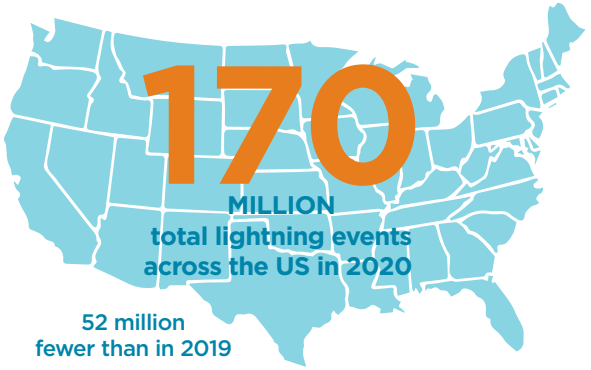
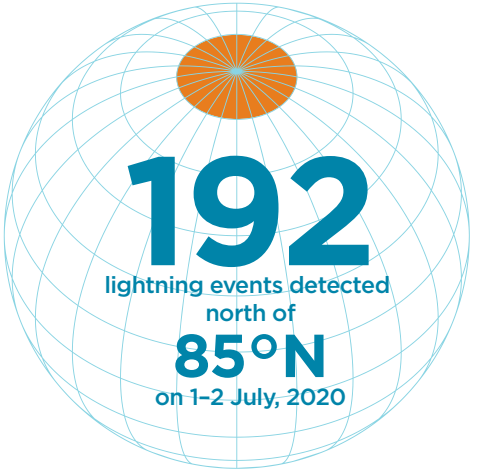
Lightning like never before

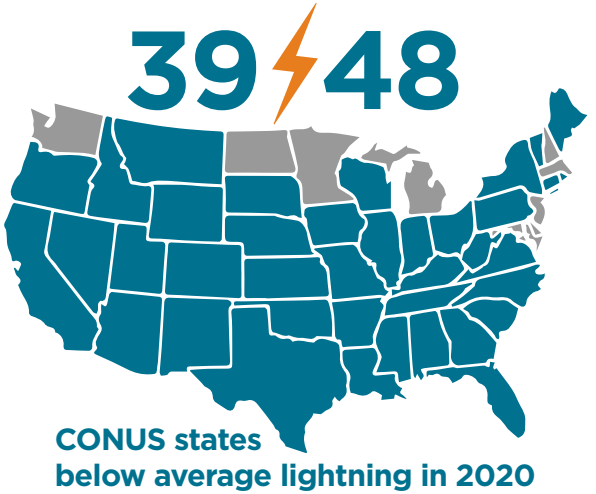
ANNUAL LIGHTNING REPORT 2020

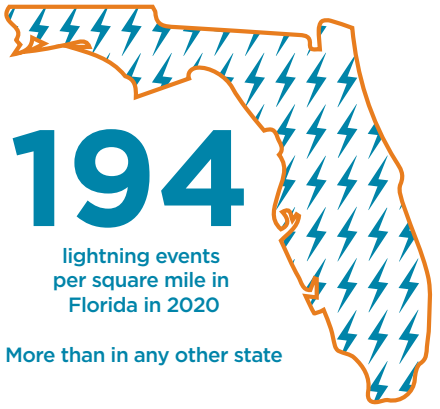
VAISALA

Highlights of lightning activity in 2020









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World's most advanced lightning detection networks

at your service

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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 unrivaled performance with excellent location accuracy and detection efficiency and is the most capable network of both detecting in-cloud and cloud-to-ground lightning, while, at the same time, correctly differentiating between the two.

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 **Chris Vagasky**.

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, and the 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, guaranteeing that detected lightning trends reflect reality and allowing accurate year-on-year comparisons and providing a reliable climatological record.

Global Lightning Dataset GLD360

The only truly global total lightning detection sensor network generates the data provided through Vaisala's owned-and-operated Global Lightning Dataset GLD360. GLD360 has the ability to instantly detect lightning and convective activity anywhere over land and sea.

The data are 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 detection efficiency and location accuracy. It detects nearly 100% of thunderstorms, even those beyond the range of radars and satellites, tracks the trajectory and the intensity of lightning discharges, and can be used to monitor the development of tropical cyclones or other potentially hazardous geophysical events.

Flashes, pulses and strokes

In-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 cloud 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 life and property.

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

Total lightning

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

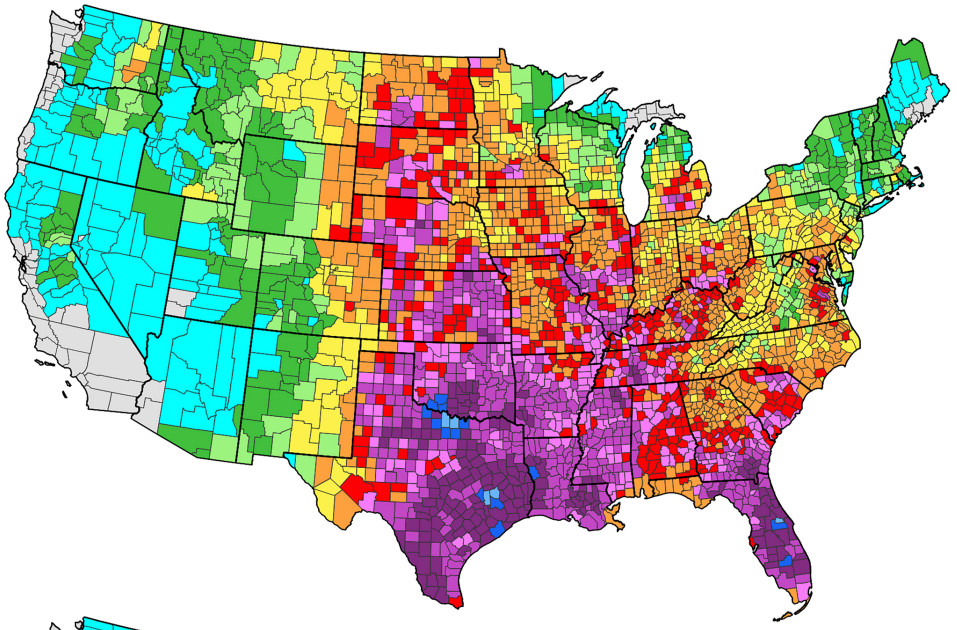
Lightning drought across lightning prone regions
April–June 2020

The Central and Southern Plains and the Gulf Coast Regions of the United States are among the most lightning prone regions in the world. With moist air moving north from the Gulf of Mexico, dry air coming from the southwest desert region, and cold air from the Rocky Mountain region, thunderstorms are very common.

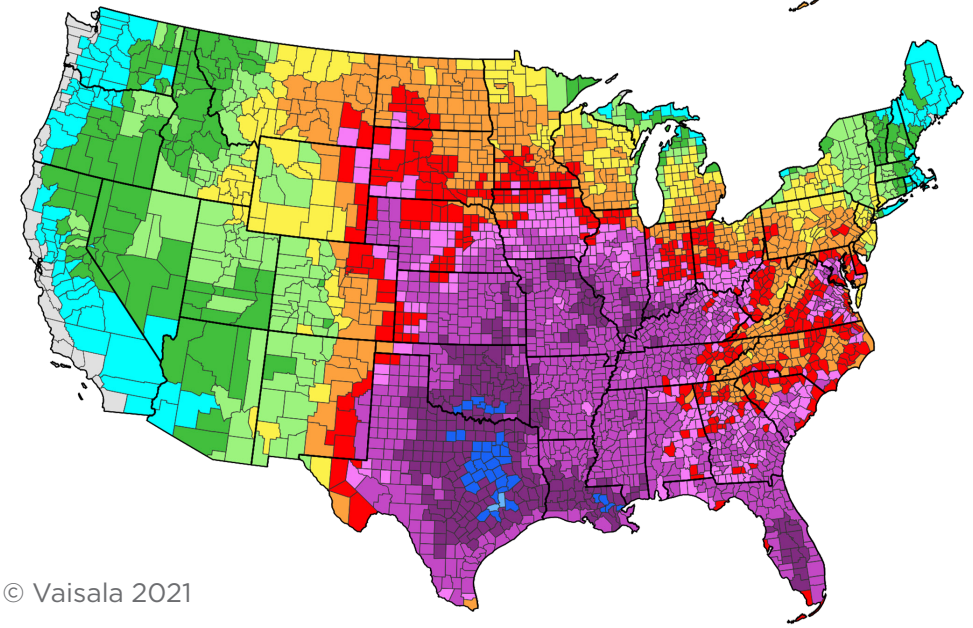
For much of spring and early summer 2020, there was an abnormally strong area of high pressure over this region. This resulted in fewer thunderstorms.

