

MONITORING SYSTEM OF THE ENVIRONMENT OF THE SLOVAK REPUBLIC — GEOLOGICAL FACTORS

A. KLUKANOVÁ

¹Geological Survey of the Slovak Republic, Mlynská dolina 1, Bratislava, Slovakia

Abstract: The paper brings a characterization of the Partial Monitoring System of the Slovak Republic, the compound of the Monitoring system of the environment of the Slovak Republic. At present, it consists of 13 subsystems. The paper provides main results of individual subsystems.

Introduction

Among general terms at the accession of states of Middle and Eastern Europe into European Community, acquisition of quality data about environment on national level, their processing into system information and mutual exchange of information play the main role.

Taking into account, that there was no complex monitoring system of the environment of the Slovak Republic, the Slovak Government by its Resolution Nr. 623 dated 21st December 1990 had directed to the former president of SKŽP (Slovak Commission for the Environment) in co-operation with touched ministries to elaborate a concept of the monitoring of the territory of the Slovak Republic, including its organisational, technical and financial support. The Government of the Slovak Republic approved this concept by its Resolution No.449 from 26th May 1992. The government directed to the ministries to realise a territory monitoring system of the Slovak Republic and partial monitoring systems in terms of designed projects. Further, the Minister of the Environment was directed to inform annually to 30th March the government on the advance of the realisation of the monitoring and information system of the environment. By the Resolution of the Government of the Slovak Republic Nr. 620 dated 7th September 1993 directed the ME SR, MA SR and MZ SR to safeguard the performance of the functions of the centres of partial monitoring systems and to co-ordinate the realisation of the partial monitoring systems and partial information systems.

This concept is based on two essential ideas: realising of the actual state of performance of previous tasks, which have been carried out in terms of the Concept of the monitoring system of the environment of the Slovak Republic and the Concept of integrated information system of the environment of the Slovak Republic from 1992, and it is based on demands, which the Slovak Republic is obliged to fulfil in preparedness process for European structures.

Information system is closely linked with monitoring system. The monitoring and information systems have to be perceived as an important tool for safeguarding of the environment

protection and creation. Simultaneously, they provide a fundament for decision-making about recent activities, as well as about further perspective intents in the environmental disciplines.

The realisation of the territory monitoring system of the environment SR itself was establishment on organizational and methodical unification in the frame of single partial monitoring systems and their mutual harmonisation. By the harmonisation of individual monitoring activities, realised in frame of available sources it is possible to reach a substantial step forward in state of art knowledge and trends of the environment of the territory of the Slovak Republic.

Monitoring system of the environment SR

The Concept of the monitoring system of the environment of the Slovak Republic and the Concept of integrated information system of the environment of the Slovak Republic define the environmental monitoring as a systematic, spatially and temporarily defined observation of precisely defined characteristics (attributes) of the environmental compounds or influences upon the environment (usually in monitoring net points). To a certain degree of reliableness they are able to characterise given area and, to a higher level a larger region.

The main objective of the monitoring is observation of a certain phenomenon, alternatively parameter in precisely defined temporal and three-dimensional conditions. Monitoring serves for objective knowledge of characteristics of the environment and evaluation their changes in monitored three-dimensional area. Recently, the monitoring system of the environment consists of the following systems: Atmosphere, Meteorology and climatology, Water, Radioactivity of the environment - ME SR (Guarantee) - SHMU Bratislava (Centre), Geological factors - ME SR - SGUDS Bratislava, Soil - MA SR - VUPOP Bratislava, Biota (fauna and flora), Wastes - ME SR - SAZP B.Bystrica, Forests - MA SR - LVU Zvolen, Contaminants in edibles and forages - MA SR - VUP Bratislava

The performance and co-ordination of monitoring activities in the frame of individual partial monitoring systems provide centres of partial monitoring systems (PMS). The centre of PMS Geological Factors is at GS SR.

Partial Monitoring System of Geologic Factors of the Environment

The concept PMS Geological Factors is derived from the concept of the monitoring of environment of the territory of the Slovak Republic. Thematically it is focused on those geological factors and on such outputs, which seem to be convenient as the input data for issues of protection of the environment and for optimum utilisation of geopotentials of the country. It is focused mainly on geological hazards, harmful natural or anthropogenic processes, which jeopardise the

environment, as well as humans. The monitoring serves for observations and assessment of the mechanisms of negative changes in the geological environment.

The guarantee of the PMS Geological Factors is the Section of Geology and Natural resources at the ME SR. Recently, PMS Geological Factors consists of 13 autonomous subsystems, defined according to different type of the influencing geological process activated by natural or artificial factors. Each subsystem is solved individually, but the optimum solution is in mutual link among several subsystems in such a way, that individual measurements complement each other and they provide sufficient data to obtain an optimum image of the state of the geological environment as a whole. The selection of monitoring sites, frequency of sampling and data collection, as well as the ways of rock samples testing and acquisition of data are subduced to this essential philosophy.

