



Supplement of

The WGLC global gridded lightning climatology and time series

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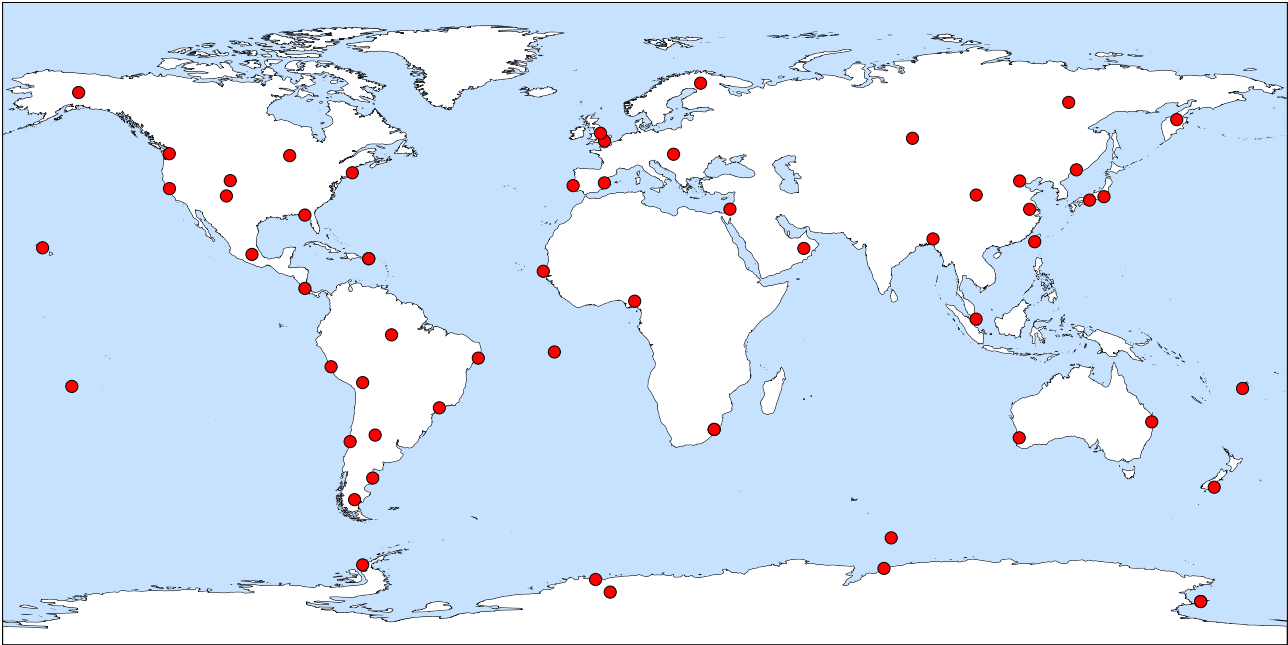


Figure S1. Location map of the WWLLN detector stations.

Gridding process for WGLC lightning climatology to 10 km ALDN projection

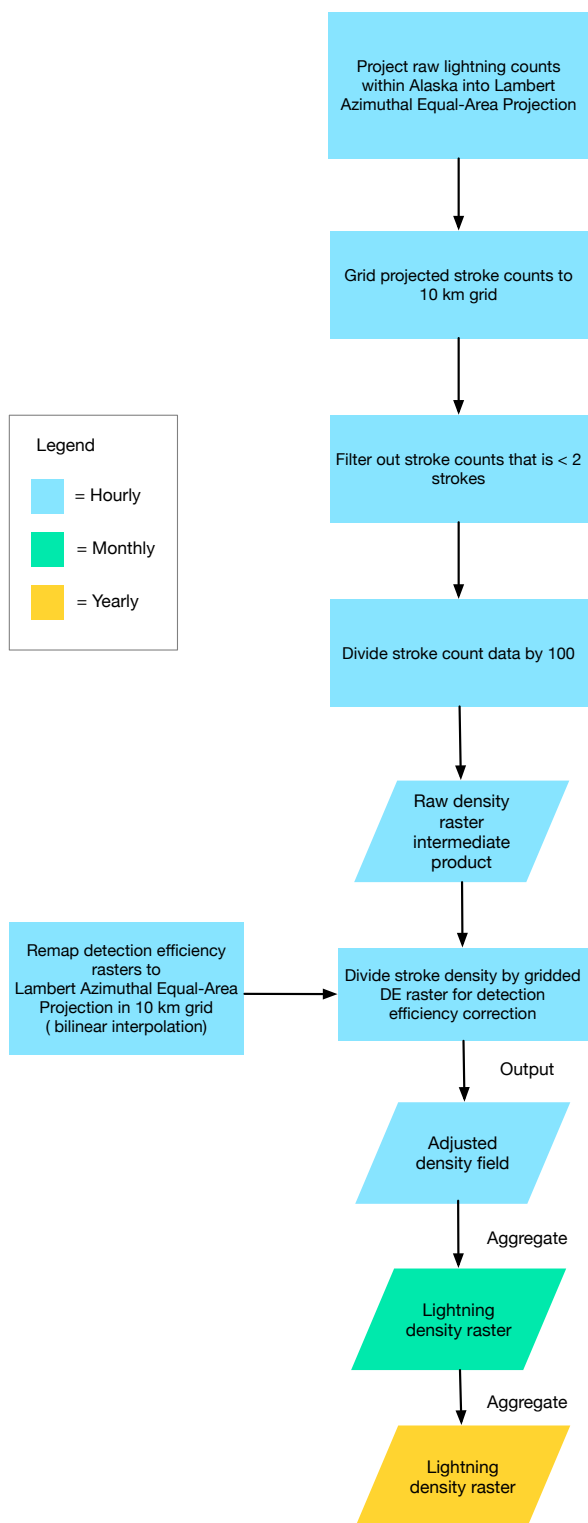


Figure S2. Flowchart of the gridding process for WGLC and ALDN stroke counts on to the 10 km equal-area grid for Alaska.