Between April and June 2020, the NLDN detected 62% fewer cloud-to-ground strokes than the same period in 2019, and 52% fewer cloud-to-ground strokes than the 2015–2019 April–June average.

NLDN
total lightning density
April–June 2020



NLDN average
total lightning density
April–June 2015–2019



Lightning density in April–June 2020

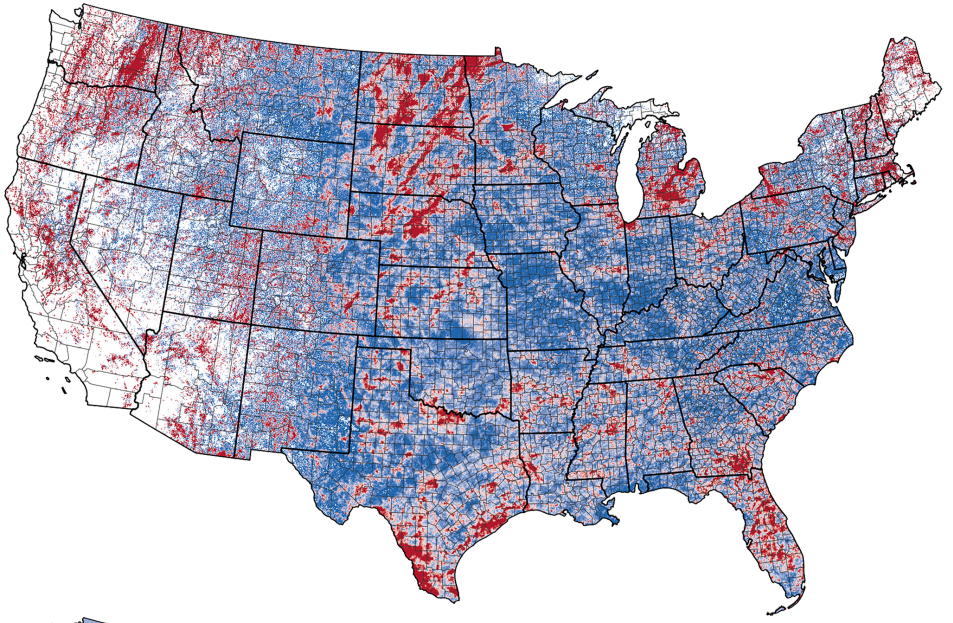
Compared to 5-year-average

When looking at the total lightning density ratio (top map) the impact of individual thunderstorms on local lightning density is evident.

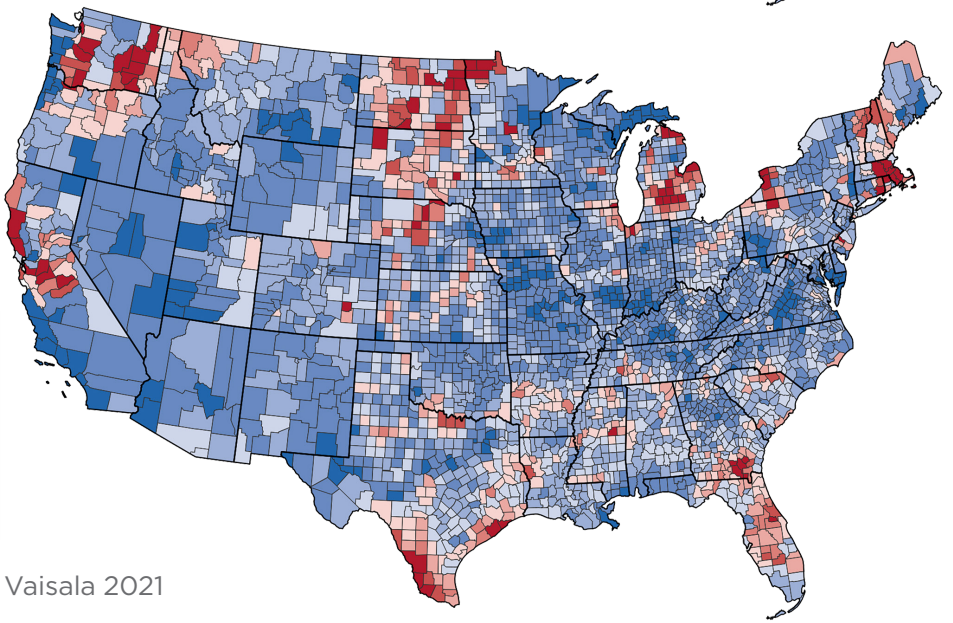
The red streaks in Washington state, for example, are related to significant thunderstorm activity on May 30. More than half of Washington's 2020 lightning occurred on this day.

Showing the lightning density ratio on a county level (bottom map) makes it clear just how much of the country saw below average lightning during the spring months of 2020.

NLDN
total lightning
density ratio
April–June 2020
compared to 5-year-average



NLDN
total lightning
density ratio per county
April–June 2020
compared to 5-year-average



Top 10 states with the most total lightning

Cloud-to-ground strokes plus cloud pulses

TOP TEN TOTAL LIGHTNING COUNTS BY STATE IN 2020		
1	Texas	33,816,168
2	Florida	12,783,178
3	Oklahoma	12,620,899
4	Kansas	8,200,370
5	Missouri	6,940,725
6	Louisiana	6,888,154
7	Arkansas	6,492,964
8	Mississippi	6,310,507
9	Nebraska	6,043,648
10	Georgia	5,722,070

Familiar places in the top-10

Due to its sheer size and favorable location, Texas always leads the United States in total lightning counts. The rest of the 2020 top-10 is a who's who of the most lightning prone states in the country.

While the rankings may change somewhat from year-to-year, you can expect that these states will generally have the most lightning in the United States.

Less lightning, less hail

Hail forms in thunderstorms with high atmospheric instability and cause millions of dollars of damage yearly. The NOAA/NWS Storm Prediction Center received approximately 25% fewer severe hail reports than average in 2020.

The atmospheric conditions that contributed to fewer thunderstorms between April and June resulted in less hail in the United States. As hail only occurs in thunderstorms, it makes sense that there was less hail in 2020.

Total lightning counts per state in 2020

Cloud-to-ground strokes plus cloud pulses – with rankings compared to 2019

1	↔	Texas	33,816,168
2	↗3	Florida	12,783,178
3	↘1	Oklahoma	12,620,899
4	↘1	Kansas	8,200,370
5	↘1	Missouri	6,940,725
6	↗1	Louisiana	6,888,154
7	↗2	Arkansas	6,492,964
8	↗2	Mississippi	6,310,507
9	↘1	Nebraska	6,043,648
10	↗4	Georgia	5,722,070
11	↘5	Illinois	5,256,505
12	↗1	South Dakota	4,595,607
13	↗3	Tennessee	4,505,027
14	↗4	Alabama	4,371,834
15	↗8	North Dakota	3,791,697
16	↗3	Minnesota	3,558,255
17	↔	Kentucky	3,504,625
18	↗3	North Carolina	3,286,035
19	↗5	South Carolina	2,934,267
20	↘8	New Mexico	2,744,287
21	↗6	Ohio	2,680,150
22	↘11	Iowa	2,608,791
23	↗2	Virginia	2,513,631
24	↘4	Colorado	2,401,750
25	↗5	Michigan	2,317,693
26	↘11	Montana	2,095,074
27	↘1	Indiana	1,816,565
28	↗1	Wisconsin	1,445,728
29	↘7	Wyoming	1,218,084
30	↘2	Pennsylvania	1,195,607
31	↔	Arizona	1,029,061
32	↗2	Maryland	921,699
33	↘1	West Virginia	919,222
34	↘1	New York	624,187
35	↗6	Alaska	415,231
36	↗1	Idaho	325,147
37	↘2	Utah	319,792
38	↗2	New Jersey	300,894
39	↔	California	283,405
40	↘2	Oregon	223,206
41	↘5	Nevada	217,357
42	↗1	Delaware	163,861
43	↘2	Washington	162,989
44	↔	Maine	102,307
45	↗3	New Hampshire	77,499
46	↔	Massachusetts	75,350
47	↔	Vermont	69,808
48	↘3	Connecticut	56,377
49	↔	Hawaii	15,549
50	↗1	District of Columbia	9,215
51	↘1	Rhode Island	8,551

Top 10 states by total lightning density

Cloud-to-ground strokes plus cloud pulses

TOP TEN STATES BY TOTAL LIGHTNING DENSITY PER km² IN 2020		
1	Florida	75.1
2	Oklahoma	69.7
3	District of Columbia	52.1
4	Louisiana	50.8
5	Mississippi	50.3
6	Texas	48.6
7	Arkansas	47.1
8	Tennessee	41.3
9	Kansas	38.5
10	Missouri	38.4

You are my density

The size of states varies greatly across the country, so normalizing regions of different size by their area allows for comparisons. While Texas has the highest lightning counts because of its size, Florida is the United States lightning capital based on density.

