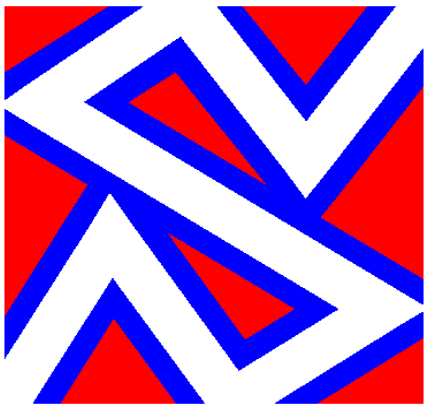
SPACE RESEARCH IN SLOVAKIA

2004 - 2005



SLOVAK ACADEMY OF SCIENCES

COSPAR

SLOVAK NATIONAL COMMITTEE

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1. EXPERIMENTS ON THE SATELLITES.

CORONAS-F.

The "CORONAS-F" satellite, the second one of CORONAS satellite series, launched on July 31, 2001 in Russia into a circular orbit with the altitude 507±21 km and 82.5 degree inclination, provided scientific data during the whole period until it entered the atmosphere on December 4, 2005. The satellite was oriented towards the Sun. A complex of instruments measuring predominantly corpuscular energetic emissions from the Sun (SKL, coordinated by Skobeltsyn Institute of Nuclear Physics, Moscow, Russia) is a part of experimental devices. Institute of Experimental Physics (IEP), SAS, Košice, Slovakia participated at a device SONG measuring energetic neutrons, gammas and protons. Several tens of events with gamma ray increases due to the solar emissions were identified during the four year period. Along with that redistribution of energetic electrons in the outer radiation belt as well as penetration of solar particles to the magnetosphere at high latitudes were observed.

DOUBLE STAR (TC-2).

The magnetospheric mission Double Star (Shuang-Xing) is a Chinese - European project agreed between European Space Agency ESA and Chinese National Space Administration. The mission constitutes of two spacecraft TC-1 and TC-2 (Tan-Ce, i.e. Explorer) and cooperates with the ESA-CLUSTER mission. Thus 6-point sounding of Earth's magnetosphere is provided, as CLUSTER already operates with four satellites.

The Energetic Neutral Atom (ENA) imager NUADU (NeUtral Atom Detection Unit, Irish National Instrument, PI Susan McKenna-Lawlor) is installed onboard of TC-2 and provides panoramatic imaging of the ENA-emitting magnetospheric regions, particularly the ring current.

NUADU was developed specifically for operation on board of the TC-2 in the frame of European - Chinese cooperation agreed among Laboratory of Space Technology at National University of Ireland STIL-NUIM in Maynooth, Swedish Institute of Space Physics IRF in Kiruna and Center for Space Science and Applied Research CSSAR in Beijing. The project also cooperates with Johns Hopkins University - Applied Physics Laboratory JHU-APL, Maryland, USA, aiming for parallel two-point (stereo) ENA-imaging in cooperation with the NASA-IMAGE satellite.

The Department of Space Physics of IEP SAS has participated on NUADU development and construction in the frame of scientific-technical cooperation between IEP-SAS and STIL-NUIM, Maynooth, Ireland.

2. SPACE PHYSICS, GEOPHYSICS AND ASTRONOMY.

The institutes of the Slovak Republic are continuing the space research activities in the directions of space solar physics and X-ray astronomy, interplanetary matter and explorations of the comets, solar wind and its interactions with the Earth's magnetosphere, energetic particles in the magnetosphere and in interplanetary space, atmosphere and ionosphere of the Earth. The following short survey presents selected activities of the abovementioned directions and the obtained results.

The dynamics of cosmic particles with the energies well below those of cosmic rays and well above those of solar wind (from few tens of keV up to several MeV) have been studied by the ***Institute of Experimental Physics, SAS, Košice*** (its Department of Space Physics, http://space.saske.sk) in the cooperation with the laboratories in abroad and with P.J. Šafárik University as well as Technical University Košice. In addition, the measurements of secondary cosmic rays observed by ground based methods have been analyzed. The analysis of the data obtained both from the low altitude and high apogee satellites, as well as development and construction of new instruments for the future studies continued in the period of years 2004 and 2005.

INTERBALL [1,3,7,10,17-20].

Both case and statistical studies were done with using the large amount of data by energetic particle instruments DOK-2 on Interball-tail and Interball-auroral, as well as by its simplified versions DOK-S on the corresponding subsatellites, Magion-4 and Magion-5, developed at the Department of Space Physics IEP SAS in cooperation with laboratories in abroad. Ions (10 to several 100 keV) are common feature in the region upstream from the Earth's bow shock. However, their origin remains the subject discussed and not unambiguously solved yet.
Energetic particle data of DOK-2 on Interball-1 (~20-600 keV) were used. Extensive set of ions upstream from the Earth's dayside bow shock for a wide variety of geomagnetic and solar wind conditions was analyzed statistically.
Multispacecraft studies using also DOK-2 data on Interball-1 were used to describe the motion of the magnetopause due to the variations of interplanetary magnetic field. Statistical study of large amount of upstream ion events by DOK-2 has shown that for the diffusive upstream events observed near the bow

shock there is much higher probability of observing high flux of protons for quasi-parallel connections to the model bow shock than for the cases with quasi-perpendicular geometry. This is in accordance with the Fermi acceleration at the shock. While such dependence is clear at low energies (~20-30 keV), it becomes less pronounced with the increasing energy. On the other hand the dependence on geomagnetic activity is increasing with energy. The relative importance of the two possible sources of the seed particles, namely those of solar wind ions and particles leaking from magnetosphere was described up to 300 keV on the large data set. The detailed energy spectra by DOK-2 instruments on Interball-1 and 2 showed many cases of dispersive velocity events. They can be used for remote timing and identification of the place of particle injection during geo-magnetic disturbances. The dependence of the dispersive events occurrence on altitude, L and magnetic local time was obtained. A case study by DOK-2 dur-ing a small substorm when Interball-1 was near the reconnection point in the central magnetotail region, has shown the strong changes of ion flux anisotropy and fast change of energy spectra when the satellite crossed the neutral sheet. Relations of energetic particle fluxes to plasma characteristics on Interball were in the foreshock region as well as in the magnetosheath were examined too.

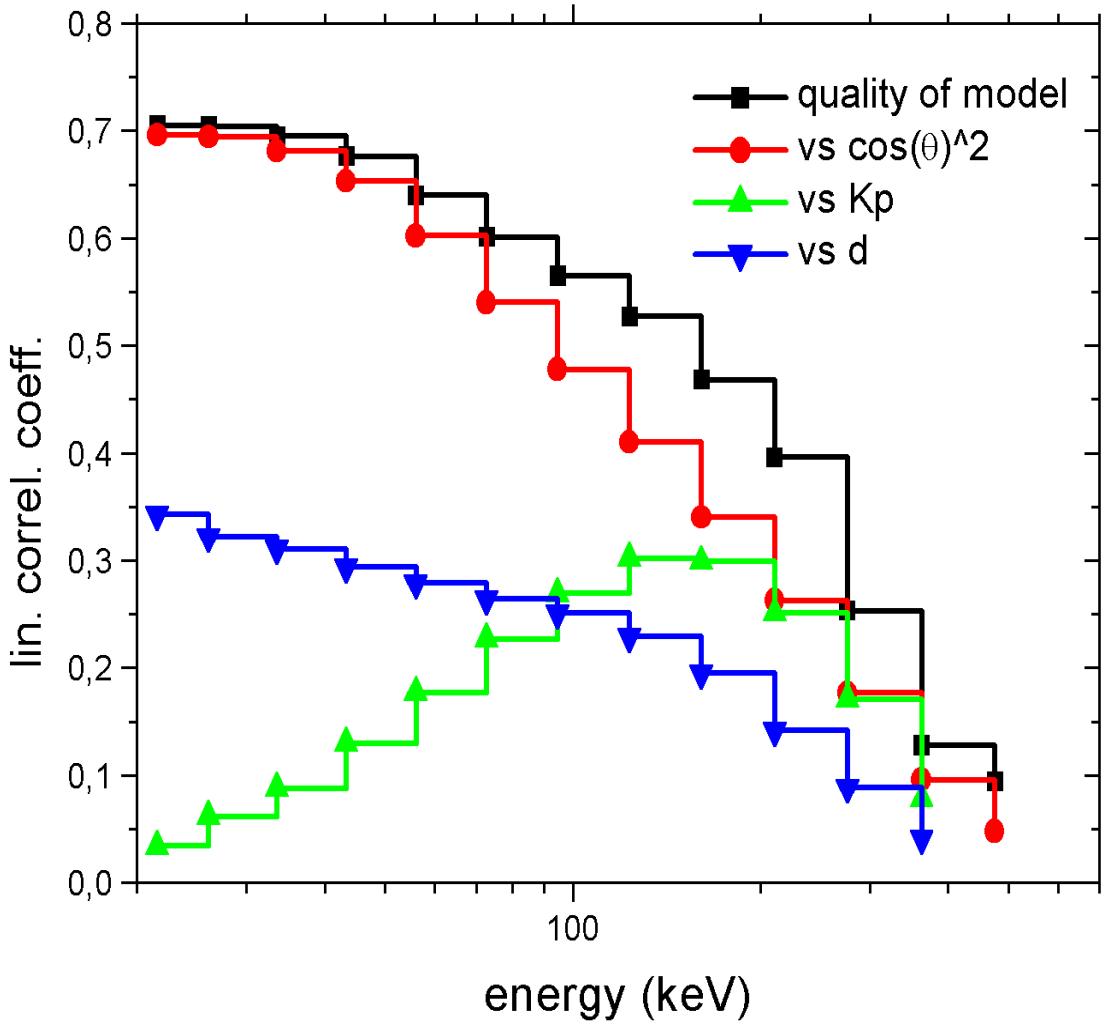

Fig.1. The linear correlation of the ion flux in the upstream region at different energies with the angle θ_{Bn} , with Kp and with d (distance to the bow shock along the magnetic field line). Observations from Interball-1.

Most important parameter controlling the flux of energetic diffusive ions outside the bow shock up to ~ 150 keV is θ_{Bn} . While flux correlation with θ_{Bn} decreases with the energy, the correlation with Kp increases and both values are comparable above 150 keV.

For quasi-parallel shocks the slope of energy spectra is strongly correlated with Vsw.cos(θ_{Bn}). However, it is also correlated with geomagnetic activity. For Bz>0 slightly higher correlation of the spectral slope is found with Vsw.cos(θ_{Bn}) than for Bz<0.

Signatures of both mechanisms, i.e. of preferential acceleration of solar wind ions at quasiparallel shock by Fermi mechanism, and of magnetospheric particle contribution to the upstream ion population, are seen. We show how their relative importance is changing with the energy on Interball orbit.

It was shown that the high correlation of energetic ions in the region upstream from the Earth's bow shock with the geometry to the bow shock is seen in the diffusional quasi-isotropic cases, while for the anisotropic cases there is much better relation to the level of geomagnetic activity than to the bow shock geometry.

Previously the pattern at low energies (from ~20 to 30 keV) was described. A survey describing the dependence of the diffusive ion flux at various energies on θ_{Bn}, on geomagnetic activity, and on the component of the solar wind speed parallel to IMF B was prepared.
Out of ~43000 the 7829 bins were selected when the connection to the bow shock was found according to the model and simultaneously the ratio of lowest energy count rates of detectors 2 and 1 did not exceed factor of 2 (diffusive events, 0.5<1p1/1p2<2).

CORONAS-I [4,5]

From the experiment SONG the fluxes of γ rays and their connection to radiation belt electrons were studied. Since altitude 100 km can be considered as a limit between zero and total absorption in the Earth's atmosphere, the line in the graph separates L-B space on two parts, the region of stable trapped charge particle population (the area below the white line where Hmin >100 km) and area of atmospheric drift loss cone particles (above the line, Hmin< 100 km). In the Earth's environment the electron bremsstrahlung is only significant mechanism for production of gamma rays in energy range of 3.-8.3 MeV. The contribution of Compton scattered gamma rays comming from decay of neutral pions originating in the nuclear interactions of protons in any local matter can also be considered.
The most intense fluxes observed at L<2 are due to local production (in satellite matter) of stable trapped particles (mainly electrons) in the inner radiation belt. The presence of enhanced fluxes in atmospheric drift loss cone (where particles live ten's minutes) for L> 2.5 indicate their high temporal variability in the outer radiation belt. There, also particles precipitated into the local loss cone contribute to the gamma ray production in both areas separates by white line. The gamma rays in the outer radiation zone are therefore combination of artificial (satellite) and atmospheric emission caused by stable trapped and precipitating particle/electron population. The higher fluxes observed in the inner zone simply

reflect fact that at low altitudes (~ 500 km), satellite can reach the highly populated equatorial region only in the inner radiation belt. This is also explaining for the steeper flux gradient in the inner zone which is controlled by the density distribution of the atmosphere.

