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Advancing Solar Energetic Particle Event Forecasting: Integrating Remote Sensing Techniques into the Relativistic Electron Alert System for Exploration

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The Relativistic Electron Alert System for Exploration (REleASE) forecasting metric, developed by Posner (2007), utilizes electron data collected by the Electron Proton Helium Instrument (EPHIN) aboard the SOHO spacecraft. Our project aims to enhance the probability of detection, decrease the false alarm rate and extend the warning time by implementing various remote sensing techniques. These include automatic flare detection and localization, as well as automatic radio burst detection using the ROBUST algorithm developed at the University of Graz.

Historically, a range of diagnostics for Solar Energetic Particle (SEP) events based on radio observations from Earth has been developed since the 1960s, which are to some extent utilized in contemporary prediction models. These diagnostics span from the occurrence of long-lasting broadband radio emissions (cm-m waves) to the spectra of microwave bursts (mm-cm waves). The presence of radio emission at meter wavelengths (e.g., type III bursts) is crucial, since it indicates particle injection into the high corona, but is absent in confined flares, where no particles escape from the active region and no CME is available to accelerate particles higher up.

Moreover, our project explores the extent to which diagnostics across diverse frequency ranges can enhance the REleASE system. Initial results of this integration and its impact on the accuracy of SEP event forecasting will be presented.