MONITORING OF THE ENVIRONMENT RADIOACTIVITY AT THE SLOVAK HYDROMETEOROLOGICAL INSTITUTE

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Radiation monitoring network of Slovak Hydrometeorological Institute as system of early warning is one part of Radiation monitoring network of Slovak Republic This system fulfils second function too: it is one part of environmental monitoring in Slovak Republic. In 1962 the department „Radiation of atmosphere“ has been established under the Hydro meteorological Institute in Bratislava. Artificial beta radiation of atmospheric deposition has been measured in the selected meteorological stations from 1962 to 1991. In 1991 the measurements of dose rate started. At present SHMI operates in its monitoring network 23 probes Gamma Tracer fy Genitron, one mobile probe and one standby probe. All active probes are placed in the professional meteorological stations in the selected parts of Slovakia. Radiation data (dose rate in the unit nSv/h) are collected via the Institute network to the National Telecommunication Centre in Bratislava. Every 10 minutes the data are inserted into the database. SHMI cooperates with other operators of radiation monitoring like: Nuclear Regulatory Authority, Slovak Army, Civil Protection, Health Regulatory Authority and Slovak Power Plants. SHMI cooperates with European Commission Joint Research Centre in Ispra within the program EURDEP (European Union Data Exchange Platform). Data between SHMI and Radiation Warning Centre Vienna are exchanging in on-line regime every 10 minutes. On the base of agreement Hungarian Ministry of Environment, Hungarian Ministry of Interior and the Slovak Ministry of Environment SHMI started the on-line data exchange with Hungary Meteoservice in summer 2002.

Key words: radiation, radiation monitoring network, radiation database, mathematical and statistical analyses, cooperation on national and international level, data exchange

MONITORING NETWORK

History

The extensive development of peace using nuclear energy after the World War II and the tests of nuclear weapons in the 50ies caused the remarkable increasing of artificial radioactivity in the atmosphere. Therefore many hygienic and meteorological services have started to monitor radiation.

In 1962 the department „Radiation of atmosphere“ has been established under the Hydrometeorological Institute in Bratislava. Artificial beta radiation of atmospheric deposition has been measured in the selected meteorological stations from 1962 to 1991. Within 1962, 1963, after the testing of nuclear weapons in the 50ies and the beginning of the 60ies, the maximum values were reached in the former Czechoslovakia. Increased values were recorded again in 1968-1971, 1974, 1981 and in 1986 after the Cernobyl accident. In 1991 the measurements of gamma dose rate started with detectors FHZ 621B (FAG).

In 2000 Centre of Partial monitoring system „Radioactivity of environment“ was established on SHMI.

Radiation monitoring network is one part of Radiation monitoring network of Slovak Republic.

Monitoring of gamma dose rate

At present SHMI operates in its monitoring network 23 detectors GammaTracer fy Genitron, one mobile detector and one standby detector. (Tab. 1)

N.	Ident.	Station	Long.	Lat.	m a.s.l.
1	11812	Malý Javorník	48 15	17 09	584
2	11813	Bratislava-Koliba	48 10	17 06	340
3	11819	Jaslovské Bohunice	48 29	17 40	176
4	11826	Piešťany	48 32	17 50	163
5	11841	Žilina - D. Hričov	49 14	18 37	310
6	11855	Nitra	48 17	18 08	135
7	11856	Mochovce	48 17	18 27	261
8	11858	Hurbanovo	47 52	18 12	115
9	11867	Prievidza	48 46	18 36	259
10	11880	Dudince	48 10	18 52	140
11	11903	Sliač	48 39	19 09	314
12	11916	Chopok	48 59	19 36	2008
13	11918	Liesek	49 22	19 41	692
14	11927	Lučenec	48 20	19 44	214
15	11930	Lomnický štít	49 12	20 13	2635
16	11933	Štrbské Pleso	49 07	20 05	1355
17	11938	Telgárt	48 51	20 11	901
18	11952	Poprad-Gánovce	49 02	20 19	695
19	11958	Kojšovská Hoľa	48 47	20 59	1242
20	11968	Košice-letisko	48 40	21 13	231
21	11976	Stropkov	49 13	21 39	216
22	11978	Milhostov-Trebišov	48 40	21 44	105
23	11993	Kamenica nadCirochou	48 56	22 00	117

