

Generation of Atmospheric Lightning Essential Climate Variable

Objective of the report:

Elaborate the procedure for Essential Climate Variable (ECV) generation

Preamble:

NRSC has established a Lightning Detection Sensor (LDS) network under which 27 nodes at various locations are operational¹⁻⁴. Lightning occurrences recorded at respective LRX/ LDS nodes across India are pushed to LDS-LRX server located at RRSC-Central, Nagpur. Entire database is built, continuously updated with new data and hosted on LDS-LRX server with MYSQL workbench. Database scheme at present has details in terms of latitude, longitude, strike type, strike current, with date and time.

Essential Climate Variable (ECV) generation:

As per the World Meteorological Organization (WMO) Global Climate Observing System (GCOS) GCOS-2016 report⁵ suggest that Cloud-to-Ground lightning frequency sampled at 10 km x 10 km spatial resolution per day is considered as Essential Climate Variable (ECV) in UT (universal time). To meet this criterion, 10 km cell size grid was generated using FISHNET tool of ARCGIS software. This constitutes 96000 grid cells covering Indian region. Visual basic .net programming interface was used for data extraction purpose. Such selected records are converted to GIS compatible shape-file format. Further, overlay analysis was performed using 10km grid file and shape-file to give lightning counts for each grid cell. Following flowchart elaborates this procedure.

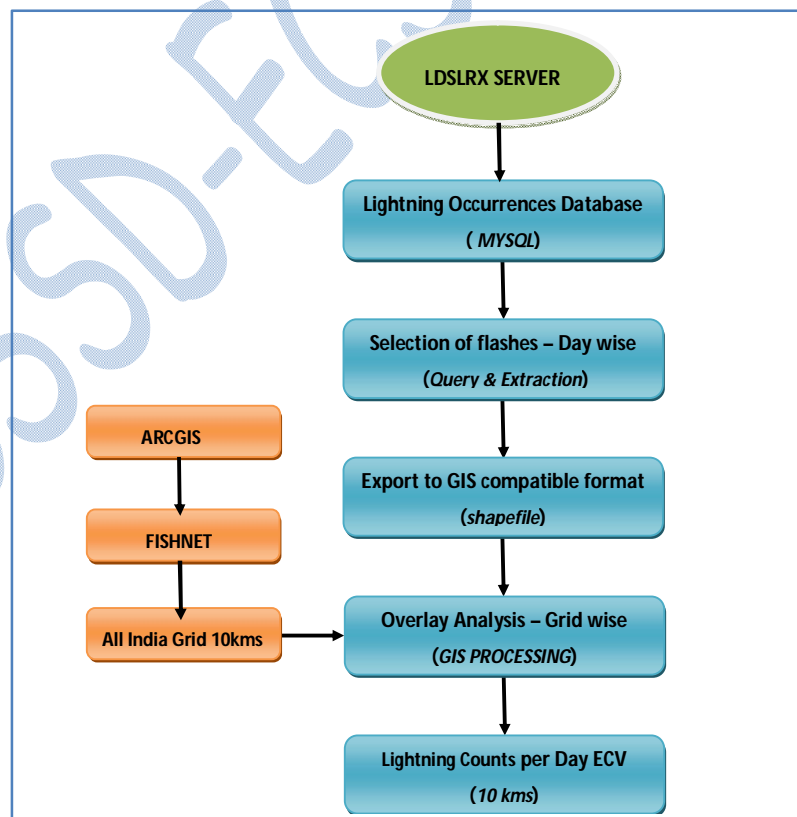


Figure 1. Procedure to generate atmospheric lightning ECV

A Sample of this analysis on the lightning data is shown in figure 2.

