TOP TEN STATES BY TOTAL LIGHTNING DENSITY PER km² IN 2019		
1	Florida	87.93
2	Oklahoma	81.61
3	Missouri	74.47
4	Texas	69.00
5	Louisiana	67.56
6	Kansas	64.91
7	Illinois	55.78
8	Arkansas	53.99
9	Mississippi	47.62
10	District of Columbia	45.51

Even With an Off-Year for Lightning, Florida Leads the Nation

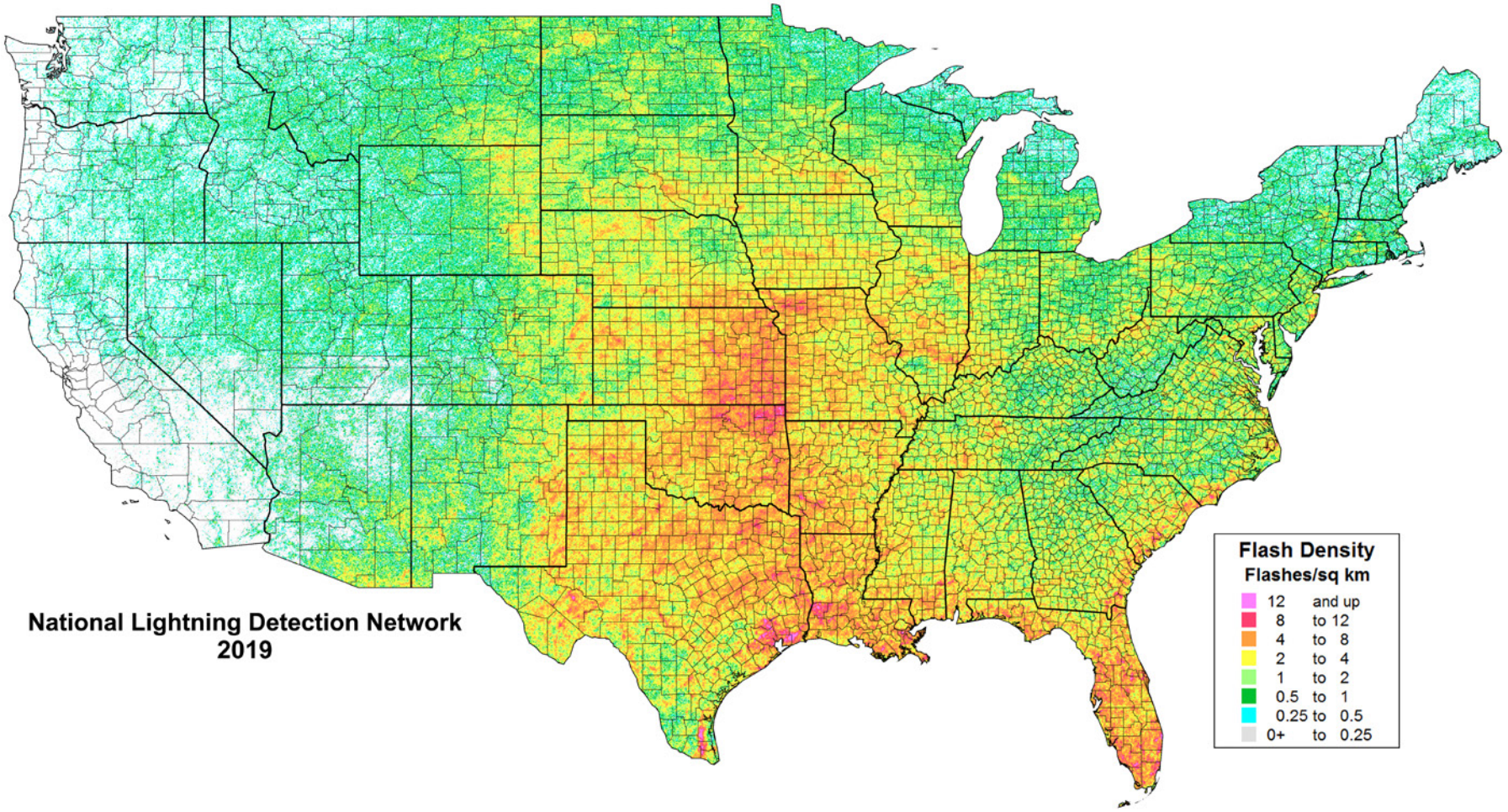
Even though Florida has 7% less lightning than average, it remains the lightning capital of the USA, with 228 lightning events per square mile or nearly 88 per square kilometer.

