

## **CHINA-RUSSIA JOINT RESEARCH CENTER ON SPACE WEATHER: 24 YEARS OF COOPERATION**

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In recent decades, near-Earth space has become an area of intense practical activity. The rapid development of technosphere and its growing expansion to space lead to the fact that the processes occurring on the Sun and in near-Earth space (space weather) significantly affect space-borne and ground-based technological systems, they also threaten human health and life. It is therefore essential to have complete information about these processes, to have the possibility to diagnose and predict space weather, and to assess the potential consequences. However, physical processes in all regions of near-Earth space are closely interrelated. The system “Sun – interplanetary medium – magnetosphere – ionosphere – atmosphere” should be studied as a whole. That is a difficult task. Accomplishing it requires new instruments and methods. Broad international cooperation is also needed, since the processes under study are planetary in scale. The China-Russia Joint Research Center on Space Weather is focused on solving these problems.

The Joint Research Center on Space Weather was established by the Institute of Solar-Terrestrial Physics of Siberian Branch of the Russian Academy of Sciences (ISTP SB RAS) and the National Space Science Center of the Chinese Academy of Sciences (NSSC CAS). The main research areas of the Joint Research Center include solar activity related to solar disturbances; propagation of solar disturbances through the solar corona and interplanetary space; dynamic processes of various spatial and temporal scales associated with the near-Earth space disturbances; propagation of disturbances from high to middle and low latitudes of the Earth’s ionosphere and atmosphere; diagnostics of near-Earth space and forecasting techniques; interaction between near-Earth space and the Earth’s atmosphere; global space weather system and its response to external influences. Many other Russian and Chinese institutions have joined our investigations: the National Astronomical Observatories of China CAS, Institute of Geology and Geophysics CAS, Peking University, Yunnan Astronomical Observatory CAS, China Research Institute of Radiowave Propagation, Shandong University, Yu.G. Shafer Institute of Cosmophysical Research and Aeronomy SB RAS, Space Research Institute RAS, Pushkov Institute of Earth Magnetism, Ionosphere and Radio Wave Propagation RAS.

The Joint Research Center promotes international cooperation. In 2016, the first joint observation campaigns were launched as part of the International Meridian Circle Program (IMCP). The large unique project of NSSC CAS, IMCP connects 120E and 60W meridian chains of ground-based observatories to enhance the ability to monitor space environment worldwide. Currently, institutes from more than 10 countries (in particular China, Russia, Brazil, Australia, Canada) participate in the Program. The monitoring instruments involve optical, radio, and geomagnetic equipment including active and passive optical instruments, ionosondes, MST radars, magnetometers, GNSS receivers, sounding rockets. The IMCP observation system will provide monitoring and better understanding of the interactions between solar activities and terrestrial processes.

The National Heliogeophysical Complex of the Russian Academy of Sciences (NHC RAS), the large unique project of ISTP SB RAS, can make a significant contribution to the MCP program for observations in middle and high latitudes at meridian 120E. NHC RAS includes five large, new generation experimental scientific instruments for research in the field of solar physics and near-Earth

space physics: Large Solar Telescope-Coronagraph, Multiwave Radioheliograph, Radiophysical Complex for Atmospheric and Ionospheric Research, Network of Coherent Ionospheric Radars, Lidar Optical Complex. Currently, the first NHC RAS tools have started their operation: radioheliograph and optical instruments. The development and construction of a large solar telescope and a radiophysical complex are underway. Reports about selected of the NHC RAS tools are presented in the Workshop Abstract book.

In 2024, the China-Russia Joint Research Center on Space Weather has celebrated its 24th anniversary. Over the 24-year period, many important results in the study of physical processes in near-Earth space have been achieved through the joint efforts of Russian and Chinese colleagues. About 60 scientific projects have been implemented, and over 400 joint scientific articles have been published. The Joint Research Center has proven its usefulness and continues its work in the study the Sun, solar-terrestrial relations, and near-Earth space.