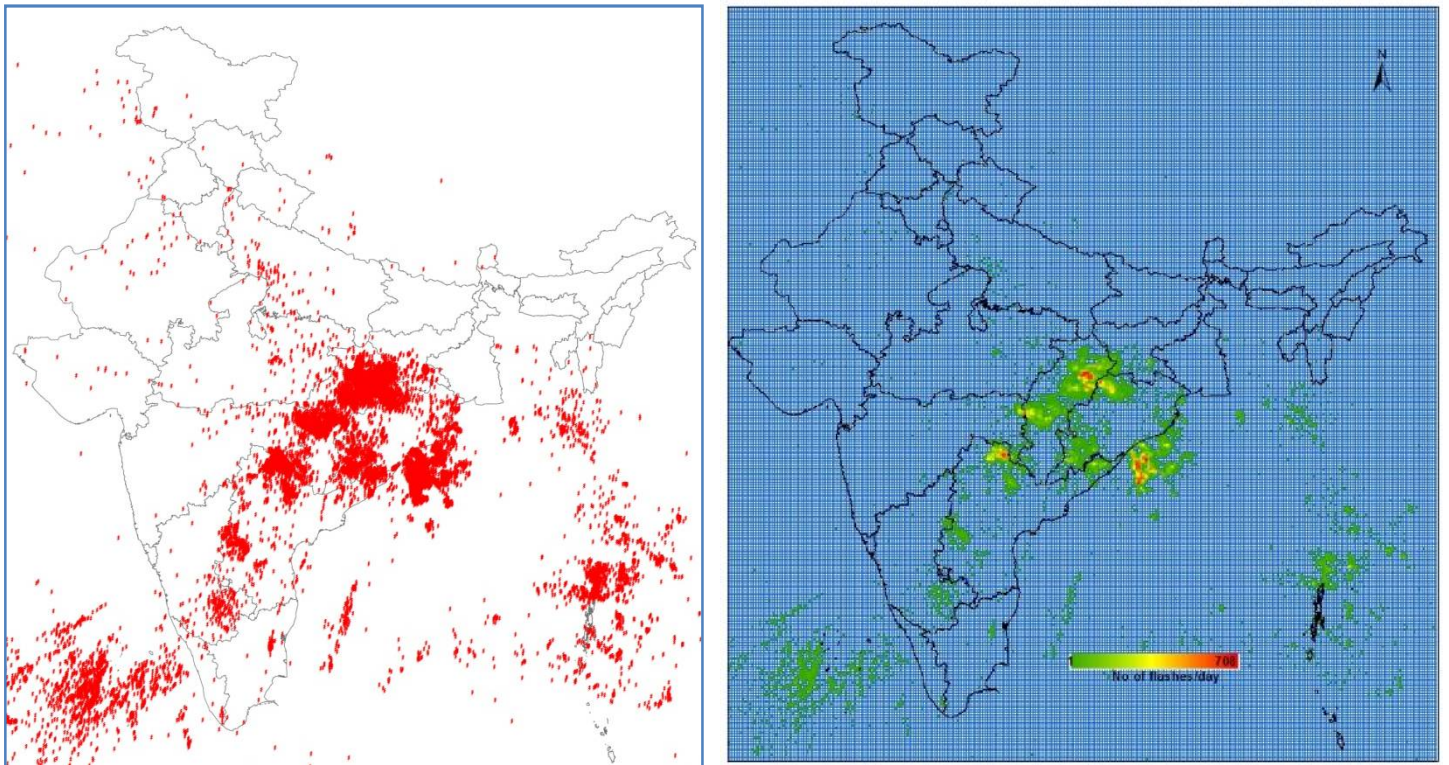


Figure 2. Point data showing the individual CG lightning flashes (left) and processed data for 10 km x 10 km spatial resolution using the fishnet tool on 29 May 2020 (right) which is an ECV.

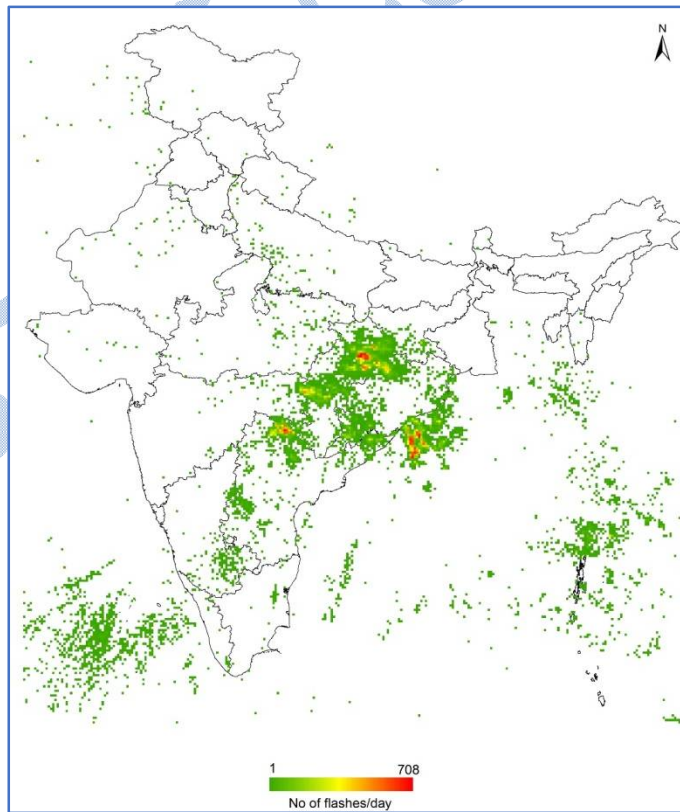


Figure 3. A final ECV map

References:

1. Investigations on the Atmospheric Lightning: establishment of network, geolocation and identification of vulnerable ones, *NRSC Technical Report*, NRSC-ECSA-ACSG-ACSD-MAR-2018-1126-1.0, 2018.
2. Detection of atmospheric lightning activity with ground based RF receivers- establishment and its geospatial representation', Alok Taori, Arun Suryavanshi, Biswadip Gharai, M. V. R. Seshasai, D. Dutta, S. V. C. Kameswara Rao and Chiranjivi Jayaram, *Indian Cartographer* (Issue: Emerging technology in Cartography) (ISSN:0927-8392), Vol.38, 80-85, 2019.
3. Detection of atmospheric lightning activity with ground-based radio frequency receivers– establishment and initial results', Alok Taori, Arun Suryavanshi, R. Goenka, B. Gharai, M. K. Madhav Haridas, M. V. R. Seshasai, D. Dutta, Uday Raj and Chiranjivi Jayaram, *Current Science*, 118, 7, 1112 – 1117, doi: 10.18520/cs/v118/i7/1112-1117, 2020.
4. NRSC-Lightning Detection Sensor Network: Time of Arrival (TOA) method based Geolocation and Essential Climate Variable Generation, *NRSC Technical Report*, NRSC-ECSA-ECSAOFF-ACT-Oct2020-TD-0001683-V1.0, October 2020.
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