Gridding process for WGLC lightning climatology to 12 km NLDN projection

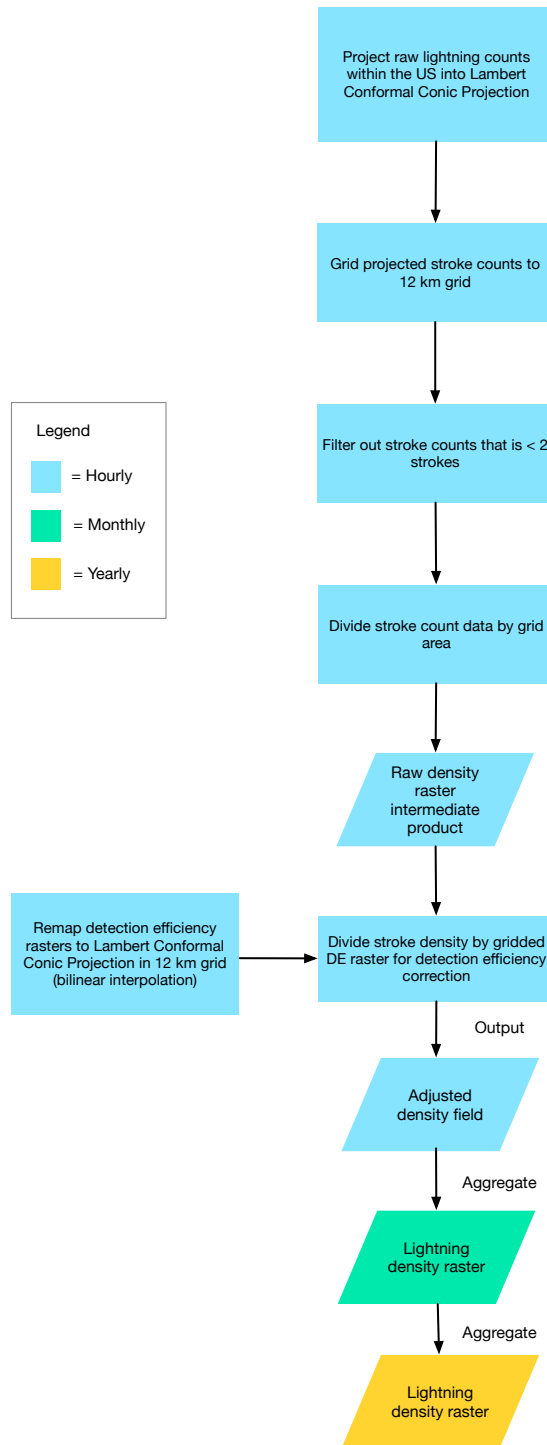


Figure S3. Flowchart of the gridding process for WGLC stroke counts on to the 12 km NLDN CMAQ grid

