

2012 Summer Campaign. Ground-based correlation between energy electrons and X-ray count increase and lightning

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The paper presents the future campaign in summer 2012 conducted in the north-east of Spain. Two NaI scintillators, two plastic scintillators will be installed in the Eagle Nest tower (2537 msl) and three scintillators will be installed in the Ebro Valley region next to three 3D lightning mapping array detectors. The point is try to observe x-Ray and energetic electrons count increase associated to thunderstorms at the Eagle Nest Tower and emissions due to individual flashes at the tower. At the Ebro Valle, we plan to measure high energy emissions of individual flashes (very close to the detectors) and map with 3D lightning mapping in the Ebro Valley Region.

1. General

The main purpose of this campaign is the observation of X-ray and energetic electrons associated to near lightning activity. This region in the north-east of Spain has a high lightning activity in the period from April to September [2], (see it in figure 1 with data taken of the LF/VLF LINET network [10]). Given to the altitude of the Eagle Neast tower (2537 msl), and the short distance between the tower and the site where scintillators will be installed it could be possible to observe a count rate increase during a thunderstorm and due to individual flashes simultaneously with electric fields in long timescale (electrostatic) and short timescale (e.g. due to stepped leaders) [1].

On the other hand, in the Ebro Valley region is already installed a total lightning system using VHF, a 3D lightning mapping array, [3]. Three NaI scintillators will be installed next to three 3D lightning mapping antennas of nine installed, in order to observe X-ray of individual flashes. We plan to study these lashes with the 3-D lightning mapping.

Is important note that both regions are inside the influence area of radar network and LINET network.

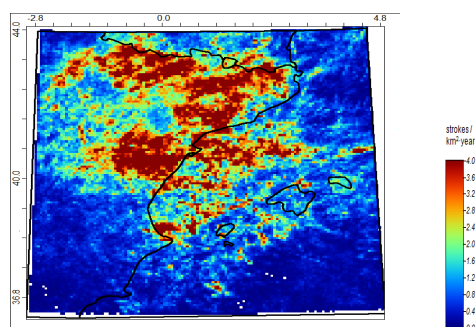


Figure 1: Lightning density (grid of 5x5 km) in the period April-September)

2. Instruments

2.1 Eagle Nest tower

Two NaI scintillators are already installed. One is used to observe the background radiation and the other is used to observe de transient events. In the same way will be installed two plastic scintillators. There is also installed a VHF interferometer to locate lightning, a high-speed camera (4000 images/second), a flat plate antenna connected to a digitizer that measures the electric field an triggers scintillator for transient event. A field mill will be installed to measure and record continuously the electric field. If lightning activity occurs in a distance of 1 km or less it's possible to observe coincidence between electric field activity and count rate increase and maybe a direct correlation with discharge activity during a thunderstorm because at the altitude of the Eagle Nest Tower the attenuation decreases[1].

On the other hand, due the very short distance from the tower to the scintillators (20-25 m), exists the possibility to observe a direct correlation between electric field change activity and X ray and energetic electrons count increase in short timescale[1].

Some data with NaI scintillators and images with high speed camera has already been taken (figure2).

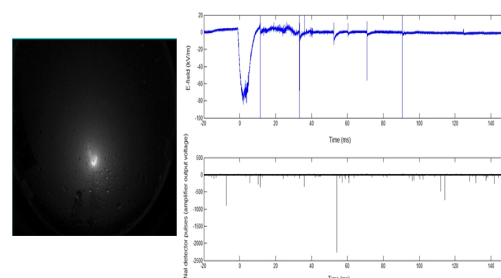


Figure 6. Left: Negative upward flash at the Eagle Nest tower. Right: Electric field (top) and high energy detections.

2.2 Ebro Valley region

A study of the lightning density activity in the Ebro Valley region will show the best locations to install the NaI scintillators and electric field antennas. It will be interesting correlate radiation due to close individual lightning with 3D lightning reconstructions.

3. Expected temporal chronology

Now is being carried out the calibration of the scintillators. It is thought to have the scintillators installed in the Eagle Nest tower in June of 2012 to have the first data and do any necessary recalibration. In the same way is expected to have installed the three NaI scintillators in the Ebro Valley region in June of 2012.

4. References

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