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Improving the REleASE solar proton forecasting capabilities with evidence of particle escape from the Sun: HESPERIA REleASE and beyond

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Providing reliable forecasts of Solar Energetic Particle (SEP) events is mandatory for human spaceflight beyond low-Earth orbit, especially outside the Earth's magnetosphere. High-energy SEPs are tracked because they penetrate deeper into the terrestrial atmosphere and contribute to the radiation dose aboard spacecraft specifically over Canada and the Southern Indian Ocean, due to the tilt of the Earth on its axis[1]. Based on the Relativistic Electron Alert System for Exploration (REleASE) forecasting scheme[2], the HESPERIA REleASE product was developed by the HESPERIA H2020 project (Project Coordinator: Dr. Olga Malandraki) and generating real-time predictions of the proton flux (30-50 MeV) at L1, making use of relativistic and near-relativistic electron measurements by the SOHO/EPHIN and ACE/EPAM experiments, respectively[1,3].

The HESPERIA REleASE tools are operational through the Space Weather Operational Unit of the National Observatory of Athens, accessible through the dedicated website (http://www.hesperia.astro.noa.gr). HESPERIA REleASE has attracted attention from various space organizations (e.g., NASA/CCMC, SRAG), due to the real-time, highly accurate and timely performance offered. ESA selected the HESPERIA REleASE products that were integrated are provided through the in the ESA Space Weather (SWE) Service Network (https://swe.ssa.esa.int/noa-hesperia-federated) under the Space Radiation Expert Service Center (R-ESC). Solar cycle 25 solar radiation storms successfully predicted by HESPERIA REleASE are presented and discussed.

Moreover, we present a currently implemented upgrade to HESPERIA REleASE+ that is using the novel approach of combining near-real-time type III solar radio burst observations by STEREO/SWAVES instrument, signifying clear evidence of particle escape from the Sun, with the HESPERIA REleASE system. To this end, we have developed an automated algorithm for identification, classification, estimation and use of spectral type III solar radio bursts, taking into account several burst properties including thresholds at 1MHz[4] and drift rates. This is expected to lead to a substantial improvement of the accuracy and reduction of false alarms.

References

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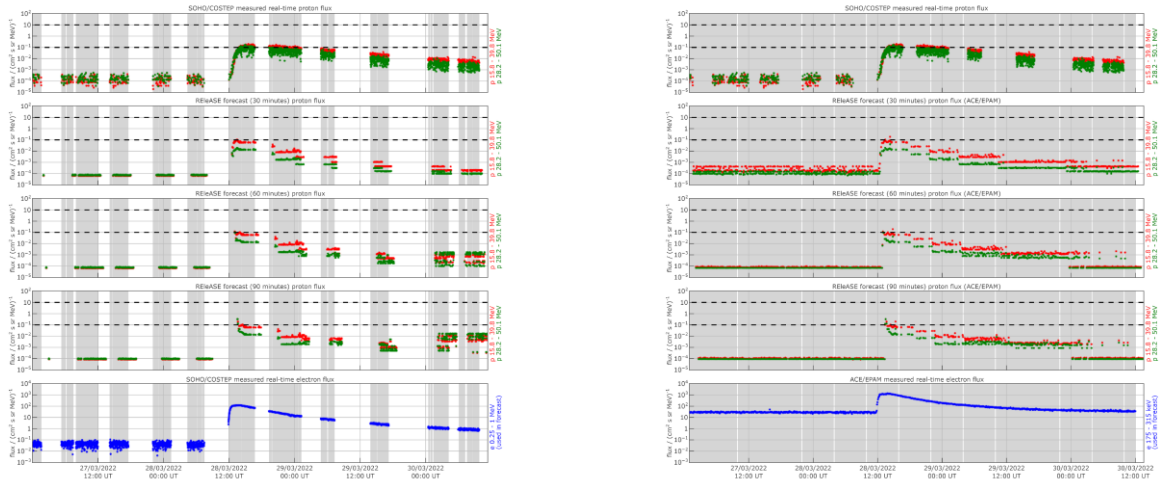

Figure 1. Solar Radiation Storm successfully predicted by HESPERIA REleASE on 28 March 2022.