State rankings by density can vary from year-to-year based on the amount of lightning a state experiences.

Lowest ranking states with <50% average lightning

Cloud-to-ground strokes plus cloud pulses

LOWEST RANKING STATES FOR 2020, WHEN COMPARED TO 2015-2019 AVERAGE			
		LIGHTNING COUNTS	% AVERAGE
50	Nevada	217,357	27%
49	Utah	319,792	31%
48	Arizona	1,029,061	32%
47	Wyoming	1,218,084	46%
46	New Mexico	2,744,287	47%
45	Iowa	2,608,791	48%
44	California	283,405	49%

The 2020 "nonsoon"

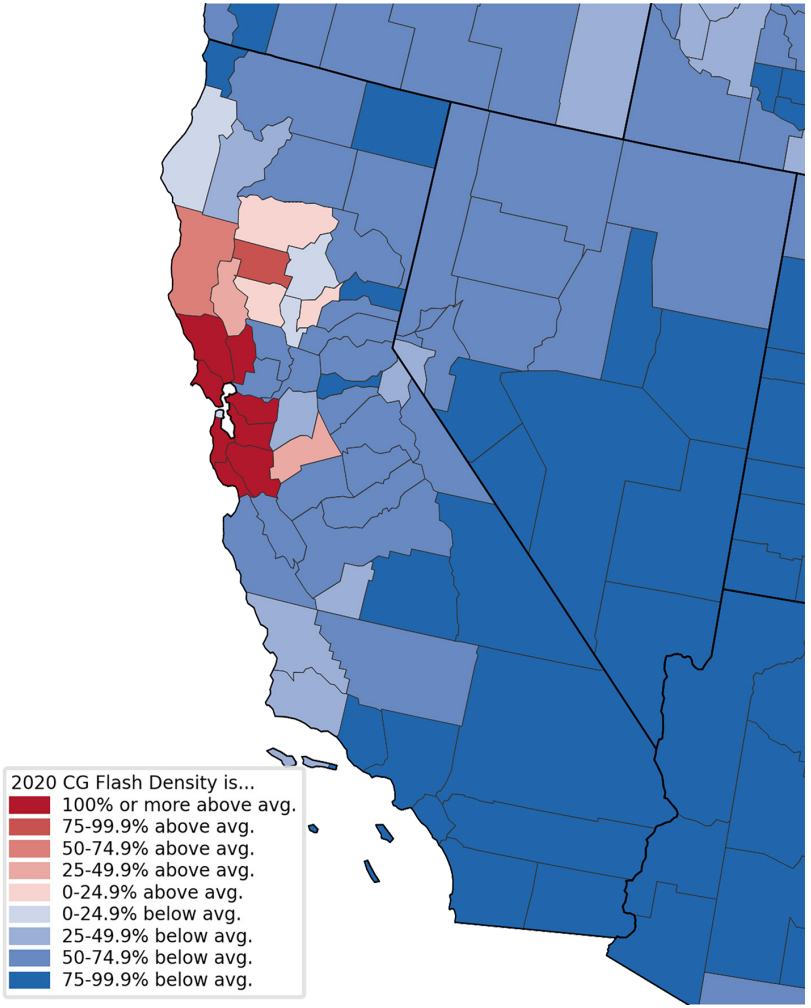
With the exception of Iowa, the states on this list ranked among the five driest years on record. Much of the lightning in the desert states comes during the monsoon season, which ranges from mid-June through mid-September. A high pressure region over the Southwestern United States limited moisture and instability, preventing thunderstorms from developing.

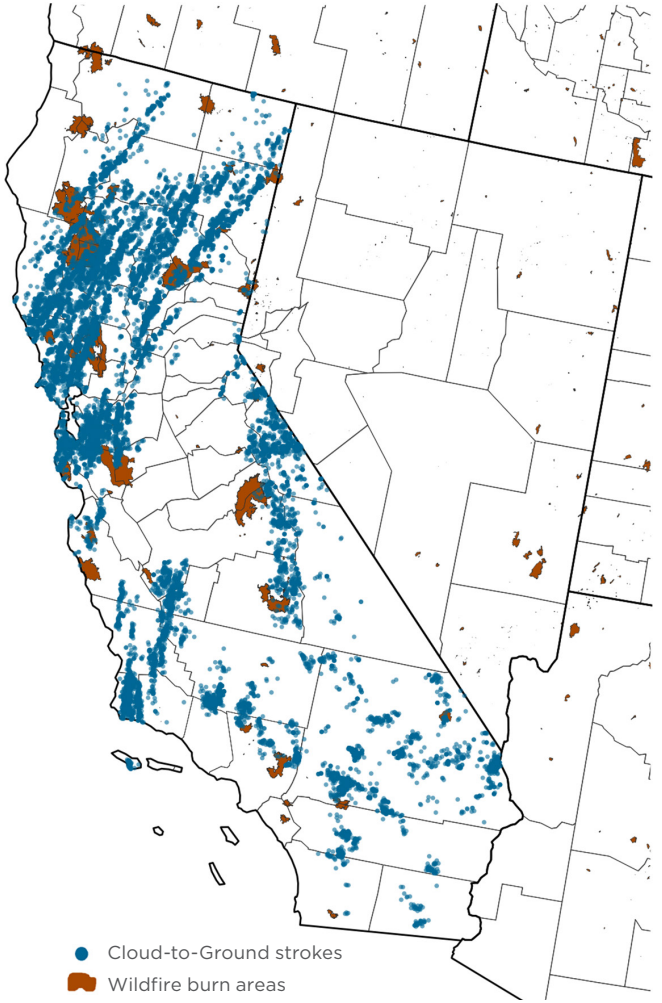
The wrong place at the wrong time

In spite of lower lightning counts across the region, there were a number of significant wildfires triggered by the lightning. The Southwestern United States has been in a longstanding drought, making the vegetation much more susceptible to catching fire if struck by lightning.