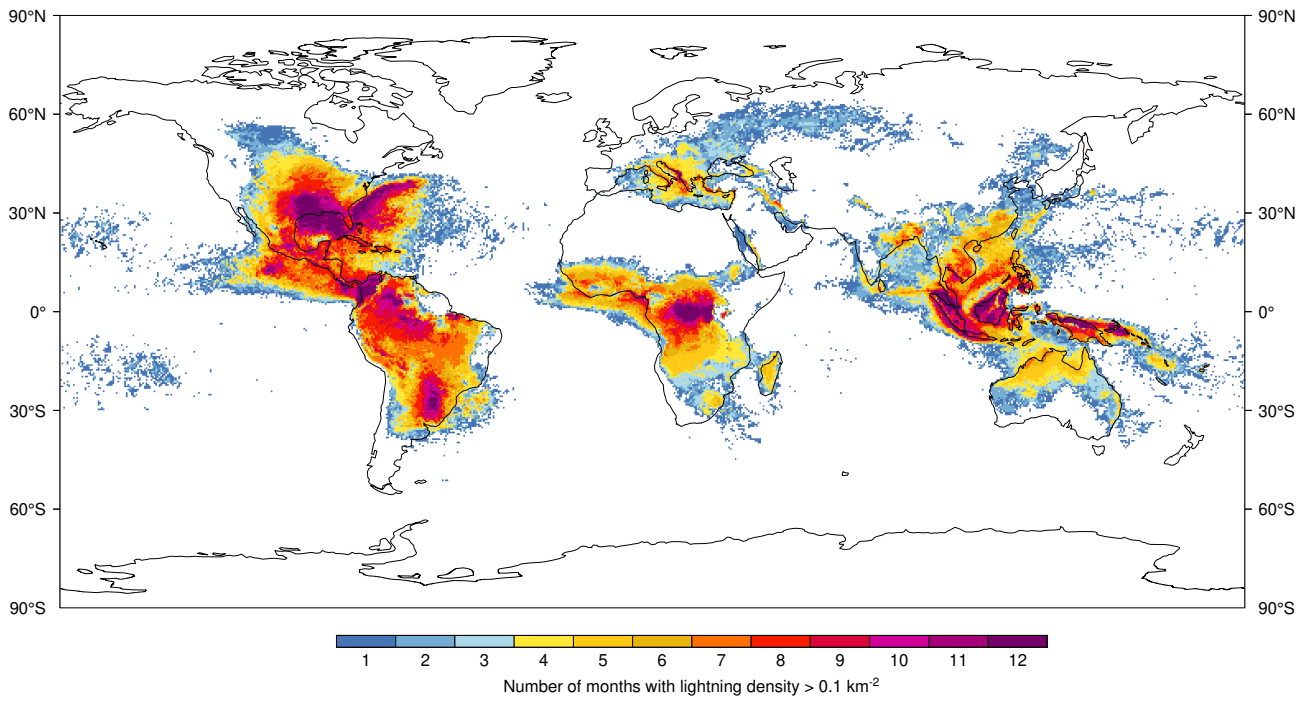


Figure S4. Number of months with lightning density greater than 0.1 km²

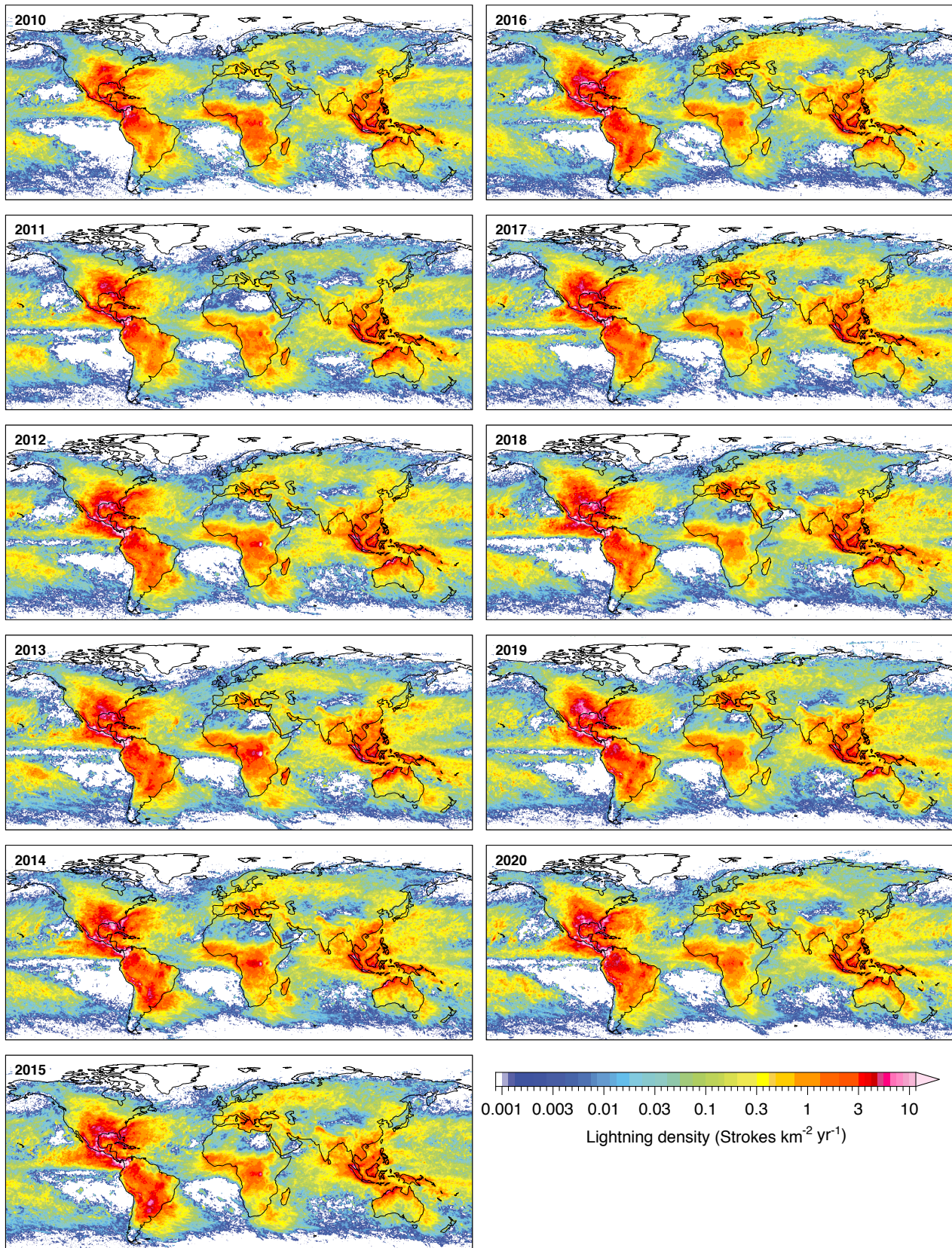


Figure S5. WGLC annual lightning density maps (2010-2020)