Measuring lightning by density per km² is one of the best ways to compare lightning because it normalizes the data across an equal measurement (km²) rather than simply comparing the total land mass of states, which vary greatly across the U.S.

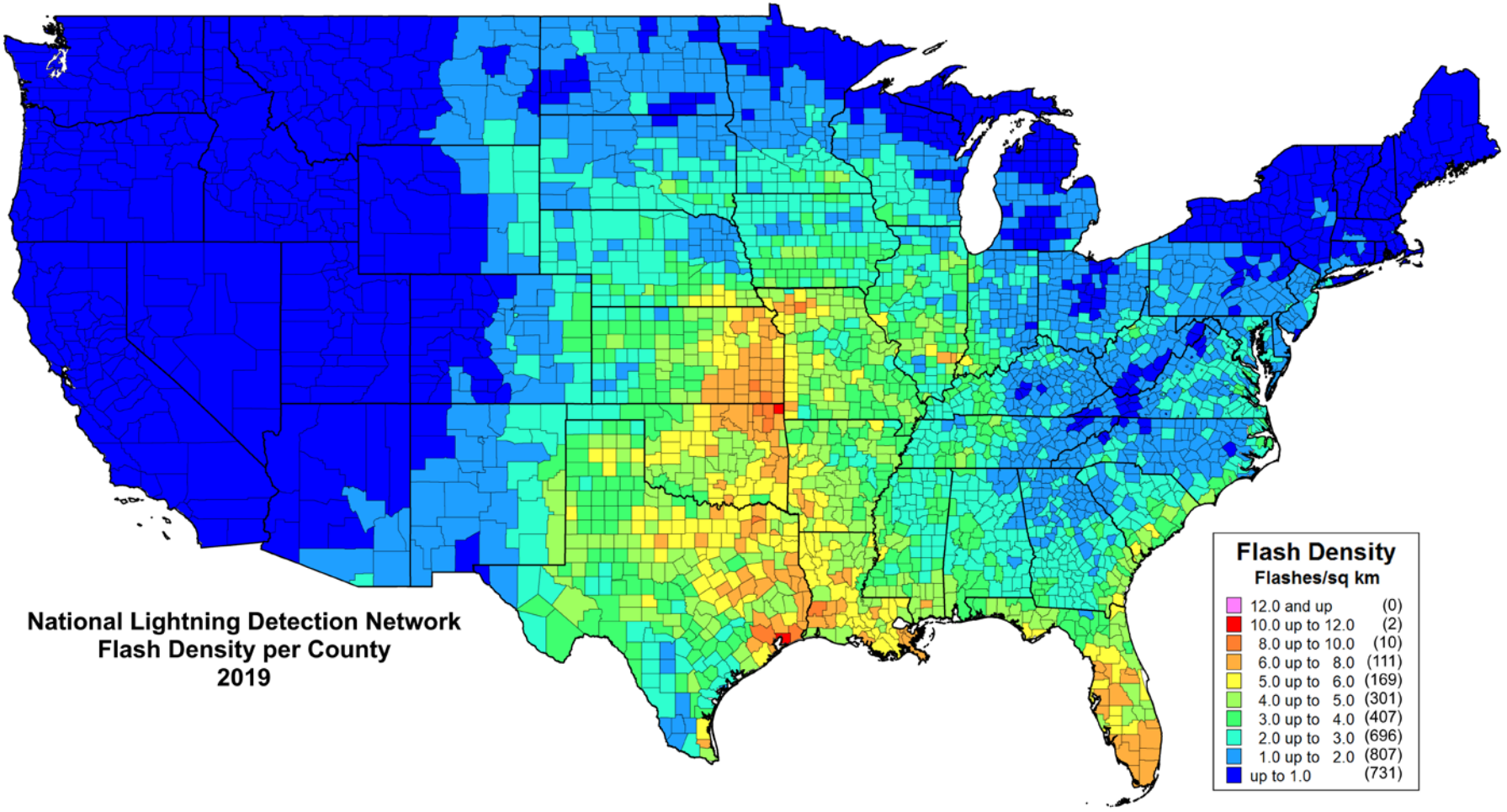
Apples-to-Apples: Flashes per km²

As the nation's second-largest state measured by area, it stands to reason that its southern location and sheer land mass consistently lands Texas at the top spot for the most lightning. However, it's also important to look at how many flashes are measured per km² or square miles in order to make an "apples-to-apples" comparison. Through that lens, the lightning ranking shifts, giving Florida the crown and seeing Texas fall to the fourth position, recording about 78% of the number of flashes per km² as lightning leader Florida.