Table 1 provides information on the fundamental structure and content of the PMS Geological Factors. Localisation of the territories solved in the frame of PMS Geological Factors is on figure 1.

The results of the monitoring from the period 1993 to 2000 are presented in the Final report Partial Monitoring System of Geological factors of the Environment SR (Klukanová et al, 2001) and in the monothematic issue *Geologické práce. Správy 106* (Klukanová, ed., 2001). Among the most significant results we can mention: In the frame of monitoring of slope deformations the sites Veľká Čausa, Handlová, Lubietová, Fintice, Okoličné are jeopardised by slope movements activation, there is a demand to extend the monitoring net. Vice versa, the frequency of measurements at the sites Bojnice, Diviaky Dolná Mičiná can be reduced. The monitoring of sites Slanec and Harvelka could be minimised. Regarding a disrepair state of several sites we propose to incorporate them into the system (Wagner et. al, 2001). The most distinct activity of the erosion processes has been observed at the Nováky site – 2,32 km of erosion gullies per 1km² (Ondrášik, 2001). The most intense weathering process has been monitored within the section of the road-cut from Harmanec to Šturec. Here, the micronivelation decrements in dolomites reached an average annual value of 19,24mm per year (Jánová, Liščák, 2001). Failed objects have been identified on the territory of the Podunajská nížina Lowland, where the objects are founded on the voluminal unstable sediments in 72 municipalities, as well as on the territory of the Východoslovenská nížina Lowland in 54 municipalities (Klukanová, Frankovská, 2001). It is supposed that the changes of properties of ashes from tailings take place due to their gradual compaction and hydratation. The change of their mineralogical composition plays also an important role (Matys, 2001). The measurements are carried out on the church in Kostol'any pod Tríbečom using the SOMET gauge. In the last quarter 2000 the recorded sinkage of the tower of the church reached 3,03 mm (Vlčko et al, 2001). In accordance with new knowledge on old ecological loads new ways of covered

anthropogenic sediments sites assessment were elaborated (Kováčiková, 2001). The results of the monitoring have confirmed a vertical tendency of the surface movements on the territory of Slovakia, namely slow uplifts of the central parts, Carpathian Flysch and Klippen Belt in the section from Bytča to Bardejov and sinkage of western and eastern part of the Inner Western Carpathians, as well as the prevailed sinkage of the rest of the Flysch and Klippen Belt (Hrašna, 2001). In the frame of the snow pack quality global and local influences on the chemical composition of snow and relations among individual ions have been identified. Global influences are typical mainly for so-called mountaineous sites like Čertovica, Chopok-S and N, Donovaly, Lomnický Štít, Tatranská Lomnica, Skalnaté and Štrbské pleso. The local influences are typical for so-called lowland areas Bratislava and its surrounds, Patince, Prievidza-Handlová, Žiar, Vojany etc. (Bodiš et al, 2001). From 1.1.1995 to 31.12.2000 35 earthquakes were macroseismically observed, from this amount 29 with epicentre on the territory of Slovakia. Seismometry identified and localised 18 micro-earthquakes (magnitude > 2.5-3) with epicentre on the territory of Slovakia (Cipcjar et al., 2001). In the frame of monitoring of active alluvial sediments the most contaminated areas Nitra-Chalmová, Štiavnica-mouth into Ipeľ, Ipeľ–Ipeľský Sokolec, Hornád-Kolinovce, Hnilec-inlet into the Ružín reservoir. They are influenced mainly by the anthropogenic activities past and recent mining metallurgical industry, which has led to distinct increased contents of Cu, Zn, Hg, Cd above the valid limit values (Bodiš et al, 2001). The radon contents are subdued to seasonal variation changes. The changes of its concentration are so important, that at their underestimation the incorrect interpretation, even blunders could occur while assessing the radon risk of the sites measured (Smolárová, 2001).

Partial information system of geological factors serves for data collection and storage. Supported by an unified approach in data processing in form of Geographic Information System (GIS) a complex set of information on the negative effects of geological factors on the environment has being created (Iglárová, Pauditš, 2001).