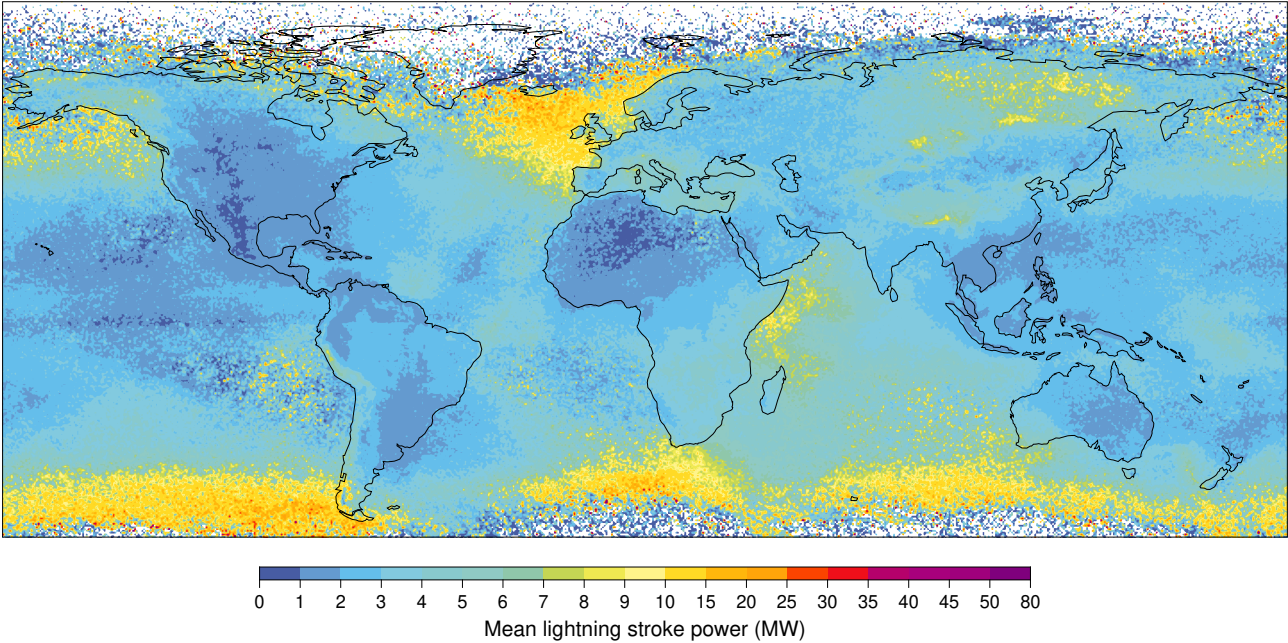


Figure S6. Climatological annual mean of the *mean* lightning power-per-stroke.

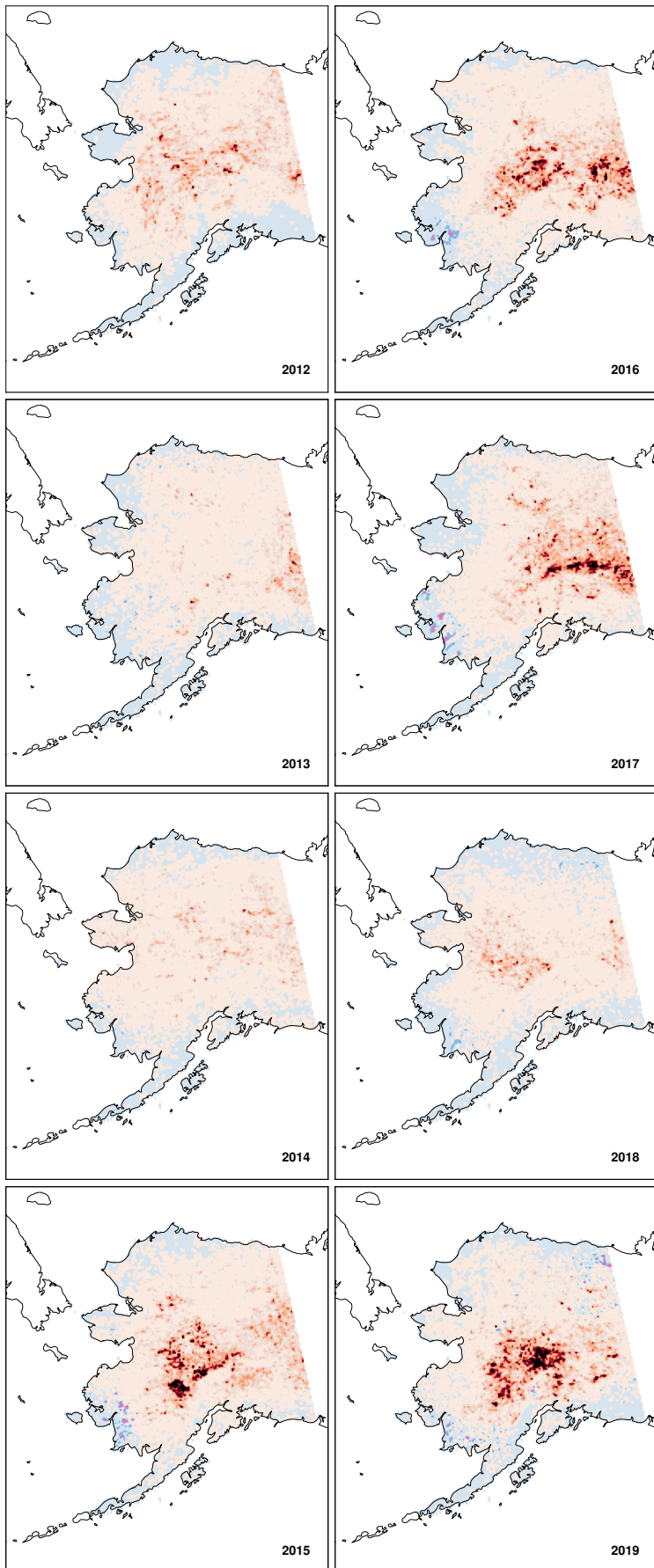
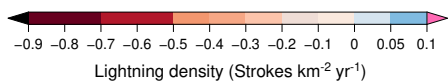


Figure S7. Differences in lightning stroke density between WGLC and ALDN. Red: ALDN > WGLC. Blue: WGLC > ALDN.



