An Integrated Weather System with Electrical Measurements
(Lightning Detection Technologies)

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In the past two decades, the Brazilian electric energy sector has incorporated lightning measurements in their operation although only part of the companies could use due to the coverage of the lightning detection network that was confined between south-central Brazil. Moreover, meteorological measurements were also integrated and had to be integrated in a database to feed a numerical weather prediction (NWP) model. The real challenge on their front consisted in integrating different databases (weather and lightning) from several companies and institutes that had their own priority.

Based on this problem we have developed an integrated weather station that combines pressure, relative humidity, temperature, precipitation and wind measurements with a Field Mill (FM) and a VLF lightning detection antenna to be deployed at remote areas or next to the electrical power stations and assist their operation. The system operates remotely and it can transmit real time data through the internet, GSM, VSAT and radio. Solar panels guarantee 24/7 operation and real-time debug detects the stability of the system that is broadcast with the data. GPS with pulse per second capability has been integrated to guarantee the temporal synchronization with 50 nanosecond accuracy. Differently from weather measurements that are acquired at every 1 second, the vertical electrical field measured by the FM and VLF are acquired at 1-100 Hz and 100 kHz respectively. The FM transmits every second the mean, maximum and minimum E field observed in addition to maximum dE/dT, while the VLF transmits the Time of Group Arrival (TOGA). Thus in the first moment, E-Field and TOGA measurements will be use to trigger lightning warning systems based on intra-cloud and cloud-to-lightning. Upon the development of several stations, TOGA measurements will be used to locate the lightning discharges.

During the next summer (December-2013 and February-2014) we will test this weather station and evaluate its performance to characterize the thunderstorms in São Paulo, Brazil, and test the algorithm that emits warning systems of severe weather and thunderstorm activity.