Data analysis of Dourbes Neutron Monitor data for solar events forecast

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Abstract

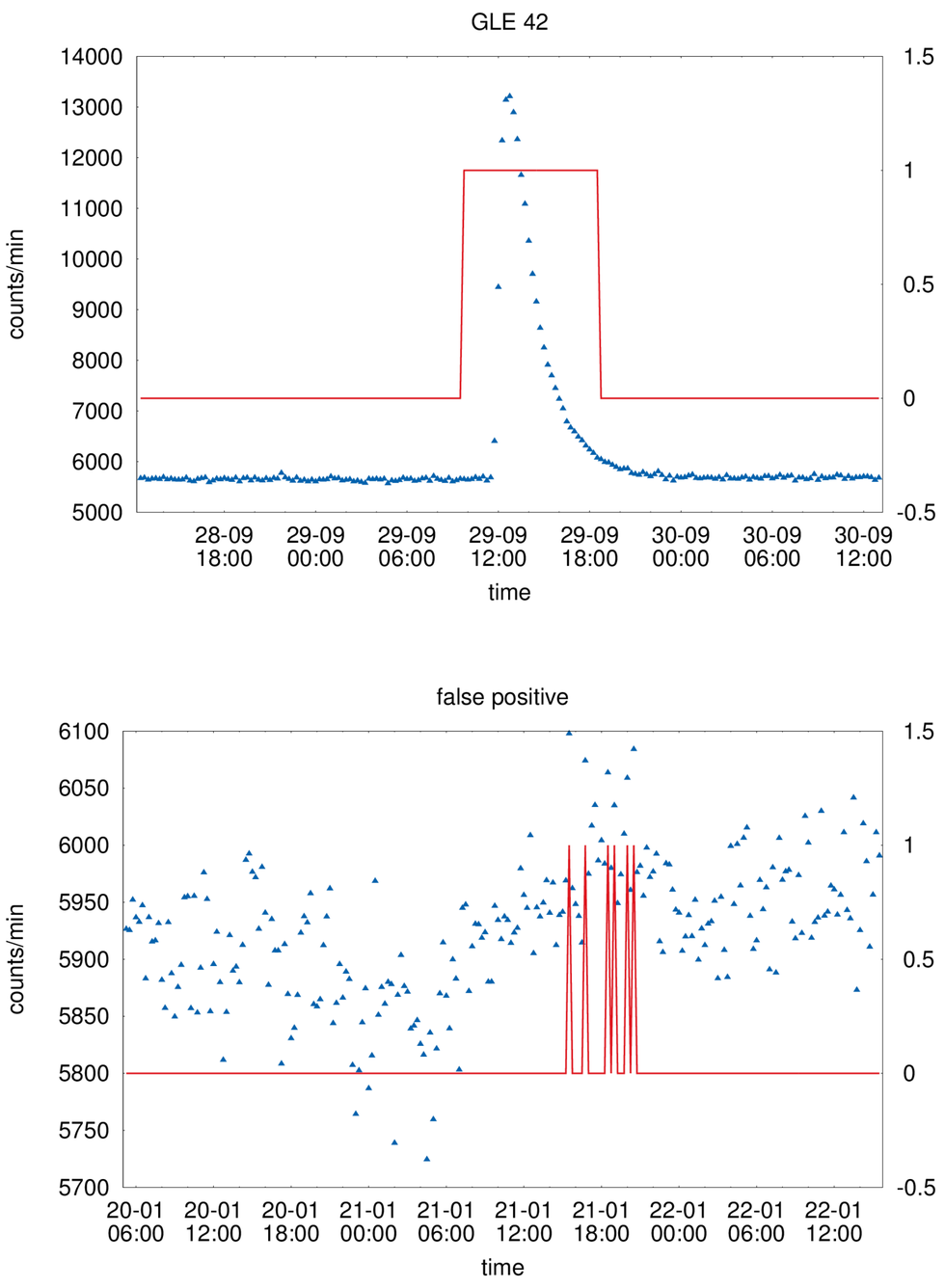
In the search for suitable precursors of solar events, the data from the neutron monitor at Dourbes, Belgium have been subjected to various deterministic and non-deterministic analyses. These analysis covered the entire data from 1989 and focused on examination of the data immediately before a Ground Level Enhancement and Forbush decrease events. In this work we report the results from this investigation and its application to a single-station model for prediction of solar events by ground based neutron monitors.

