

Long Delayed Sprites – Project Report

Background: This project was to seed a novel collaboration between the University of Bath and the Instituto de Astrofisica de Andalucia, i.e., Martin Fullekrug and Alejandro Luque. The aim was to install a radio receiver at the Astronomical Observatory Calar Alto in the Sierra Nevada in southern Spain. The installation is part of larger network of four existing radio receivers at the University of Bath/UK, CNRS in Orleans/France, Laboratoire Souterrain a Bas Bruit in Rustrel/France and at the Laboratoire d'Aerologie in Lannemezan/France. It is planned to expand the existing network to the European scale by adding five more stations, possibly in Plymouth, Reading, Sopron, Crete and in the Negev desert in the Israel.

Installation: The instruments were shipped by the University of Bath to the Instituto de Astrofisica de Andalucia at the end of May, 2013. Martin Fullekrug visited Francisco Gordillo-Vazquez, Alejandro Luque, Maria Passas-Varo and Justo Sanchez del Rio from June 10-14. The first day of the visit was used to discuss the practicalities of the installation of the radio receiver at Calar Alto. An alternative deployment on the roof of the institute in Granada was tested, but the resulting data quality was considered to be insufficient. It was finally decided to pursue the deployment at Calar Alto as planned. The second and third day of the visit was used to deploy the radio receiver on the Calar Alto observatory (Fig. 1). The first measurements were taken shortly after the deployment and show the LORAN transmitters which are used for marine navigation (Fig. 2). The LORAN transmitters are well documented and they are often used as a reference for a quality control of the low frequency radio recordings.

Objectives: The scientific discussions surrounding the experimental work tackled various aspects of TLE research where a combination of the radio recordings from the University of Bath with the optical recordings from the Instituto de Astrofisica de Andalucia might be particularly promising. It was found that an accurate modelling of the optical response of the mesosphere requires the inclusion of actual lightning parameters such as their rise time, peak current and continuing current which are normally not available from lightning detection networks. Another objective of future research is the occurrence of day time sprites for which there is compelling experimental evidence which could be complemented by theoretical modeling. Long delayed sprites were considered to be only a secondary science objective because the radio measurements would not be able to discriminate between proposed theories.



Figure 1. The radio receiver deployed at the Astronomical Observatory of Calar Alto in the Sierra Nevada in southern Spain.

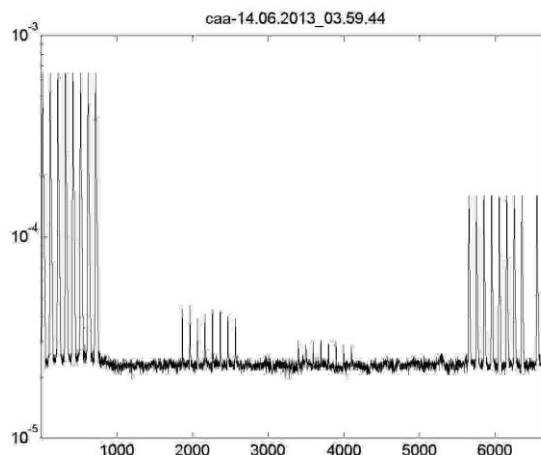


Figure 2. First measurements of the radio receiver in Calar Alto. The time series show four LORAN transmitters which are used for marine navigation.