



Employing VLF and field mill measurements to predict lightning activity

Moacir Lacerda and **Carlos Augusto Morales Rodrigues**

University of São Paulo

The STORM-T Laboratory of University of São Paulo (USP) – Brazil operates a VLF long range lightning detection network known as STARNET (Morales et al., 2014) and a local field mill network. We have developed and implemented two operational schemes to predict the thunderstorm activity and propagation for the next 30 minutes (Now-STARNET) and the probability of occurrence of lightning strikes in a local area within 10 minutes (YANSA – Lacerda et al., 2022). Now-STARNET scheme is based on the cell-tracking algorithm proposed by Betz et al. (2008) to identify active thunderstorms over South America (90-30W and 60S-10N). STARNET lightning measurements are hourly accumulated over grids of 0.1 x 0.1 degrees and those cumulative grids are used to identify active thunderstorms that are defined as contiguous lightning grids. For each identified thunderstorm, we retrieve the lightning activity every 1 minute and the area, speed and direction of propagation every 5 minutes. Based on these temporal and dynamical features we adjust polynomial functions to forecast the position of active thunderstorms (must have lightning activity in the last 5 minutes) for the next 30 minutes every 5 minutes. Finally, the projected areas are used to identify the Brazilian cities that will have lightning activity to issue warnings. YANSA tool uses the temporal variation of the vertical electrical field observed by field mills to compute the time between the first lightning pulse and the first cloud-to-ground stroke as defined by Rodrigues and Lacerda (2022). Based on the elapsed time and the magnitude of the electrical field, YANSA issues different warning messages (no-risk, low, moderate, high and extreme risk) that help the users to know the probability of CG occurrence and time spam for lightning activity. YANSA was configured to use 4 field mills deployed in the USP campus transmitting every 1 minute and issue warning of lightning activity in area of the university. For the conference we will present the skills of both Now-STARNET and YANSA tools in predicting lightning activity and lightning strikes by means of contingency table tests, i.e., POD, FAR and CSI. For Now-STARNET we will use STARNET measurements of 2022 and 2023 and explore how the skills change with thunderstorm size and location. For YANSA, we will use LINET and STARNET lightning strokes observed in the vicinity of the University of São Paulo during the period of 2023 to validate each message.

Rodrigues F. and M. Lacerda, "Warning of lightning risk for the first lightning produced by a thunderstorm using electric field mill network records," *2022 36th International Conference on Lightning Protection (ICLP)*, Cape Town, South Africa, 2022, pp. 720-723, doi: 10.1109/ICLP56858.2022.9942596.

Lacerda, M. Rodrigues, F., Verly, R., Morales C.A.R. (2023). Monitoring lightning activity by using the YANSA platform to emit warnings of lightning risk in real time with an electric field mill network. risk for the first lightning produced by a thunderstorm using electric field mill network records," *2022 36th International Conference on Lightning Protection (ICLP)*, Cape Town, South Africa, 2022,