A web-based prototype system for predicting Solar Energetic Particle (SEP) events and Solar Flares to be used by space launch operators is presented. The system has been developed as a result of the European Space Agency (ESA) project named SEPFLARES, which stands for Solar Events Prediction System for Space Launch Risk Assessment. A web-based prototype system for predicting Solar Flares and Solar Energetic Particle (SEP) events was developed by space launch operators or any other interested user has been implemented. The main goal of this system, called SEPFLARES, is to provide warnings/predictions with forecast horizons from 48 hours before to a few hours before to the SEP peak event, and duration predictions.

**SEPFLARES Overview**

SEPFLARES main objective has been the development of a web-based prototype system (see right figure) with capabilities of improved forecasts on solar flares and SEP events and provide warning alerts on safe/unsafe conditions for launch operators or any other interested user. For this purpose, the system consists of several modules covering from pre-flare to intra-SEP scenarios:

1. **The prediction of solar flares by means of an updated Automated Solar Activity Prediction System (ASAP)** (see: https://spaceweather.efr.fr/; [1])
2. **An early SEP occurrence Warning tool based on SEPFLARES ASAP.**
3. **The prediction of SEP occurrence and onset by means of UMA Solar energetic proton Event Predictor SEP prediction (UMASEP).**
5. **The prediction of SEP characteristics, such as SEP peak and duration.**

The real-time image of solar flare occurrence by means of GNSS-based techniques (GSFLAD and SISTED) [5] and [4], respectively.

**Solar Flare Prediction module**

The module responsible for predicting solar flares is based on the well-known ASAP flare predictor [2], which learns by using machine learning techniques on SOHO/SOHO solar images to automatically detect sunspots, classifies them based on the McIntosh classification system, and predicts C, M, and X-class flares.

The SF_PMod has been trained on data from 1st January, 1982 till 31st December, 2011 and the performance has been evaluated on new data from 1st January, 2014 till 31st May, 2014 for forecast horizons of 6, 12, 24 and 48 hours. In this period, 98 M- and X-class flares and 2,318 pairs of SOHO/HMI intensity-magnetogram images have been used.

The 24-hour window was found to provide the best performance: the Probability of Detection (POD), False Alarm Rate (FAR) and True Skill Statistic (TSS) estimations were 63.8% 99.0% and 0.5 respectively for predicting M-class X-flares, and 88.7%, 87.0% and 0.59 respectively, for predicting M-class X-flares. The POD and FAR confidence intervals are shown in classical and the SEPFLARES ASAP Predictions.

**References**


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**Conclusions**

SEPFLARES is a newly developed web-based prototype system close to be operational at http://sepflares.esa.int. Its main purpose is the provision of forecasts on solar flares and SEP events. In this regard, ASAP has been improved with new functions, also enabling 6, 12, 24, and 48 hours forecast horizons. Also, the latest version of UMASEP has been included and a new Warning Module was developed for processing SEPFLARES SEP flare predictions and providing warnings on potential proton flux enhancements. Also, a new SEP Peak and Enduration prediction module was developed that uses a new Shock Arrival time prediction Model (SARM) [6] and a static Parker Spiral. Finally, the system provides nowcasts of solar flares facing the Earth from GNSS-based GSFLAD and SISTED.