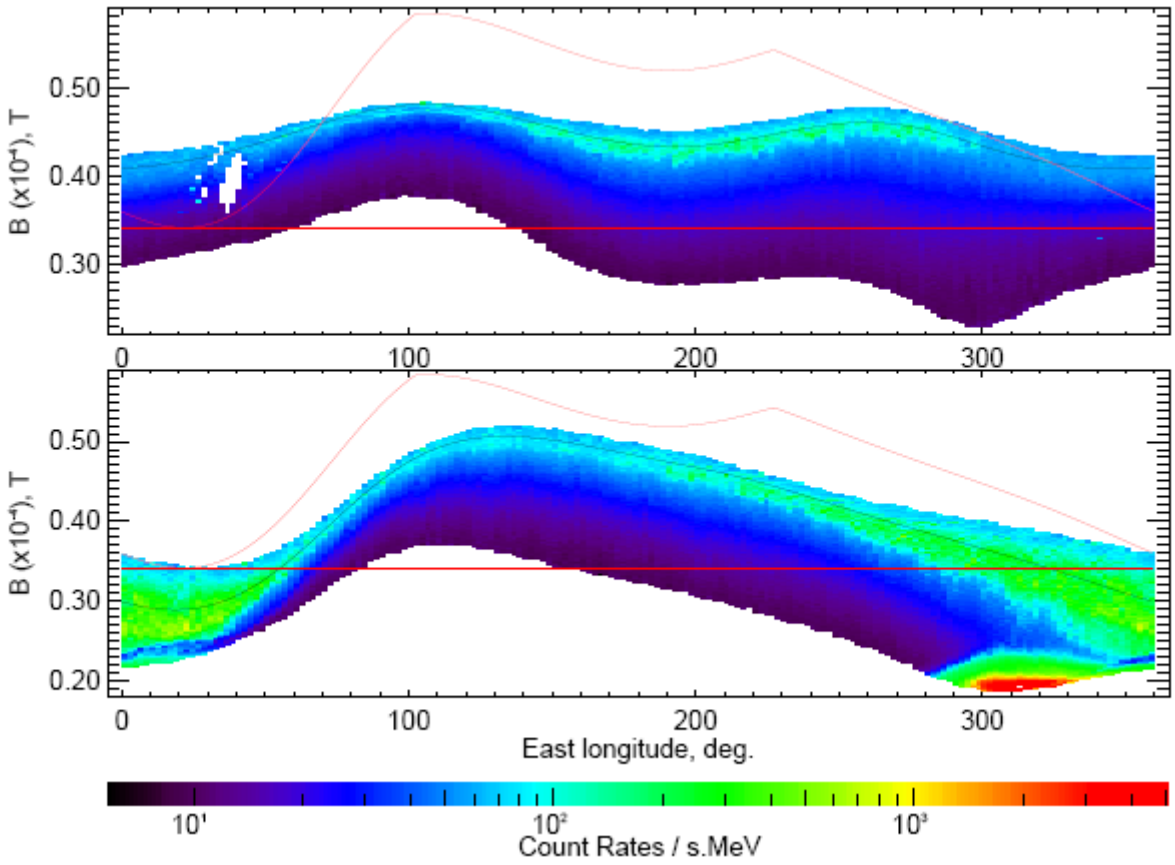

Fig.2. The longitude distribution of 3 – 8.3 MeV CORONAS-I gamma rays at Northern (top) and Southern (bottom) Hemispheres for L – shells between 1.6 and 6. The black line indicates L=3.9 at 500 km altitude, and atmospheric loss cones at L=3.9 are illustrated by the red curves.

CORONAS-F [6,13,21].

SONG instrument on low altitude polar orbiting satellite CORONAS-F was measuring continuously the energetic particles both electrically charged as well as gamma rays and neutrons from August 2001 until December 2005. Large amount of measurements was analyzed in cooperation with Skobeltsyn Institute of Nuclear Physics, Moscow State University, Russia. About 40 high energy solar gamma ray emission events were identified from the data in years 2002

and 2003. First results using data from instument SONG on CORONAS F are in [13].

The unusually strong solar, interplanetary and geomagnetic disturbances observed in late October and in November 2003 produced also emissions of high energy solar gamma rays.

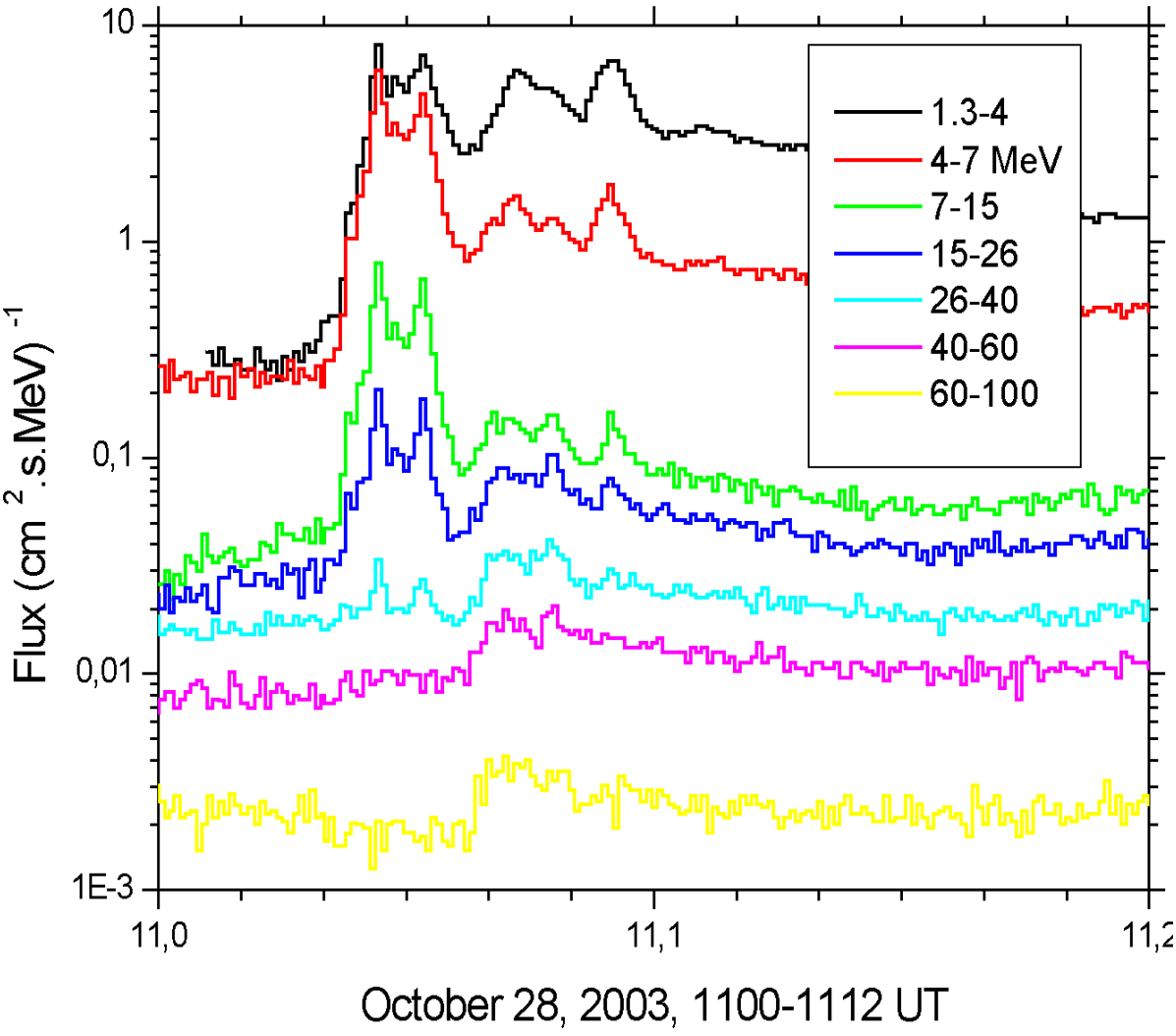

Fig. 3. The flux of gamma rays observed by SONG-M from the solar flare on October 28, 2003. The flare was of class 17.2 and of importance 4B, its coordinates were S16E18. A double structure with different spectral slopes is apparent. The Second impulse at ~ 1104 UT has much harder spectra than the first one and indicates the nuclear reactions induced by accelerated protons with the production of neutral pions.

The strong geomagnetic disturbances in late October – November 2003 lead also to unusual redistribution of the energetic electrons of the outer radiation belts, as observed on CORONAS-F.

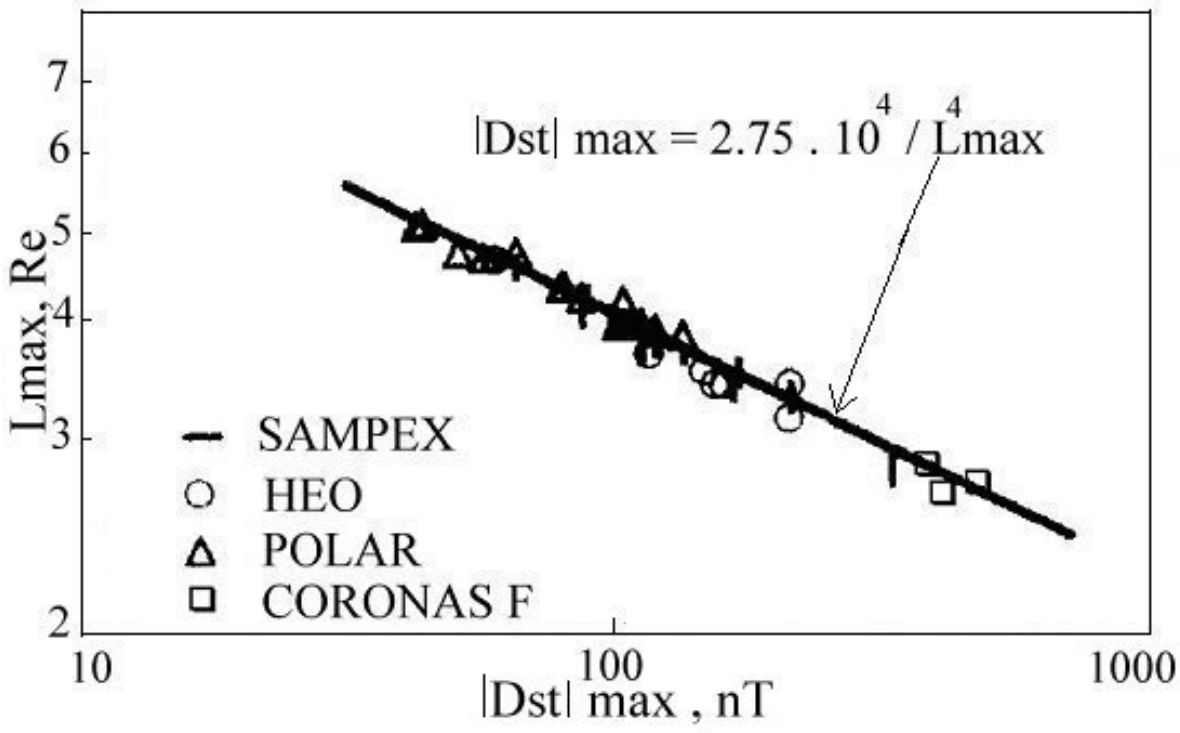

Fig. 4. During the three geomagnetic storms in late October and in November 2003 a strong shift of the position of the outer electron radiation belt maximum to unusually low L values was observed by CORONAS-F. It was possible to test the value of the shift earlier found empirically and confirmed at weaker geomagnetic disturbances. The three points added at the scatter plot L_{max} vs $|Dst|_{max}$, measured by SAMPEX, HEO accomplished by CORONAS-F indicate the validity of the relation between L_{max} and $|Dst|_{max}$ for strong disturbances.

DOUBLE STAR / NUADU [14,15].

Double Star mission (cooperation ESA and China) TC-2 was launched in China on July 25, 2004 onto the orbit with 90 ^{o} inclination, apogee ~38 thousand km and perigee ~680 km. The orbital period is ~11.5 hours. The NUADU instrument was constructed with participation of technicians and scientists of the Department of Space Physics in the frame of cooperation between STIL Maynooth, Ireland and IEP SAS, under the supervision of Prof. Susan McKenna-Lawlor, PI of the experiment. After the launch the instrument started to work correctly according to the expectations based on tests before the launch. The first examples of events with energetic neutral atom emission indications have been found.

