Karst process and phenomena

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Karst definition

Karst is a topography formed from the dissolution of soluble rocks such as limestone, dolomite, and gypsum. It is characterized by underground drainage systems with sinkholes and caves.

Karst landscape in North Lithuania
The bedrock surface in karst terrains is often highly fissured and permeable. In areas lacking soil, this surface can be directly viewed and is called karst pavement.
Main factors of karst process

- Precipitation
- Recharge
- Soluble rock
- Groundwater flow
Karstic rocks in Lithuania and Latvia

1. Carbonates with old karst.
2. Carbonates with recent karst.
3. Sulphates with old karst.
4. Sulphates with recent karst.
Karst process and phenomena

The process is dissolution of rock and wash out of dissolved products.

In some cases it is not possible to separate karst process that results in chemical wash out and suffosion process when small particles are removed by ground water flow.

The phenomena are the forms of landscape or changes of rock structure underground.

Surface phenomena are sinkholes, hollows, depressions, ponors, etc.

Underground phenomena are caves, cavities, fissures, fractures, etc.
Main phenomena

Sinkhole - is the phenomenon caused by karst process, open surface form that appears immediately.

In some cases it is not possible to separate karst that results in chemical wash out and sulfossion when small particles are mechanically removed by ground water flow. Most part of surface phenomena is caused by mixture of mentioned processes.

There are about 12 000 surface karst forms (mostly sinkholes) in North Lithuania.
Hazardous phenomena
Hazardous phenomena

Shallow and underground phenomena become hazardous when the damages of buildings, infrastructure or even human health appear.
Density of karst sinkholes in Pasvalys town.
According to Marcinkevičius 2007, LGT
Investigations of North Lithuania karst
Geological mapping

Tectonic faults and karst sinkholes in North Lithuania
Recent sinkholes in Pasvalys (original scale 1:5000)
Investigations of North Lithuania karst
Evaluation of engineering geological conditions

15 boreholes drilled in 2004 cavities of 0.2-5 m. height were detected
Biržai dist., Latveliškis village geoelectric cross-section of living house territory, borehole No Nr. 41861.
Investigations of North Lithuania karst
Karst landscape monitoring

Lithuanian geological survey carries out karst landscape monitoring since 1992.

Large sinkhole (7.8 m wide and 3.8 m deep) in Žadeikonys (Pasvalys district) appeared in 2009.

Two sinkholes appeared near each other in 2011 and 2012.
Investigations of North Lithuania karst
Karst landscape monitoring

Recently, karst landscape monitoring consists of making aerial images by drone and checking the forms in the field.

UAV senseFly eBee+RTK is ready for take-off and flight mission performing:
Investigations of North Lithuania karst
Monitoring of dissolved gypsum

Monitoring of dissolved gypsum have been carried out since 1963. The results show the volume (m$^3$) of dissolved gypsum from the area (km$^2$) per time (year).
Environmental issues

Density of sinkholes cause land vulnerability.

North Lithuania karst region and active karst zone

LEGENDA

- Šiaurės Lietuvos karstinojų rajono riba
- Žemų ekologinio pažeidžiamumo grupės
  - I
  - II
  - III
  - IV

Vulnerability categories according to density of sinkholes per square kilometer

- 5 - 20
- 20 - 50
- 50 - 80
- >80
Building and construction conditions

Zones of high and low karst activity had been distinguished (according to sinkhole density and time of appearance). Different requirements for engineering geological investigations and construction approved.
Most important Legal acts for activity regulation in karst area

▪ The decision of the Government of the Republic of Lithuania of 12th of May, 1992 No 343 “On special land and forest use conditions”


▪ The law of the Republic of Lithuania “Special land use conditions“ (will come into force 01-01-2020)
THANK YOU FOR YOUR ATTENTION