UPDATING OF GEOGRAPHICAL NAMES IN THE TATRA MOUNTAINS REGION

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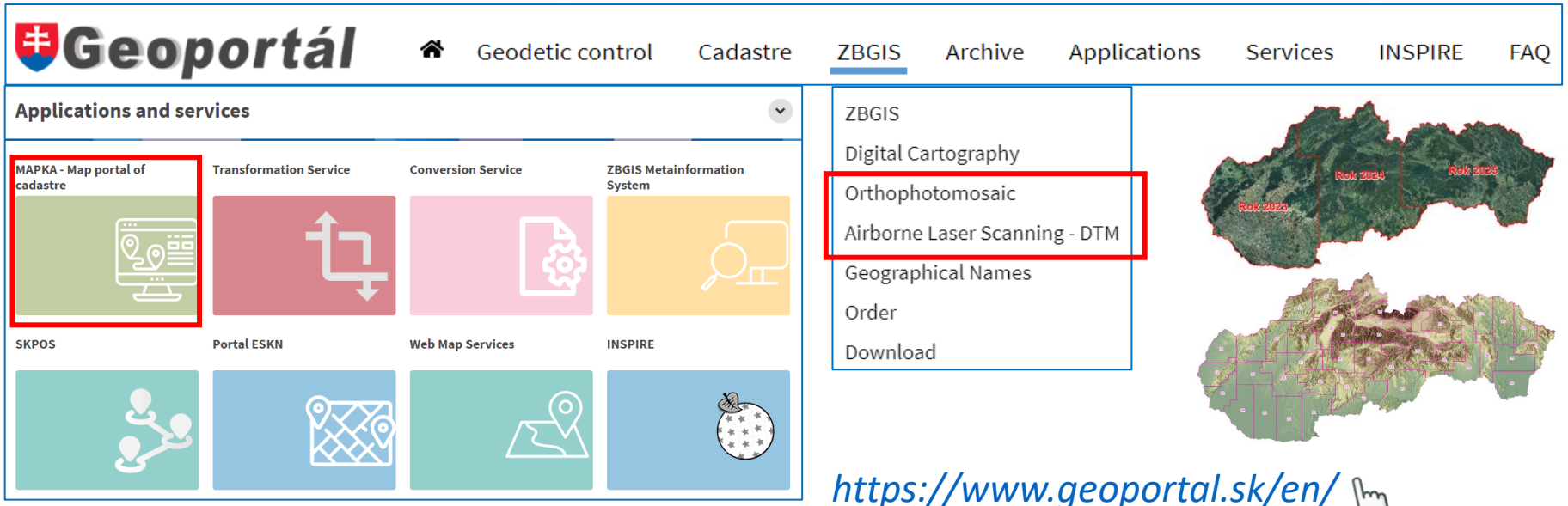
Products (ÚGKK SR, GKÚ BA, VÚGK)



https://www.geoportal.sk/en/

Kataster nehnuteľností (3D zobrazenie)
- parcely C, parcely E, stavby, vlastníci, listy vlastníctva, LPIS

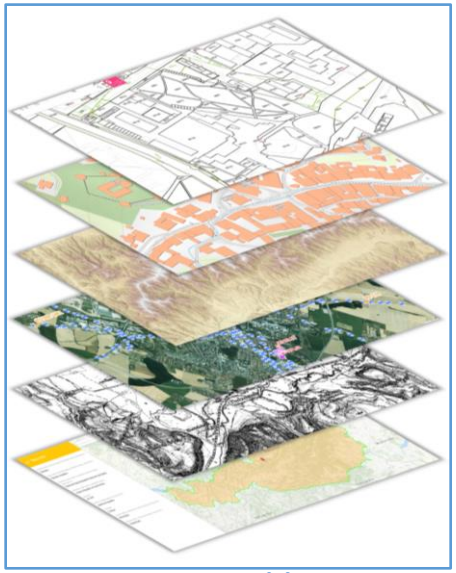
Základná mapa (3D zobrazenie)
- ZBGIS, adresné body, ulice, územnosprávne členenie

Terén (3D zobrazenie)
- sklon terénu, orientácia voči svetovým stranám, nadmorská výška (DMR 3.5), DMR 1.0, DMR 5.0, mračná bodov

Geodetické základy
- referenčné geodetické body (ŠPS, ŠNS, ŠGS, ŠTS)

Archív
- klady mapových listov, AMSR, ZMSR, TM, ŠMO5 2. vydanie, historická mapa III. Vojenského mapovania

Geografické názvoslovie
- štandardizované geografické názvoslovie mimo územia SR (štáty, hlavné mestá, oceány, moria, jazerá)



- **Visualization of ZBGIS®**
  - **Map themes**

MAPKA

Map portal of cadastre

https://zbgis.skgeodesy.sk/mapka/en/

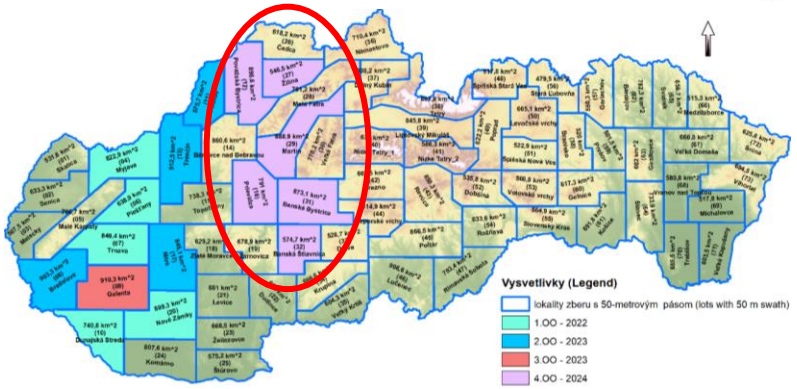
Airborne Laser Scanning (ALS) project of the Slovak territory

