

DESCRIPTION FOR THE GENERAL PUBLIC (IN ENGLISH)

The main aim of the project 'Research on the physical parameters changes of Earth's upper ionosphere triggered by the atmospheric discharges' is to investigate the influence of the atmospheric discharges on changes within upper layers of the Earth's atmosphere (460-660 km a.g.l.) in reference to standard 11 years long solar cycle. Prior scientific researches related to bilateral dependencies between storms and their electrical discharges with integrated physical system ionosphere-magnetosphere were focused on changes within lower atmosphere. The DEMETER satellite measurements operating on altitude 660 km a.g.l. proved that low atmosphere storms effects can be seen and tracked in the upper ionosphere also. Both, satellite and ground based information on the atmosphere-Earth system will be utilised in the frame of this project. The satellite data will be derived from polar-orbiting satellite DEMETER but also from constellation of three SWARM satellites. The ground based measurements of atmospheric discharges will be obtained from WERA system (World ELF Radiolocation Array), WWLLN (World Wide Lightning Location Network), Perun (SAFIR 3000 system by Vaisala operated by Institute of Meteorology and Water Management – National Research Institute in Poland) and EUCLID (European Cooperation for Lightning Detection), if needed (optional data source). The detection and localisation of large storm systems visiting Europe and Africa periodically, namely Mesoscale Convective Systems (MCS), will be based on satellite data derived from EUMETSAT geostationary satellite.

The adopted methodology will mainly rely on simultaneous measurements of investigated effects by means of satellite tele detection and available ground based systems.

The research will be conducted within the following research plan:

- a) Studies of the ionospheric parameters and electromagnetic signals measured on board of satellites and associated with the thunderstorm activity;
- b) Synoptic analysis of the selected cases of MSC and their connection with detected ionospheric disturbances;
- c) Studies of the satellite and ground based registrations of the ELF/VLF emissions in coincidence with the Earth's storm activity;
- d) Studies of the influence of the solar cycle phase on the discussed events detected in the upper ionosphere bound by storm activity in the lower atmosphere.

The coincidentally detected cases of 'satellite' and 'ground based' electrical discharges (detected by means of satellite tele detection and ground based systems respectively) will be investigated in detail.

The atmospheric storms are one of the most dangerous phenomena in the human environment. Some scientists consider that total energy accumulated during the separation phase within the storm cell could be potentially used to provide a medium size city with the electricity for a period of one month. Part of this energy is released within one second during the electrical discharge which makes the lightning one of the most spectacular and dangerous phenomena on Earth. One of the most important aspects of those events is fact that localised in limited area in the atmosphere they release energy in lightning discharge creating narrow plasma channel of temperature higher than that characterising Sun's chromosphere. These values are higher than average values measured in the Earth's ionosphere.

By its research area the project relates to earlier scientific researches suggesting dependences between lightning discharges. In recent years one can observe rise in scientific interest in this field what resulted in intensification of research efforts, both in theoretical and in experimental studies. Proper understanding, interpretation and application of new knowledge are crucial for human economy, especially as we are facing progressing climate changes.