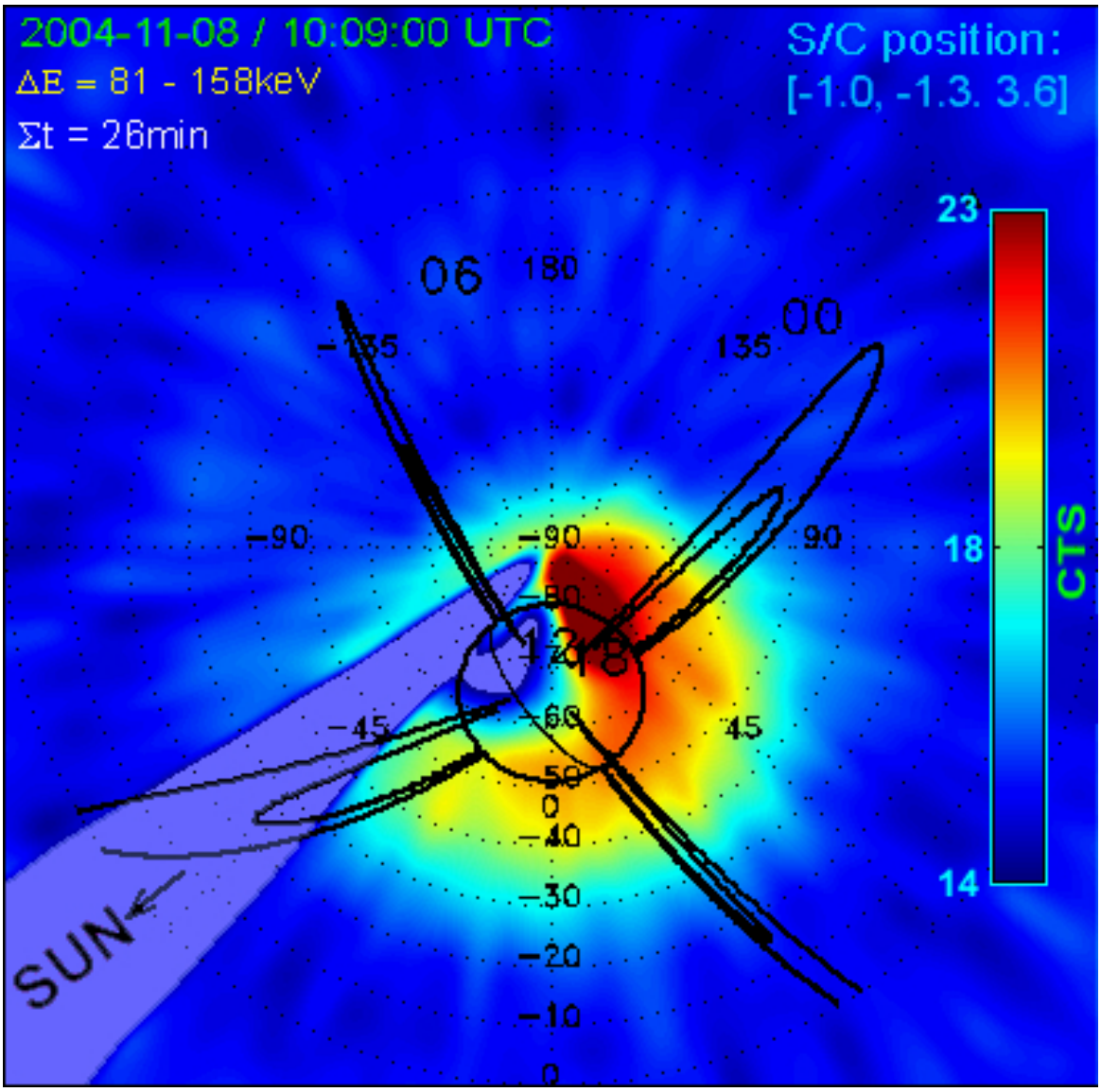

Fig.5. Example of intensity of energetic neutral atoms observed by NUADU experiment on Double Star TC-2 during the geomagnetic storm on November 8, 2004.

GROUND BASED MEASUREMENTS. MAGNETOSPHERIC TRANSMISSIVITY FOR COSMIC RAYS. [2,9,11,12,16,21,22].

Data from cosmic ray continuous measurements by neutron monitor at Lomnický Štít with 1 min resolution are now available in real time at http://neutronmonitor.ta3.sk. The modulation of cosmic rays in the heliosphere and sensitivity of neutron monitor to galactic cosmic rays was studied. Connections between cosmic rays, solar variability and space weather effects, as well as temporal evolution of quasiperiodicities in cosmic ray records were examined.

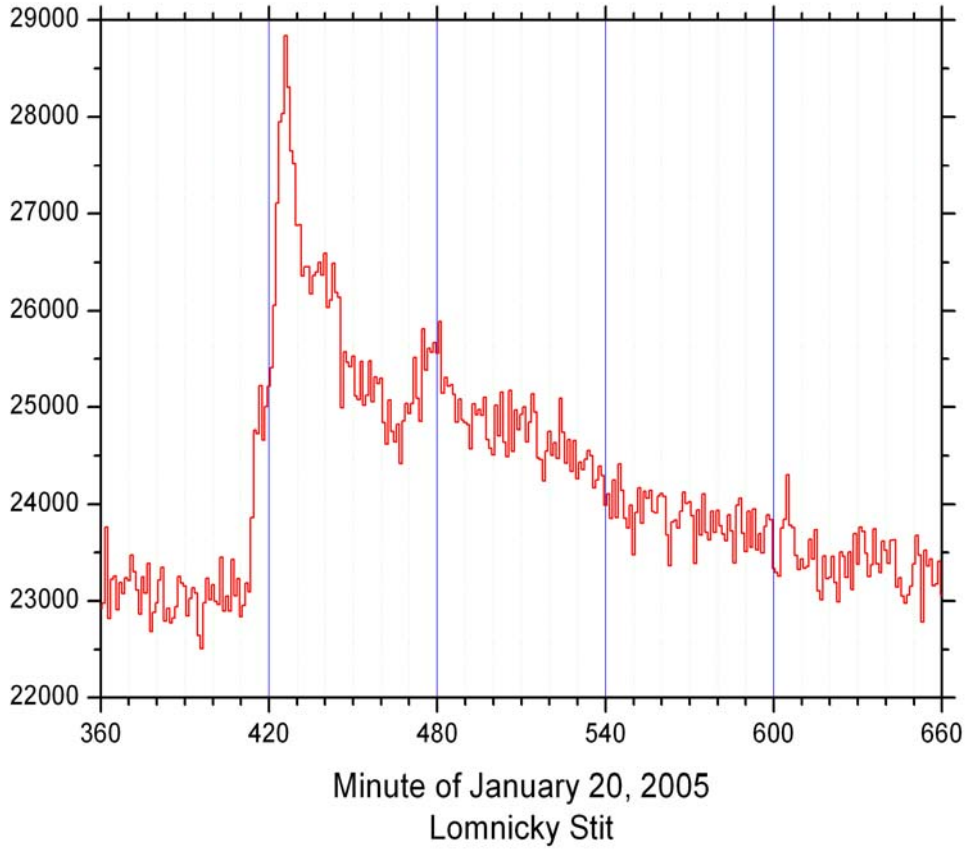

Fig.6. Ground level event observed at Lomnický Štít neutron monitor on January 20, 2005. Particle with the energy above that corresponding to the vertical cut-off rigidity (~4 GV) are indicated to be accelerated at the Sun with maximum at ~0707 UT. The effect was strongly anisotropic.

The geomagnetic effects on cosmic rays have been checked by methods of trajectory computations in model geomagnetic field. Besides the transmissivity in the disturbed magnetosphere also the estimates of its changes during the past period using available magnetic field representations were computed.

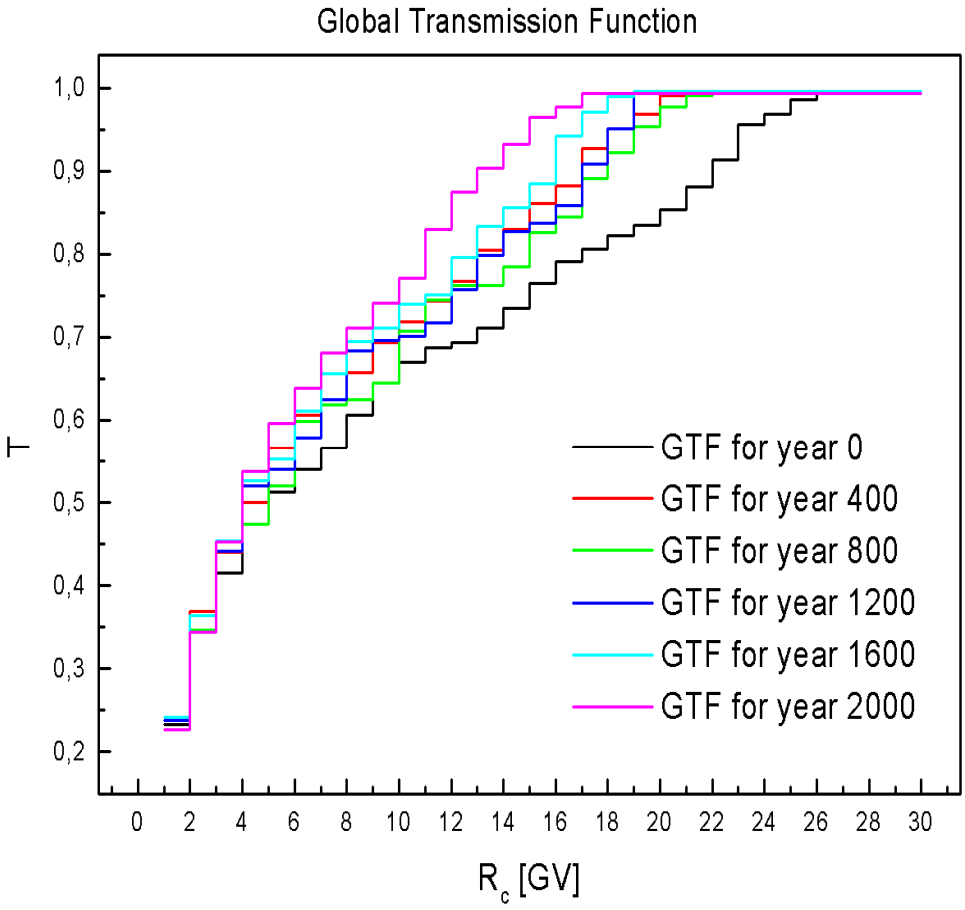

Fig.7. Global transmission functions for different epochs. The fraction of the Earth's surface at which the vertical access of cosmic rays is allowed above a given value R_c.

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During the years 2004-2005 the ***Faculty of Mathematics, Physics and Informatics, Comenius University, Bratislava*** continued mainly in the modeling of cosmic-ray induced reactions leading to the production of cosmogenic nuclides and gamma rays.

We participated in Mars Odyssey mission experiment with gamma ray and neutron spectrometer. Our contribution was in simulation of expected gamma ray fluxes and comparison of our simulation with obtained experimental data. Based on this, algorithm for deconvolution of measured spectra into chemical composition of surface was developed. For this mission we carried out simulations of gamma ray production and transport from the point of origin to the detector. About two hundred different chemical compositions were supposed and simulated. The results of simulations were used for the study of dependence of production rates of gamma rays on chemical composition, water content and thickness of atmosphere. Results of our simulations are used for physical interpretations of measured fluxes of gamma rays and neutrons escaping from the surface of Mars. For validation and benchmarking our simulations thick target experiment simulating the cosmic ray protons bombardment of martian surface was carried out a few years ago. Finaly we got to the interpretation of this experiment. In collaboration with colleges from LPL in Tucson and from UNM Albuquerque we carried out simulation of production of rare gases at the surface of Europe and carried out study for prospects of in situ chronology.

A number of meteorites were studied from the point of view of cosmogenic nuclide production, their exposure histories, and other effects and processes occurring in the parent bodies. Result of these studies were used for determination of their origin, exposure age, terrestrial age and other characteristics. Relation between Martian atmosphere and regolith composition was studied by investigation of neutron-capture produced cosmogenic nuclides that were used as tracers of exchange processes between surface and atmosphere. For Jupiter moon Europe, we evaluated the production of rare gasses and their possible use for determination of exposure ages of Europe`s surface. At present we are involved in preparation of Mars Smart Lander mission experiment measuring in situ production of cosmogenic nuclides.

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At the ***Geophysical Institute of the Slovak Academy of Sciences, Bratislava***, the study of the Sun-Earth interactions during the 2004–2005 period was carried out from the viewpoint of space weather and its variability. The non-linear processes in the Sun-Earth system were studied. The analysis of non-linear characteristics of the magnetic field was carried out and it was shown that interplanetary disturbances with a significant portion of intermittent fluctuations are more geoeffective [1]. To better understand the relative contribution of intermittence to the efficiency of solar wind – magnetosphere coupling the correlations between the fluctuations and the mean values of some geoeffective parameters were investigated. The key role of intermittence in the interaction processes between the solar wind and magnetosphere was shown for intervals of enhanced disturbances [2, 3].

The identification of characteristics of nonlinear fluctuations of the studied physical parameters at the Sun, in the solar wind and within the different regions of the Earth's magnetosphere allowed to construct a generic picture of multiscale couplings for the plasma processes in the Sun-Earth system. In line with this new picture the primary solar energy is non-homogeneously and intermittently distributed within the solar atmosphere and in the solar wind over magnetohydrodynamic time and spatial scales. According to results obtained on mezo- and microscales, the non-homogeneous distribution of the energy also influences the interaction processes between the solar wind and the Earth's magnetosphere. Moreover, magnetic fluctuations in the polar regions of the Earth and within the magnetotail show similar qualitative multiscale and intermittent characteristics as the fluctuations in the solar wind, however, scaling features typical only for the Earth's magnetosphere are also present [1, 4, 5].

A new neural network (NN) model for prediction of Kp indices during geomagnetic storms was proposed. The NN model based on the one-hour averages of solar wind parameters Bz, n, and V measured at libration point L1 was proposed. Altogether 34 networks were considered for pairs of values for the number of hidden nodes and length of input vectors as chosen taking into account results of the validation test. Within the final test of the NN model the prediction profiles during three storm intervals on 26–29 August 1998, 18–22 October 1998, and 7–11 November 2004 were performed. The averaged statistical parameters indicate quite good coincidence of observed and modeled Kp values. The comparison with results of modeling based on three-hour averages gives evidence that in case of NN model based on the one-hour averages the more accurate Kp predictions during the selected storm intervals were obtained [6].

The study of dynamics of plasma precipitation boundaries location at ionospheric altitudes improves our understanding of the magnetospheric magnetic field variability and promotes its more adequate modeling. Empirical relationships to calculate the plasma precipitation boundary location are representative for both magneto-quiet and disturbed conditions. The results reported can be used for aims of space weather forecasting [7].

