

Using type III radio bursts as evidence of particle escape from the Sun for enhancing solar proton forecasting capabilities

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Reliable forecasts with sufficient advance warning of Solar Energetic Particle (SEP) events can contribute to swift mitigation of space weather effects by reducing radiation hazards to astronauts, especially in low-shielding situations on future Lunar and Mars missions. The HESPERIA Relativistic Electron Alert System for Exploration (REleASE) forecasting tools currently provide real-time predictions of the proton flux (30-50 MeV) at L1. These predictions are based on relativistic and near-relativistic electron measurements from the SOHO/EPHIN and ACE/EPAM instruments using proton forecasting matrices derived from historical electron and proton data. Likewise, a recently developed forecasting scheme, STEREO REleASE, provides real-time predictions of proton flux (21-40 MeV) for the first time at the location of STEREO-A, relying on electron measurements by the Solar Electron Proton Telescope (SEPT) and the High Energy Telescope (HET) and respective forecasting matrices derived from the analysis of 15-years of historical SEPT/HET electron and HET proton data. Additionally, two novel implementations are also reported, namely, HESPERIA REleASE+ and STEREO REleASE+, that combine for the first time real-time Type III solar radio burst observations by the STEREO S/WAVES instrument, as clear evidence of particle escape from the Sun, within the HESPERIA and STEREO REleASE systems respectively, with the goal of improving their accuracy by reducing known sources of false alarms. Type III-burst identification and their use in connection with SEP event forecasting in cislunar space and at STEREO resulted from an international collaboration between partners with complementary expertise in particles and radio data analysis. From an exploration perspective, these new real-time products inform current and future strategies for SEP forecasting and monitoring at L1 and beyond, where longitudinal separation and magnetic connectivity can strongly influence SEP forecasting and advanced warning performance. Our forecasting schemes have attracted attention and are used to inform various space organizations (e.g., ESA Space Weather Service Network (SWESNET), CCMC, NASA/SRAG) They are accessible through the Space Weather Operational Unit of the National Observatory of Athens i.e. <https://hesperia.astro.noa.gr>:

HESPERIA REleASE+: <https://hesperia.astro.noa.gr/hesperia-release-plus>

HESPERIA REleASE+ Alert: <https://hesperia.astro.noa.gr/hesperia-release-plus-alert>

STEREO REleASE: <https://hesperia.astro.noa.gr/stereo-release>

STEREO REleASE Alert: <https://hesperia.astro.noa.gr/stereo-release-alert>

STEREO REleASE+: <https://hesperia.astro.noa.gr/stereo-release-plus>

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