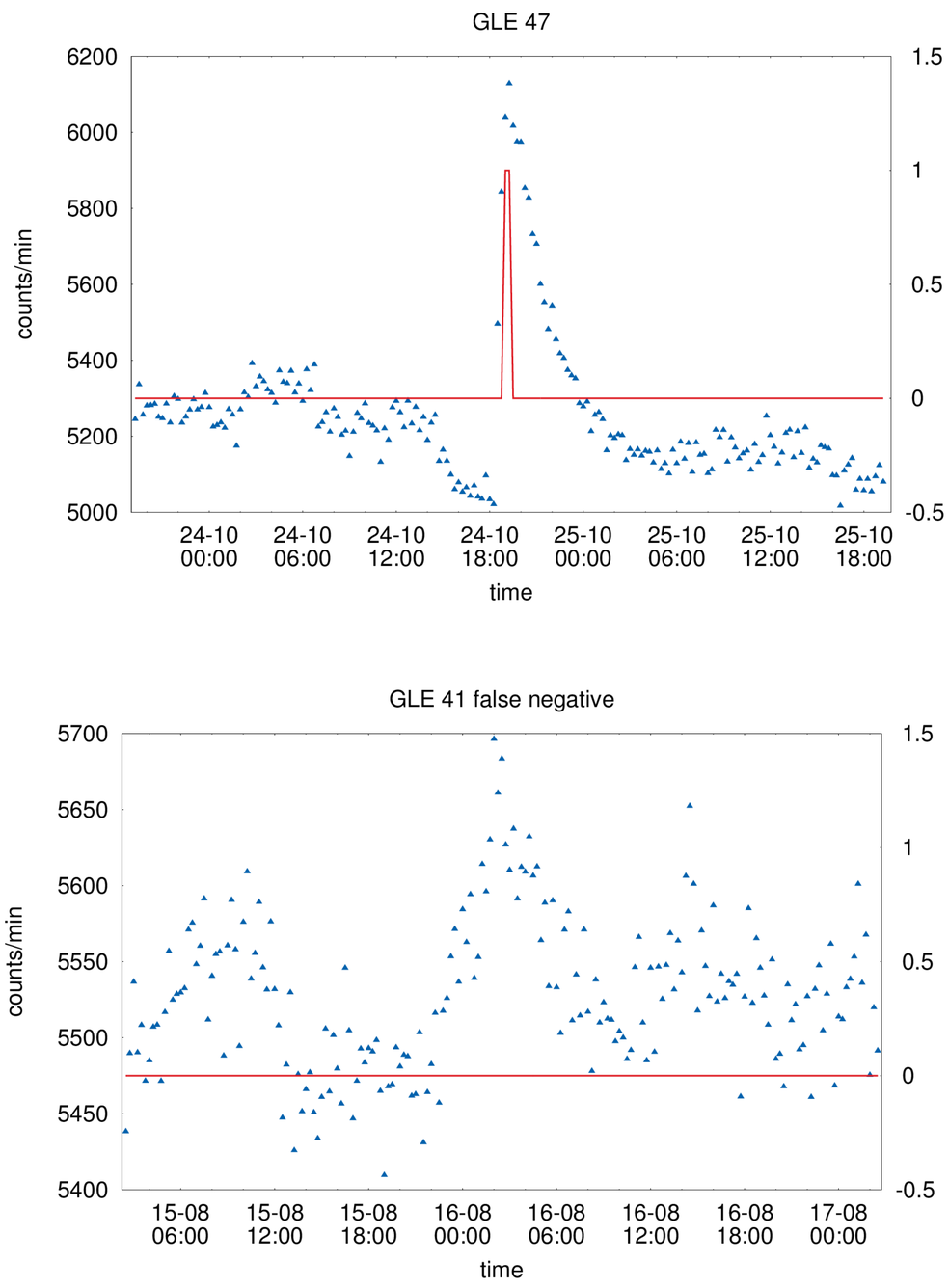
Method:

A single station peak forecasting algorithm was implemented and tested on data of significant GLE events during 1989 to investigate the ability of the algorithm to predict the occurrence of a GLE event.

At this stage, the test was carried out only on a Corrected CR intensity data for large magnitude GLE events. The method is based on simple peak detection algorithms [1,2,3] used in data evaluation. For prediction we have replaced the points after the peak by an extrapolation of the weighted average of the data before the peak.

Results: On the figures, the red line shows when the algorithm has detected (value 1) an incoming peak – real (true positive) with a lead time (GLE 42) or without lead time (GLE 47).





Conclusions:

Despite the limitation of the single station data to predict and forecast GLE events, the potency of peak identification algorithms to forecast solar events has been show. The lead times are not constant and depend on factors like approximating function, noise and magnitude of the event. An advantage is that, there is no necessity for other stations data transfer and coordination. A drawback is that depending on the station rigidity cut-off, some events with lower energies won't be detected at all. Additional work is undergoing on the alert confidence level (i.e. false positive and false negative alerts), detection of noisy events and development of better approximation functions.

References:

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