- **ALS** – highly accurate and detailed method of landscape mapping

- **1st project cycle**: 09.2017 – 05.2023
- **2nd project cycle**: 2022 – 2026 (2034)

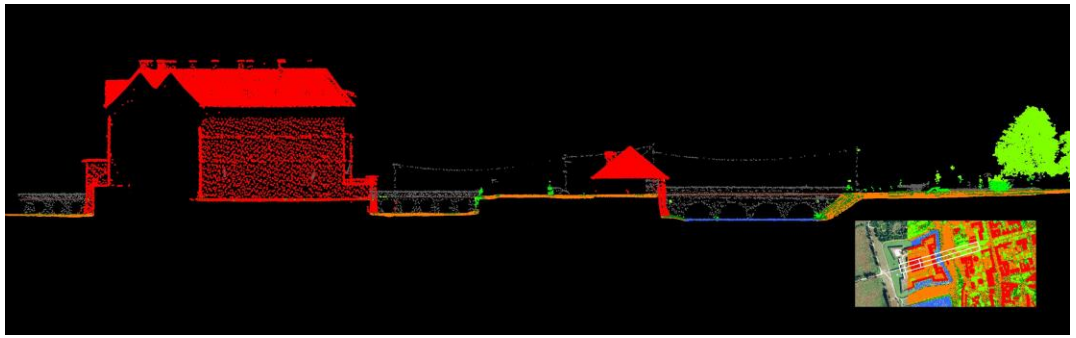
https://www.geoportal.sk/en/zbgis/als/

https://www.geoportal.sk/en/zbgis/als/2nd-cycle/



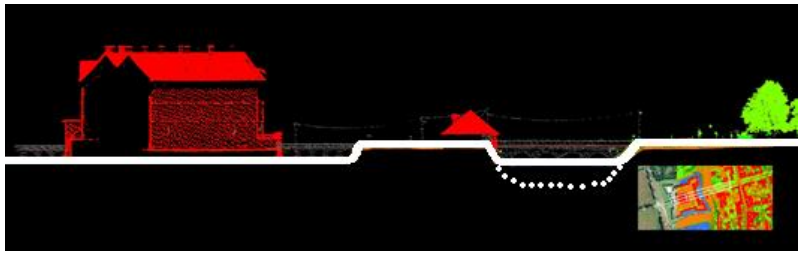
- **ALS** – during the vegetation-free winter period

- **ALS products**

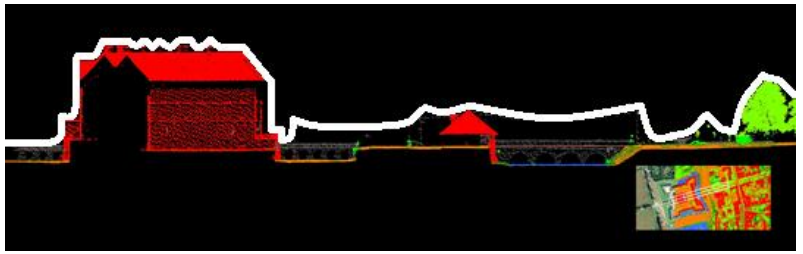


- **Classified Point Clouds**

- Digital Terrain Model (**DTM 5.0**)



- Digital Surface Model (**DSM 1.0**)



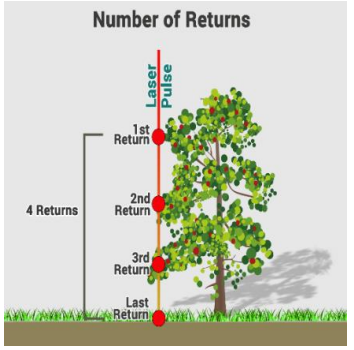
Quality parameters of ALS products

- **Accuracy:**
- Accuracy control on paved surface:
  - vertical accuracy of cloud points (ETRS89-h): values up to **0,10** m
  - positional accuracy of cloud points (ETRS89-TM34): values up to **0,20** m

- 1st ALS project cycle: m_h 〈**0,02m ; 0,09m**〉 m_P 〈**0,04m ; 0,17m**〉
- 2nd ALS project cycle: m_h 〈**0,01m ; 0,05m**〉 m_P 〈**0,04m ; 0,14m**〉

- DTM vertical accuracy tested on unpaved surfaces:
  - in build-up areas (grassland): values up to **0,15** m
  - outside build-up areas (fields): values up to **0,25** m
  - in wooded areas: values up to **0,50** m

- **Average density of points**:
  - 1st ALS project cycle:
    - density of last reflection points: **15 – 52** p/m^2
    - density of points hitting the terrain: **8 – 39** p/m^2
  - 2nd ALS project cycle:
    - density of last reflection points: **34 – 45** p/m^2
    - density of points hitting the terrain: **32 – 40** p/m^2