California lightning siege

August 15–18, 2020

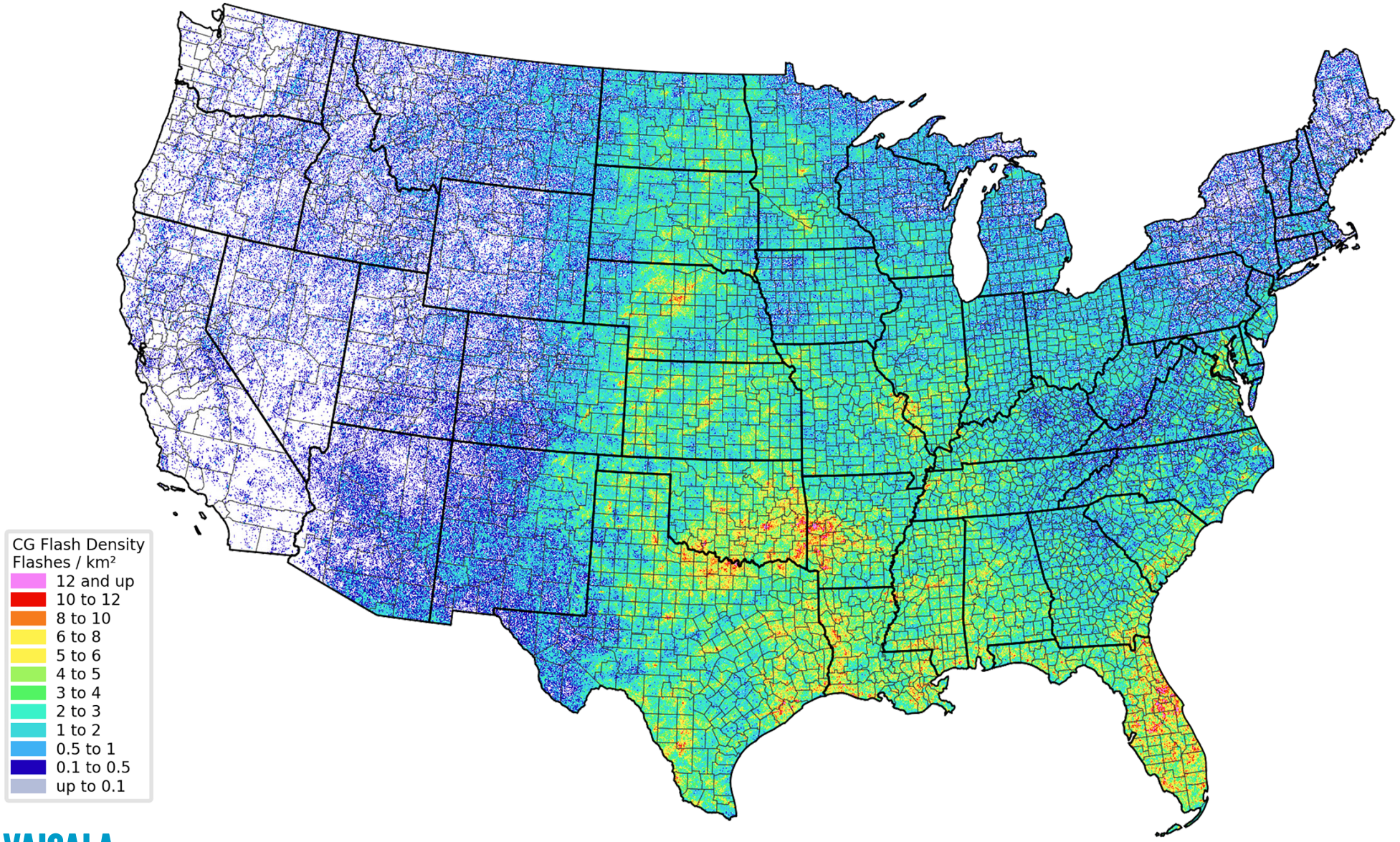




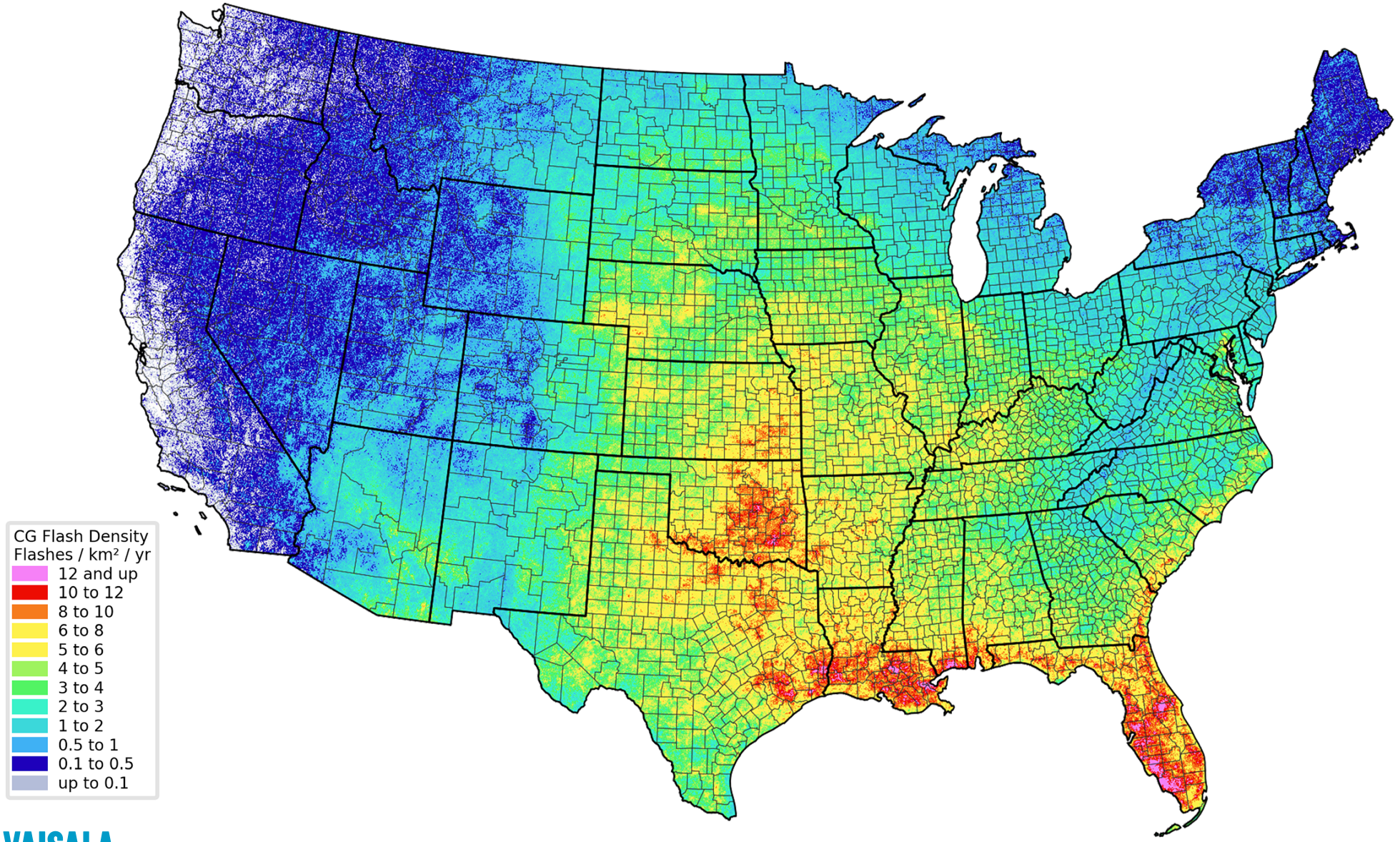
Although California only saw 49% of its average annual lightning in 2020, several counties in the Bay Area and the north-central coast were significantly above average.

Much of this lightning occurred during a 4-day period in August, in what was described as a lightning siege. In a drought-ravaged state, the lightning triggered wildfires, which burned more than 1.8 million acres of land.