Tab. 1 Radiation Monitoring Network of SHMI (1. 7. 2006)

All active detectors are placed in the professional meteorological stations in the selected parts of Slovakia. First one of these detectors was installed in 1999 and they replaced former type of detector FHZ 621B (FAG). Last two detectors were installed in 2002. Detector GammaTracer (Fig. 1) has range of measurement from 20nSv/h to 10 Sv/h. The detectors are verified every 2 years in the Slovak Institute of Metrology in compliance with the calibration plan. Every 4 years detectors are calibrated. In the last year quality of measurements was improved. We started verification with deviation +-5 % (earlier it was only with deviation +- 15 %).

Fig. 1 Detector GammaTracer (Genitron)

Aerosol sampling stations

SHMI operates 4 aerosol sampling stations in Hurbanovo, Lucenec, Stropkov and Liesek. Filters from these stations are analysed in the Public Health Authority laboratories (Cs-137, Be-7).

On the base of bilateral agreement between the Austrian Ministry of Agriculture, Forestry, Environment and Water-Management and the Slovak Ministry of Environment Austrian side gave into the ownership of the Slovak side an automatic aerosol monitor AMS-02 including container and weather station. This monitor was installed in meteorological station Jaslovske Bohunice on 4-th October 2001. The Slovak Ministry of Environment provides the Austrian Ministry of Agriculture, Forestry, Environment and Water-Management with the readings of this monitor, free of charge, for at least 3 years and vice versa, the Austrian side gives the readings of the Austrian aerosol monitors to the Slovak Ministry of Environment free of charge. At present national monitoring centre in Bratislava-Koliba is connected via ISDN line with Jaslovske Bohunice and Austrian center providing the data exchange.

DATABASE OF RADIATION MONITORING

Collecting of data

Radiation data (dose rate in the unit nSv/h) from detectors in the automated meteorological stations are transmitted by datalogger and private institute network to National Telecommunication Centre in Bratislava. The service program runs on the server RADMON in SHMI and every 10 minutes the data (dose rate and precipitation) from MSS (message switch system) are inserted into the database. The 2hours and 24hours averages are computed on the server automatically. Delay between time of measurements and time of inserting data to database is only 10min.

Radiation files from SHMI network are on-line transmitted to information system of Nuclear Regulatory Authority of the Slovak Republic and to information system of Slovak Army. Transmission to to Crisis Centre of Civil Protection is under reconstruction at present.

Database

Two backuped servers work in the system of radiation monitoring under Windows 2000 Server operating system and MS SQL Server 7.0 database system.

Database contains one table for radiation data and several tables for configurations, catalogues of

stations and additional tables.

Database works in environment client-server. On client PC runs the user front-end application. This application provides to display the data using many filters, to display tables with configurations concerning technical equipment, to display maps, graphs, etc. There is the possibility to store data into the archives, to make reports.

This extensive database gives good opportunity to design reports in many formats based on SQL scripts.

Data Analysis

Time series from monitoring sites are analysed by the environment of the statistical software STATISTICA 6.0. and presented in reports and yearbooks. (Examples Fig. 2)

Precipitations values from meteorological stations were integrated do the information system of radiation monitoring for better interpretation of gamma dose rate values. (Examples Fig. 3, Fig. 4)