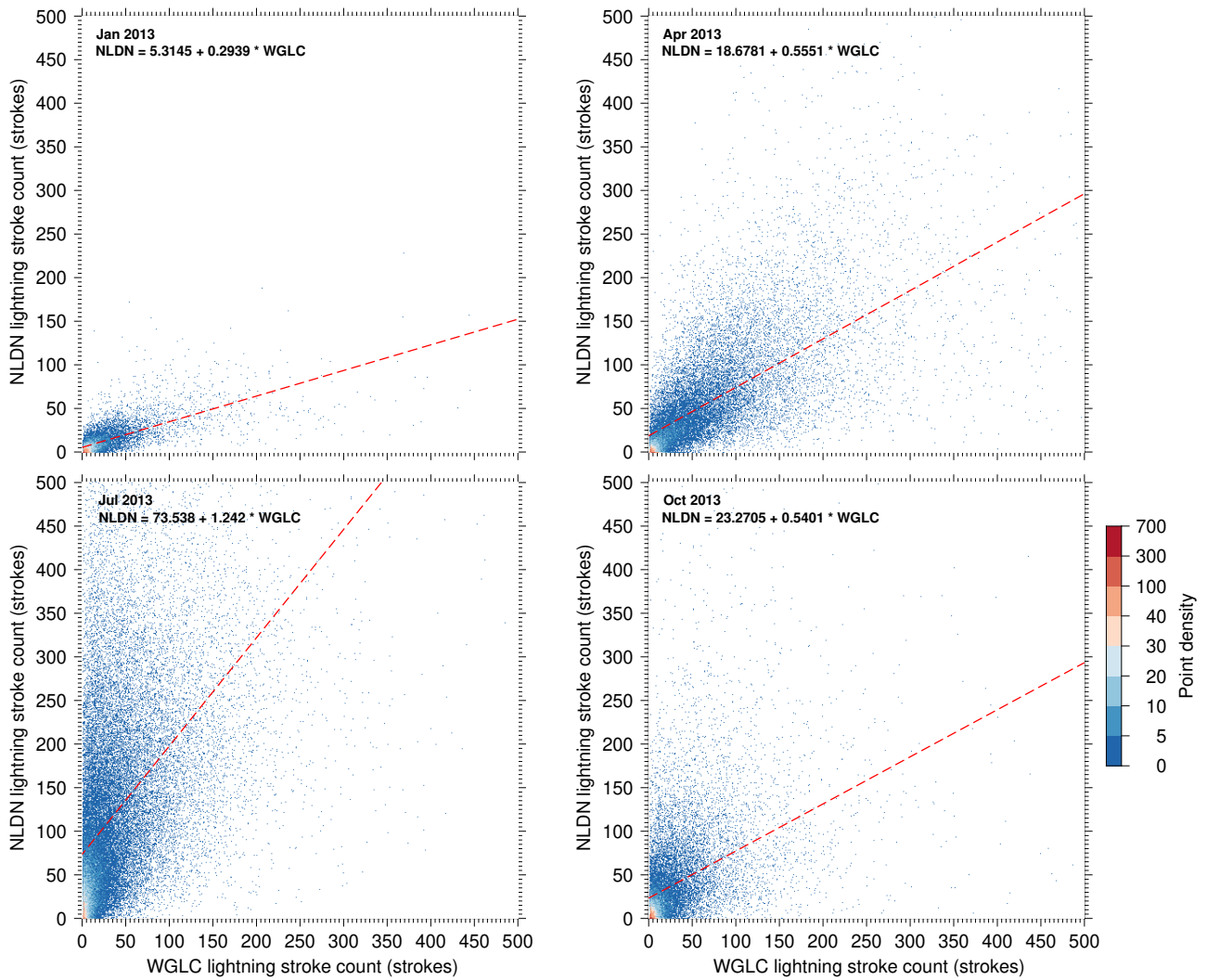


Figure S8. Examples of the relationship between WGLC and NLDN lightning stroke count in January, April, July, and October, 2013. The slope of the linear regression (red dashed line) shows the correlation between the two climatologies. WGLC generally records greater lightning density than NLDN outside of the peak season, with 1.8 times more lightning in April and October and 3.4 times during January.