U.S. Cloud-to-Ground Flash Density in 2019

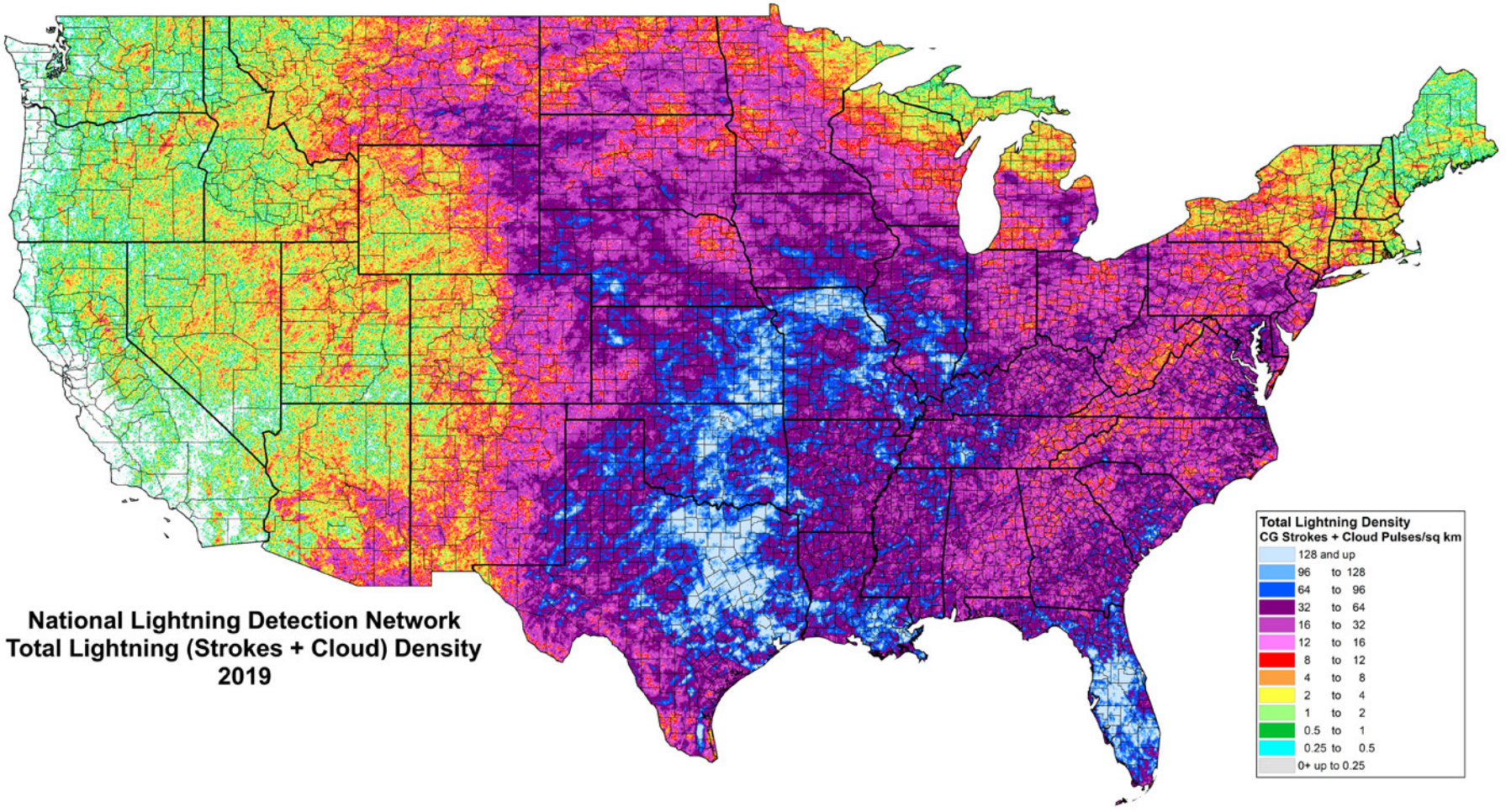


U.S. Cloud-to-Ground Flash