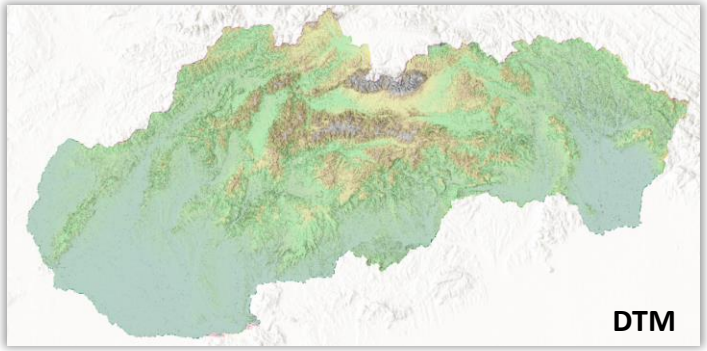
Provision of ALS products

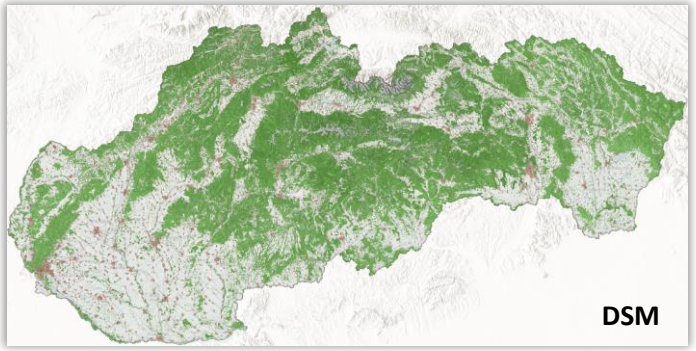
FREE OF CHARGE

Source of ALS products: „**ÚGKK SR**“

- **1st cycle**: **DTM 5.0, DSM 1.0**
  - format: raster (**TIFF**) with resolution – **1** x **1** m
  - horizontal and vertical system: **S-JTSK(JTSK03) + H_{Bpv}**
    ETRS89-TM34 + h_{ETRS89}

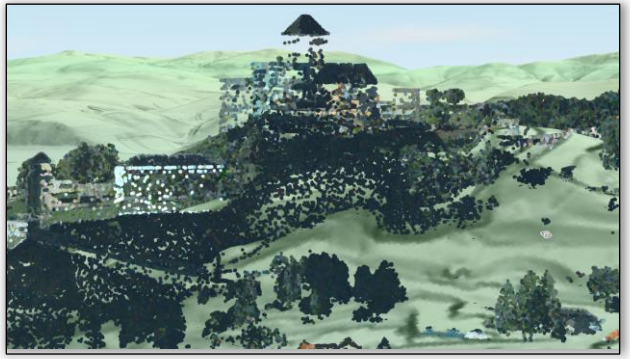
- **2nd cycle: DTM 6.0, DSM 2.0**
  - resolution – **0,5** x **0,5** m
  - available – LOT 04, 06, 07, 10, 20





- **Classified Point Clouds**
  - format: **LAZ**
  - horizontal and vertical system: **S-JTSK(JTSK03) + H_{Bpv}**
    ETRS89-TM34 + h_{ETRS89}

3D TEST



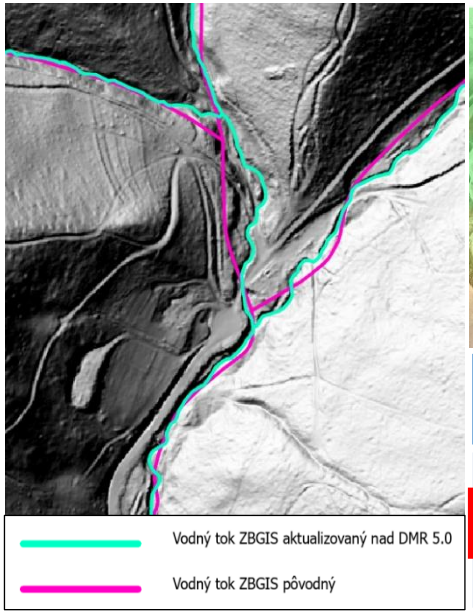
Note:

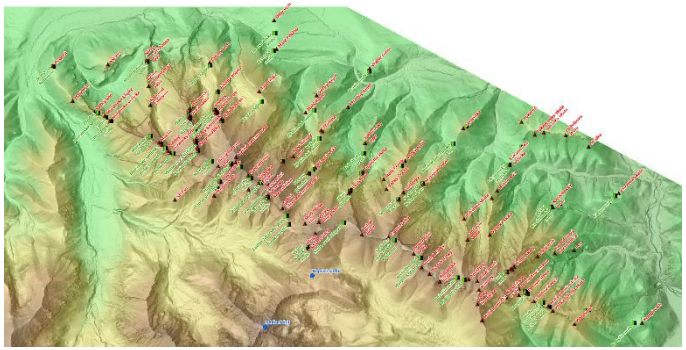
S-JTSK (JTSK03)	– EPSG: 8353
H_{Bpv}	– EPSG: 8357
ETRS89-TM34	– EPSG: 3046
h_{ETRS89}	– EPSG: 4937
S-JTSK (JTSK)	– EPSG: 5514

https://www.geoportal.sk/en/zbgis/als/provision-als-products/

Use of ALS products

- **within our Authority (ÚGKK SR)**:
  - refinement/updating of topographical data (**ZB*GIS*®**):
    - processing of the Orthophotomosaic of Slovakia,
    - refinement of the water courses,
    - **refinement of the location (position, height) of geomorphological features (peaks, saddles, etc.) and verification of their names,**
  - 3D building modelling – LoD 2.