The satellite data of monitoring the geomagnetic field (GOES data) and space measurements of particle precipitation (DMPS data) were used for the modeling of global magnetic disturbances. Within the frame of international co-operation the 24–26 September 1998 intense magnetic storm was analyzed in detail. Its modeled profile replicates the storm development in a better way when the significant contribution of the magnetotail current to the Dst variation is taken into account. Its enhanced magnetic effect can be explained by the tail current sheet shifting to deep L shells (up to ~4 R_E) during the storm main phase [8]

The results of the extensive analysis of changes of most known meteorological characteristics (air temperature T and precipitation totals P) from the chosen sets from the world-wide network of meteorological stations were summarized. As shown, the modulation of the T and P profiles by solar forcing on the time scale of cyclic and secular changes appears to be apparent in spite of some irregularities can be indicated. Due to non-linearity of the climatic system these irregularities can be explained in terms of its limiting behavior which allows the transition from a regular regime to chaotic oscillations by means of the Feingenbaum mechanism [9].

At the ***Department of Astronomy, Physics of the Earth, and Meteorology, Faculty of Mathematics, Physics and Informatics, Comenius University, Bratislava,*** the height-dependent response of the ionosphere was analyzed with regards to solar cosmic rays variability. Data on solar proton fluxes measured by satellites “Meteor” were used for calculations of ionization rates. GOES 7 1-8A X-ray fluxes were used as well as electron density enhancement after the October 1989 SPE was as much as three orders of magnitude at 50–60 km. Simulated response of the lower ionosphere to solar energetic particles for different seasons showed that the increase of electron density was greater for July 2000 SPE than for the October 1989 SPE. This result is in agreement with absorption measurements. Strong contribution of neutral species changes after SPEs seems to be the main factor for seasonal character of the ionospheric response to SPEs. The model simulations of the D-region ion composition and electron density response to strong solar proton events were based on measurements (GOES 8 satellite) of SPE fluxes and X-rays fluxes [10, 11].

Measurements of the Schumann resonance frequencies (first 4 modes at about 7.8, 14, 20 and 26 Hz) at Modra Observatory were analyzed with respect to the strong solar energetic proton flux in October 2003. For the determination of the onset of perturbations, satellite data from GOES 11 were used. No significant effect on frequencies or amplitudes was revealed [12].

In the ***Department of Astronomy, Physics of the Earth and Meteorology, Faculty of Mathematics, Physics and Informatics, Comenius University, Bratislava,*** some issues have been studied using the satellite data, e.g. SOHO (SUMER, MDI, EIT), TRACE, and GOES.

The SOHO/SUMER observations of EUV bi-directional jets were studied. The phenomenon was observed in chromospheric S III 1251.16 Å and C I 1251.17 Å, transition region N V 1238.8 Å but there was no detectable signature in the coronal line Mg X 625 Å. However, TRACE imager with the 171 Å filter detected the phenomenon clearly. The discrepancy was explained using a non-Maxwellian electron distribution. This could also have implications for other phenomena observed in the TRACE pass-bands, including the transition region `moss' and the 3- and 5-min oscillations [13].

The flare accompanied with a surge was analyzed in EUV (TRACE), Hα, radio and HXR (GOES). The observed structure of the flaring active region and its topology was compared with the potential magnetic field model. The start of the surge was accompanied with HXR pulses, type III radio bursts, several slowly negatively drifting features and with huge EUV brightening close to the position where quasi-separatrix layer cuts the photosphere. The magnetic reconnection as a driving mechanism for this surge was discussed [14].

Assuming the presence of non-thermal (power) distribution of electrons during the impulsive phase of a flare, the theoretical line synthetic spectra (X-ray) for Fe XXV were calculated. The series of models were computed for the observed temporal evolution of plasma temperature, density and with the assumption of different temporal evolution of the shape of the distribution function. The results confirmed that under the strongly non-thermal distribution of electrons the ratio of satellite lines to allowed lines increases [15, 16].

Computation of the excitation equilibrium of Fe IX – Fe XV for non-thermal (power) electron distribution shows that at given temperature and electron density the excitation rates increase significantly with the deviation of the distribution function from the Maxwellian one while the de-excitation rates are not influenced so much. As a result, the population of higher levels increases and the emissivities of lines belonging to the transitions starting from these levels also

increase. The synthetic spectrum at 180–300 Å was computed for different power distributions, mean energies of distribution and electron densities. [17].

The influence of the electron power distribution on the excitation equilibrium of He-like Si and Ca has been studied. The changes in the excitation equilibrium increase with the increase of the deviation of the distribution shape from Maxwellian one. For strongly non-thermal distribution also the unusual line ratios can be found. The possibilities to diagnose the shape of the distribution from line ratios in solar flare plasma are showed [18].

The possible connection between C IV enhanced emission and non-thermal distribution has been studied. C IV flare intensities vary by factor of 3400 over preflare levels. This anomalous intensity enhancement can be explained by the presence of the non-thermal distribution with the enhanced number of particles in high energy tail. The synthetic spectrum for this type of the distribution has been computed. The observed enhanced emission of C IV resonance lines of the transition region (TRACE) is compared with location of magnetic structures (SOHO/MDI) and with the intersection of quasi-separatrix layers with photosphere [19].

Hα and EUV filaments (Astronomical and Geophysical Observatory, FMFI UK, Slovakia, TRACE 195 Å, respectively) associated with C-class flare have been observed in active region NOAA 10 582 on March 31, 2004. Several shorter threads were lying almost along the inversion line creating the longer filament seeing in absorption. The part of filament interacted with dark loop of near arch filament system during C-class flare. The X-ray images (Solar X-ray Imager) have been used to identify the hottest part of flaring filament. The SOHO/MDI longitudinal photospheric magnetogram has been used for the potential and linear force-free field extrapolation of magnetic field of the active region. The structure of the extrapolated magnetic field has been compared with observed EUV and Hα structures and a possible reconnection scenario has been suggested [20].

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The activities of ***the Astronomical Institute of the Slovak Academy of Sciences (AISAS)***, Tatranská Lomnica (http://www.astro.sk), related to COSPAR, were devoted to the research in solar and stellar physics using satellite observations, mainly in the UV, XUV and X-ray spectral regions. Solar data concern mainly the current SOHO mission and the TRACE satellite and previous satellites of the NOAA and GOES series. Stellar data of the IUE satellite and the Hubble Space Telescope were used for research of various variable stars. Some other studies were focused on the solar corona emission and the cosmic rays with respect to the solar cycle.

In the research of interacting binaries with a long orbital period (the symbiotic stars) the archival ultraviolet spectra made by the IUE (International Ultraviolet Explorer) and the HST (Hubble Space Telescope) satellites were used and a new method of disentangling the composite spectra of symbiotic binaries in the range of UV/optical/IR wavelengths was developed [14-18]. This approach allowed to determine precise quantities of physical parameters of the individual components of radiation. In addition, modeling the far-UV continuum around the Ly-alpha line revealed the effect of a strong Rayleigh scattering of hard UV photons on a huge slab of neutral atoms of hydrogen (Fig.8) [16].

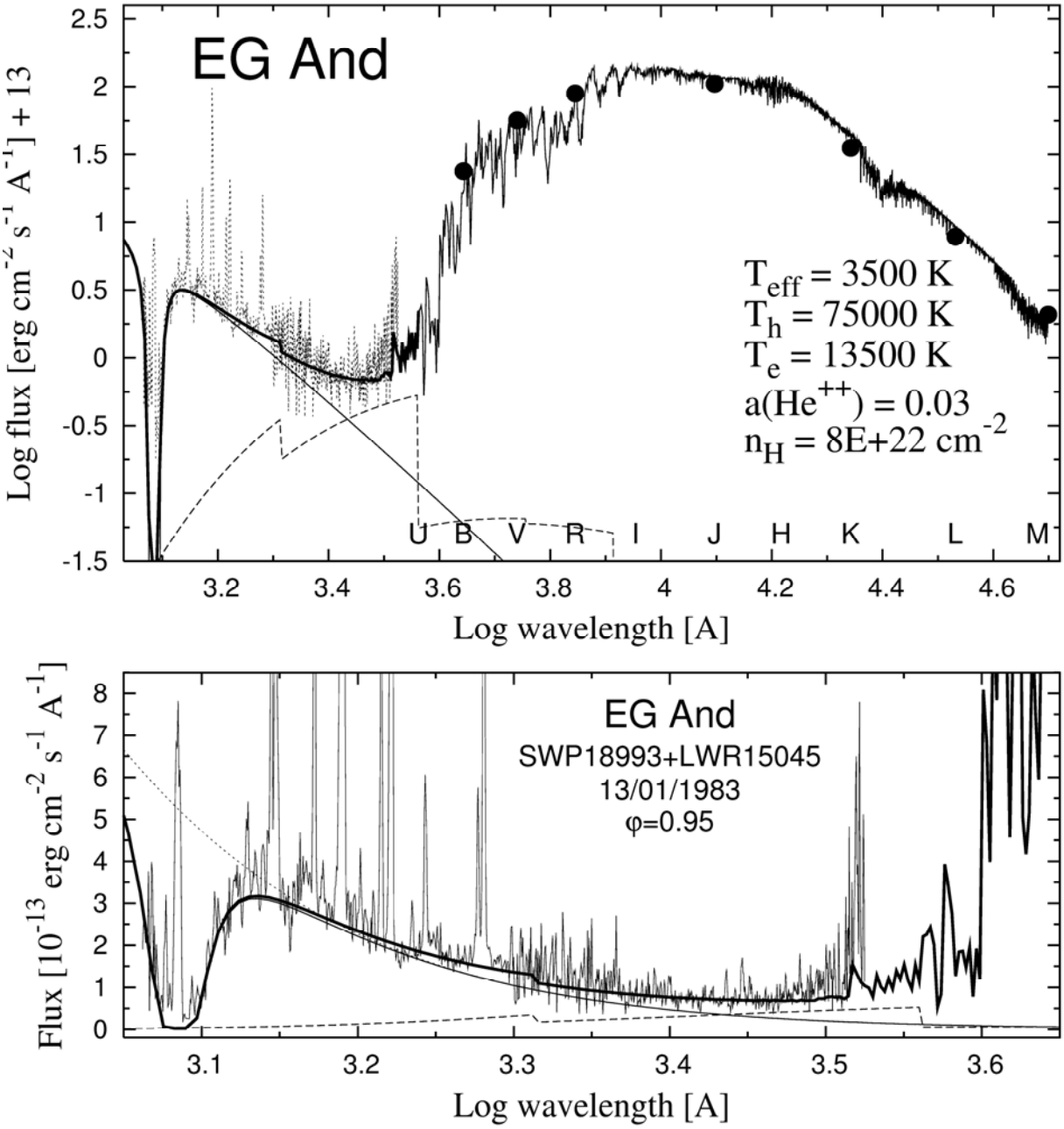

Fig. 8. Top: Reconstructed SED in the UV/optical/IR continuum of EG And. Solid thin and dashed lines represent the hot stellar and the nebular component of radiation. The solid thick line is the resulting modeled continuum. Radiation from the giant is represented by the synthetic spectrum. Bottom: A detail of the top panel covering the ultraviolet region. Note the pronounced Rayleigh attenuation in the far-UV due to 8E+22 atoms of hydrogen on the line of sight [S2].

Application of our method [14] to a sample of 21 symbiotic systems led to revealing of common characteristics of the UV-continuum during outbursts. In was interpreted in terms of an edge-on flared disk surrounded by the neutral material at the orbital plane and the nebula located above/below its surface (Fig. 9).

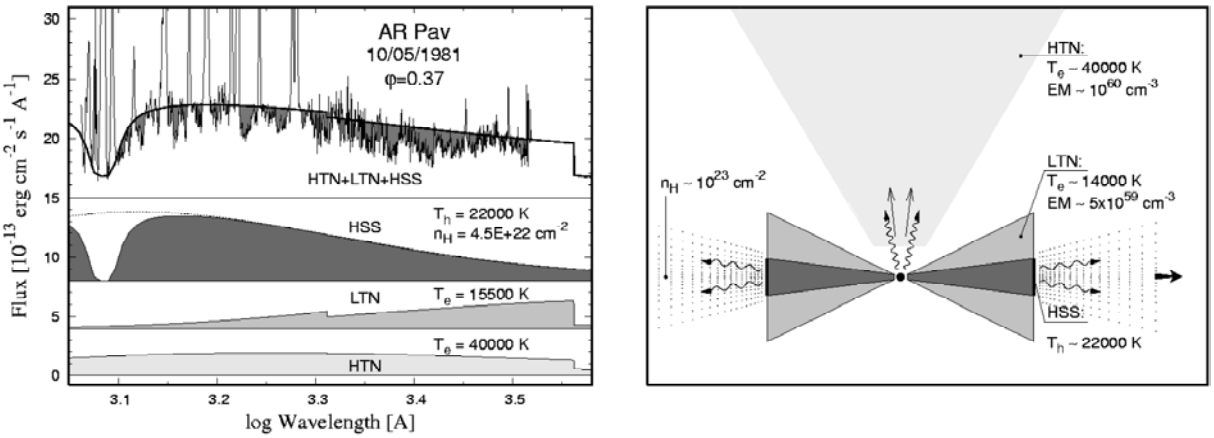

Fig.9. Schematic representation of a basic structure of hot objects in symbiotic binaries during outbursts. Left: Individual components of radiation isolated from the AR Pav spectrum. Right: A sketch of the corresponding emitting regions as seen on a cut perpendicular to the orbital plane containing the accretor [S1]

On the basis of spectral energy distribution in the UV/optical domain main features of a complex behaviour observed in the light curves of symbiotic binaries were explained, e.g., the wave-like variation as a function of the orbital phase produced by the orbitally-related variation in the emission measure of the symbiotic nebula [15].