U.S. cloud-to-ground flash density in 2020

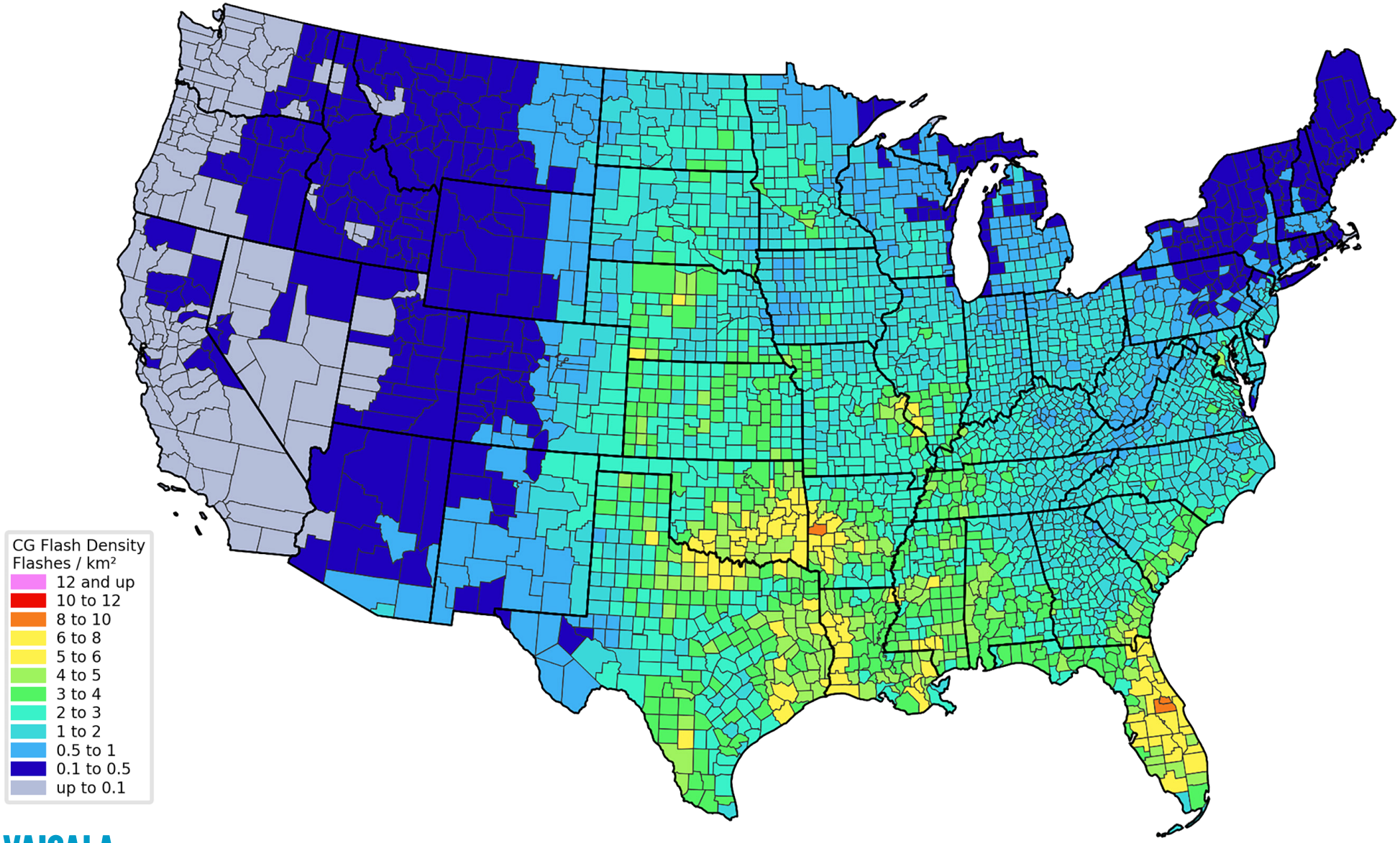


Average U.S. cloud-to-ground flash density in 2015–2019



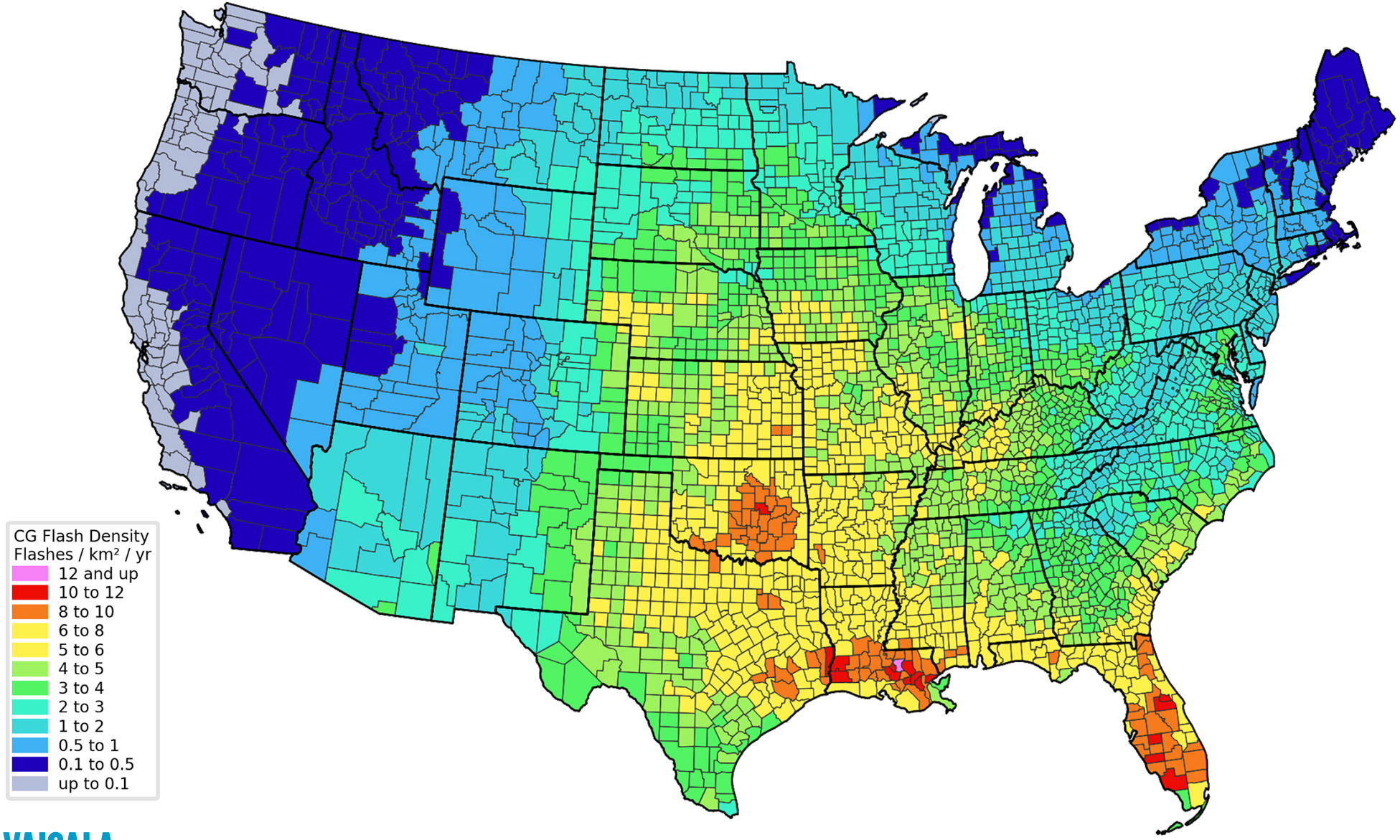
U.S. cloud-to-ground flash density in 2020

per county



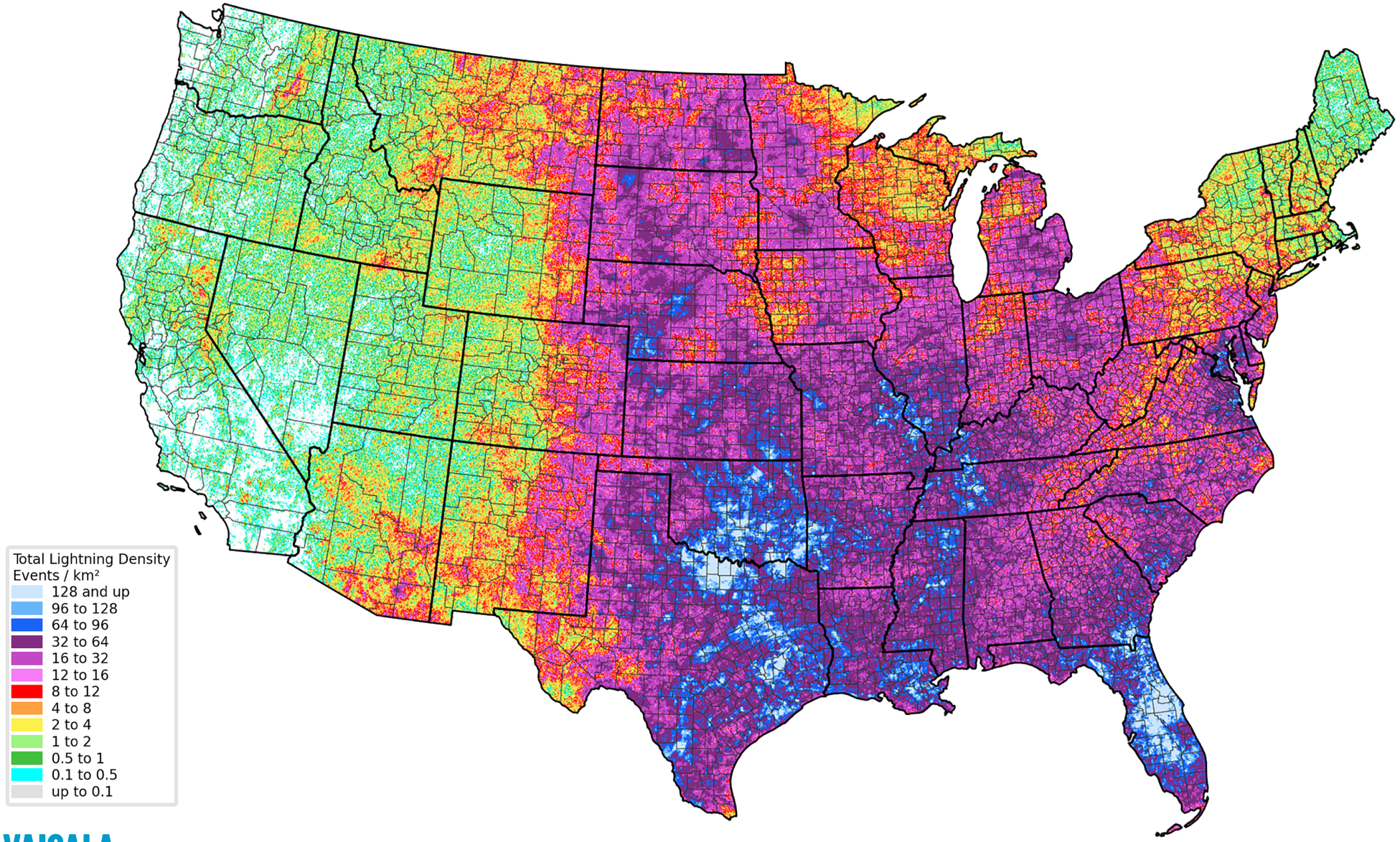
Average U.S. cloud-to-ground flash density in 2015–2019