	Peaks		Saddles	
	SGN	Densified	SGN	Densified
Vysoké Tatry	168	ca 770	39	ca 700
Belian. Tatry	22	ca 117	2	ca 75
Západné Tatry	88	ca 148	23	ca 58

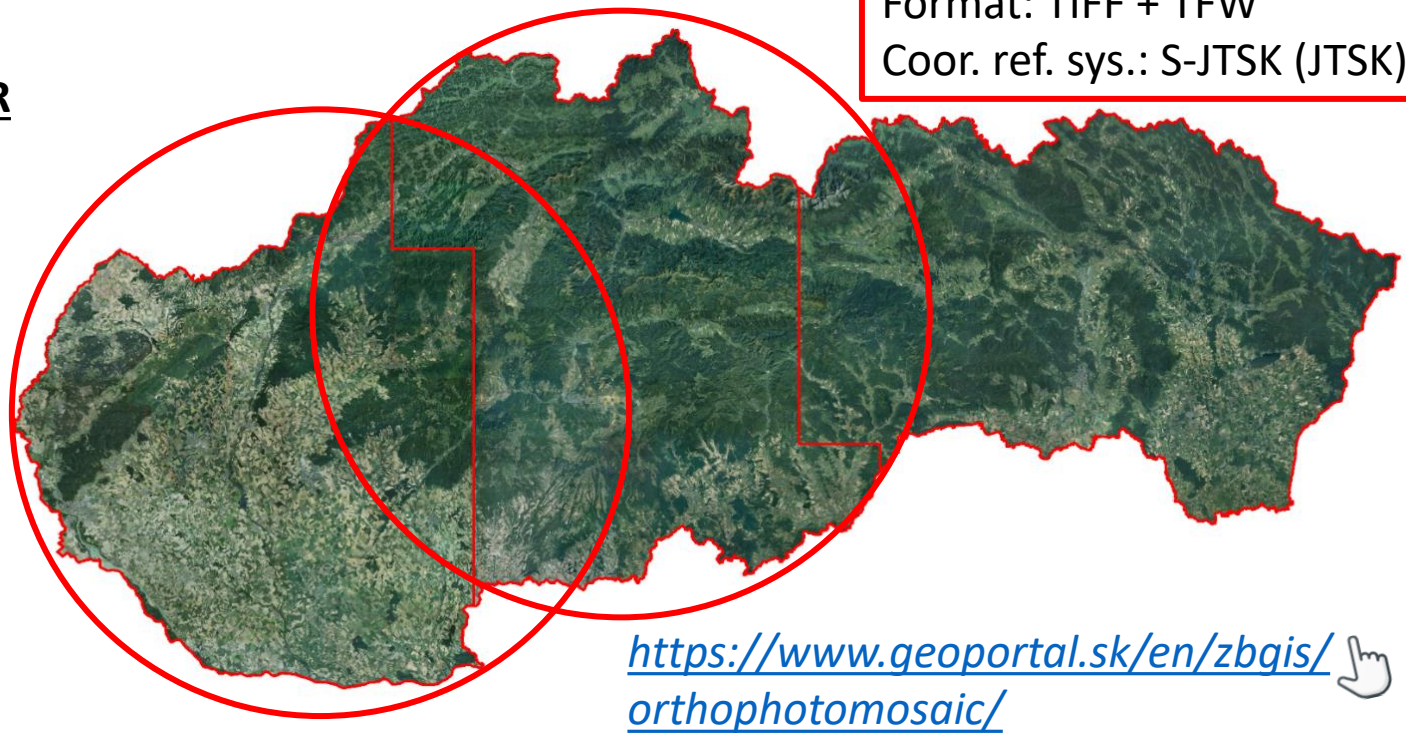
LoD 2 – shape of the object with an emphasis on the shape of the roof covering

Orthophotomosaic of Slovakia

Format: TIFF + TFW
Coor. ref. sys.: S-JTSK (JTSK)

Western part of SR
Imaging period:
Summer 2023
Availability:
July 2024

Central part of SR
Imaging period:
Summer 2024
Availability:
May 2025



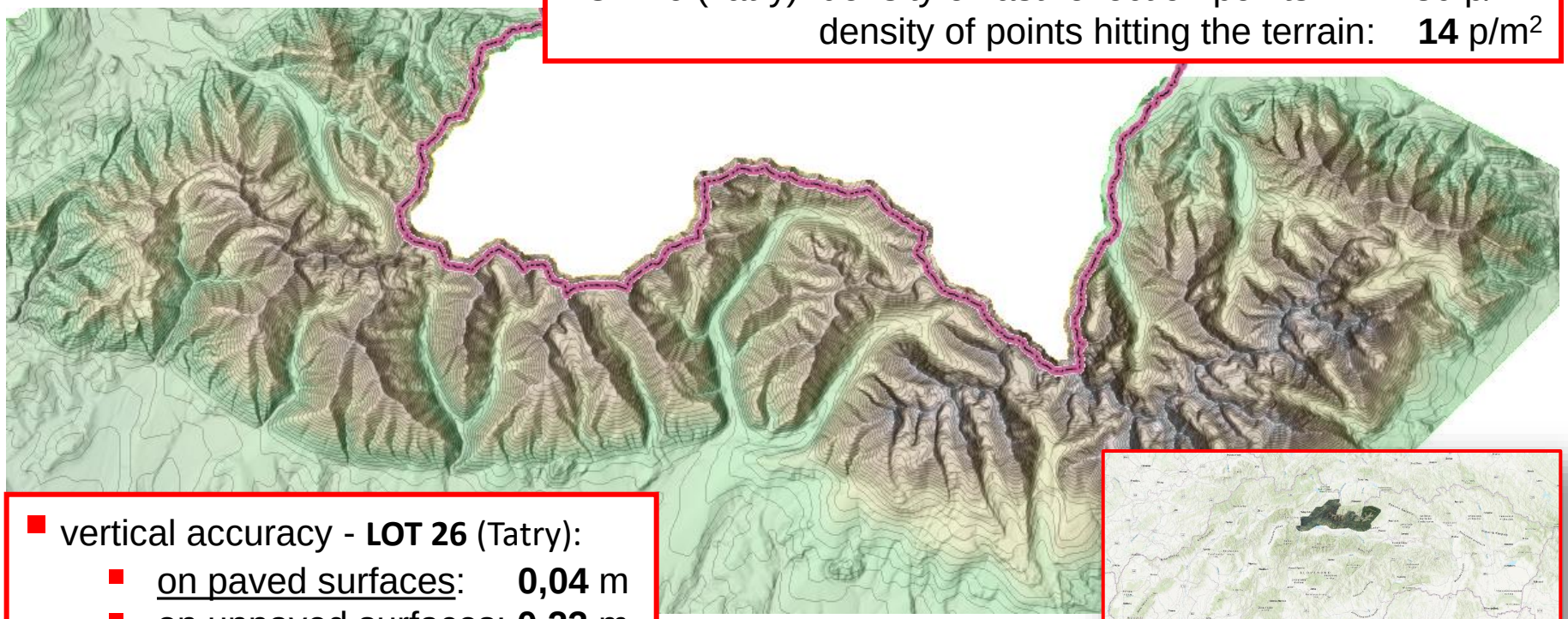
https://www.geoportal.sk/en/zbgis/orthophotomosaic/