Density per County in 2019



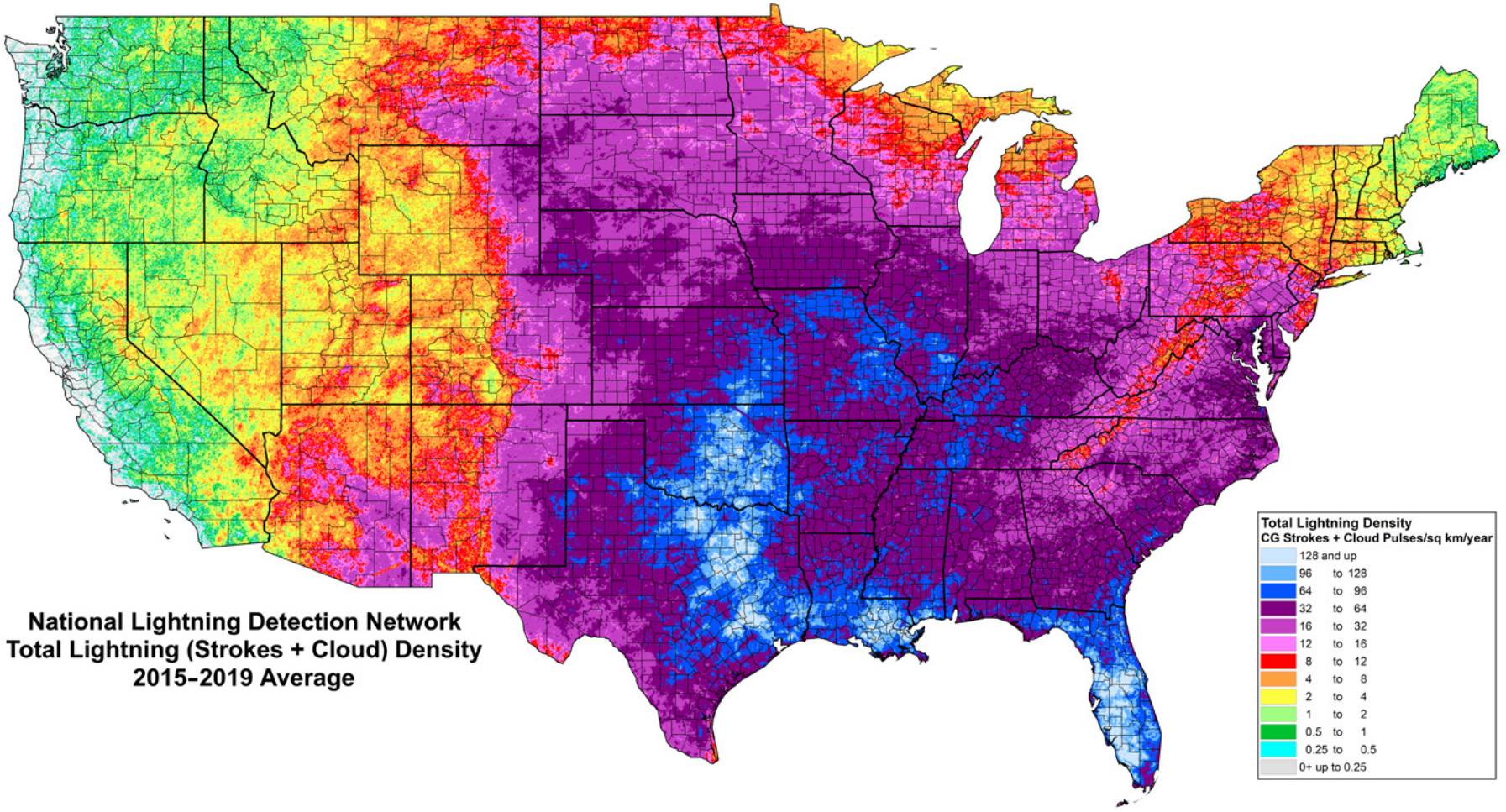
U.S. Total Lightning Density in 2019