per county



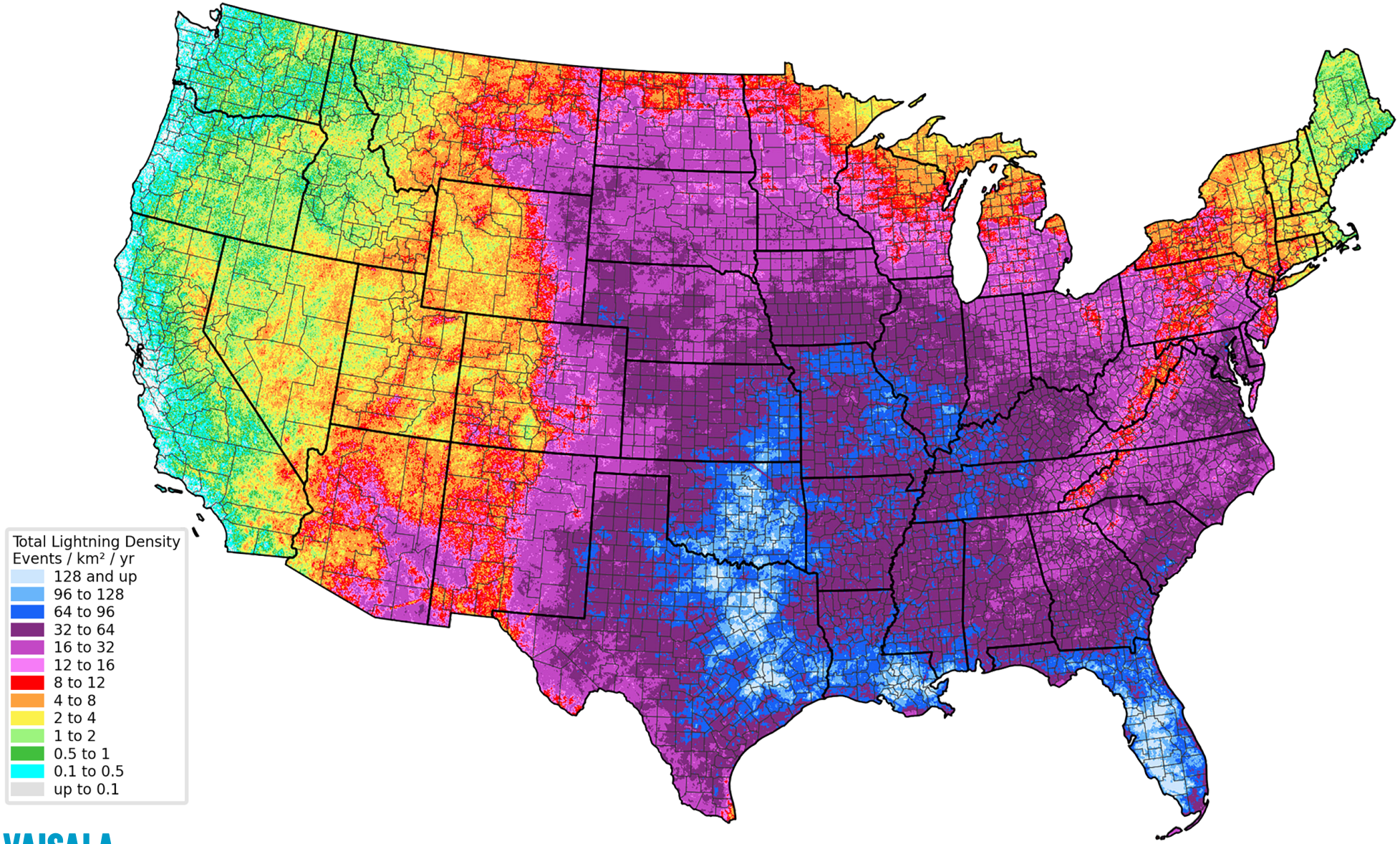
U.S. total lightning density in 2020

170,549,822 events detected

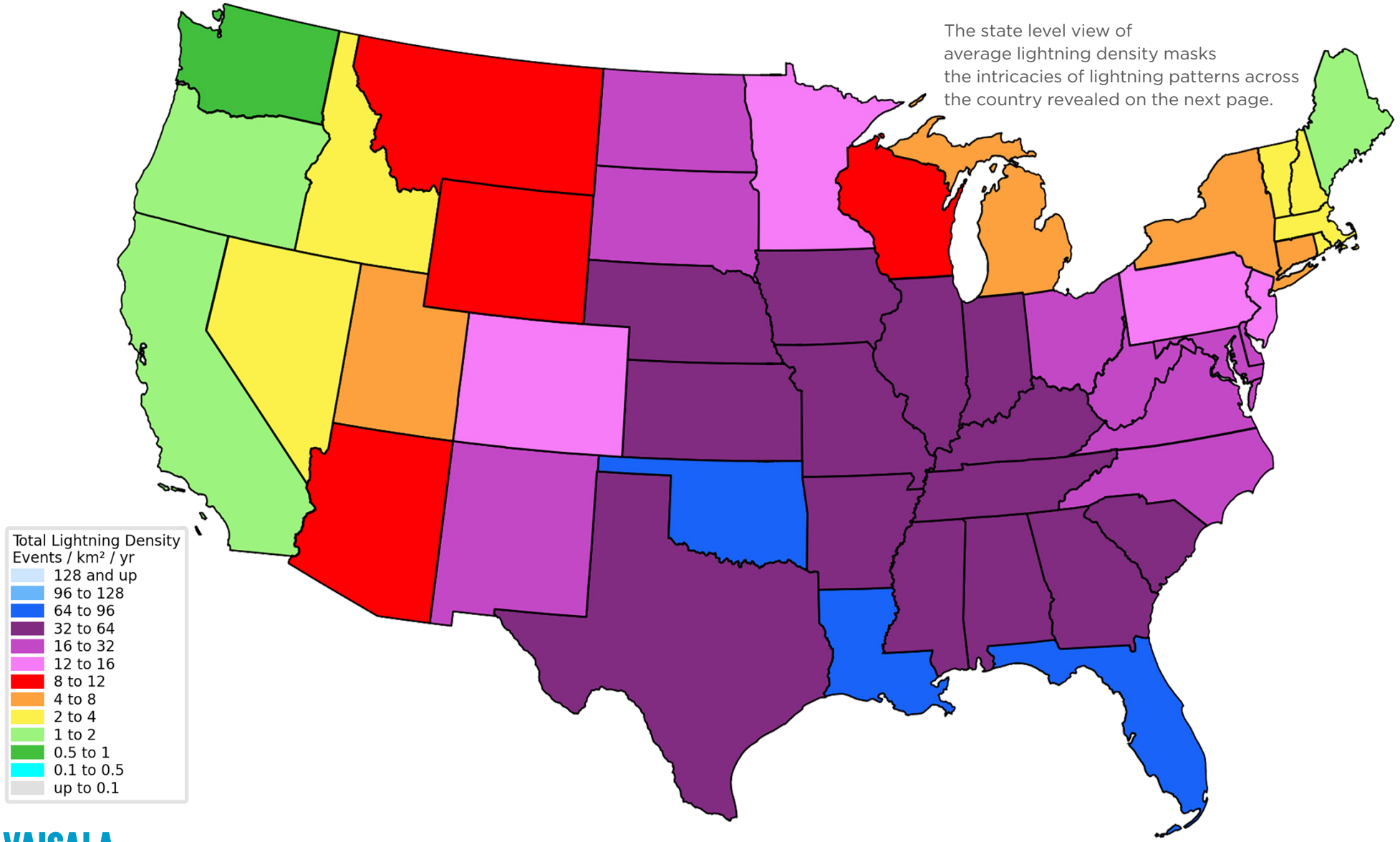


Average U.S. total lightning density, 2015–2019

1,084,890,070 events detected



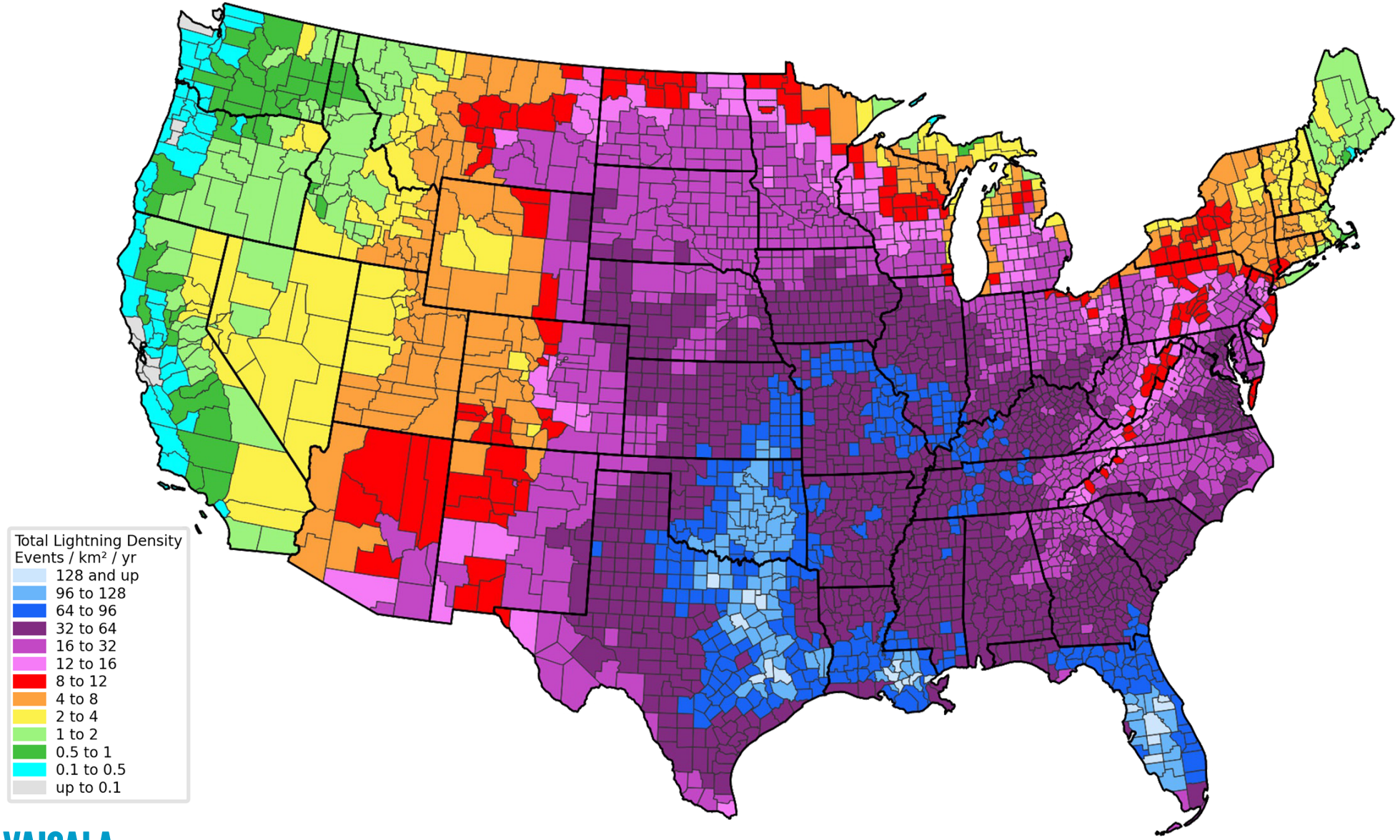