	1st cycle (2017-2019)	2nd cycle (2020-2022)	3rd cycle (2023-2025)
Ground Sampling Distance (GSD):	25 cm/pixel	20 cm/pixel	**15** cm/pixel
Number of channels:	3 (RGB, 8-bit)	4 (RGB+NIR, 8-bit)	**4** (RGB+**NIR**, 8-bit)
Root mean square error $RMSE_{xy}$	$RMSE_{xy}$ = 0,30 m	$RMSE_{xy}$ = 0,21 m	$RMSE_{xy}$ = (West $RMSE_{xy}$ = 0,17m)

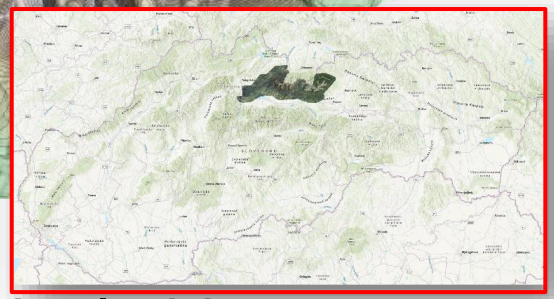
Use of DMR 5.0 to refine the position and height of the Tatra mountains (TM)

- **August 2019** – ALS products available from the TM region (ALS **summer 2018**)

LOT 26 (Tatry): density of last reflection points: **30** p/m^2
density of points hitting the terrain: **14** p/m^2



- vertical accuracy - **LOT 26** (Tatry):
  - on paved surfaces: **0,04** m
  - on unpaved surfaces: **0,23** m



- DTM from ALS – detailed location of individual objects
  - high detail and vertical accuracy of the new terrain mapping, which is from several centimetres to decimetres depending on the terrain

Use of DTM 5.0 to refine the position and height of the Tatra mountains

- **August 2020** – online report – the map publisher compared „**their**“ locations and heights of the peaks in the Tatras with the heights on **DTM 5.0** from ALS
  - differences in heights – from a few meters to more than 100 m
  - the biggest difference – **127** m (Malá Litvorová veža)

- **Cause of the problem**:
  - original heights – unknown origin, unknown accuracy
  - without the exact location of the feature (coordinates) – it is not possible to find out the correct height
  - different literature – different values of heights and names
  - confusion of peaks

Map publishers have given/used different locations (altitudes) and forms of feature names

History of height measurement in the TM

(*Jozef Marek*, Geodeti a kartografi v Tatrách, 2019)

- since the 19th century – various specific measurements of the heights of the main peaks – various heights
- first measurements – **heights of the main peaks were determined according to the height of the trigonometric point** (**TP**)
  - Note: the trigonometric point was not always placed at the highest point of the hill, but was placed at a point from which there was a good view of the surrounding trigonometric points

- *1964*

- heights of peaks **without TP** were determined from aerial images or by carto-metric method
  - the accuracy of the determination of heights is at the meter level
- present – Global Navigation Satellite Systems (GNSS)

  Airborne Laser Scanning (LiDAR, ALS)

- *since 1998*

Various sources

(Different technologies – Various quality)

Revision and updating of Standardised Geographical Names (SGN)

- the refinement of heights as well as positions – is linked to the SGN
- **Problems**: 1. ambiguously identified names of geographic features
  2. incorrectly positioned geographical name on the map
- **Standardised Geographical Name** (**SGN**) – identifier – orientation on the map, in the field, on the internet, in navigation
- Database of SGN – created from the State map series (Basic maps BM10, BM 50) and Topographic maps (TM25, TM50)
  - more than **130 000** SGN
  - *in the period 1995 – 2003*

Caves and natural waterfalls: according to the Nature and Landscape Protection Act - natural monuments, under the responsibility of the Ministry of Environment of the SR

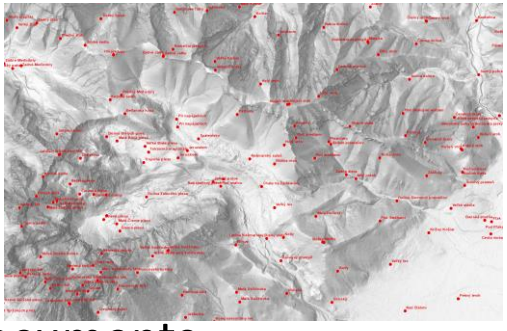
- selected categories of SGN:
  - **Peak; Pass, saddle;** Valley; Ridge, back; ~~Cave, gorge; Waterfall;~~ Ravine, gully, gutter; Slope; Lake, tarn; etc.
    - gallery, lookout, terrace, wall, pillar, footbridge etc.

