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FORTE In-Cloud Lightning Altitude Distributions from
"FORTE Measurements of Global Lightning Altitudes"

Abstract

This dataset contains the global distributions of lightning altitudes derived from joint optical and Radio Frequency (RF) measurements taken by the FORTE satellite. These altitudes are computed in the standard way from the prior literature where the optical sensor provides the geographic position of the lightning source and then the time difference between the direct and reflected pulses in the RF waveform are used to derive an altitude estimate for the source. The precise absolute time of the RF pulse is not needed and the precise location of the optical source is not included in this dataset.

This dataset contains two files in hdf5 format. The first file (FORTE_Global_Altitude_Distributions.h5) contains FORTE lightning event counts on a coarse 4-dimensional grid in Longitude x Latitude x Altitude x Month of the Year. Latitude and longitude are specified on a 2.5 degree grid, while altitude is on a 1 km grid. A screenshot of this data is provided in Figure 1 that shows the total event counts per latitude / longitude gridpoint in (a), the latitude / altitude distribution in (b), the longitude / altitude distribution in (c), and a global altitude profile in (d).

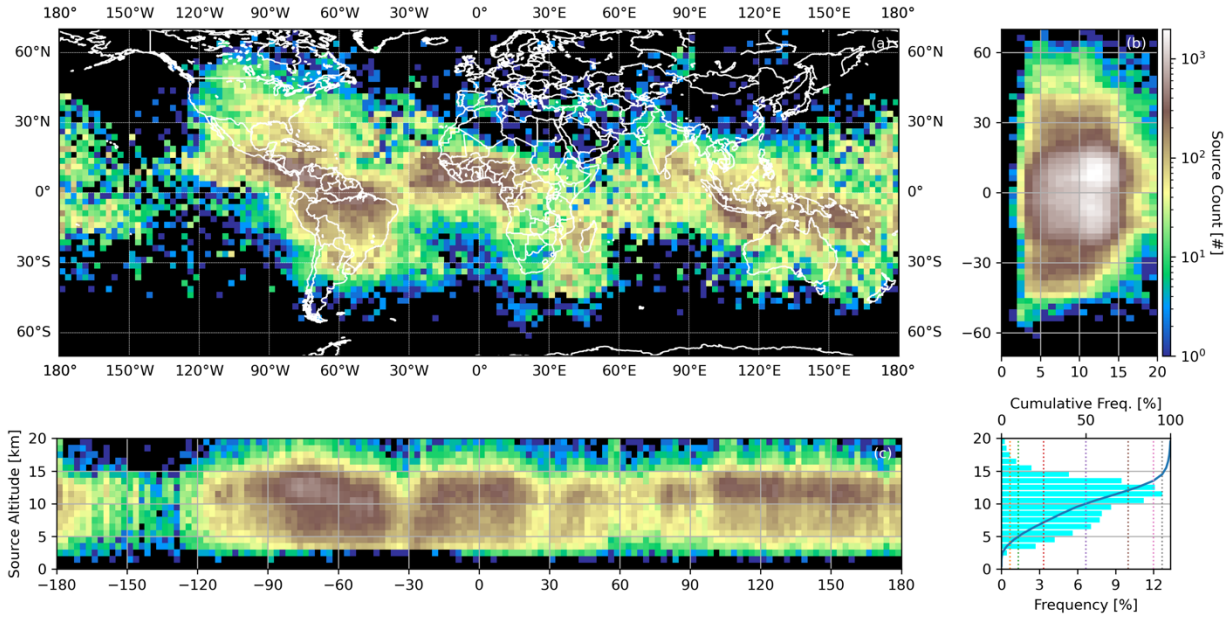

Figure 1. The contents of FORTE_Global_Altitude_Distributions.h5. The file contains a latitude / longitude / altitude / month of the year gridded dataset counting the number of in-cloud lighting events per gridpoint.

The second file (FORTE_Parent_Flash_Altitudes.h5) lists the in-cloud lightning events that are part of larger flashes (i.e., not just isolated discharges or noise sources). The dataset contains 3

groups. The first group describes the source altitudes of the lightning events in relation to the flash and contains the parameters in Table 1 below.

Table 1. Fields in the "sources_in_flash/" group within FORTE_Parent_Flash_Altitudes.h5

Parameter	Precision	Description
alt	1 km	Lightning event source altitude
terrain	0-2	Terrain mask: 0 – open ocean, 1 – land, 2 – coastal ocean
time_offset	1 ms	Time offset of source within parent flash

The second group contains information about the parent flashes from the sources_in_flash/ group, and is sumarized in Table 2.

Table 2. Fields in the "flashes/" group within FORTE_Parent_Flash_Altitudes.h5

Parameter	Precision	Description
init_alt	1 km	Flash initiation altitude derived from constituent events
prop_alt	1 km	Flash propagation altitude derived from constituent events

Lastly, the third group repeats the analysis from the sources_in_flash/ group in Table 1 using flashes constructed with the optical Lightning Location System (LLS) data. The parameters in this sources_in_llsflash/ group are listed in Table 3.

Table 3. Fields in the "sources_in_llsflash/" group within FORTE_Parent_Flash_Altitudes.h5

Parameter	Precision	Description
alt	1 km	Lightning event source altitude
terrain	0-2	Terrain mask: 0 – open ocean, 1 – land, 2 – coastal ocean
time_offset_beginning	1 ms	Time offset of source from the first LLS detection in the flash
time_offset_end	1 ms	Time offset of source from the final LLS detection in the flash