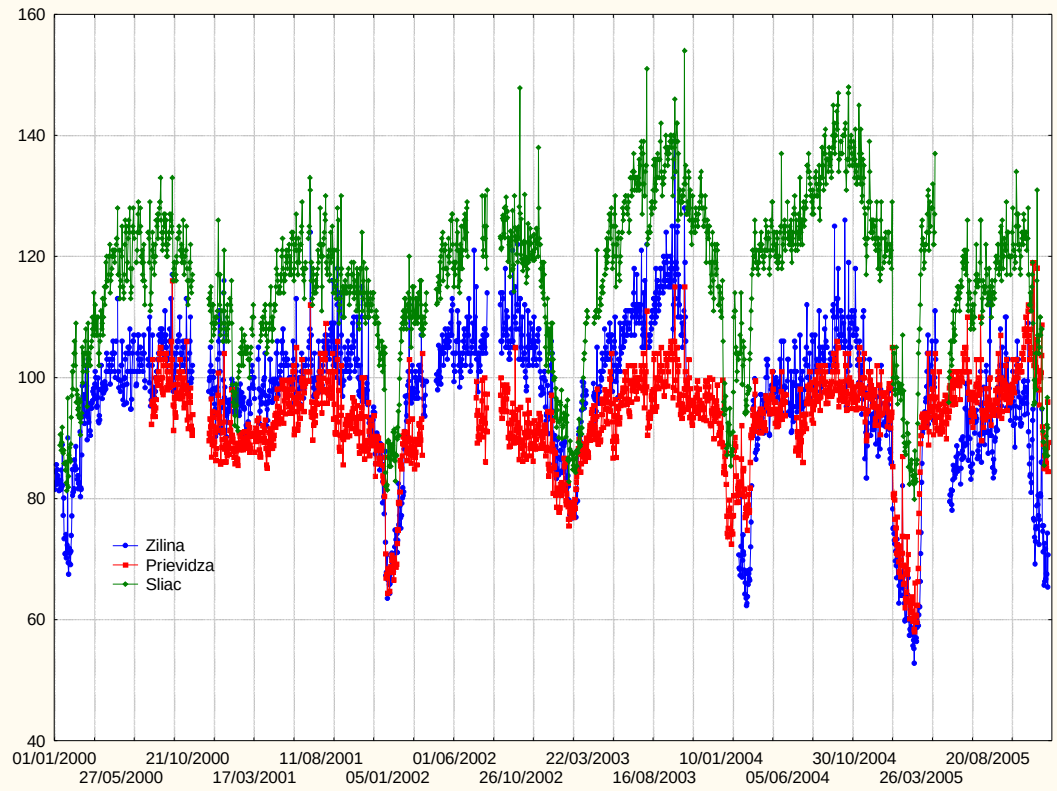

Fig. 2 Time series from selected stations, 24hours averages of gamma dose rate, nSv/h, 2000 – 2005