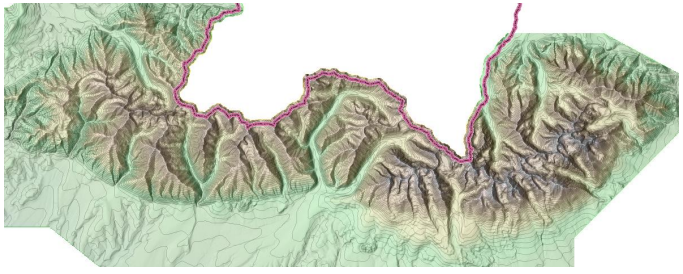
„***Other geomorphological form***“

Refinement of position of geomorphological features and verification of their names

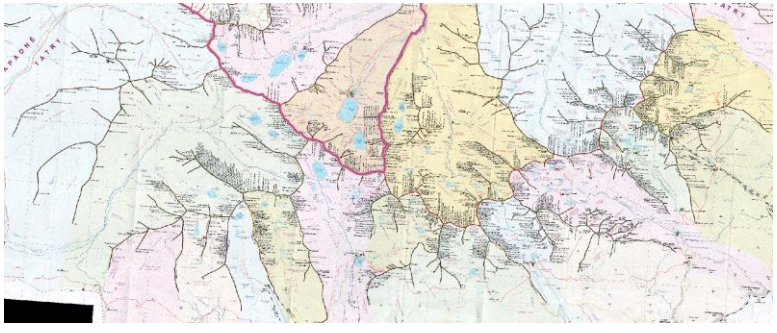
- **Material used for refinement and completion of the SGN**

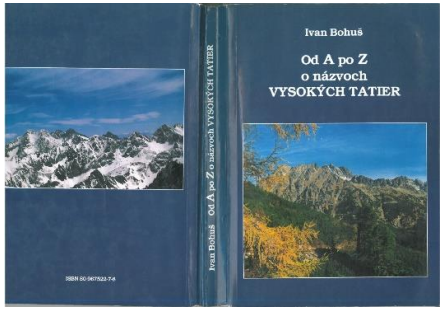
- **SGN** – select categories
- **DTM 5.0**

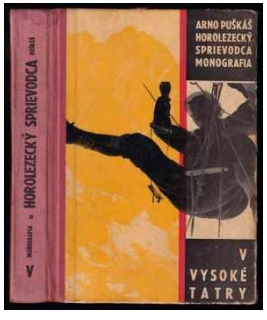


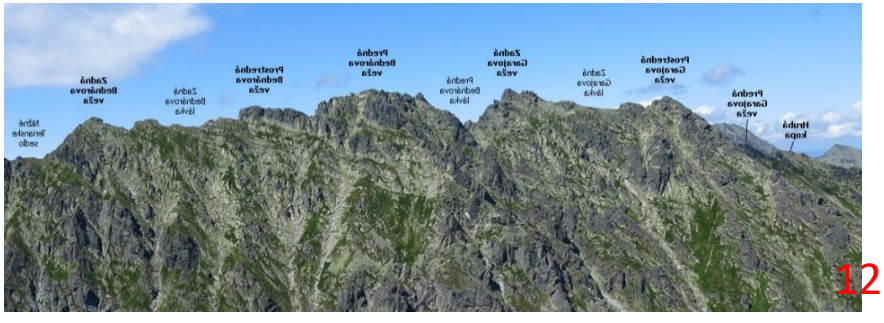


- Various **map** and **book** documents









Technological procedure

- Analyses of local extremes – from ***DTM 5.0***
  - automatic generation of local extremes using *ArcPython script*
    - **MAX** – to identify and locate peaks - a GN feature class **peak** was used as a benchmark
    - **MIN** - to identify and locate saddles

SGN

- **Automatic shift of the GN position** – under the condition of the suitability of the shift

Automatic shift = New GN position

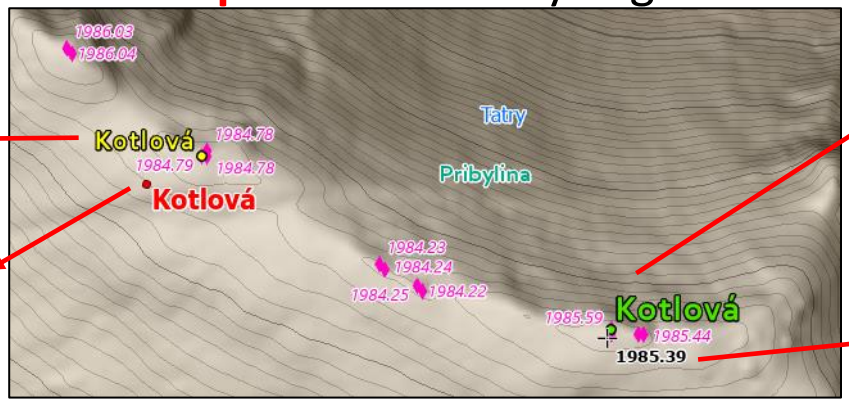
GN position displayed on the DTM 5.0

local extreme - MAX

- SGN location analysis
  - **Manual shift of the GN position** – analyzing the GN location on available documents

