

README: WWLLN GLOBAL THUNDER HOUR CLIMATOLOGY

Basic information

This thunder hour climatology is based on lightning observations from the World-Wide Lightning Location Network ([WWLLN](#)) for 2013-present. The climatology is provided at 0.05° latitude/longitude resolution, with several variations to enable climatological investigation:

- A monthly-mean, hourly climatology
- An annual-mean, hourly climatology
- An annual-mean climatology

The following processing is applied to the stroke data:

- **Buddy-checking:** From 2 February 2015 onward, the WWLLN processing system has applied buddy-checking to reduce noise. Strokes detected by only 5 or 6 stations are matched to “buddy” strokes located by 6 or more stations within the previous 60 minutes and ± 0.75 latitude/longitude. If no “buddy” is found, the stroke is discarded. For this dataset, buddy-checking has also been applied to WWLLN data prior to 2 February 2015.
- **De-duplication:** Duplicates strokes occur when the WWLLN processing system receives sufficient wave packets to locate a stroke, pauses to calculate the location, and then receives additional wave packets such that the stroke is recorded again. The result is a duplicate stroke that is very close in space and time. For this dataset, for strokes within 50 μ s and 15 km of each other, the stroke that is located by fewer stations or with a later timestamp is discarded.

We follow [DiGangi et al. \(2021\)](#) in first calculating the probability of thunder hour being observed for each UTC hour. To obtain the annual thunder hours reported in this climatology, the hourly probability of thunder hour occurrence is multiplied by 8760 (=24*365), with units of thunder hours per year.

File name convention

- *WWLLN_th_monthly_hourly_?t.nc*: Annual thunder hours for each month and hour of the day.
- *WWLLN_th_annual_hourly_?t.nc*: Annual thunder hours for each hour of the day.
- *WWLLN_th_annual.nc*: Annual thunder hours.
- Files ending in *_ut.nc* and *_lt.nc* are for Coordinated Universal Time (UTC) and local time, respectively.

File contents

- *WWLLN_th_monthly_hourly_?t.nc*
 - *lat(nlat)*: Latitude coordinates for center of grid boxes.
 - *lon(nlon)*: Longitude coordinates for center of grid boxes.
 - *hr(nhr)*: UTC hour. Thunder hours associated with the 00 hour are based on lightning observed from 00:00 to 00:59.
 - *mon(nmon)*: Month (1 = January, 2 = February, etc.). Thunder hours associated with January are based on lightning observed from 01 January to 31 January.
 - *thunder_hours(nmon,nhr,nlat,nlon)*: Climatological thunder hours at indicated time and location. Units are hours per year.

- *mon(nmon)*: Month (1 = January, 2 = February, etc.). Lightning associated with January is summed from 01 January to 31 January.
- *WWLLN_th_annual_hourly_?t.nc*
 - *lat(nlat)*: Latitude coordinates for center of grid boxes.
 - *lon(nlon)*: Longitude coordinates for center of grid boxes.
 - *hr(nhr)*: UTC hour. Thunder hours associated with the 00 hour are based on lightning observed from 00:00 to 00:59.
 - *thunder_hours(nmon,nhr,nlat,nlon)*: Climatological thunder hours at indicated time and location. Units are hours per year.
- *WWLLN_th_annual.nc*
 - *lat(nlat)*: Latitude coordinates for center of grid boxes.
 - *lon(nlon)*: Longitude coordinates for center of grid boxes.
 - *thunder_hours(nmon,nhr,nlat,nlon)*: Climatological thunder hours at indicated location. Units are hours per year.

Note: the aggregation period (i.e., which years are included in the climatology) is specified in the NetCDF file attributes.