222,988,888 Events Detected



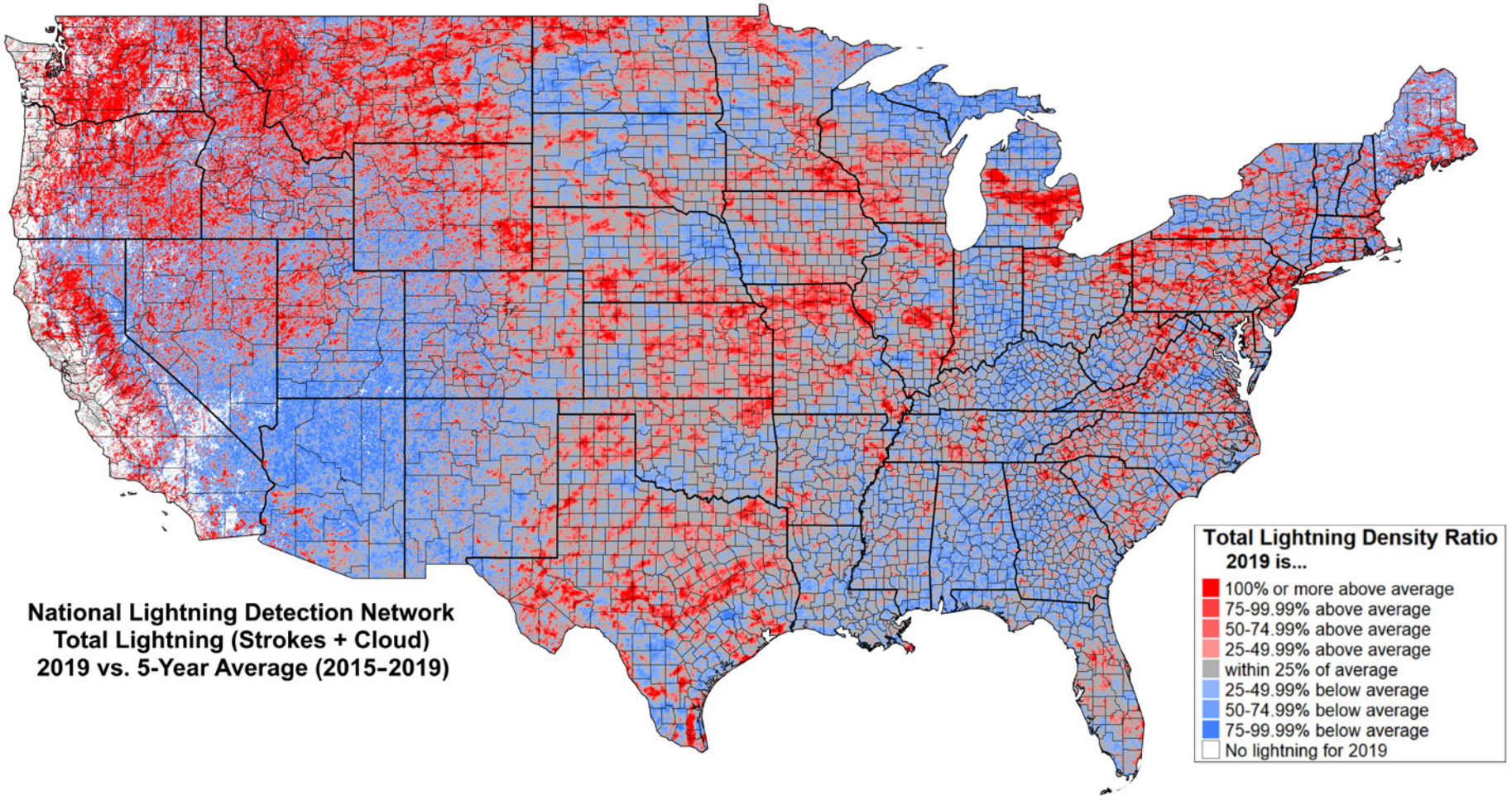
Average U.S. Total Lightning Density, 2015–2019