Automatic shift

GN position displayed on the DTM 5.0



New GN position - manual shift

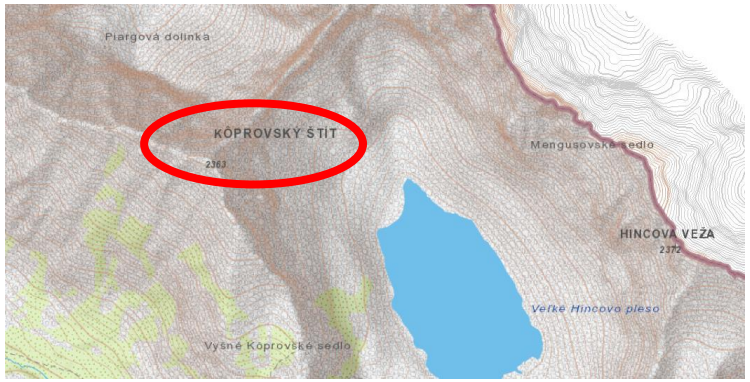
local extreme - MAX

TP

Technological procedure

- Corrections in maps after analyzing the GN location – <u>position and hight</u> – **<u>major mistakes</u>**:
  - addition: **Kôprovský štít**,
  - shift: Capie veže, Divá veža, Hranatá veža, Svišťový štít, Štôlska veža, Zadná Garajova veža, Žeruchova veža, Jastrabia veža etc.

SGN



Corrections at the annotation level

Proposal for new location of GN features

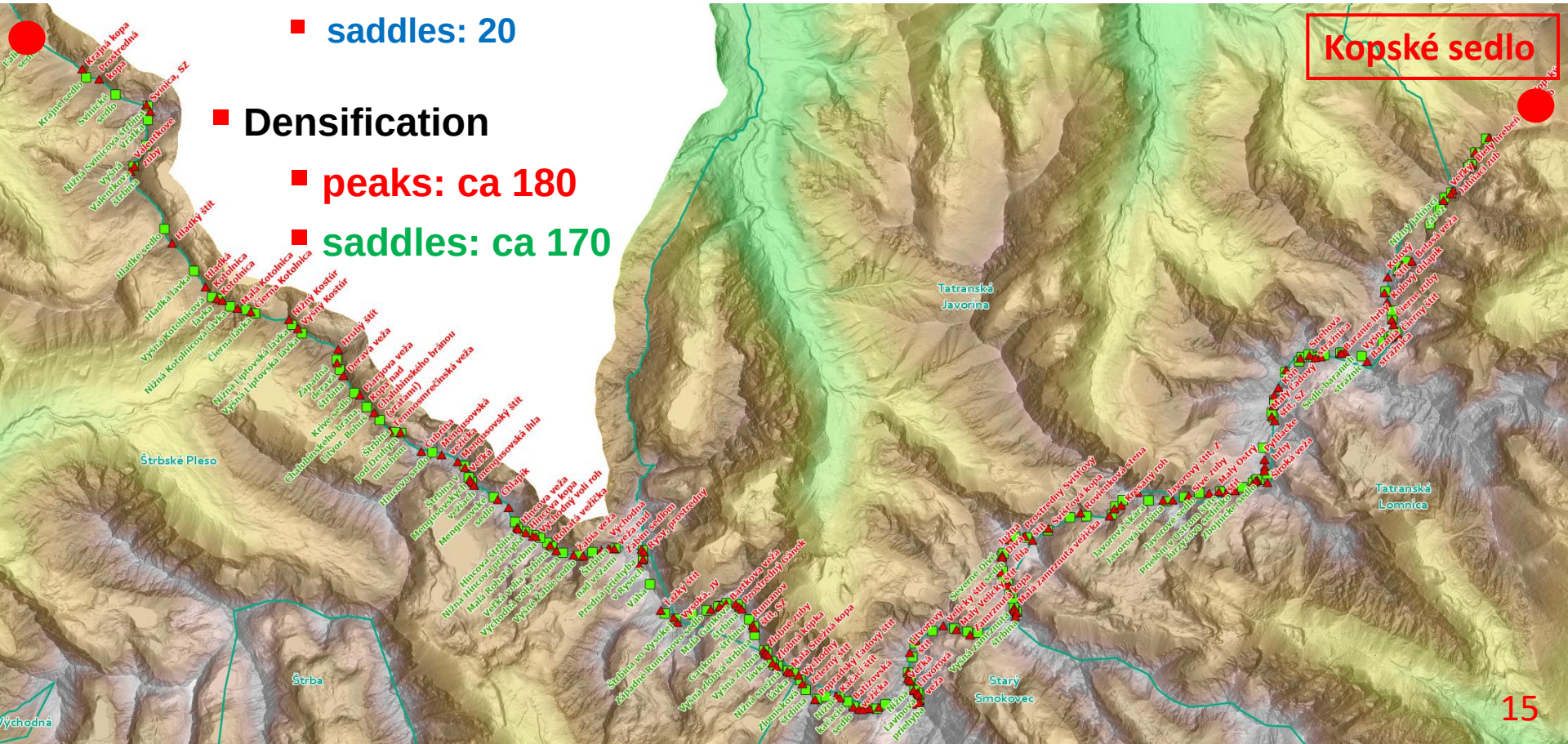
- SGN features on the **main ridge** of the High Tatras (part of TM)
- Densification (position, height and name) of GN features
  - **SGN: 58 features**
    - peaks: 38
    - saddles: 20
  - **Densification**
    - **peaks: ca 180**
    - **saddles: ca 170**