Average U.S. total lightning density in 2015–2019
per state



The state level view of average lightning density masks the intricacies of lightning patterns across the country revealed on the next page.

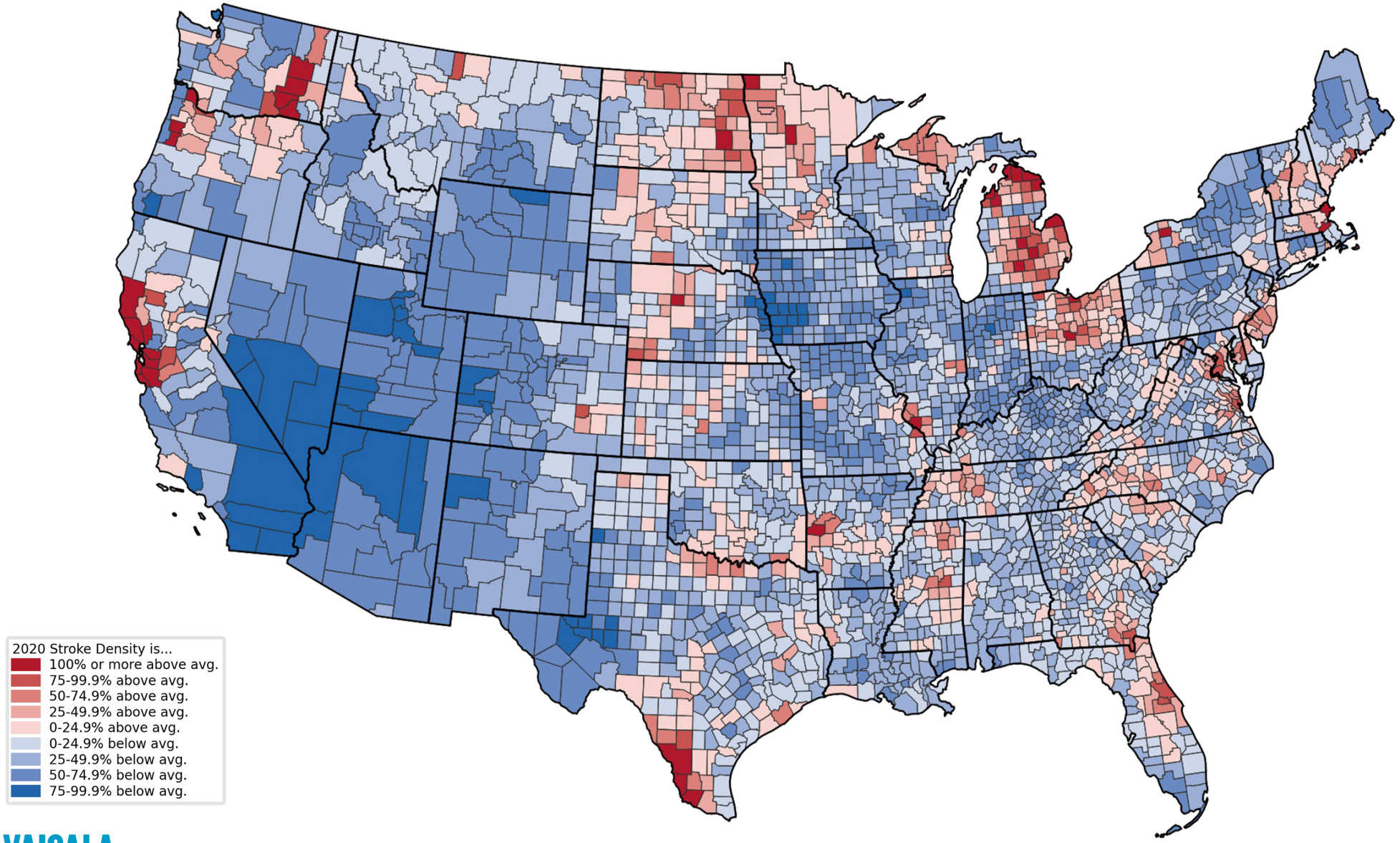
Average U.S. total lightning density in 2015–2019