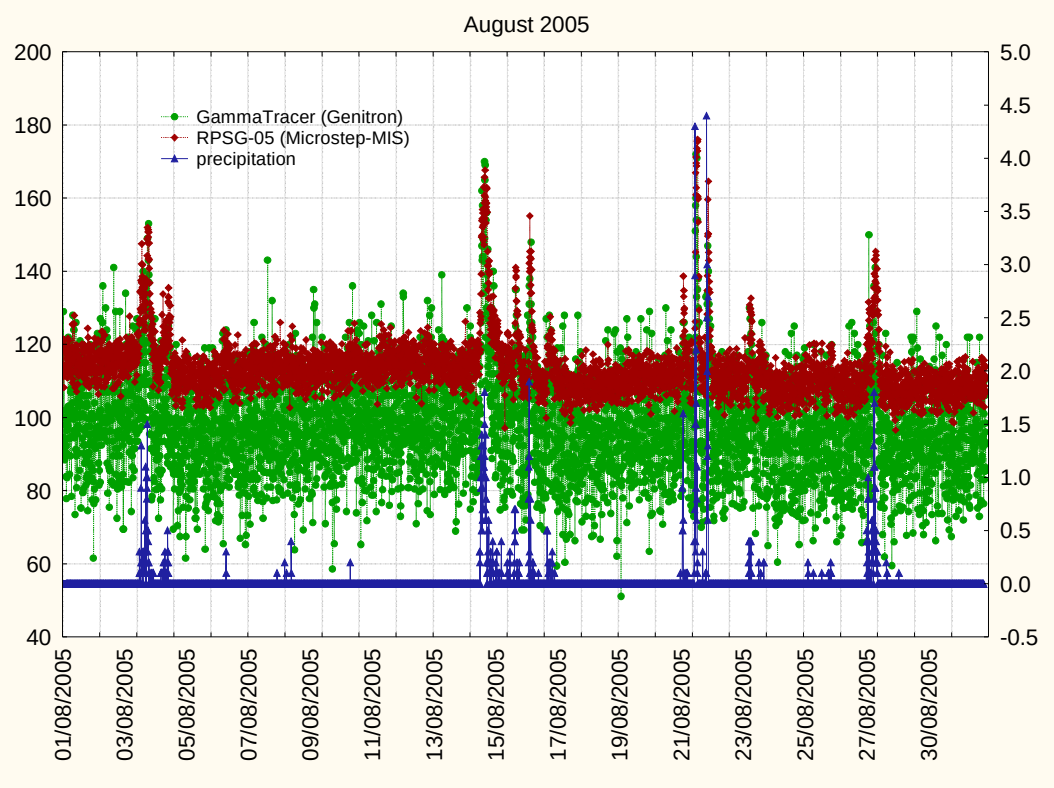

Fig. 3 Correlation between values of gamma dose rate and precipitation in Bratislava, 10min averages, nSv/h and mm, 2005, two type of detectors(Gamma-Tracer, RPSG-05)

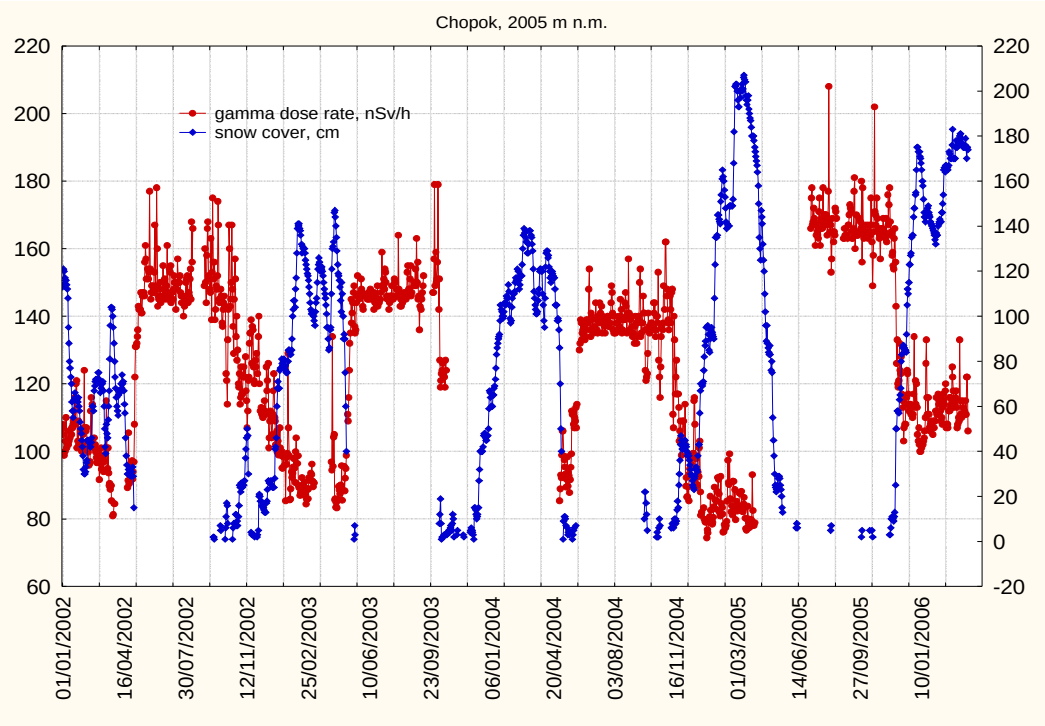

Fig. 4 Correlation between values of gamma dose rate and snow cover in Chopok, 24hours averages, nSv/h and cm, 2002 – 2006

COOPERATION IN THE DATA EXCHANGE ON THE NATIONAL LEVEL

On the base resolution of government Commission for radiation accidents SHMI is operating Unit database of radiation data in the Slovak Republic. In the frame this database SHMI cooperates with other partners like: Slovak Army, Civil Protection, Ministry of Health, Slovak Power Plants. At present bilateral of-line data exchange with Slovak Army, Ministry of Health, Slovak Power Plants and Civil Protection is running. Unit database is common platform for data processing, analysis, comparison and cooperation between partners.

