An operational integrated short-term warning solution for solar radiation storms: introducing the Forecasting Solar Particle Events and Flares (FORSPEF) system

Anastasios Anastasiadis (1), Ingmar Sandberg (1), Athanasios Papaioannou (1), Manolis Georgoulis (2), Kostas Tziotziou (1), Piers Jiggens (3), and Alain Hilgers (3)

(1) National Observatory of Athens, Institute for Astronomy, Astrophysics, Space Applications & Remote Sensing, Penteli, Greece (anastasi@noa.gr), (2) Research Center for Astronomy and Applied Mathematics, Academy of Athens, Greece, (3) ESTEC/ESA, The Netherlands

We present a novel integrated prediction system, of both solar flares and solar energetic particle (SEP) events, which is in place to provide short-term warnings for hazardous solar radiation storms. FORSPEF system provides forecasting of solar eruptive events, such as solar flares with a projection to coronal mass ejections (CMEs) (occurrence and velocity) and the likelihood of occurrence of a SEP event. It also provides nowcasting of SEP events based on actual solar flare and CME near real-time alerts, as well as SEP characteristics (peak flux, fluence, rise time, duration) per parent solar event. The prediction of solar flares relies on a morphological method which is based on the sophisticated derivation of the effective connected magnetic field strength (Beff) of potentially flaring active-region (AR) magnetic configurations and it utilizes analysis of a large number of AR magnetograms. For the prediction of SEP events a new reductive statistical method has been implemented based on a newly constructed database of solar flares, CMEs and SEP events that covers a large time span from 1984-2013. The method is based on flare location (longitude), flare size (maximum soft X-ray intensity), and the occurrence (or not) of a CME. Warnings are issued for all > C1.0 soft X-ray flares. The warning time in the forecasting scheme extends to 24 hours with a refresh rate of 3 hours while the respective warning time for the nowcasting scheme depends on the availability of the near real-time data and falls between 15-20 minutes. We discuss the modules of the FORSPEF system, their interconnection and the operational set up. The dual approach in the development of FORPSEF (i.e. forecasting and nowcasting scheme) permits the refinement of predictions upon the availability of new data that characterize changes on the Sun and the interplanetary space, while the combined usage of solar flare and SEP forecasting methods upgrades FORSPEF to an integrated forecasting solution.