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Correlations between NOAA satellite particle bursts and strong earthquakes

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The data provided by particle and plasma physics satellites represent a potentially important source of information for the study of seismic activity on a planetary scale. Moreover, the increasing number of observations concerning meteorological and telecommunication satellites indicates that particle precipitation, IR emission and anomalies in communication links may be associated, although not yet in a systematic manner, with earthquakes. Several studies have attempted to correlate satellite observations with seismic phenomena, however few have presented statistically significant results. The Polar Orbital Environmental Satellites (POES) of the National Oceanic and Atmospheric Administration (NOAA) contain particle detectors which monitor fluxes of energetic ions and electrons entering the atmosphere, as well as the particle radiation environment at the altitude of the satellites. The satellites have been placed in polar orbit with inclination angles of about 99 degrees at altitudes between 807-854 km. More than a decade of NOAA-15 particle flux data offers an opportunity to test claims of correlations between seismic activity and effects on the ionosphere. These particle fluxes are characterised by anomalous short-term and sharp increases in high energy particle counting rates, referred to as particle bursts. Two electron telescopes monitor the flux in three energy bands in the range 30 keV to 2.5 MeV. The opening angle aperture for the two telescopes is 30 degrees. The geometric acceptances are 0.1 cmˆ2-sr. One telescope views at an angle of 9 degrees with respect to the local zenith. The second telescope views in the orthogonal direction. In the literature, at least two other satellites have shown significant particle correlations with earthquakes: DEMETER and SAMPEX. Their detector energies cover similar ranges of energy as those covered by NOAA detectors. There are, however, some important differences regarding the detector geometries and orbits which might explain the different results observed on the various detectors. Furthermore, NOAA satellites allow for simultaneous observations of the magnetosphere using the same type of detectors from several satellites at different positions; as now NOAA-16, NOAA-17, NOAA-18 and NOAA-19 are all active. With respect to previous publications of our work, contiguous particle bursts have been defined and their self-correlations studied. The latter was used to determine the origins of the observed fluctuations. After developing an suitable algorithm we studied the correlations with seismic activity, correcting for the consequences of earthquake clustering, seasonal variations of particle bursts and solar activity. We present some correlation results and discuss their validity.