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Magnetospheric response to two extreme solar events, as observed by the Cluster and Double Star spacecraft

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Extreme solar events can drive extraordinary responses of the terrestrial Magnetosphere, characterised by strong deformations of the Magnetic field and the plasma populations. Magnetospheric changes following two extreme solar events have been analysed using particle data issued from the Cluster and Double Star missions. On the 24th of October 2003, the NOAA (National Oceanic and Atmospheric Administration) registered a huge CME (Coronal Mass Ejection), emitted by the Sun. During this ejection, the Sun, ACE, Cluster and the Earth were almost aligned, and the ACE spacecraft, situated along the Sun/Earth direction, recorded a sharp increase on the solar wind velocity, which jumped from about 450 km/s to more than 600 km/s. The proton density, which was about 3 to 4 particles.cm^{-3}, increased to more than 20 while the proton temperature in the solar wind at this instant was multiplied by a factor of 8. During this event, Cluster was situated in the southern magnetospheric lobe, close to the inner magnetosphere (near the ring current region), where it registered the effects of the solar wind pressure on the magnetosphere: a huge compression, provoked by the pressure increase, was detected by Cluster which was suddenly situated out of the Southern magnetospheric lobe into the Magnetosheath, whereas the spacecraft were only at a 6.8 R_E distance from the Earth. The 17 January 2005 event was characterised by the arrival of an interplanetary cloud of solar energetic particles at the Earth orbit. The Double Star (TC – 1) spacecraft was situated in the Magnetosheath and detected a sudden Magnetosheath compression (increased density and temperature), whereas the Cluster spacecraft, situated in the Solar wind, recorded a substantial increase of the particle flux at all energy ranges, characteristic of background provoked by the presence of penetrating particles. An analysis of the Magnetospheric modifications induced by these two distinct solar events, as recorded by the Cluster and Double Star spacecraft, will be presented.