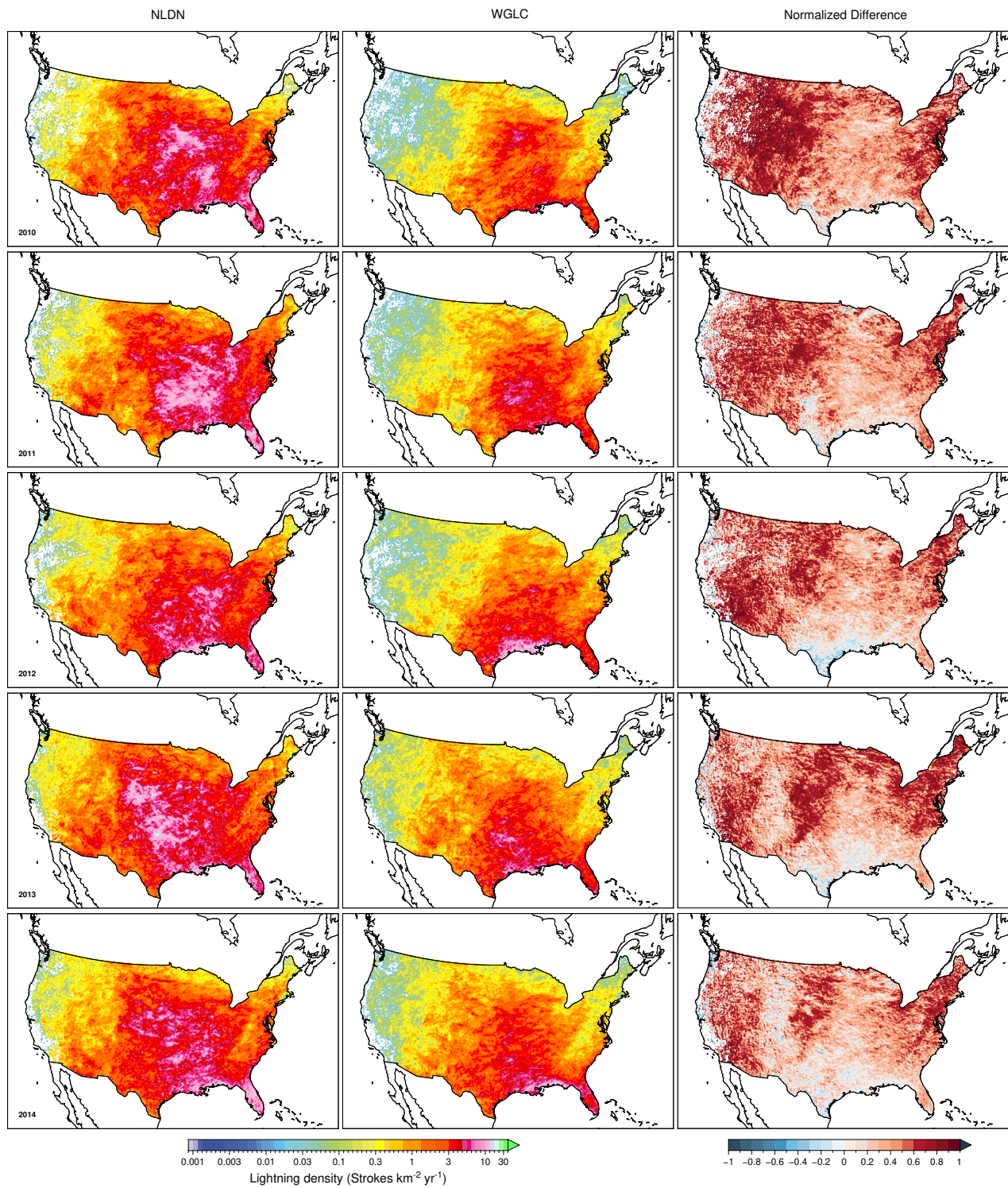


Figure S9. Annual lightning density of NLDN (left column) and WGLC (middle column) over the conterminous United States from 2010 to 2014 (12 km CMAQ grid). Normalised difference between NLDN cloud-to-ground strokes and WGLC (right column). Red colour indicates NLDN lightning density is greater than WGLC.

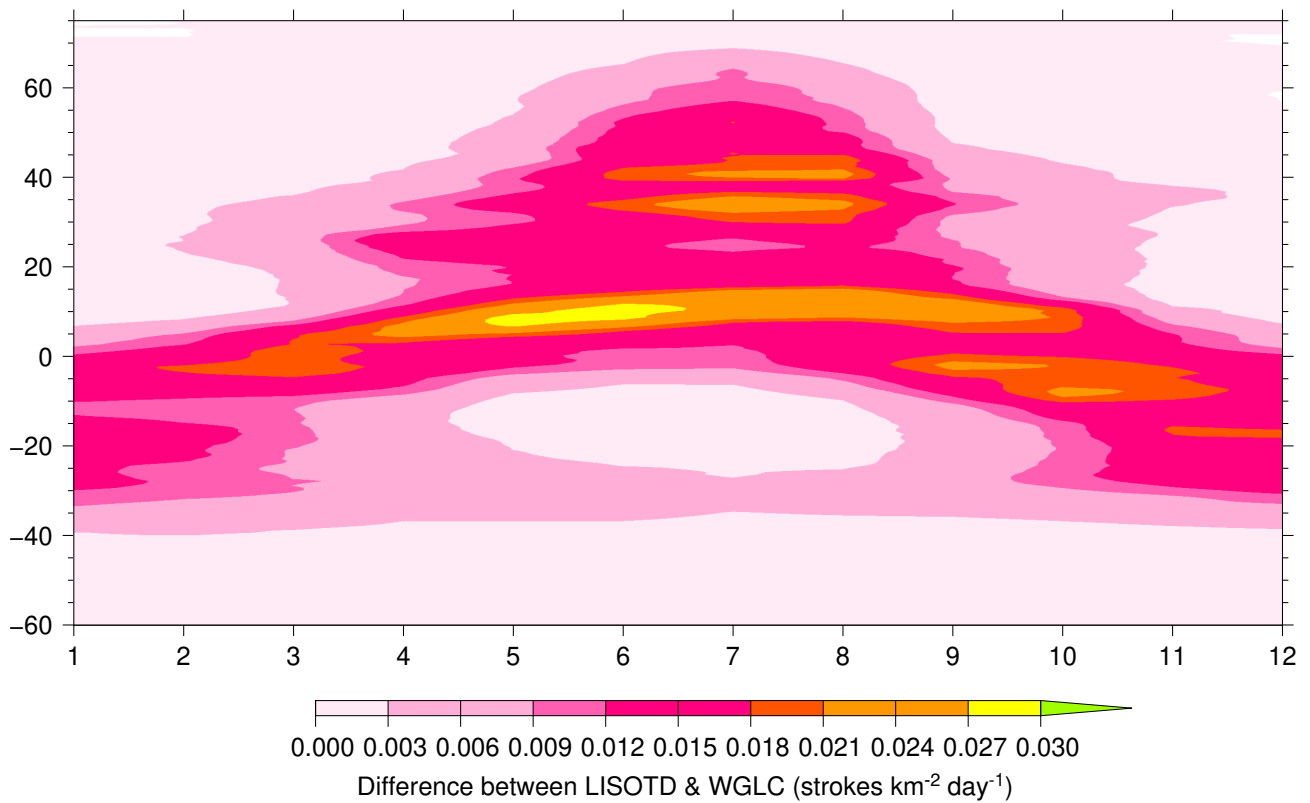


Figure S10. Temporal difference between LIS/OTD and WGLC. The largest differences are seen just north of the equator in May and June, just south of the Equator from September to December, and in the northern mid-latitudes in July and August.

