Space weather research and forecast services using CubeSats

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The research on space weather and its effects will be more and more important in the near future, as a continuous increase in human presence is in progress in the Near-Earth region and the technology dependency of the human civilization is becoming higher than ever mainly in the fields of energy and telecommunication systems. The radiation level in orbit may be two orders of magnitude higher than under the shield of Earth's atmosphere and magnetosphere. The disturbances generated by our Sun can reduce the shielding capability of the magnetosphere resulting significantly higher radiation intensity in the atmosphere of the Earth.

Generally the incoming primary cosmic rays (the Galactic Cosmic Rays originating from the Universe and the Solar Cosmic Rays originating from the Sun) interact with the Earth's magnetosphere and the atmosphere providing a complex radiation environment changing with the geomagnetic latitude [1]. One of the key indicators of the space weather is the cosmic radiation level, which can have significant influence on our everyday life through its possible effects on the technologies used. The influence on the energy and telecommunication systems is the most critical question; these systems need to be protected by a reliable forecast system about the space weather in the Near-Earth region. Additionally needs to be mentioned that space weather can have influences on the weather conditions of the Earth and thus the climate itself, which underlines the importance of space weather research. To study the space weather, as a first step, a detailed monitoring system needs to be built up to provide scientific data about the cosmic ray intensity level and the status of the magnetosphere in order to provide possibility for a reliable forecast database. Since the monitoring instruments are relatively small this kind of monitoring system can be realized using several CubeSats in the same orbit and in different orbits as well providing the possibility to monitor the cosmic radiation with sufficient statistics in the Near-Earth region. The Centre for Energy Research has a very long history in the research of the cosmic rays in the Near-Earth region and the development of radiation monitoring instruments [2].

The present paper provides a short overview about the space weather and its possible effects in the Near-Earth region, some past results from the cosmic ray and space weather research of the Centre for Energy Research [3] and a detailed study about the possible future use of CubeSats in space weather monitoring and forecast services.

Keywords: space weather, cosmic rays, CubeSat

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