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The perturbation characteristics in plasma parameters in ionosphere before strong earthquakes

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Based on the data observed by DEMETER satellite, the perturbation characteristics of plasma parameters were analyzed and summarized, such as Ni(O+), Ne and so on. Two cases were presented as examples, which are Yushu M7.1 earthquake in China on April 13 2010 and Tanga M7.9 earthquake on May 3 2006. Around Yushu earthquake, more than seven-month data were selected since Oct. 2009 in a distance of 2000km to the epicenter. Long time comparison over a certain region revealed that the Ni(O+) began to increase in Feb. 2010, two months before this event, and the maximum oxygen ion density occurred on April 13, 20 hours before the earthquake with the amplitude of more than 100% relative to the normal peak values at the south of this seismic region. Before and after the earthquake during more than 7 months, the peak values of Ni(O+) had never been so large in quiet magnetic conditions. As for the Ms7.9 Tonga Islands earthquake, perturbations of plasma parameters above epicenter were detected six days, two days, one day before and two days after it. The variation feature of O+ density was more obvious than that of H+ and He+ density. Compared with the 16-day revisiting orbits in 2 years of the half orbit just one day before the earthquake, O+ density increased 20% more at the orbit closest to the epicenter than the other orbits in the same day, and it increased nearly an order of magnitude referred to the mean of O+ density in May from 2006 to 2008 by taking account of the seasonal variations in it. In addition, electron density detected simultaneously to increase with O+ density onboard DEMETER at the above-mentioned revisiting orbits. Furthermore, the statistic analysis was carried out on the earthquakes with magnitude larger than 6.0 during Jan. 2006 to Apr. 2010 in China and a few earthquakes with $M \geq 7.0$ in the world. It was found that perturbations in plasma parameters occurred before 15 cases in all 29 cases. The ionospheric disturbances were detected 1-7 days before these strong earthquakes and they were exhibited both at the west or the east to the epicenter, but always turned to the equator. Finally, the enhancement phenomena of electron and ion density before earthquakes and its formation mechanism were discussed based on our study results.