

# Improvement of Flare and SPE Prediction

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## Parallel activities to improve space weather forecasting

New parallel activities developing tools to improve and combine predictions of Solar Flares and Energetic Particle Events (SPEs) were kicked-off in November and December 2013. The aim of these developments is to increase warning times and reliability for the prediction of enhancements of solar high energy particles which impact spacecraft such as the production of single event effects (SEEs) seen in launchers.

### FORecasting Solar Particle Events and Flares (FORSPEF)

The FORSPEF concept considers the provision of combined flare and SPE forecasts and nowcasts with a real-time implementation. The first element is to forecast the likelihood of upcoming solar flares using observations of active regions. Existing algorithms are suitably capable to be re-used for the development of this system. The second element is to forecast the occurrence of SPEs and make a prediction of the time before onset. The SPE onset is the time between the solar event and the particle flux of a given energy exceeding a certain threshold. The third element of the forecast is the SEP flux profile for an upcoming event including synoptic information on the peak intensity and duration. Development of the algorithms for the second and third elements is needed as part of this activity.

The objective of this activity is to combine existing methods with new forecasting methods in order to create a prototype tool which is capable of making 3-tier forecasts of SPEs, in support of launch operations. The developed software shall include modules for warning of possible solar flares and the prediction of the timing, size, profile and duration of particle enhancements. The model(s) shall be validated using past solar and solar particle event data.

This study is being undertaken by the Institute for Astronomy, Astrophysics, Space Applications & Remote Sensing at the National Observatory of Athens (Greece). The team is led by Dr. Anastasios Anastasiadis. The project website can be found [here](#).

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### SEPsFLAREs - Solar Events Prediction system For space LAunch Risk Estimation

A web-based prototype system will be implemented comprising of two existing predictive tools, [the Automated Solar Activity Prediction \(ASAP\)](#) and [the SEP prediction algorithm \(UMASEP\)](#), combined with new, additional developments to utilise the outputs of these two prediction tools to give value-added warnings of SPEs and to improve the forecasting of SEP time profiles. There will be the possibility to display outputs in textual format or in graphical format. In addition, warning alerts on safe/un-safe conditions will be available to interested users.

The ASAP and UMASEP prediction tools have been running in real-time for several years and their functions and performance are well documented. The development will seek to further verify and test the results of these

tools and to validate the outputs of the new developments foreseen in the SEPsFLAREs activity. Furthermore, additional software modules will be developed for each of the prediction services in order to enable: (1) Ingestion of external data, (2) User queries via a command line and (3) Output of relevant images and data displaying predictions.

This study is being undertaken by a consortium comprising of Universitat Politècnica de Catalunya (Spain), Universidad de Málaga (Spain) and University of Bradford (UK). The team is led by Prof. Manuel Hernández-Pajares and Dr. Alberto García-Rigo. The project website can be found [here](#).

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**For more details on either or both of these activities please contact [Piers Jiggins](#).**

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