Geophysical Research Abstracts
Vol. 20, EGU2018-17098-5, 2018
EGU General Assembly 2018

Study of the correlations between precipitating Van-Allen particles and seismic events: the methodology and the HEPD particle detector of CSES satellite.

Livio Conti (1,2), Giovanni Ambrosi (3), Roberto Battiston (4,5), Andrea Contin (6), Angelo De Santis (7), Cristian De Santis (2), Roberto Iuppa (5), Giuseppe Osteria (8), Piergiorgio Picozza (9,2,1), Marco Ricci (10), Roberta Sparvoli (9,2), Pietro Ubertini (11), Simona Zoffoli (4), and the Limadou - CSES collaboration

(1) Uninettuno University, C.so Vittorio Emanuele II, 39, 00186, Rome, Italy (livio.conti@uninettunouniversity.net), (2) INFN - Sezione Roma 2, V. della Ricerca Scientifica 1, 00133, Rome, Italy, (3) INFN - Sezione of Perugia, V. A. Pascoli, 06123, Perugia, Italy, (4) Agenzia Spaziale Italiana, V. del Politecnico snc, 00133 Rome, Italy, (5) University of Trento and INFN - TIFPA, V. Sommarive 14, 38123 Povo (TN), Italy, (6) University of Bologna and INFN - Sezione of Bologna, V.le Berti Pichat 6/2, Bologna, Italy, (7) INGV, V. di Vigna Murata 605, 00143 Rome, Italy, (8) INFN - Sezione of Napoli, via Cintia, I-80126, Napoli, Italy, (9) University of Tor Vergata, V. della Ricerca Scientifica 1, 00133, Rome, Italy, (10) INFN - LNF, V. E. Fermi, 40, 00044 Frascati (RM), Italy, (11) INAF - IAPS, V. Fosso del Cavaliere 100, 00133, Rome, Italy

We present the method and a particle detector (HEPD) for studying the spatial and temporal correlation between precipitations of high-energy particle bursts from the inner Van Allen radiation belt and the occurrence of earthquakes of medium and strong magnitude. The seismo-electromagnetic perturbations induced by earthquakes in the ionosphere-magnetosphere transition zone can induce the precipitation of trapped electrons and protons (from a few MeV to several tens of MeV) due to diffusion of particles pitch-angle. Several authors have pointed out the existence of a seismic-precursor (of anomalous particle precipitation) occurring a few hours before seismic events. Due to the longitudinal drift along same L-shell, anomalous particle bursts of precipitating particles could be detected by satellites not only on the epicentral area of the incoming earthquake, but along the drift path. Moreover, the opposite drift directions of positive and negative particles could allow reconstructing the longitude of the earthquake focal area. Although, the earthquake prediction is not within the reach of current knowledge, however the study of the precursors aims at collecting all relevant information that can infer the spatial and temporal coordinates of the seismic events from measurements. At this purposes, it is essential to detect particles in a wide range of energies (because particles of different energies are sensitive to different frequencies of seismo-electromagnetic emissions), with a good angular resolution (in order to separate fluxes of trapped and precipitating particles), and excellent ability to recognize the charge (that determines the direction of the longitudinal drift of precipitating particles). The East-West or West-East drift direction is an essential information to retrieve the longitude of the starting point of the burst precipitation and then to reconstruct the geographical area where the interaction between particles and seismo-electromagnetic emissions occurred. In this framework, the Limadou-CSES collaboration have designed and built an advanced high energy particle detector (HEPD) installed on board of the China Seismo-Electromagnetic Satellite (CSES). HEPD can provide good energy resolution and high angular resolution for electrons (3 - 100 MeV) and proton (30 - 200 MeV). The instrument consists of: two planes of double-side silicon microstrip sensors placed on the top of the instrument (that provide the direction of the incident particle); two layers of plastic scintillators (for the trigger) and a calorimeter (constituted by other 16 scintillators and a layer of LYSO sensors). A scintillator veto system completes the instrument. HEPD aims at studying the temporal stability of the inner Van Allen radiation belts and at investigating precipitation of trapped particles induced by magnetospheric, ionosferic and tropospheric EM emissions, as well as by the seismo-electromagnetic and anthropogenic disturbances. We present the method for studying the correlation between data gathered in space and seismic data, and describe in details the HEPD detector.