The Influence of Space Weather on the Near Earth Debris Environment

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Since the beginning of space flight, an increasing number of artificial objects, the so called space debris, have been put in near Earth orbits. Space debris is defined as all objects which are no longer used and which are not intended to be used in the future. These objects pose a risk to active space missions due to the high impact velocities (10 km/s at an average) and due to the relative high masses of the projectiles involved. Typically, the kinetic energy of an impact of an 1 cm aluminium sphere is comparable with the energy released by an exploding hand grenade. The course addresses the major headlines of the man made particulate near Earth environment, i.e. description of the sources and sinks of debris with the related dynamics, risk assessment for current and future missions, and debris mitigation practices. Examples are given for debris measurement campaigns and their results. Since complete measurements of the debris environment are not feasible, debris modelling approaches are presented on the basis of the ESA MASTER model, which recently has been updated. The knowledge of the particulate environment is necessary in order to design impact protection measures like spacecraft shielding. All the above debris issues are influenced by space weather, mainly by the interaction of the solar activity and the Earth atmosphere and magnetic field. The course outlines the quantity of these influences on both, the modelling and measurement activities and the protection measures. In this connection, sensitivity analysis and the problems arising from the reduced ability in long-term forecasting of the solar activity are described. Finally, the current status of international agreements concerning the minimisation and control of the debris environment, e.g. at the United Nations and among the space agencies are discussed.