1,084,890,070 Events Detected



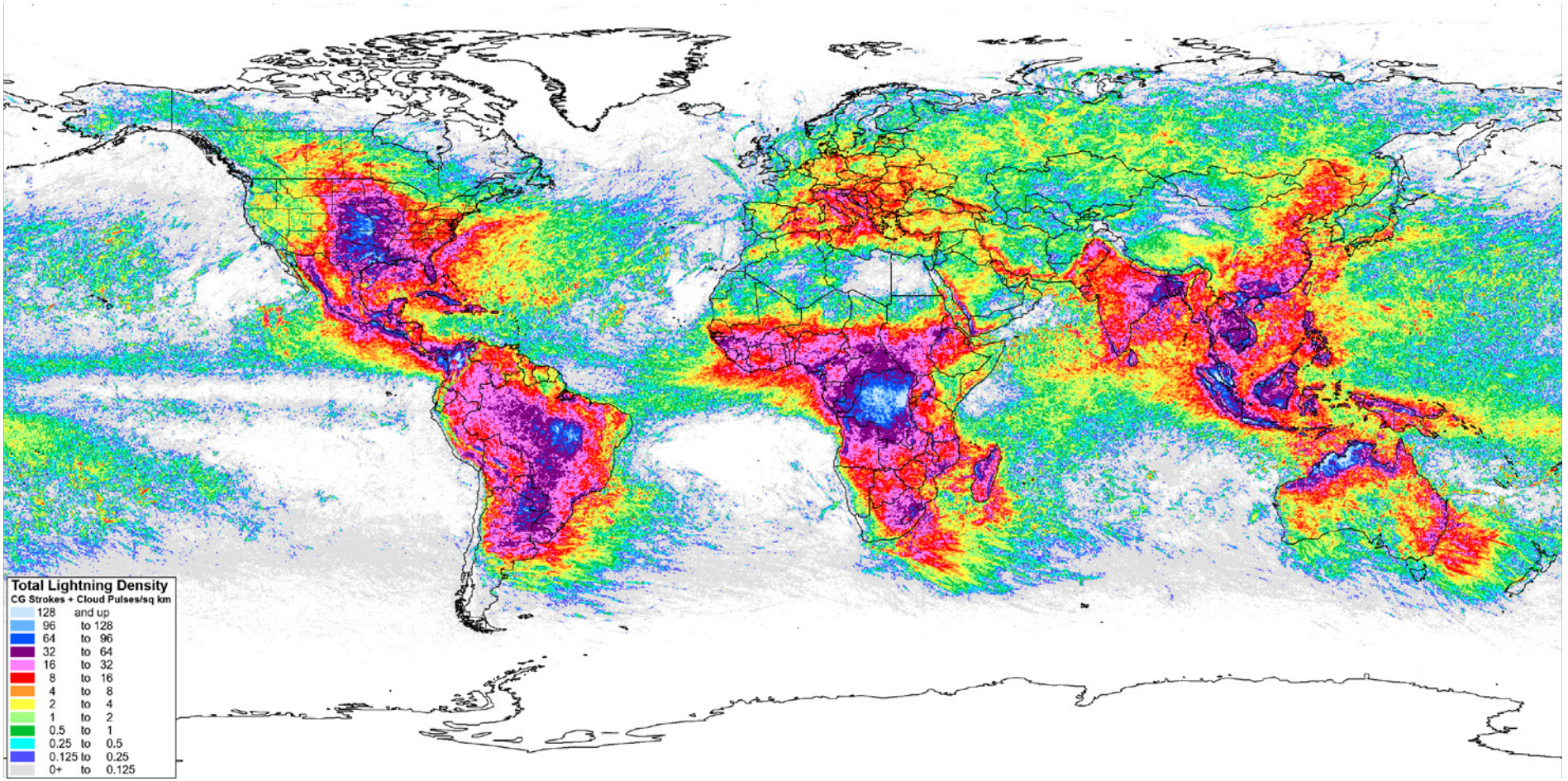
U.S. Total Lightning Density Ratio in 2019