Dynamics and energy transfer in the outer layers of the solar atmosphere was studied in a series of papers devoted to quiet solar network and to active events in the supergranular internetwork with help of data acquired in frame of the SOHO/TRACE joint operation programs JOP078 and JOP171 using CDS, SUMER, EIT instruments on-board SOHO as well as the TRACE satellite. In particular, a particular explosive event and its relation to plasma in different temperature regimes was investigated [23,24], mutual relations of the upper layers of the quiet solar atmosphere in/above chromospheric network were studied in order to identify physical mechanisms which control energy transfer to the corona [5,6,12].

Three new runs of the SOHO joint observing program JOP 171 for instruments onboard the SOHO and the TRACE satellites were performed (June 5-9, 2004: MEDOC13 Campaign; July 8-15, 2004: VTT and DOT observing campaign; October 18-31, 2005: SST and DOT observing campaign). These data will be utilized in the near future. In particular very detail observational data have been acquired for a M5.4 solar flare on July 13, 2004 [7].

Investigation of the space-time distribution of the solar corona brightness revealed a number of regularities over more than five solar cycles. A pronounced north/south asymmetry of the solar corona was identified and discussed including the quasi-biennial oscillations and rotation of the solar corona [2,3,4,19].

Archive data of the X-ray flares acquired on the orbit (as well as H alpha obtained on the ground) were investigated statistically in order to derive periodicities of their occurrence around the rotational period as well in the interval of the intermediate periods [1,11,13,20,21]. The 24-day periodicity of the solar flares was explained [22].

Relations of the cosmic rays and the green coronal index variability to the space weather were studied [8,9,10].

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3. LIFE SCIENCES.

The project "Effect of endurance training and subsequent physical inactivity on glycaemic control after oral glucose load and physical exercise in healthy men" was performed on the collaboration of the ***Institute of Experimental Endocrinology, Slovak Academy of Sciences (SAS), Bratislava, Slovakia*** and ***Department of Applied Physiology, Medical Research Center, Polish Academy of Sciences, Warsaw, Poland***

It was demonstrated that physical inactivity during space flight has a profound effect on glucose metabolism. The aim of this study was to test whether endurance training (ET) may improve a negative effect of subsequent -6° head-down bed rest (HDBR) on glucose metabolism. Fourteen healthy males completed the study consisting of 6 weeks lasting ET followed by 6 days HDBR. Oral glucose tolerance test (OGTT) and treadmill exercise at 80% of pre-training VO_2max were performed before and after ET as well as after HDBR. ET increased VO_2max by 11 %. ET significantly lowered while HDBR had no effect on fasting and OGTT plasma glucose levels. ET had no effect while HDBR was followed by an augmentation of insulin and C-peptide response to OGTT. Insulin sensitivity tended to increase after ET and to decrease during HDBR, however, mostly without statistical significance. Plasma glucose, insulin and C-peptide response to exercise were elevated after HDBR only. Our study shows that antecedent physical training could ameliorate a negative effect of simulated microgravity on insulin-mediated glucose metabolism.

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The research work on the project " Influence of simulated microgravity on human postural responses to sensory stimulation" was performed at ***the Institute of Normal and Pathological Physiology, SAS, Bratislava*** in research collaboration with ***NSI- Oregon Health Science University Portland, USA (Research Collaboration on project: "Sensory Integration in Spatial Orientation for Stance and Gait"***). The aim of project was to investigate the role of altered sensory interaction in postural instabilities after space flight. It was noted that altered sensory interaction influenced human body orientation in space on the Earth and also during microgravity condition. The postural orientation during a combined somatosensory and visual stimulation was tested. Results showed that a stable visual scene is important for the successful reaction of human balance control system. During rotation of visual scene the postural response to muscle vibration were started as in condition with absence of visual input.

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XVIIth Conference on Postural and Gait Research, May 29-June 2, 2005, Marseille, France, Gait & Posture, vol.21, 2005, p. S27. ISSN 0966-6362

The research work on the project "Accumulation and persistence of cytogenetic damage induced by radiation and other factors of space flight" was performed at the ***Institute of Biological and Ecological Sciences, Faculty of Sciences, Šafárik University, Košice .***

In relation to previous findings from this laboratory, regarding the transgenerational transfer of radiation-induced genomic damage of intact and regenerating liver of rats, now the rate of elimination of damaged cells by the mitotic death in course of ontogenesis was studied. The elimination of damage was investigated in embryonic tissues and brain of progeny of irradiated rat males at various stages of intrauterine and postnatal development. It was found that mitotic activity was decreased and frequency of chromosomal aberrations, mainly chromosomal bridges, was increased in embryos and brain (hemispheres and little brain) of sucklings. The effects transferred to progeny from irradiated spermatids (induced by irradiation of males of F_0 generation with the dose of 3 Gy 25 days before fertilization) were more marked as effects transferred from irradiated spermatogonia (induced by irradiation 80 days before fertilization). During embryonic development and early postnatal period, the changes of mitotic index partially alleviated. The incidence of cells with irreparable DNA damage (chromosomal bridges), however, was high till the end of experiment. These findings we consider as a manifestation of increased genome instability induced in the progeny by paternal irradiation with the sublethal dose of gamma irradiation.

In the brain of adult rats, the cell proliferation occurs only in very few places, including the rostral migratory stream (RMS) where the proliferation continues until reaching the olfactory bulb. Therefore effect of ionizing radiation on proliferating cell numbers in the RMS of male rats of parental generation was investigated 25 and 80 days after whole body gamma irradiation with the dose of 3 Gy. Temporary increase (by 30 %) in proliferation was seen in the whole RMS at 25^{th} day after irradiation. The most distinct increase occurred in the RMS vertical arm (by 60 %) and elbow (about 37 %). The numbers of dividing cells reduced till 80th day after exposure. These results showed that gamma radiation significantly affected the extent of cell proliferation in the adult rat RMS.

The study of cytogenetic changes in the brain of adult rats exposed to the sublethal dose of ionizing radiation and in their progeny may be important in respect of long-term space flight effect on genome stability.

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The project “Automated Electronic System for Experiments with Stress Loadings by Hypergravitation was performed with the participation ***of Institute of Experimental Endocrinology, Institute of Animal Biochemistry and Genetics and Institute of Measurement Sciences, all in the Slovak Academy of Sciences, Bratislava.***

Special equipment was developed in ***Institute of Measurement Sciences***, which serves for implementation of series of experiments on small animals that are exposed to hypokinesia or hypergravity during different time intervals. The instrumentation is equipped by telemetric control system for programmable blood collection using cannulation from experimental animals located in hypokinetic boxes or on a centrifuge. The goal of experiments is monitoring of an influence of gravity changes on blood properties during different gravitational acceleration values G, evaluation of hormone levels, neurotransmitters and metabolite plasma concentrations. Important fact is that this equipment is able to cool collected samples of blood during centrifugation and thus protect a degradation of hormones, neurotransmitters during the experiments. Results serve for evaluation of living organism ability to overcome the stress load.

The new set of the automated electronic system consists of a transmitter and receiver equipped by microcomputers, 28 pairs of active rotor stepping motors, each driving two pairs of syringes. Transmitter and data signals receivers are active on frequency of 433,92 MHz using modulation ensuring high immunity towards malfunction. The equipment is controlled by computer equipped by interactive user-friendly program.

The equipment can be also used for study of microgravity effects in the animal organism during space flights for the understanding of the mechanism of the activity changes of neuroendocrine system and metabolic processes. Successful tests on animals has been performed in the project “Neuroendocrine function system changes during artificial microgravitational a hypergravitational exposition” Co-operational institutes: ***Institute of Experimental Endocrinology SAS, Institute of Biochemistry and Genetics of Animals SAS and Institute Measurement Sciences SAS.***

Fig. 10. Installation of the control part of a telemetric system on the centrifuge central axis

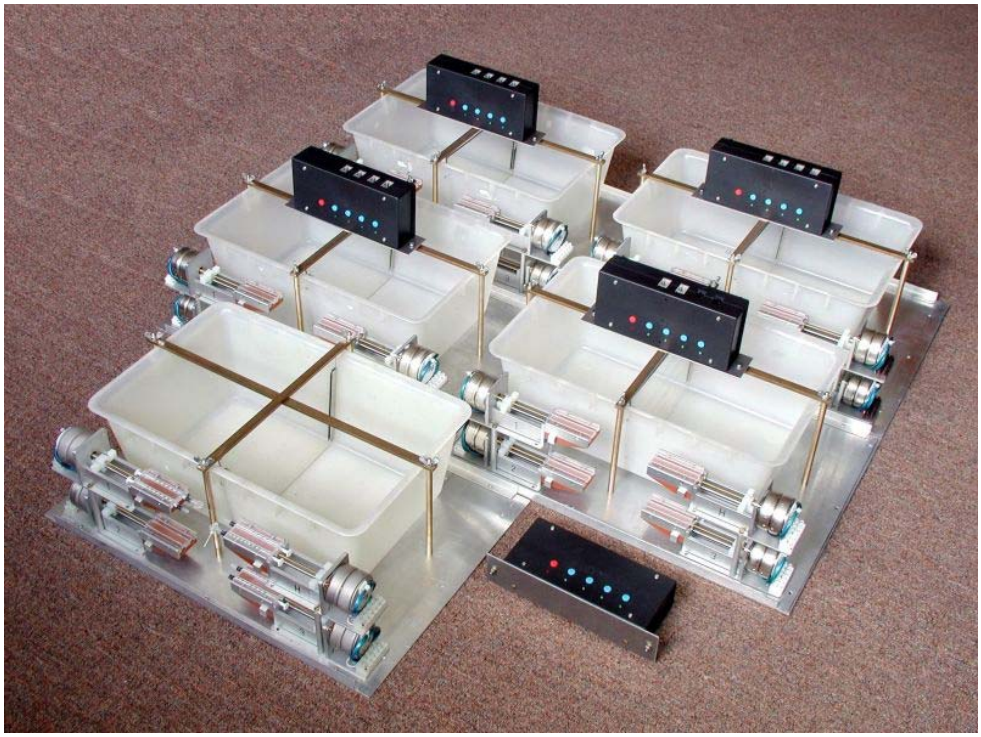

Fig. 11. Experimental boxes equipped by electronic control units and stepper motors for programmable blood collection.

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4. REMOTE SENSING

Research activities of the ***Institute of Geography, Slovak Academy of Sciences in Bratislava*** in co-operation with the ***Slovak Environmental Agency in Banska Bystrica*** in the field of remote sensing during the period 2004-2005 were focused on the identification, analysis and assessment of the land cover changes in Slovakia by application of the CORINE land cover 90 (CLC90) and CLC2000 data layers (derived from the Landsat TM images).

The CLC changes of Slovakia.

The largest changes of the total 2,070 km^2 (4.2 % of the total surface of Slovakia) were: changes of forest into transitional woodland/shrubs (580.3 km^2, see Figs. 12 and 13b), changes of transitional woodland/shrubs into forest (529.3 km^2), enlargement of complex cultivation patterns by 165.5 km^2 (most of it at the cost of arable land, by 132.1 km^2, see Figs. 12 and 13a), enlargement of the area of settlement, industrial, sport and leisure areas and transport units by 44.6 km^2, and water bodies with their inlet channels by 64.2 km^2 (http://atlas.sazp.sk).