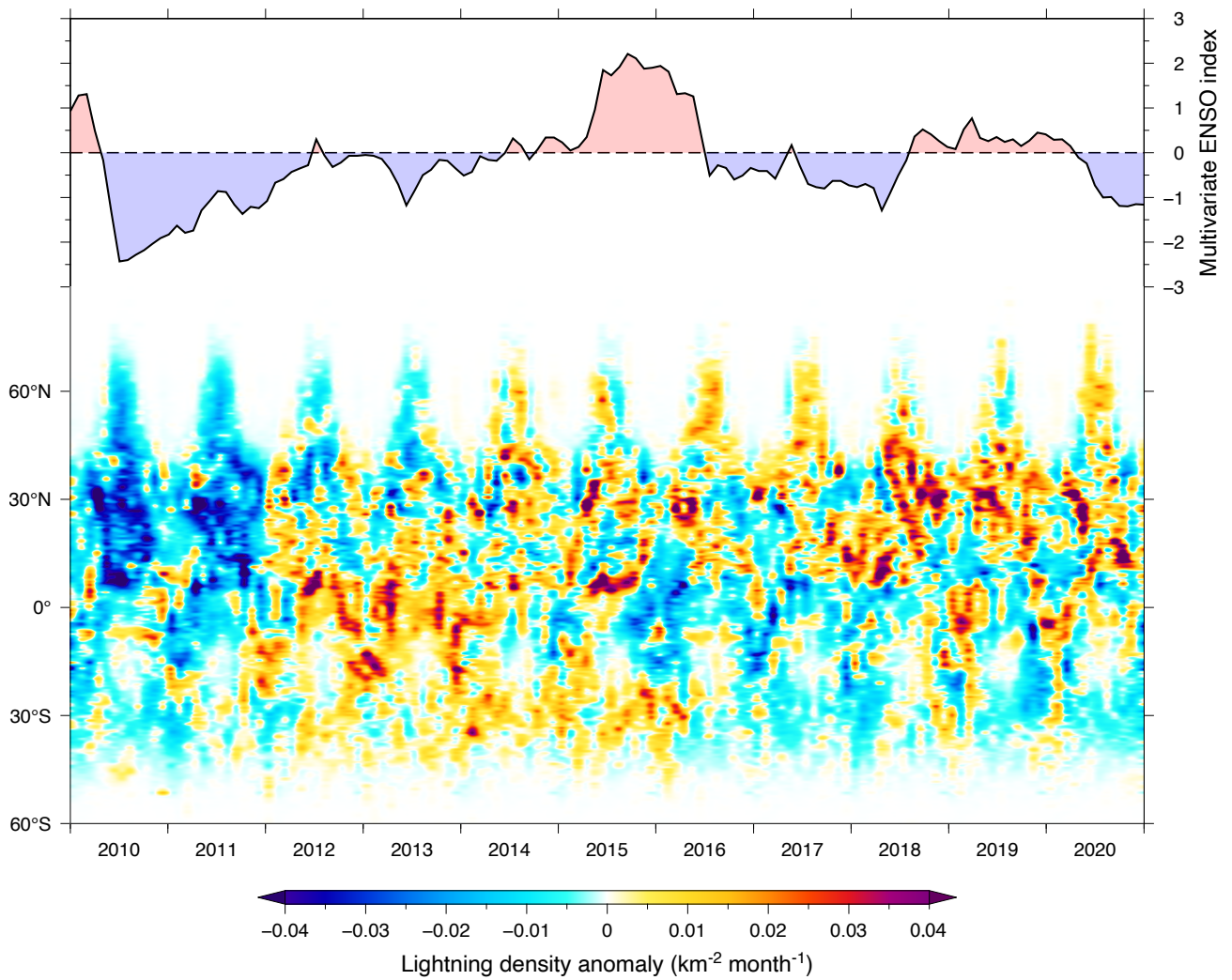


Figure S11. Timeseries of Multivariate ENSO index (NOAA, 2021; upper panel) and WGLC Zonal mean lightning stroke density anomalies (lower panel) (monthly value relative to the climatological monthly mean from 2010-2020).

