

MAGNETIC SOLAR FLARE EFFECTS (SFES), X-RAY FLARES AND THE CARRINGTON FLARE REVISITED

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The scientific importance of geomagnetic observatories has never been better demonstrated by the fact that the solar flare effect (SFE) recorded at Kew Observatory on 1 September 1859 corresponding to the first reported observation of a white light flare (Carrington, 1860 and Hodgson, 1860), provided the first evidence of a connection between solar and ground observations. It is now well known that an SFE, as measured at observatories recording continuous variations in the geomagnetic field, indicates changes in the ionospheric currents associated with enhanced electromagnetic radiation from the Sun. Originally termed magnetic crochets, these events have been observed and scaled from observatory magnetograms for many years. They appear as a relatively sudden temporary increase to the normal quiet diurnal variation, as the ionospheric current system is enhanced by the increased radiation.

In this study we review previous work to estimate the magnitude of the Carrington flare and re-examine the SFE on the Kew Observatory magnetogram. A data base of more recent SFES is constructed from: existing SFE data available on-line and from magnetic observatory yearbooks; SFE data collected and processed by Ebre Observatory; and SFES scaled from identified events using one-minute values from INTERMAGNET and WDC magnetic observatories. Using these data and GOES X-ray flux data, we investigate the relationship between SFE magnitude and X-ray flux during solar flares, with respect to solar zenith angle. We use the results to estimate the X-ray flux of selected events, including the Carrington flare.

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