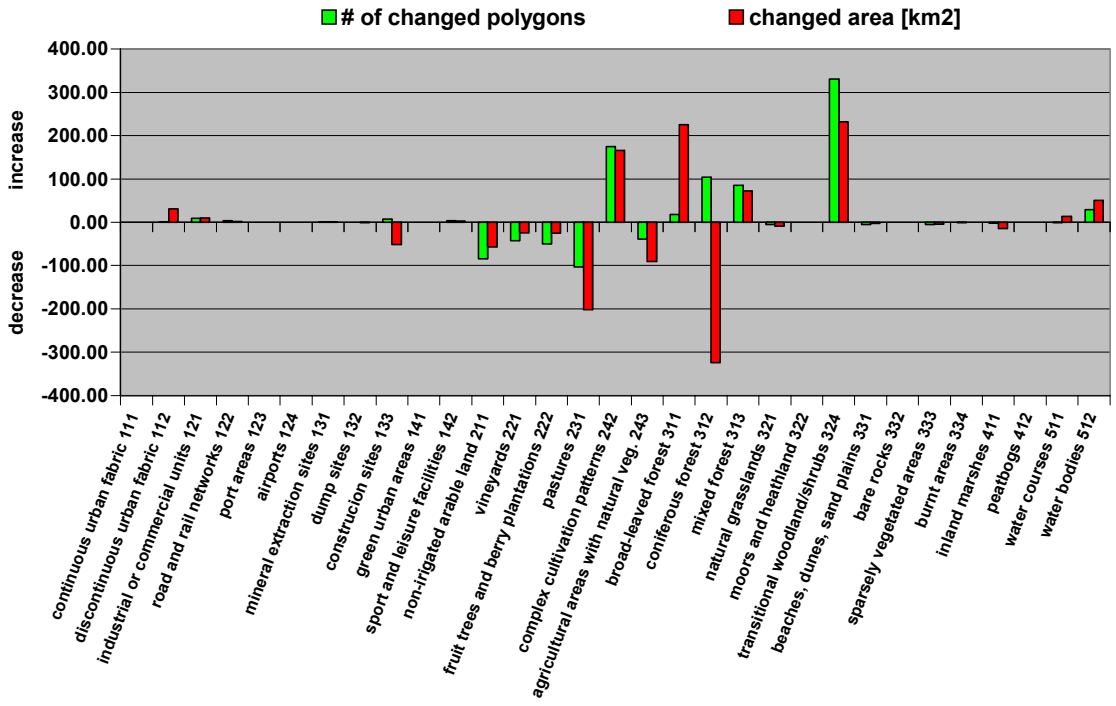


Fig. 12. Changes of CLC classes area in Slovakia for the period 1990-2000

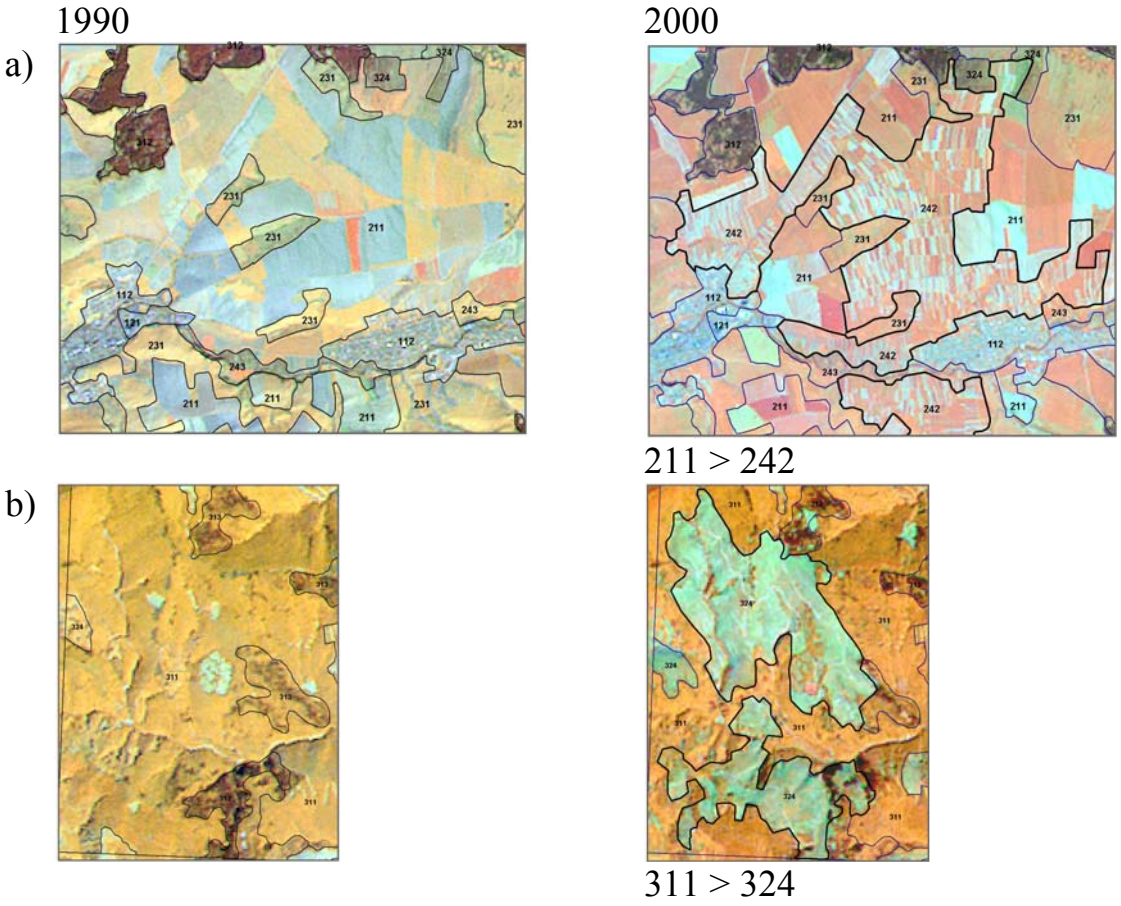


Fig. 13. Example of CLC changes, a) extensive change of arable land (211) to complex cultivation patterns (242), b) deforestation – change of broad-leaved forest to transitional-woodland/shrubs

Changes of the agricultural landscape in administrative regions of Slovakia in 1990-2000 identified by application of the CLC data layers. This example brings results of analysis and assessment of the changes of agricultural landscape in Slovakia in the years 1990-2000 obtained by change identification for the CLC classes 211 – arable land in favour of classes 231 – pastures and 242 – complex cultivation patterns (see Fig. 14). The area of class 242 increased by 13,111.7 ha above all in hinterland of rural settlements of northern and central Slovakia and in viticultural regions of south-western Slovakia (see Fig. 15). The cause of this change lies in restitution of farmland and its lease to new private farmers. The area of class 231 increased at the cost of the class 211 by 4,530.9 ha. This change was identified in almost all districts of mountain and sub-mountain regions of Slovakia and primarily it is due to the transformed agrarian policy of the State after political changes in 1989.

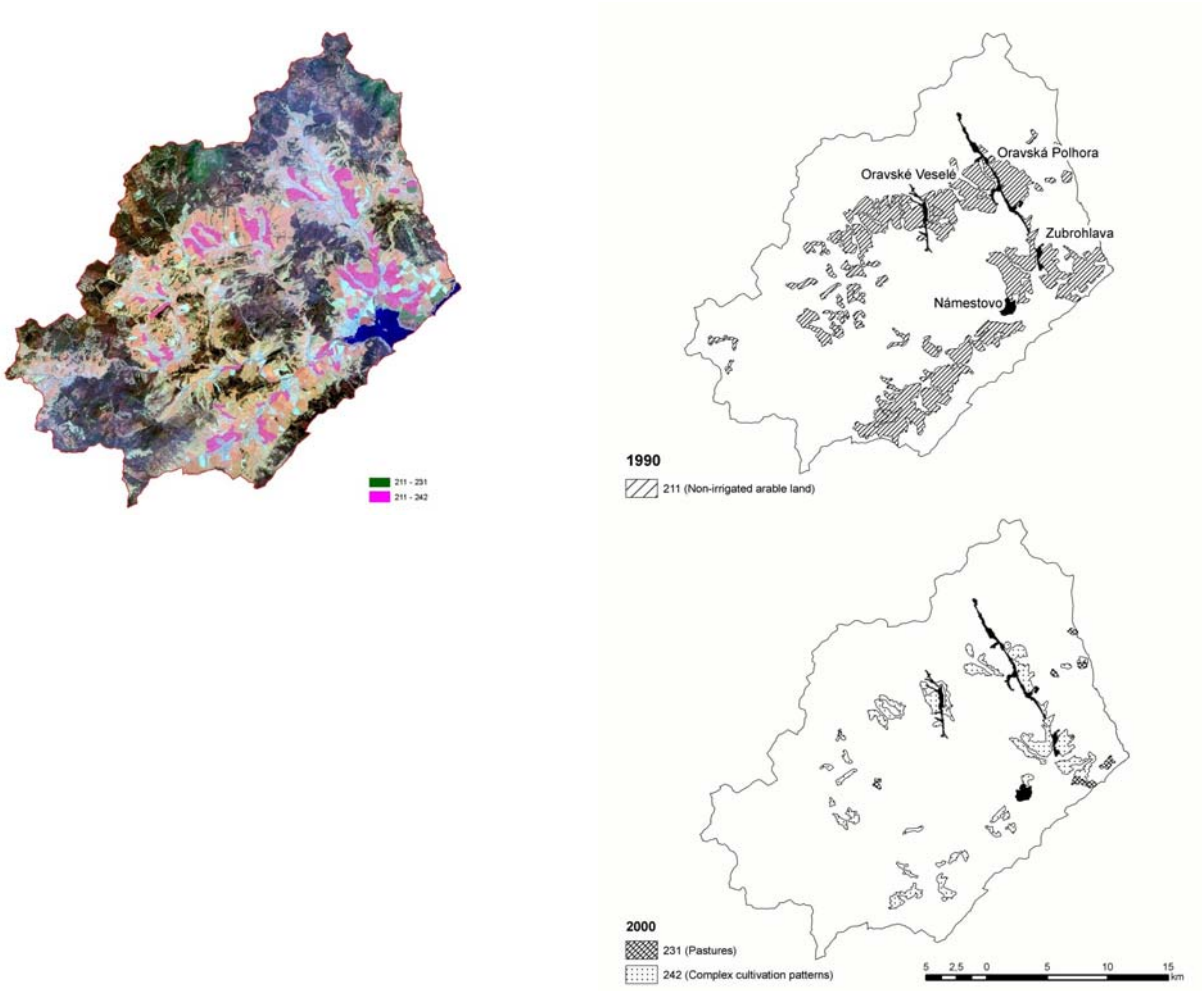


Fig. 14. GIS overlay of CLC90 and CLC2000 data layers with emphasis on identification of conversion from class 211 to classes 231 and 242) in the district Námestovo

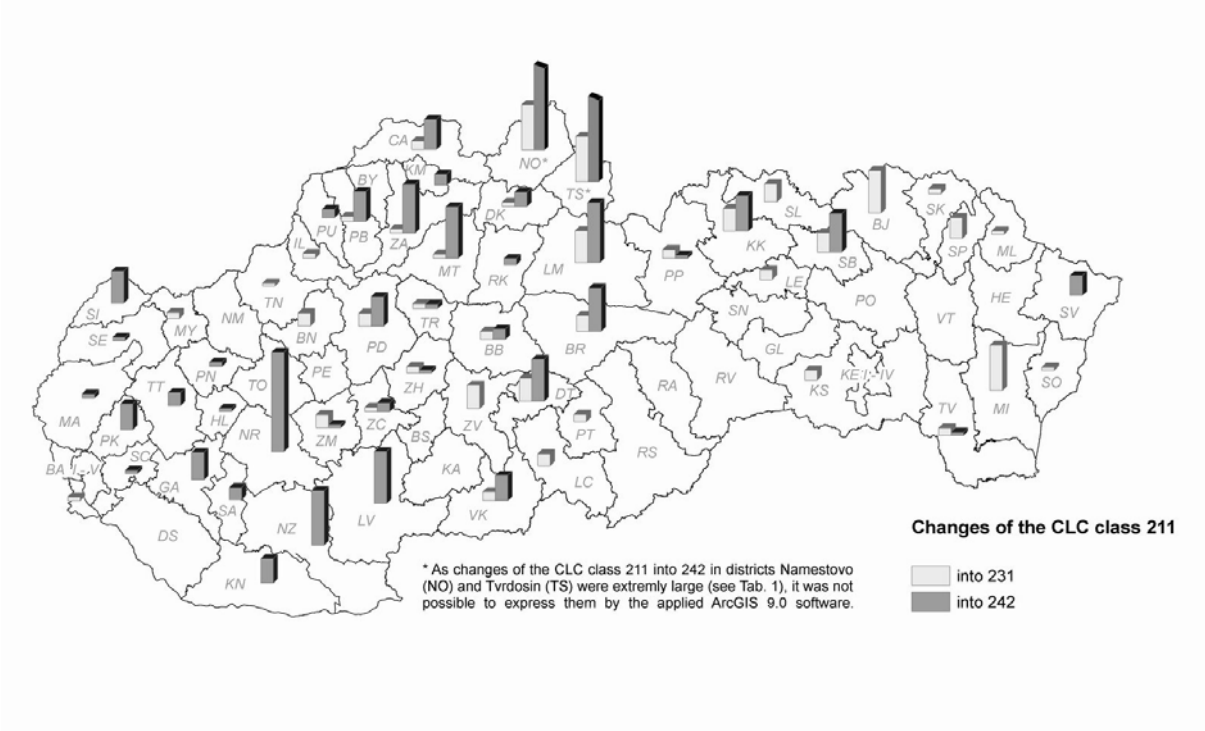


Fig. 15. Changes of the CLC class 211 into classes 231 and 242 according to administrative districts of Slovakia

Slovak Environment Agency was active in the following remote sensing projects/tasks in period 2004-2005 : land cover mapping and changes analyses, windstorm forest damage assesment, potential risc map of selected parasites, real time GPS service and participation in GMES initiative. Remote Sensing Dept. at Slovak Environment Agency is located in Banska Bystrica, it has 4 persons, using ESRI products Unix ArcInfo, Win ArcGIS, ArcView, ArcIMS, PCI product Geomatica and many open source SW supported by Debian and Solaris, futher info is accessible at URL http://www.sazp.sk/DPZ email dpz@sazp.sk

CORINE land cover 2000

This project was financed by Slovak Ministry of Environment and European Environment Agency. Institute of Geography, Slovak Academy of Sciences in Bratislava, as subcontractor of this project, was responsible of visual inter-pretation. Remote Sensing Dept. at Slovak Environment Agency completed these tasks: georeferencing of LANDSAT 7 ETM data over the whole Slovak territory, image enhancement for visual interpretation, mosaic of cloud areas by aerosurvey datasets, GIS processing of coverages and changes, topology building, statistic analyses, collection of metainformation, promotion of results via WEB site and CD ROM, development of MAP service (see Figs. 16, 17, 18 and 19). Further info about this project is presented in section about Institute of Geography, not to duplicate it in both sections. All results are publicly available via Internet.
http://www.sazp.sk/corine
http://atlas.sazp.sk

