Geophysical Research Abstracts,
Vol. 10, EGU2008-A-11299, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-11299
EGU General Assembly 2008

Searching for correlation between NOAA particle data and seismic activity

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The National Oceanic and Atmospheric Administration (NOAA) and the National Aeronautics and Space Administration (NASA) have jointly developed a valuable series of polar operational environmental satellites (POES). These advanced TIROS-N (ATN) spacecrafts, named after the prototype satellites, TIROS-N (Television Infrared Observation Satellites), have been flying since 1978. The system consists of pairs of satellites, which ensure that every part of the Earth is regularly observed at least twice every 12 hours from about 800 km altitude. Starting with the NOAA-15 satellite in 1998, an upgraded version of the space environment monitor (SEM-2) is being flown. The SEM-2 contains two sets of instruments that monitor the energetic charged-particle environment near the Earth. They detect and monitor the influx of energetic ions and electrons into the atmosphere and the particle radiation environment at the altitude of the satellite. Both phenomena vary as a result of solar and geomagnetic activity. About 10 years of NOAA-15 particle flux data are now available and these offer an interesting possibility to test the validity of the observations of seismic effects on the ionosphere and Van Allen Belts. During the last two decades, potentially very interesting observations in the ionosphere-magnetosphere transition region have been debated. It consists of anomalous particle fluxes detected by several space experiments and correlated with the earthquakes occurrence. These particle fluxes are characterized by an anomalous short-term and sharp increase of high energy particle counting rates, referred to as “particle bursts” (PBs). Most of PBs have been collected near the South Atlantic Anomaly (SAA) at altitudes generally between about 400 and 1200 km, by several satellites. Recent attempts to confirm the pre-seismic character of these PBs, by using PBs-EQs statistical correlations, were made under

the hypothesis that pre-seismic ULF/ELF electro magnetic emissions (EME) wave-trapped particle interaction may cause the precipitation of Van Allen belt electrons and protons. The altitude where pre-seismic EME-waves may be captured in the geomagnetic field lines and, then, propagate up to the inner radiation belt interacting with particles, has been estimated from PBs space observations and resulted to be around 300-500 km. But, up to now, particles flux data analysis has been concerned principally with a time interval of a few months, up to a maximum of 16 months of SAMPEX database, and the evidence of a new phenomenon is not conclusive. The NOAA set of solid-state energetic particle detectors monitor the intensities of protons and electrons over a range of lower energies than that of the mentioned experiments, also their accuracy angles and acceptance are not as precise. Further, a large gradient particle fluxes exists for these energies in the low altitude orbits, so the criteria for PBs selection has been reviewed with particular attention. More general rules for PBs selection have been defined and tested, inside and outside the SAA, on four satellites' data (NOAA-15,16,17,18) during periods of solar quiet activity in connection with great earthquakes. This preliminary study concentrates on periods of major Indonesian earthquakes from 1998, including Sumatra event M=9, during which Ap index was less than 20 and with no sudden ionospheric disturbances (SID=0). During these periods PBs spatial and temporal distributions show only a weak correspondence with earthquake location and time. Global PBs-EQs correlations are in progress.