Compared to 5-Year Average



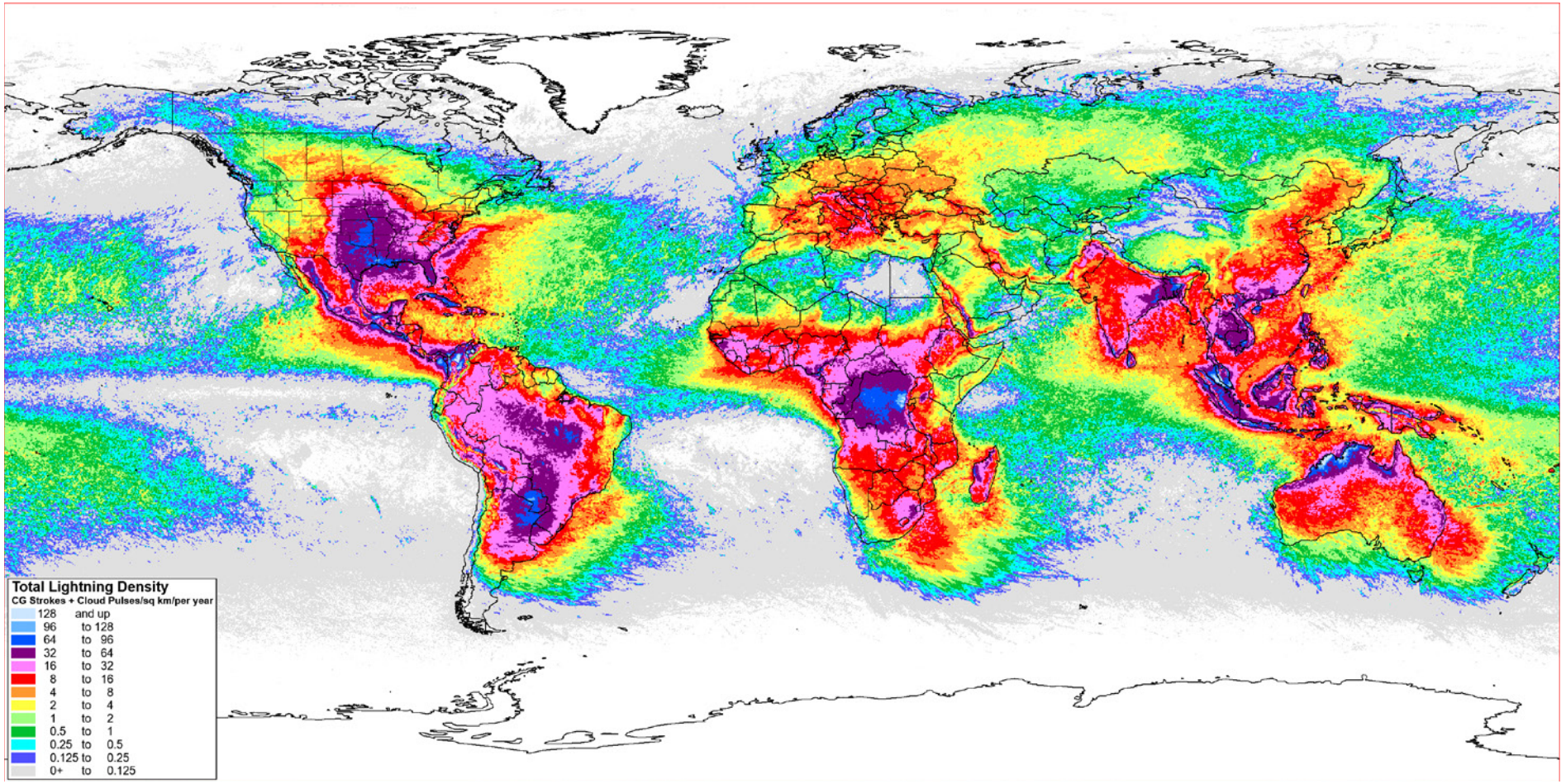
Global Total Lightning Density in 2019

2,353,476,704 Events Detected



Average Global Total Lightning Density, 2015–2019

10,661,259,470 Events Detected



VAISALA

vaisala.com/lightning