INTERNATIONAL DATA EXCHANGE

European Commission Joint Research Centre Ispra

SHMI cooperates with European Commission Joint Research Centre (EC JRC) in Ispra in the frame EURDEP (European Union Data Exchange Platform) from 1998. EURDEP system is a standard format for radiological environmental monitoring data and a platform by which to exchange this data. The data-exchange is regulated for the EU Member States by the Recommendation 2000/473/Euratom, for the ECURIE (European Community Urgent Radiological Information Exchange) Member States by the Council Decision 87/600/Euratom that data will be made available or be sent at least once a day during routine and at least once each two hours during an emergency. At present we use in the data exchange with EC JRC format EURDEP 2.0 from 1.12.2002, new format EURDEP XML is prepared. We send data from our monitoring network on the ftp server of SHMI every 24 hours and then the data are downloaded to database in Ispra. We took part on all international emergency exercise (INEX, ConvEx).

Austria

Data between SHMI and Radiation Warning Centre Vienna are exchanging by means of directories on the ftp-server of SHMI. Every 10 minutes data from 336 Austrian stations are stored into the directory on our ftp server and then inserted into the radiation database. Every 10 minutes data from our monitoring network are stored to the directory on ftp server on our side and then downloaded to the Austrian side. Data from bilateral data exchange are evaluated in environment of proffesional statistical software. (Example Fig. 5)

EURDEP format version 1.3 is used. We prepare the migration on platform EURDEP 2.0.

The data exchange is regulated by bilateral agreement.

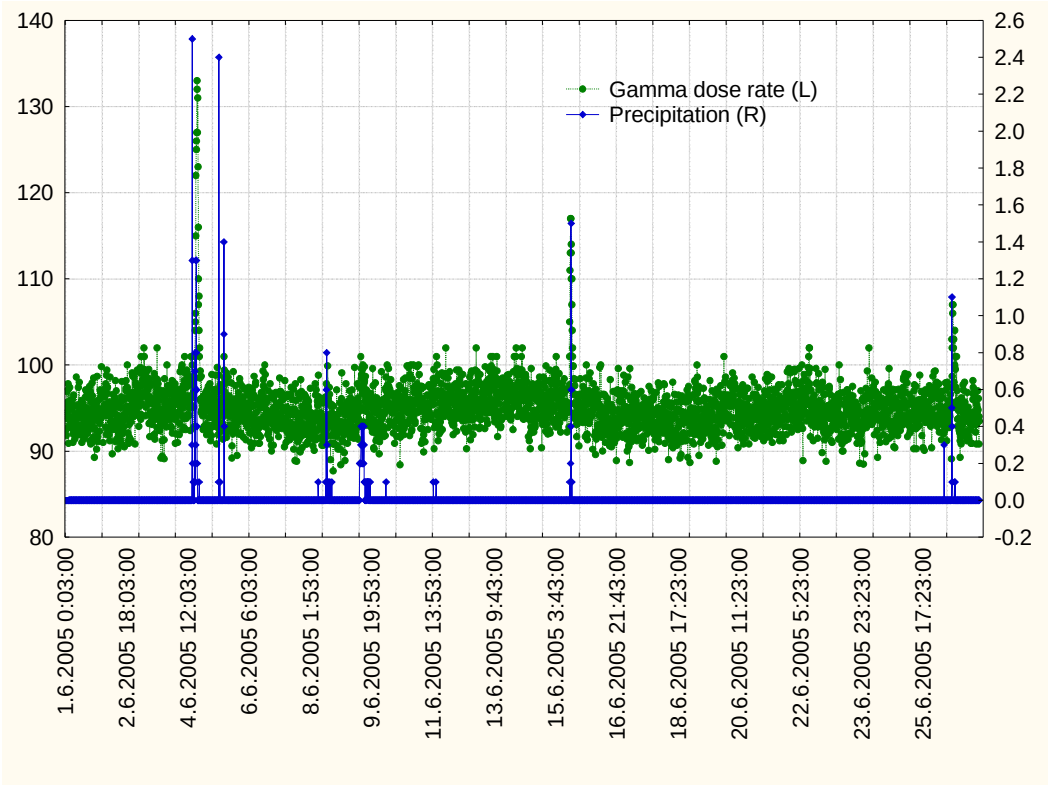

Fig. 5 Time series from austrian monitoring network, Kitsee, correlation gamma dose rate with precipitation, 10min averages, nSv/h and mm, 2005

Hungary

On the base of agreement between Hungarian Ministry of Environment, Hungarian Ministry of Interior and the Slovak Ministry of Environment, SHMI started the data exchange with Hungary Meteoservices in summer 2002. Leased line Bratislava – Budapest of capacity 16 kbit/s was established. Data files with the radiation data in the EURDEP 2.0 format are exported from our database every 10 minutes and then files are downloaded to the server in Meteoservice Hungary. Files with radiation data are downloaded from Hungarian side each 1 hour (10 minutes averages).