per county



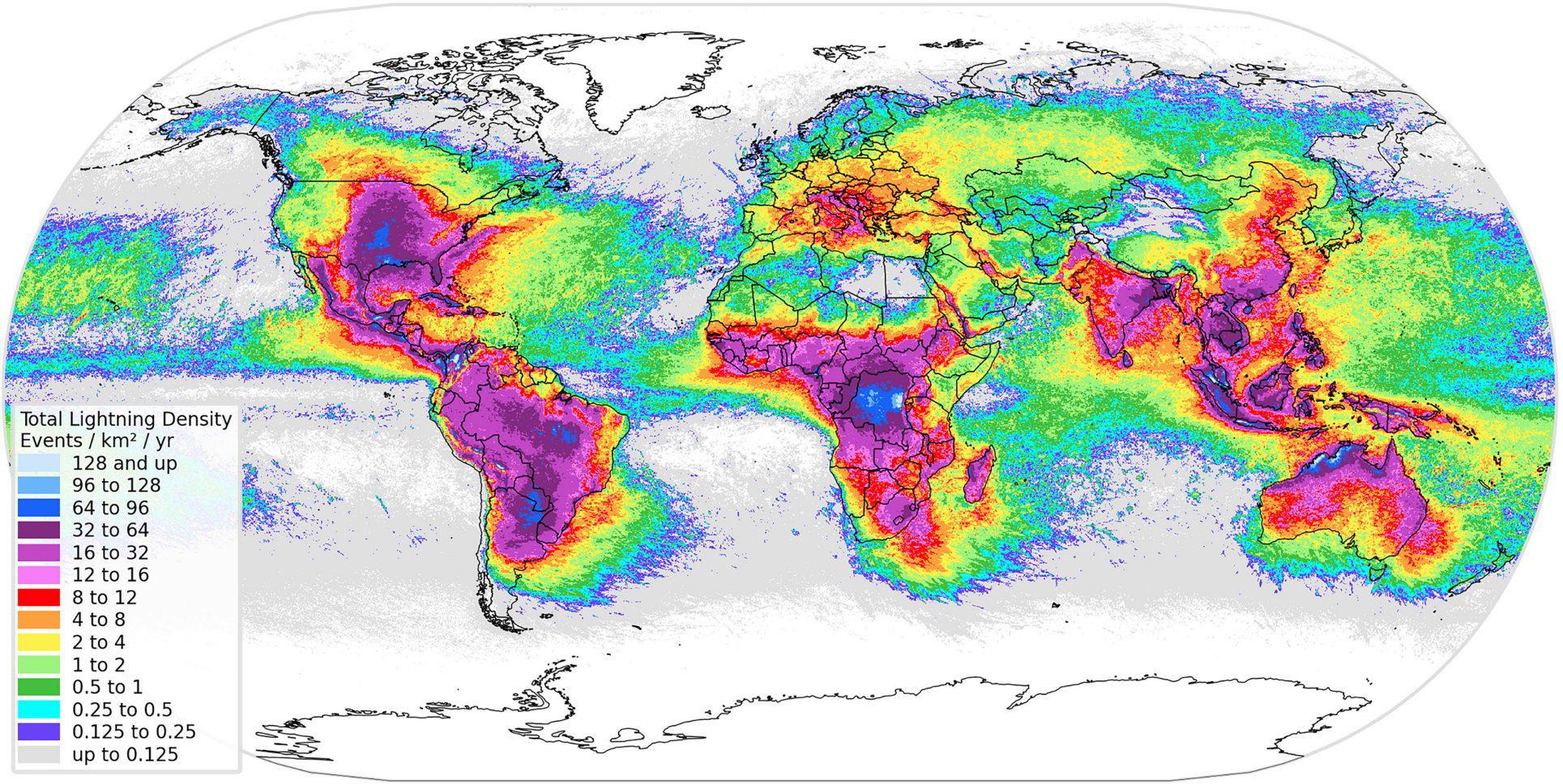
U.S. total lightning density ratio per county in 2020

Compared to 5-year average

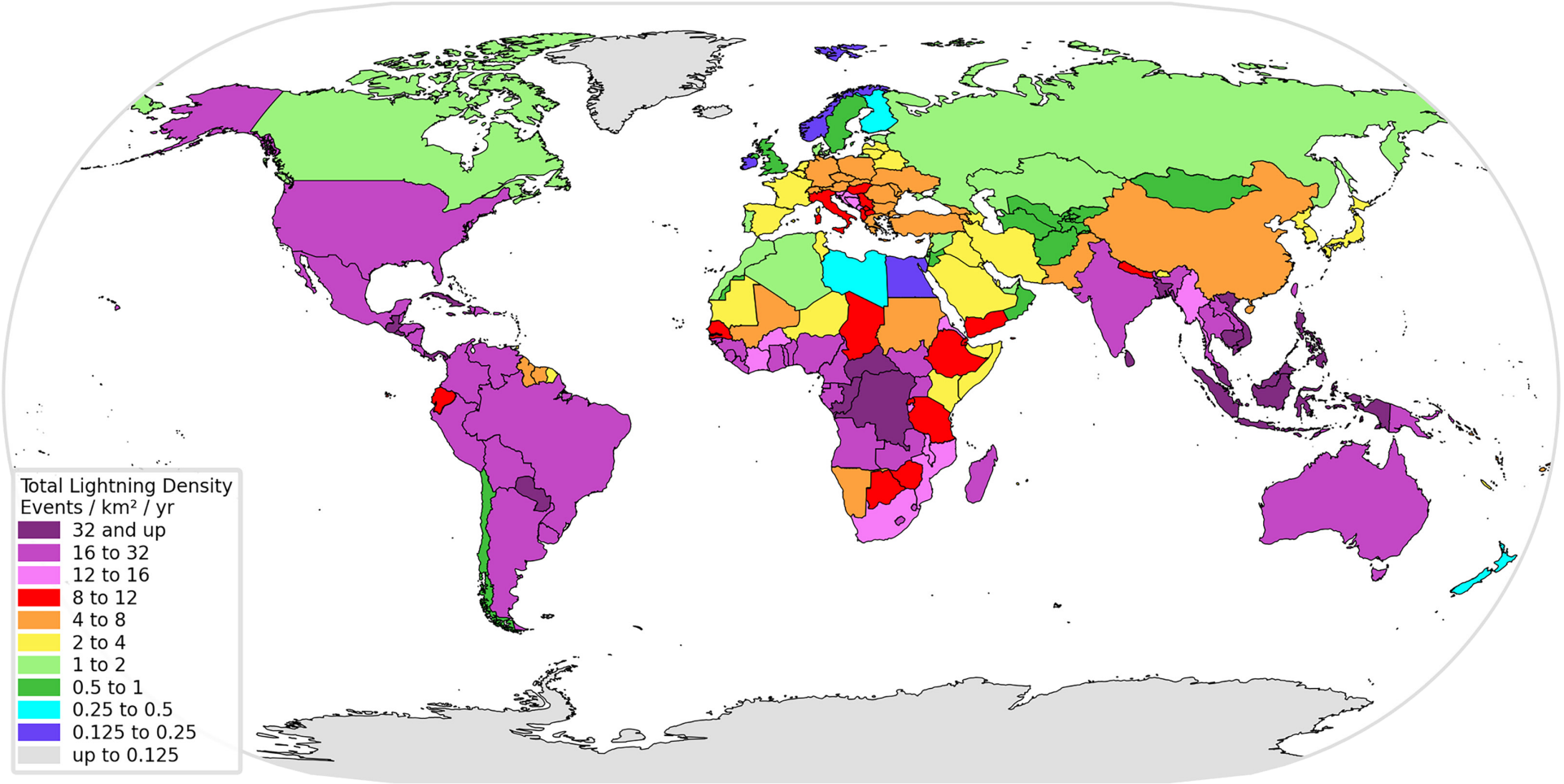


Average global total lightning density, 2016–2020

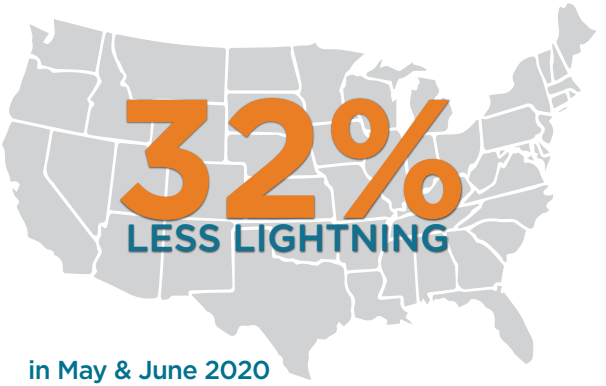
More than 10 billion events detected



Average total lightning densities by country 2016–2020



Lightning fast reads
2020 blogs on vaisala.com



in May & June 2020
when compared to the 5-year average

February

Revising the record on record lightning at the North Pole

March

Lightning triggered by TV antennas and wind turbines

Start of thunderstorm season in the U.S.

April

Eruptive electricity – The shocking presence of volcanic lightning

Vaisala's GLD360 detects enveloped eyewall lightning signature in cyclone Harold

May

Vaisala's technology helps keep people safe from thunderstorms

June

How does Vaisala detect lightning?

Lightning safety around the world

Staying lightning safe in the great outdoors

Lightning safety for your business

Lightning data to kick off Lightning Safety Awareness Week

Striking history: Lightning and the Washington Monument

Continuing Current Dataset identifies the lightning strokes with potential to be the most destructive

July

To launch or not to launch: the impact of weather on space launches

August

Making your own thunderstorm (do NOT try this at home!)

Where's all my lightning?

September

Lightning at airports: Keeping ramp operations running safely

One strike, you're out! Take me (safely!) out to the ball game

Vaisala lightning nowcasts on your platform

October

Vaisala's Global Lightning Dataset GLD360 now accurate to one kilometer

December

Vaisala flips the switch on one-kilometer accuracy for Global Lightning Dataset GLD360

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