# CZECH REPUBLIC SPACE WEATHER INITIATIVES

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ABSTRACT

A brief information about the space weather research in four Institutes of the Academy of Sciences of the Czech Republic is presented.

Keywords: Solar Physics, Heliospheric Physics, Space Physics, Space Weather Research

## 1. ASTRONOMICAL INSTITUTE AS CR

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At the Astronomical Institute the space weather research can be divided into three parts (for more details, see the paper "Space Research at the Ondřejov Observatory, this Proceedings):

a) The ground-based solar optical and radio observations

At the Ondřejov Observatory the Sun is observed by optical telescopes in the H$\alpha$ line and in the white light and by a multichannel flare spectrograph. The observations contribute data to the world net ISES (as station No. 31516) and to the SIDC in Brussels. Besides solar observations all available data on the actual state of the solar activity are collected and used for preparation of weekly solar-activity forecasts. Selected images and the forecasts are presented on the WWW page: **http://sunkl.asu.cas.cz/~sunwatch/**. Besides optical observations the Sun is observed at the Ondřejov Observatory by three radio telescopes: (a) RT3 – single frequency 3 GHz receiver with 10 ms time resolution, (b) RT4 – radio spectrograph 2.0–4.5 GHz with 100 ms time resolution, (c) RT5 – radio spectrograph 0.8–2.0 GHz with 100 ms time resolution. The observations are run daily. Overall images of individual radio events in GIF format are presented on the WWW page: **http://sunkl.asu.cas.cz/~radio/**.

b) Numerical modelling, Drs. D. Odstrčil, M. Vandas, odstrcil@asu.cas.cz, vandas@ig.cas.cz, Refs. 1-3

Several hydrodynamic and magnetohydrodynamic models are used for the study of solar flares, active prominences, coronal mass ejections, interplanetary shocks and magnetic clouds.

c) Space research, Dr. F. Fárník, ffarnik@asu.cas.cz

Solar broad-band hard X-ray spectrometer observing in 8 channels in the 13.2–250 keV energy range is in a preparation for a launch in October 1999 onboard the Multispectral Thermal Imager (MTI) USA satellite.

## 2. GEOPHYSICAL INSTITUTE AS CR

Boční II/1401, 141 31 Praha 4, Czech Republic, gfu@ig.cas.cz

At the Geophysical Institute the space weather research can be divided into three parts:

a) Forecasts of geomagnetic activity based on terrestrial and satellite data, Drs. J. Bochníček, V. Bucha, P. Hejda, jboch@ig.cas.cz

Short-term forecasts of geomagnetic activity have been carried out for over four years. These forecasts are based on the knowledge of the long-term and seasonal characteristics of conditions observed at the Geomagnetic Observatory Budkov in southern Bohemia, on daily observations of the Sun carried out at the Astronomical Institute, Ondřejov, and on solar activity data, coronal holes and geomagnetic indices from WDC Boulder through INTERNET. The Boulder data serving both as the supplement and comparison of Budkov and Ondřejov data. From 1995 the YOHKOH soft X-ray images are also used. The research is concentrated on an analysis of the geoeffectivness of coronal holes as the source of regular geomagnetic activity.

b) The solar activity and the orbit of the centre of the Sun around the centre of mass of the solar system, Dr. I. Charvátová, ich@ig.cas.cz, Ref. 4

The orbit of the centre of the Sun around the centre of mass of the solar system can be the ordered (in a JS-trefoil) and chaotic. The area in which the Sun moves has a diameter of 0.02 AU. The Sun enters into trefoils with a spacing of 178.7 years. While the trefoils are, after a rotating, the same, the chaotic

orbits differ from one to another. The Wolf, Sporer, Maunder and Dalton chaotic intervals coincide with the respective prolonged minima of solar activity.

c) Ionospheric studies, Dr. K. Prikner, kpri@ig.cas.cz, Ref. 5

The numerical method of the ionospheric ULF-wave filtration has been developed on the basic of the full wave analysis. The fast computer algorithm is applicable on the real ionospheric plasma altitude profiles and is able to simulate the real ionospheric Alfvén resonator (IAR). Presently this method has been applied on realistic plasma conditions in the non-stationary IAR during the Intervals of Pulsations Diminishing in Periods (IPDR) in the subauroral regions, using the Scandinavian EISCAT radar measurements of the ionospheric plasma variations. There are cooperations with Finnish Observatories (OULU, SODANKYLA, etc. on the latitude profile) and Russian Geophysical Institutes.

## 3. INSTITUTE OF THE ATMOSPHERIC PHYSICS AS CR

Boční II/1401, 141 31 Praha 4, Czech Republic, ufa@ufa.cas.cz

At the Institute of the Atmospheric Physics the space weather research can be divided into two parts:

a) MAGION 4 and MAGION 5 satellites, Drs. P. Tříska, L. Třísková, ptr@ufa.cas.cz

Two smalll satellites MAGION 4 and MAGION 5 have been developed in the Czech Republic (Institute of Atmospheric Physics) as a contribution to the international (20 participating countries) INTERBALL Mission. MAGION is the Czech microsatellite program devoted to the MAGnetosphere-IONosphere research. The previous three MAGION microsatellites have been launched 1978, 1989 and 1990 as subsatellites in the MAGIK, ACTIVE and APEX Missions (low orbits). MAGION 4 (58.7 kg) was launched together with the INTERBALL 1 on 3 August 1995 into the high elliptic orbit with the apogee of 192000 km. Data from this satellite allowed to study the fine structures and dynamics od the magnetosphere and magnetospheric boundaries and solar wind. MAGION 5 (68.5 kg) was launched on 29 August 1996 together with the INTERBALL 2 satellite; the apogee was 20000 km. This satellite was used for the study of the inner plasmasphere.

b) Effects of geomagnetic storms, Drs. J. Laštovička, D. Burešová, jla@ufa.cas.cz, buresd@ufa.cas.cz, Ref. 6

Using both ground-based and satellite data, a significant and persistent effect of geomagnetic storms on the total ozone at higher middle latitudes was found. However, such effect was found only along the $50^oN$ latitudinal circle, not at $40^oN$ and $60^oN$. This effect is observable only in winter.

An analysis of the ionospheric response to the geomagnetic storm have been made with a special emphasis paid to the F1 layer behaviour. Series of electron densities derived by POLAN software from all available Pruhonice ionosonde ($50^oN$, $15^oE$) hourly ionograms for storm periods in different seasons at low solar activity years have been analyzed to investigate electron density variability at 160–190 km heights.

## 4. FACULTY OF MATHEMATICS AND PHYSICS, CHARLES UNIVERSITY

V Holešovičkách 2, 180 00 Praha 8, Czech Republic, Dr. J. Šafránková, safr@aurora.troja.mff.cuni.cz, Ref. 7

The Faculty of Mathematics and Physics, Charles University concentrates its attention on the interaction of the solar wind with the Earth's magnetic field with an emphasis on the penetration of the solar wind plasma into the magnetosphere and the formation and motion of the magnetospheric boundaries. The investigation is based on the multipoint measurements of the plasma parameters carried out by our own devices onboard INTERBALL 1, MAGION 4, and MAGION 5 satellites completed with the observations of other ISTP spacecraft (WIND, GEOTAIL, IMP–8, POLAR).

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