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Tab. 1. Structure and content of the PMS Geological Factors

N°	Name of subsystem	Solved issue
01	Landslides and other slope deformation	Continuous site monitoring of selected sites at exactness level corresponding to the site significance and its localisation within regional geological units. Extrapolation of acquired results to territories with analogous geological setting and climatic conditions according to defined criteria. Monitoring of territories prone to hazardous landslides and verification of corrective measures issues.
02	Erosion processes	Study of genesis, trends and dynamics of processes influencing the relief evolution at present geomorphologic cycle with consequences on changes due to construction impacts prognosis
03	Weathering processes	Issues of road–cuts stability influenced by contribution of weathered material from non–protected rocky walls
04	Voluminal unstable sediments	Issues of behaviour of volumetric unstable sediments, in which due to over–moisturising normal over–load deterioration of their structure and voluminal changes take place
05	Influence of minerals exploitation upon environment	identification and monitoring of damages in environment due to mining activities (manifestations of undermining and sinking of territory, cave-ins, changes in hydrogeologic water regime, chemical composition of waters in the vicinity of deposits and treatment plants)
06	Changes of anthropogenic sediments	Study of changes in fine–grained materials of tailings of various origin
07	Stability of massifs underlying historic objects	Study of the activity of slow slope gravitational phenomena, evaluation of causes of their origin and specification of secondary influences (climatic)
08	Covered anthropogenic sediments	Identification of empty spaces after exploitation filled with wastes of various types:: communal and industrial wastes, materials from mining and treatment activities
09	Tectonic and seismic activity of the territory	Territory monitoring and assessment of movements activity of geological structures and of the relative rate of movements along faults
10	Monitoring of snow pack quality	Territory evaluation of chemical composition of the snow pack in Slovakia focusing on its influence on accumulation of reserves and chemical composition of groundwaters, acidification of soils, degree and character of contamination of the environment of SR.
11	Monitoring of seismic phenomena	Continuous registration of seismic events on the territory of SR
12	Monitoring of stream sediments	Monitoring of anthropogenic loads of active river sediments and their influences upon the quality class of surface streams
13	Monitoring of the radon volume activity	Radon contained in soils is monitored in selected cities with prognosis of increased radon risk, radon in waters of selected mineral and thermal springs, radon along faults.

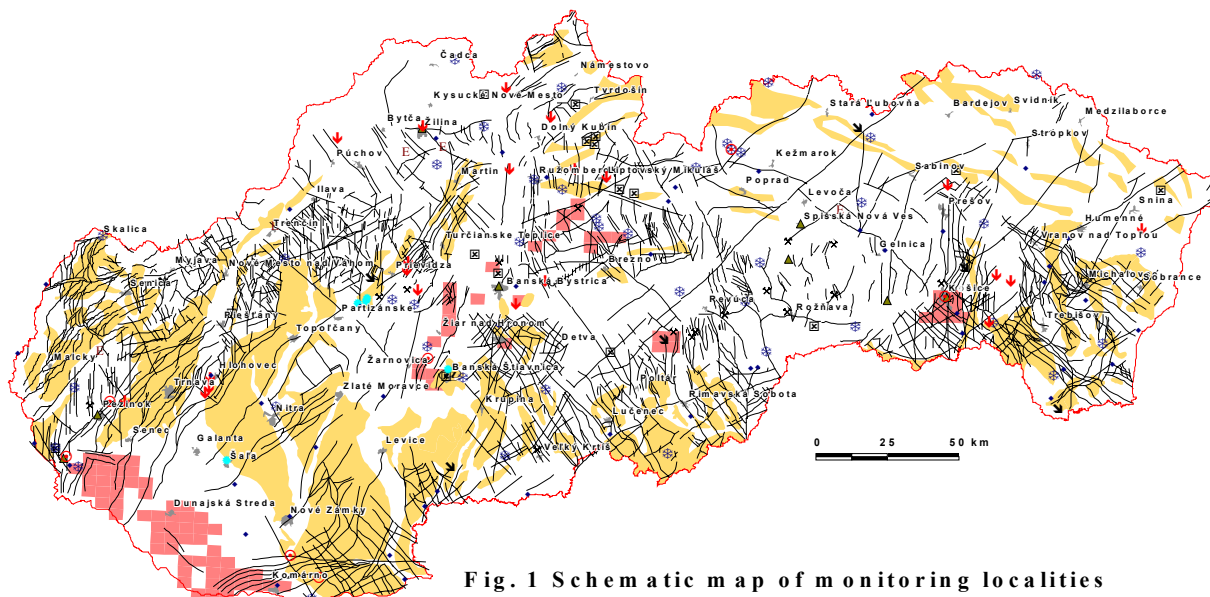


Fig. 1 Schematic map of monitoring localities

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| ↓ | 01 – Slope deformations | ■ | 08 – Covered anthropogenic sediments |
| ⚡ | 02 – Erosion processes | ⚡ | 09 – Tectonic and seismic activity |
| ☒ | 03 – Weathering processes | ❄ | 10 – Monitoring of snow pack quality |
| ■ | 04 – Voluminal unstable sediment | ⊙ | 11 – Monitoring of seismic phenomena |
| ✖ | 05 – Mining activities | • | 12 – Monitoring of stream sediments |
| ● | 06 – Changes of anthropogenic sediments | ▲ | 13 – Monitoring of the radon volume activity |
| E | 07 – Stability of massifs underlying historic objects | | |