Data from bilateral data exchange are evaluated in environment of proffesional statistical software. (Example Fig. 6)

In-situ measurements were done on all monitoring points SHMI in the cooperation with Hungarian National Directorate General for Disaster Management.

Data between SHMI and Meteoservices Hungary and SHMI and Radiation Warning Centre Vienna are transmitted via Regional Meteorological Data Communication Network (RMDCN).

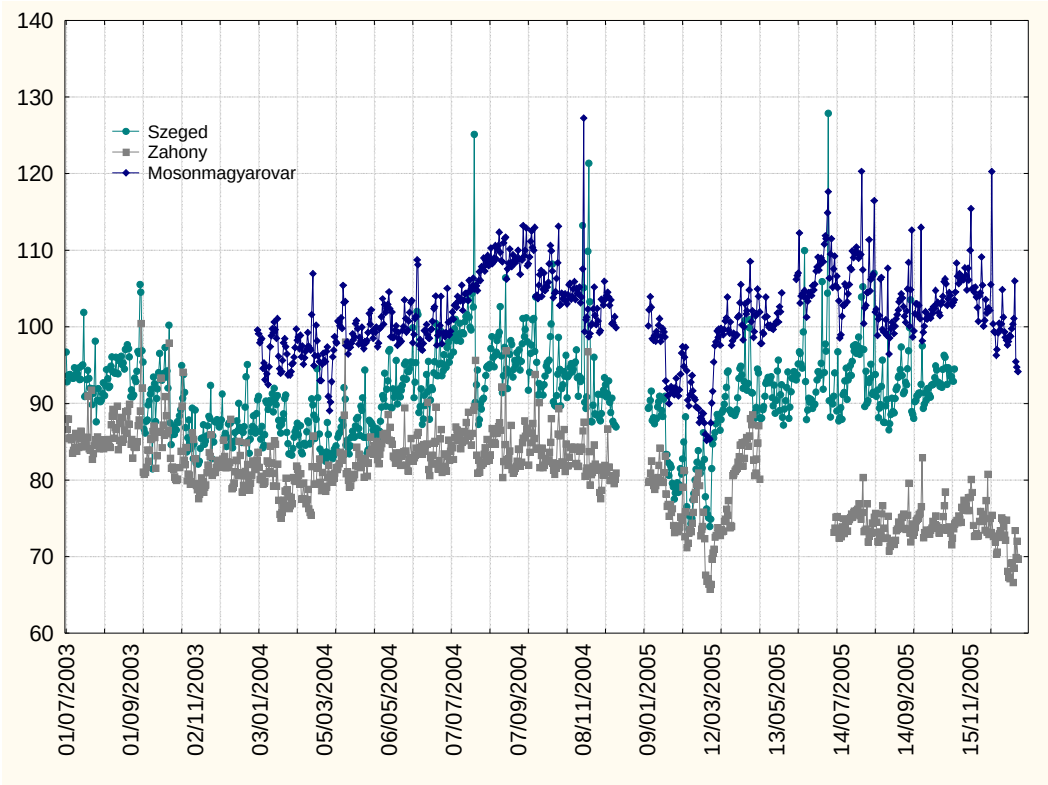

Fig. 6 Time series from selected monitoring sites of Hungary, gamma dose rate, 24hours averages, nSv/h, 2003 - 2005

Conclusion

Radiation monitoring is important part of early warning system, hazard management and monitoring of environment. In the conditions of SHMI it is one part of monitoring activities.
Radiation monitoring network of SHMI is good equipped with metrologic verified devices. Data are evaluated in many mathematical and statistical analyses.
SHMI is responsible for international data exchange with Euuropean Commision and with partners in Austria and Hungary.

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