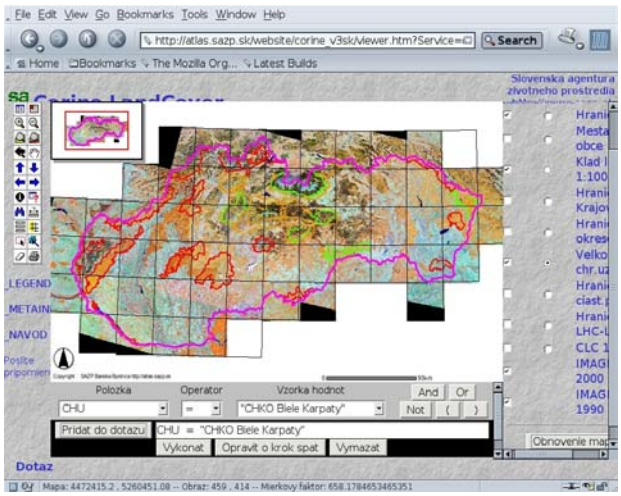


Fig. 16	*Overall mapservice design with satellite image mosaic of Slovakia from LANDSAT 7 ETM in 2000 and boundaries of protected areas.*

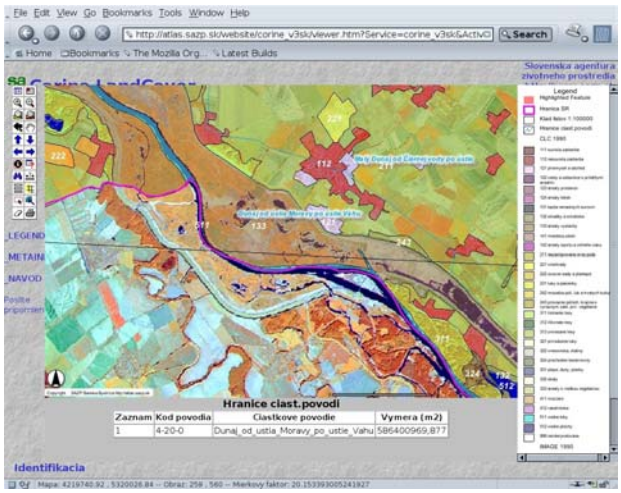


Fig. 17	*View at Gabcikovo near barrage system and land cover Dunakiliti in 1990 via interactive dynamic map service.*

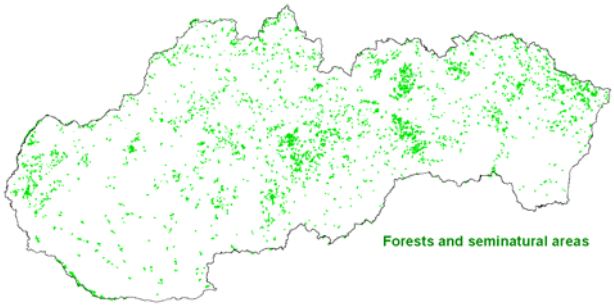


Fig. 18	*Spatial distribution of changes in forest and seminatural categories of land cover*

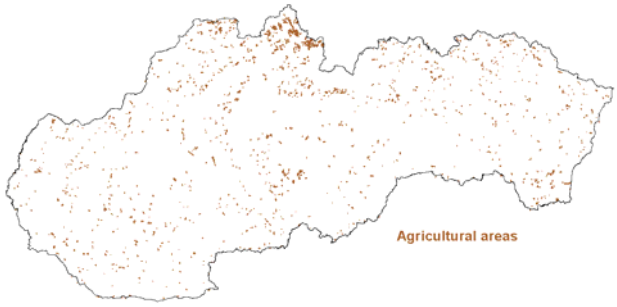


Fig. 19	*Spatial distribution of changes in agricultural categories of land cover*

Windstorm forest damage assesment

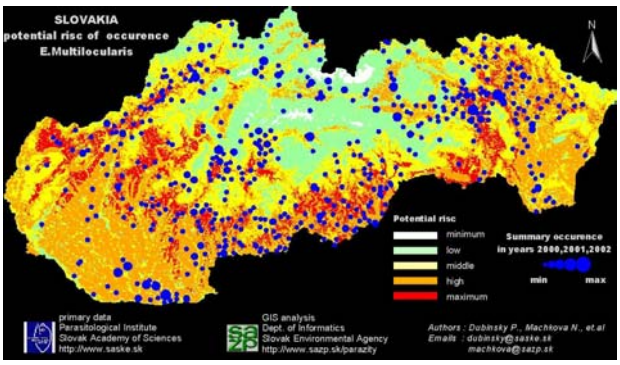
After windstorm in High Tatras region (19th November 2004) assesment of damaged forest area and volume was done thanks to immediate cooperation between JRC Ispra, Slovak Environment Agency, Forest Research Institute and National park TANAP. Several satellite datasources were used: RADARSAT, LANDSAT ETM, SPOT4, MODIS, ASTER. GIS layers from project CORINE land cover 2000 along with data from Forest Research Institute database were used later on overall revitalization study for High Tatras territory coordinated by Slovak Ministry of Environment. Proposal to buy new satellite images from summer

2005/2006 (IRS, LANDSAT or SPOT) to undergo detail analyses and planning was ignored by Slovak Ministry of Environment.

Region name	***forested area [ha]***	***damaged forest area [ha]***	***estimated damaged volume [m^3]***
Červený Kláštor	9661	8	1944
Vysoké Tatry	39180	5296	1355870
Rackova	7830	50	11076
Nízke Tatry		266	

Spatial modelling of selected parasites

Project is based on cooperation with ***Parasitological Institute, Slovak Academy of Sciences in Košice*** and many datasets collected from regional ***State Veterinary Service, Institute of Public Health and Hydrometeorogy Institute***. Multitemporal analyses along with GIS processing help to find spatial relations and develop risc map of potential occurences of selected parasites *Echinococus Multilocularis, Trichinella Spiralis,* Ixodes. These parasites cause several diseases especially alveolar echinococcosis, trichinellosis and lyme borreliosis. Spatial time sequence analyses of precipitation, temperature, landcover and other relevant phenomena are under preparation for model prototype (see Figs. 20 and 21). Results would be published in 2006/2007 in form of interactive map service via Internet and as a wall calendar at hospitals.
http://www.sazp.sk/parasites



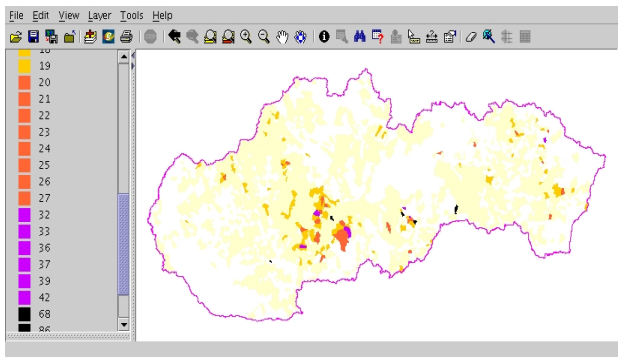


Fig. 20	*Potential risc map of Echinoccocus Multilocularis occurence in Slovakia*	*Fig. 21*	*Occurence of human lyme borreliosis per 100 inhabitants in Slovakia for period 1995-2004*

Real time DGPS service

Slovak Environment Agency Banska Bystrica in cooperation with ***GEOTECH Bratislava*** has ensured real time DGPS permanent service since 2003. It is accessible by users via GPRS. Older pernament DGPS service suitable for offline postprocessing is still functional (operative since 1998) and ensured by Remote Sensing Dept. directly in Banska Bystrica. NAVSTAR satellites are used at both LEICA reference stations which have accuracy suitable for GIS applications. Pernament measurements (24h 365d) with interval 1s are archived in raw and RINEX format.

GMES

Global Monitoring for Environment and Security as the European initiative depends on EC and ESA agreements. ***Slovak Environment Agency, supervised by Slovak Ministry of Environment, represents Slovakia at official GMES meetings***, where we support implementation of CORINE and INSPIRE project and experience into the GMES services, but we disagree with commercialization of GMES services especialy in case of disasters, rescue operations and environment protection.

Soil Science and Conservation Research Institute in Bratislava has recently focused on the remote control of area-based subsidies. These play a key role in agricultural sector and contribute to the prosperity of agricultural firms. The subsidies to agricultural sector represent a major part of the European budget and it also is the reason why emphasis is put on the control of the correct use of subsidies. The European Commission takes this fact into consideration and uses more methods of control. The most effective method is the Control with Remote Sensing (CwRS). This method allows controlling large areas in short time at a relatively low cost.

To increase the precision and reliability of controls, the European Commission tries to keep up to the trend and use satellite images with very high resolution. To process these data, high level of quality is required, especially concerning the geometric precision. Many methods of orthorectification exist and each of them poses own requirements in terms of the input data quality. The European Commission realizes the importance of geometric accuracy of used satellite images and defines strict criteria.

Soil Science and Conservation Research Institute (SSCRI) possesses experience in CwRS since 2001. The pilot project in 2003 was one of pilot projects in the EU Candidate Countries coordinated by the Joint Research Centre, Ispra (JRC). In 2003 JRC also worked on a pilot project of using very high resolution (VHR) images in CwRS. Year 2004 was the first year with the usage of VHR images in CwRS campaign and was also the first year of practical application of CwRS in the Slovak Republic.

In CwRS, a set of high resolution (HR) multispectral images as SPOT, Landsat and IRS (mainly 3 or 4) are used for precise identification of the grown crop. Since 2004 VHR images from IKONOS2, QuickBird-2, EROS-A1 and SPOT 5 Supermode are used for precise measurement of the cultivated area.

The controlled schemes are the following:
SAPS – Single area payment scheme,
CNDPs – Complementary National Direct Payment scheme (crops).

Experiences in 2004 – 2005

The Control with Remote Sensing in 2004 and 2005 was performed by SSCRI based on multi-annual agreement with Agricultural Paying Agency (APA).

The 2004 campaign

In 2004 campaign 6.4% of the applications for the subsidies were controlled via satellite images. The Slovak administration decided to have two control sites for CwRS (marked in yellow in Fig. 23):

- PODU – represented by circle with 25km radius, SPOT 5 images with resolution of 3m/ pixel were used for area measurements,
- VRAN – defined by square 20×20km, IKONOS2 satellite images with resolution of 1m/pixel were used for area measurements.

The control was carried out in total on 786 applications. Tab. 1 below shows the division of the applications by schemes and sites.

2004	**Number of applications controlled by RS**	
Schemes	*SAPS*	*CNDPs*
PODU	675	622
VRAN	111	89
Total	**786**	711

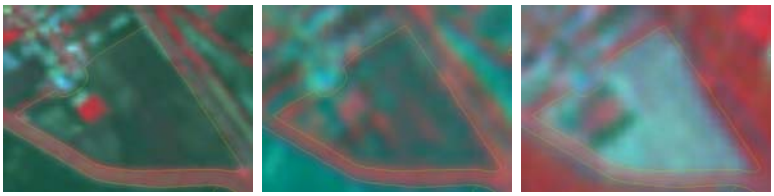
Tab. 1. Number of applications controlled on satellite images (HR and VHR)

The number of used satellite images for this campaign was 10 – 6HR (Fig. 22) images and 4 VHR images (Tab. 2). These satellite images were processed (geometrically corrected) by the experts of the SSCRI.

2004	**PODU**		**VRAN**	
Spring1	22.04.2004 SPOT5 10m		15.4.2004 SPOT2 20m	
Spring2	08.06.2004 SPOT4 20m		14.6.2004 SPOT4 20m	
VHR	**04.08.2004 SPOT5PAN 3m**	**09.08.2004 SPOT5PAN 3m**	**8.6.2004 IKONOS_2 1m**	**8.6.2004 IKONOS_2 1m**
Summer1	21.07.2004 SPOT2 20m		19.7.2004 SPOT5 10m	

Tab. 2. High resolution (HR) and very high resolution (VHR) satellite images used in the 2004 campaign

In the figure below brings an example of crop identification is showed on the multitemporal HR satellite images.



SPOT5 SPOT4 SPOT2

Figure 22. Example of crop identification on high resolution images

The 2005 campaign

In the 2005 campaign, the total number of applications for area-based subsidies was 13,797; the number of applications controlled by remote sensing is 773 (5.6 % of all applications).
Slovak administration decided to have three control sites (marked in orange on Fig. 23):
LEVI – defined by square 20x20km,
RIMA – defined by square 20x20km,
TREB – defined by rectangle 20x25km.
Two sites were covered by IKONOS images (LEVI, TREB) and one site by QuickBird images (RIMA).
The Tab. 3 shows the division of the applications by schemes and sites.

2005	**Number of applications controlled by RS**	
Schemes	*SAPS*	*CNDPs*
LEVI	250	240
RIMA	203	188
TREB	320	317
Total	**773**	745

Tab. 3. Number of applications controlled on satellite images (HR and VHR)

The number of satellite images used for this campaign was 20 – 14 HR images and 6 VHR images (Tab. 4, Fig. 23). These satellite images were processed (geometrically corrected) by the experts of SSCRI.