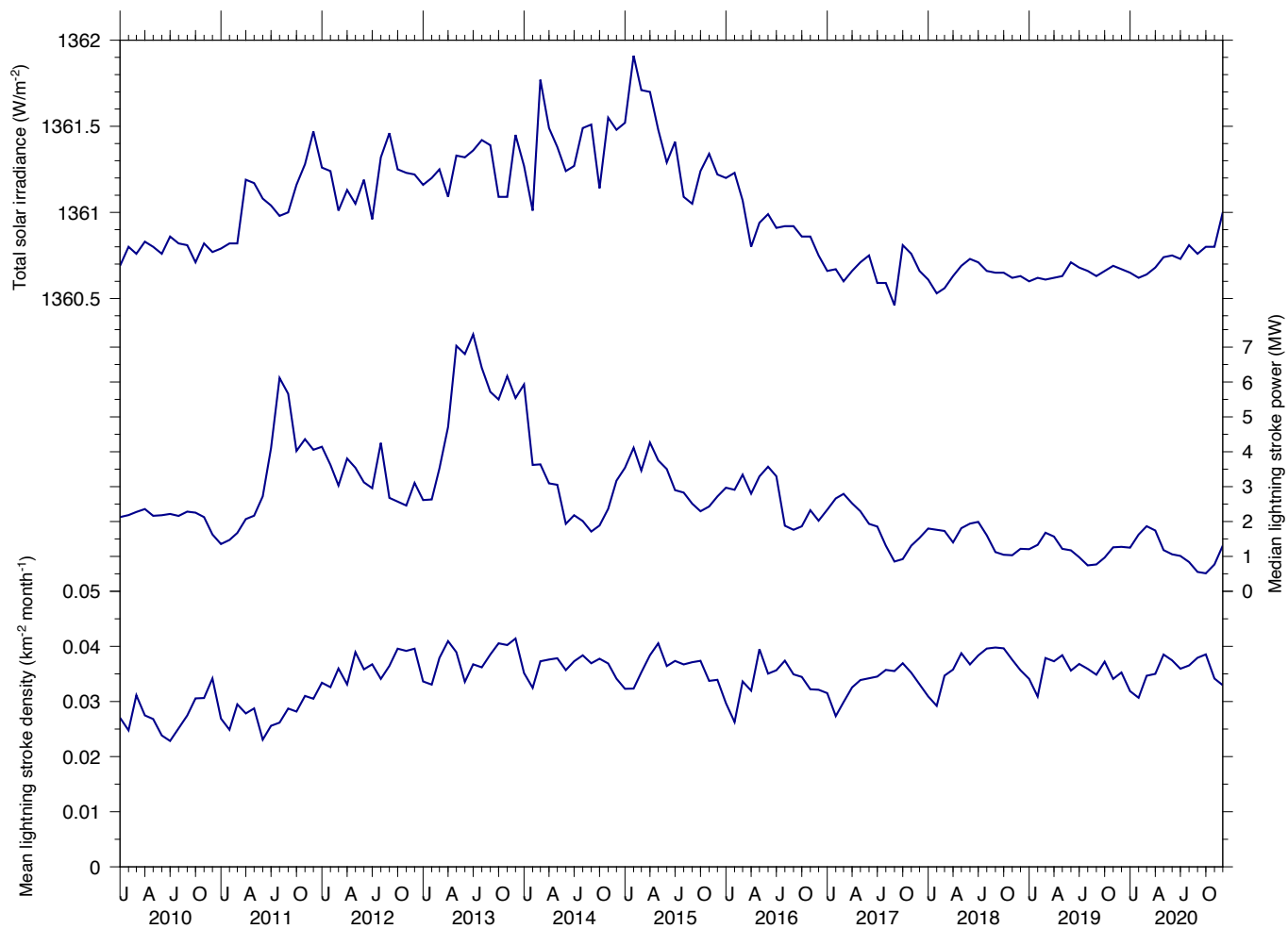


Figure S12. Timeseries of total solar irradiance (TSI) (LASP, 2021), monthly median of WGLC global lightning stroke power and the month mean of WGLC global lightning density.

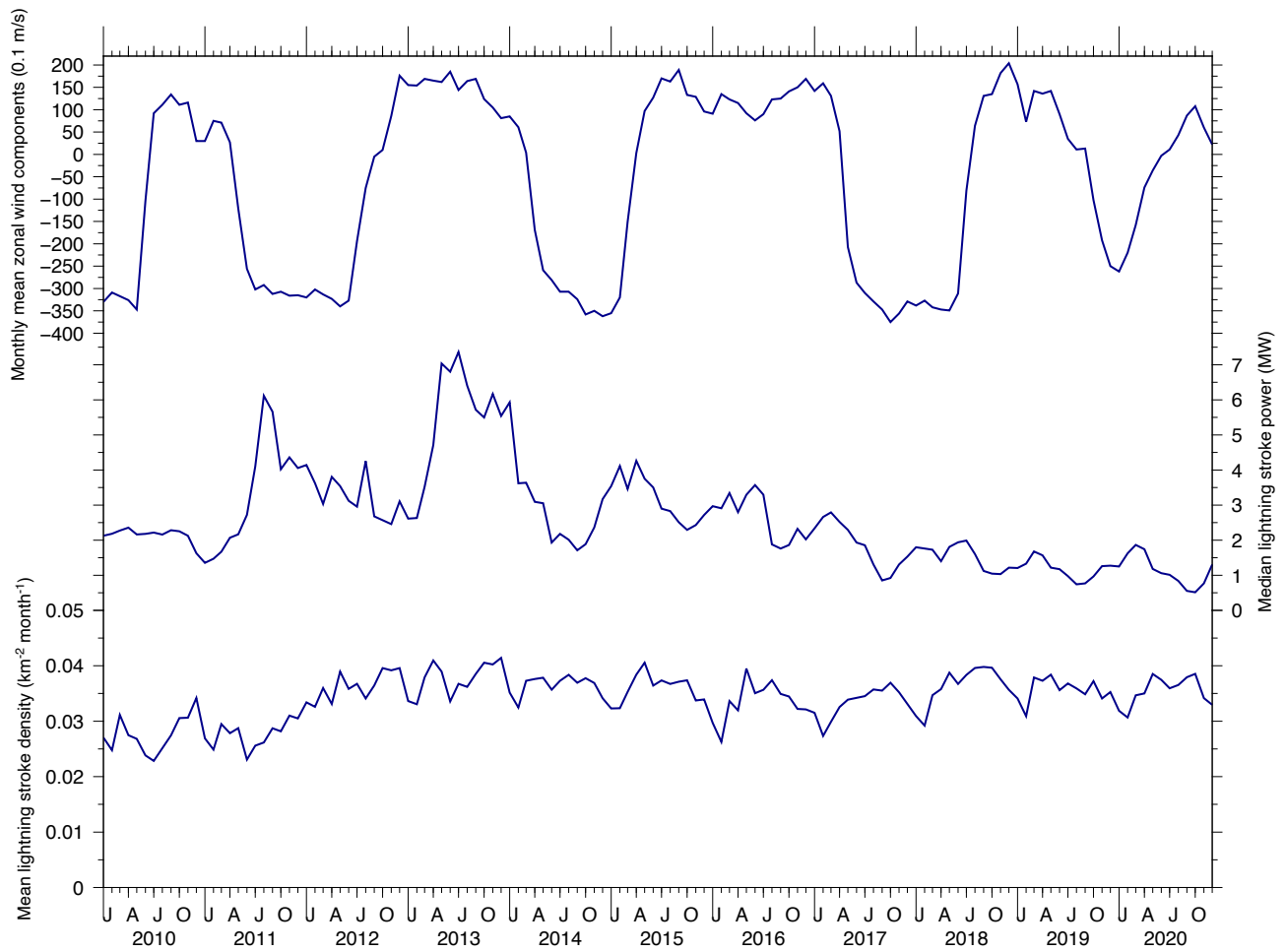


Figure S13. Timeseries of Quasi-Biennial Oscillation (QBO) (Free University of Berlin, 2021), monthly median of WGLC global lightning stroke power and the monthly mean of WGLC global lightning density.

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Community Modeling and Analysis System: CMAQv5.0 - CMAQv5.1 Monthly NLDN Flash Counts, <https://www.cmascenter.org/download/data/nldn.cfm>, 2021.

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Lasp Interactive Solar Irradiance Datacenter: NRLTSI2 Monthly Averages Timeseries, https://lasp.colorado.edu/lisird/data/nrl2_tsi_P1M/, 2021.

Institute of Meteorology of Free University of Berlin: The Quasi-Biennial-Oscillation (QBO) Data Serie, <https://www.geo.fu-berlin.de/en/met/ag/strat/produkte/qbo/index.html#access>, 2021.