2005	LEVI		RIMA		TREB	
Autmn	17.01.2005 SPOT4 20m		17.01.2005 SPOT4 20m		30.03.2005 IRS-P6 LISS-III 23m	
Spring1	15.04.2005 SPOT5 10m		22.04.2005 SPOT4 20m		27.04.2005 SPOT4 20m	
Spring2	21.05.2005 SPOT5 10m		21.05.2005 SPOT5 10m		23.05.2005 SPOT5PAN 3m	
VHR	**20.05.2005 IKONOS_2 1m**	**23.05.2005 IKONOS_2 1m**	**22.05.2005 QuickBird 1m**	**14.06.2005 QuickBird 1m**	**14.05.2005 IKONOS-2 1m**	**14.05.2005 IKONOS-2 1m**
Summer1	17.06.2005 SPOT5 10m	17.06.2005 SPOT5PAN 3m	21.06.2005 SPOT5 10m	21.05.2005 SPOT5PAN 3m	16.06.2005 SPOT5 10m	

Tab. 4. The HR and VHR satellite images used in the 2005 campaign

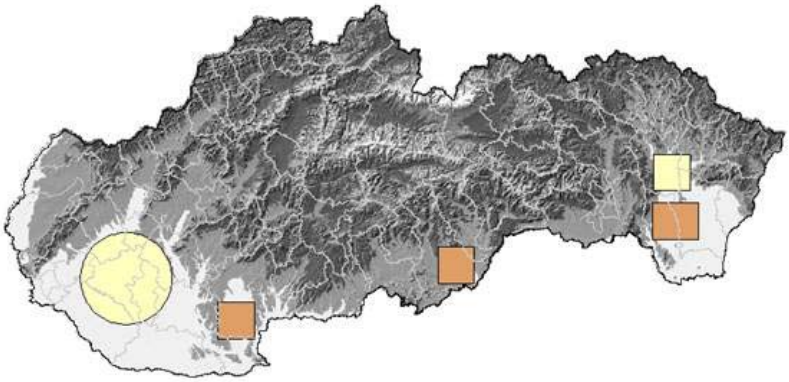


Fig. 23. Localization of the controlled sites in campaigns 2004 (yellow) and 2005 (orange)

The Fig. 24 shows an example of boundary identification on the VHR satellite image.

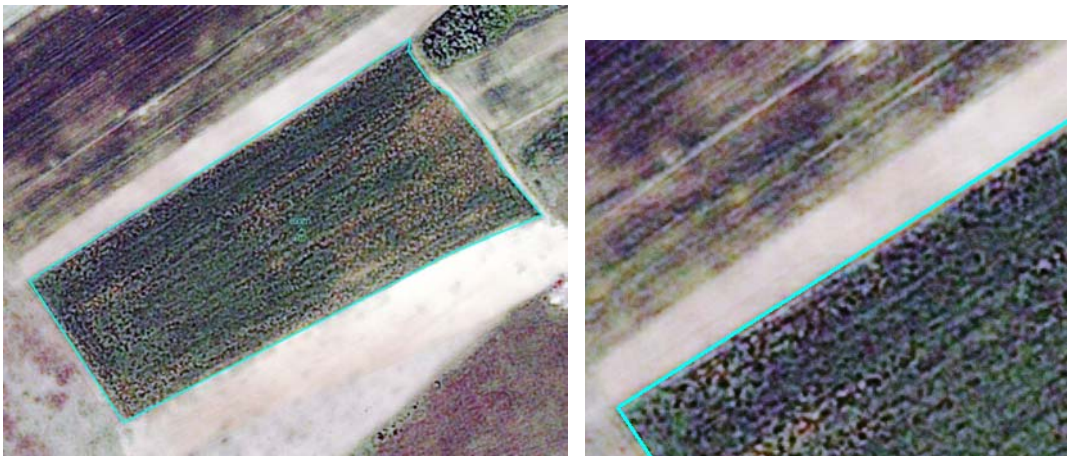


Fig. 24. Example of boundary identification on the very high resolution image – detail on the right picture

Control with remote sensing performed by SSCRI represents the operational and real usage of remote sensing data. Results obtained during this process lead to concrete decision-making and financial consequences.
The method of control with remote sensing turned out to be effective, large areas can be easily controlled in a short time and costs relatively less then the on-the-spot controls. The geometric corrections of satellite images are very important parts of the CwRS. Other activities as boundary check of the parcels and crop checks are done through these images. Usage of satellite images with inappropriate geometric accuracy would lead to doubts in evaluation and control of the applications chosen for the CwRS.

Regarding the issue of remote sensing, ***Forest Research Institute in Zvolen*** has performed activities oriented mainly to the research and applications of satellite and aerial RS in the survey and monitoring of the forests condition.

In a year 2004, the change of forest health status was assessed. The classifications of forests health condition from satellite imagery Landsat TM/ETM+ for the years 1990 and 2002 were used as the base for this evaluation. The change detection between these periods was performed by the post-classification comparison using the independent classifications results in compared periods. The results showed that change of forest health condition should be generally characterized by a slight improvement - slight improvement category is prevailing in change categories in the mentioned period, nevertheless the category of distinctive deterioration is bigger than the category of distinctive improvement.

Analysis of spatial distribution of damage to forests by abiotic agents was performed with regard to spatial distribution of forest derived from the Landsat TM satellite imagery (Konôpka B., Konôpka J., Raši 2005). Wind was identified as the most harmful agent for the spruce forests. At the end of year 2004, (November 19), results of the previous work were confirmed. Slovakia was struck by a windstorm that caused enormous damage to natural resources, the extensive damage of forests caused by wind occurred above all in the High Tatra Mountains. The methods of aerial and satellite RS were applied to discover the damaged forest areas promptly. The cooperation of FRI Zvolen at the international level for damaged area identification was characterized by the data support to the EC DG JRC Ispra – IES (***Institute for Environment and Sustainability***) where an independent assessment of the calamity extent has been performed. The cooperation has been also at national level. The visual interpretation of calamity area from aerial photographs (provided by the Ministry of Defence) was realized at Lesoprojekt Zvolen. The classification of calamity area from satellite imagery Landsat TM/ETM+ and SPOT 5 XS was performed at FRI Zvolen, a large destroyed area was identified in the High Tatra Mountains (see Fig. 25), where 6,400 hectares of forest stands was destroyed and the other 3,900 hectares of forest stands were damaged (Pavlenda *et al.* 2006). The total acreage of damaged forests interpreted from aerial photographs is 9,700 hectares in the High Tatras. Large damage of forests has been also identified from satellite imagery in the Low Tatra Mountains (see. Fig. 26; decrease by 4,100 hectares of forests against the reference year 2003). Besides, damaged areas of forests were identified in the Orava region and in the area of the mountains Slovenské rudohorie.

The methods of satellite RS were applied for the spatial analysis of the Norwegian spruce forests dying in the Kysuce region. The time series analysis of Landsat TM/ETM+ imagery since 1990 to 2005 was carried out. As part of international cooperation, the expert for RS from the FRI Zvolen works at the

European Commission JRC - IES (Institute for Environment and Sustainability) from 2004. The project worked on is oriented to the analysis and processing of medium spatial and high spectral resolution satellite imagery (MODIS, MERIS). FRI Zvolen prepared the special study on acquisition, processing and utilization of ASTER satellite imagery, above all for identification of deforestation for EC JRC – IES (Hlásny and Raši 2005). The study area was located in the Russian Far East, identified as "hot" area with regard to illegal cuttings and timber market.

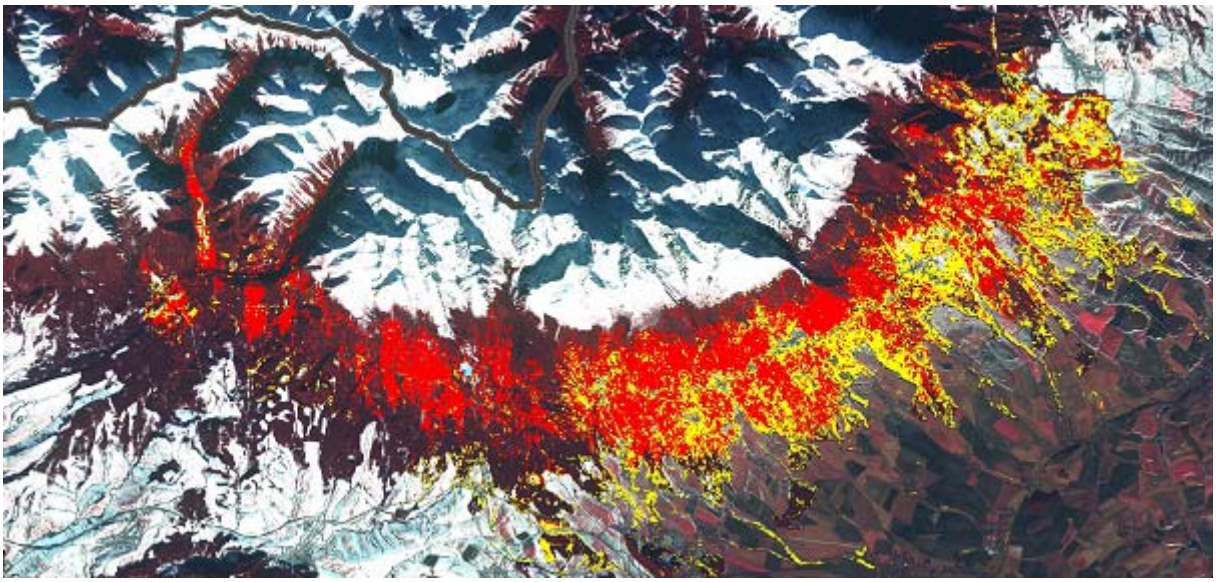


Fig. 25. High Tatra Mountains - forest damage classification after wind-storm in November 2004. Red areas - totally destroyed forests, yellow areas - lower intensity damaged forests. Spot 5 XS image (channels 1,2,3; Dec. 5, 2004) in the background. Covered area: 21 x 41 km

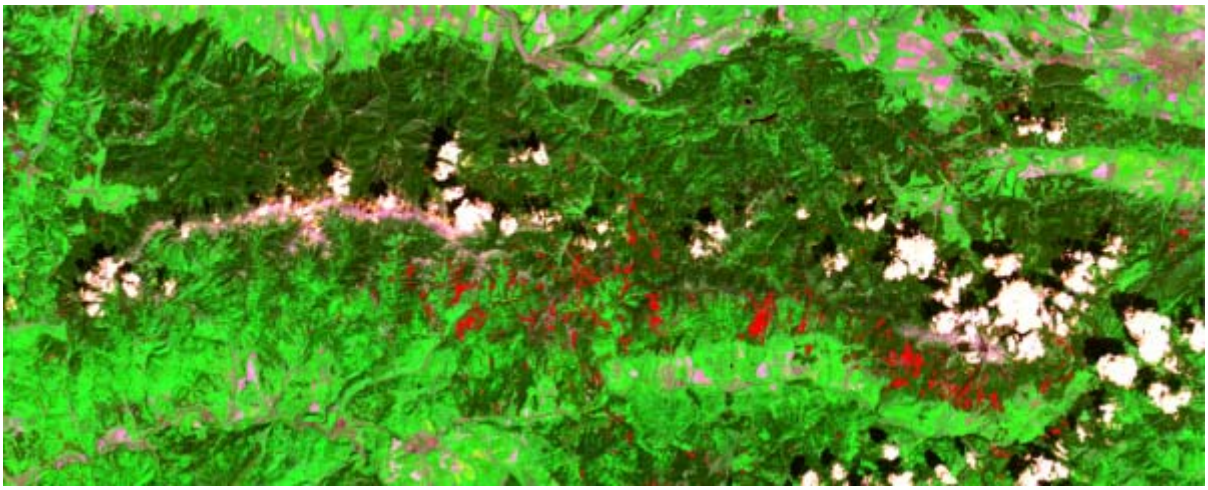


Fig. 26. Low Tatra Mountains - forest damage classification after wind-storm in November 2004. Red areas - totally destroyed forests. Landsat TM image (channels 3, 4, 7, stretched) in the background. Covered area: 32 x 80 km.

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5. SPACE METEOROLOGY.

Slovak Hydrometyeorological Institute (SHMI) is involved in the CONEX II project (common project of central European countries). Development of now-casting methods based on distance measurements including meteorological satellite data and numerical weather prediction model outputs are some of the topics of this project. The algorithm for fog and low clouds detection developed by ZAMG partner was installed and later elaborated for more effective detection of low clouds and fog in critical conditions – dusk and down. Other algorithms, like convective storm detection, atmospheric motion vectors and forecasted satellite image products were started with routine operation on the base of new MSG satellite data.

On the 1st of September 2005, subagreements between the Italian meteorological service UGM and members of Hydrological SAF consortium were signed. Hydrological SAF is a common 5-years project of EUMETSAT and EUMETSAT member states, including Slovakia with the aim to develop products like precipitation, snow cover and soil moisture from satellite data to support operational hydrology. SHMI is involved in tasks of calibration and validation of precipitation products and hydrological validation. In the frame of hydrological validation there are 5 subcatchments selected in the Slovak territory, on which the H-SAF products will be tested by means of hydrological models and several impact studies of new products on operational hydrology will be elaborated.

6. Institutions involved in Space Research relevant to COSPAR.

Members of the National Committee of COSPAR with their e-mail addresses are listed too. More informations about space activities in Slovakia can be found also at www.space.savba.sk (the homepage of the recently established ***Slovak Commission for Research and Peaceful Uses of Outer Space at the Council for Science and Technology of Government of Slovak Republic)*** *or at the website of NC http://nccospar.saske.sk.*

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