Ľaliové sedlo

Original position of SGN features

Correction of position and densification of GN

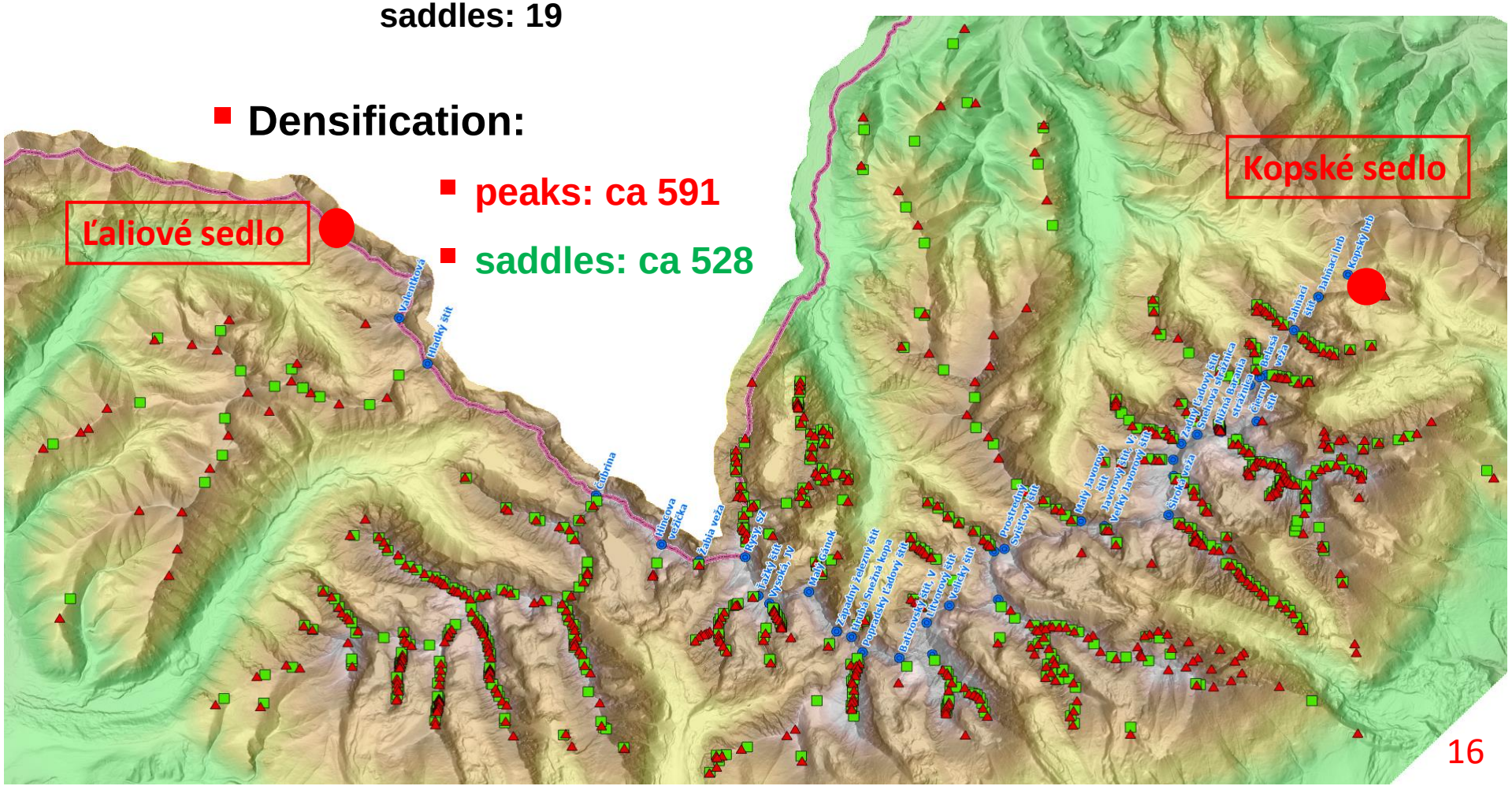
Kopské sedlo



Proposal for new location of GN features

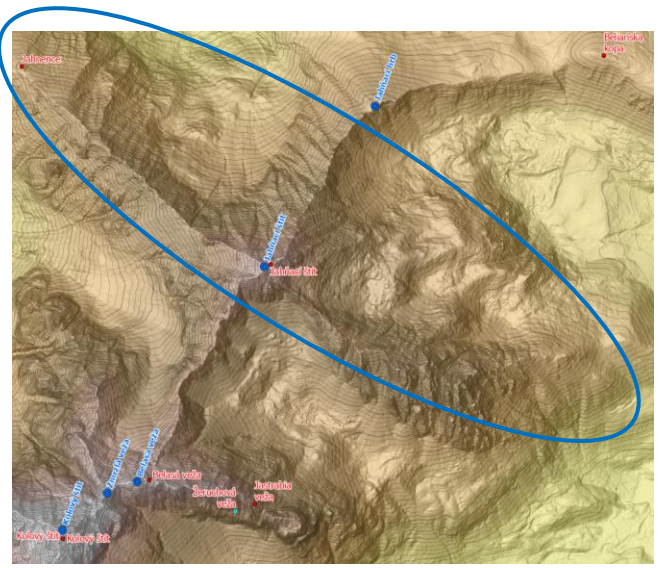
- Densification (position, height and name) of GN features (category Peak and Saddle) on the **side ridges** of the High Tatras
  - **SGN:** **peaks: 130**

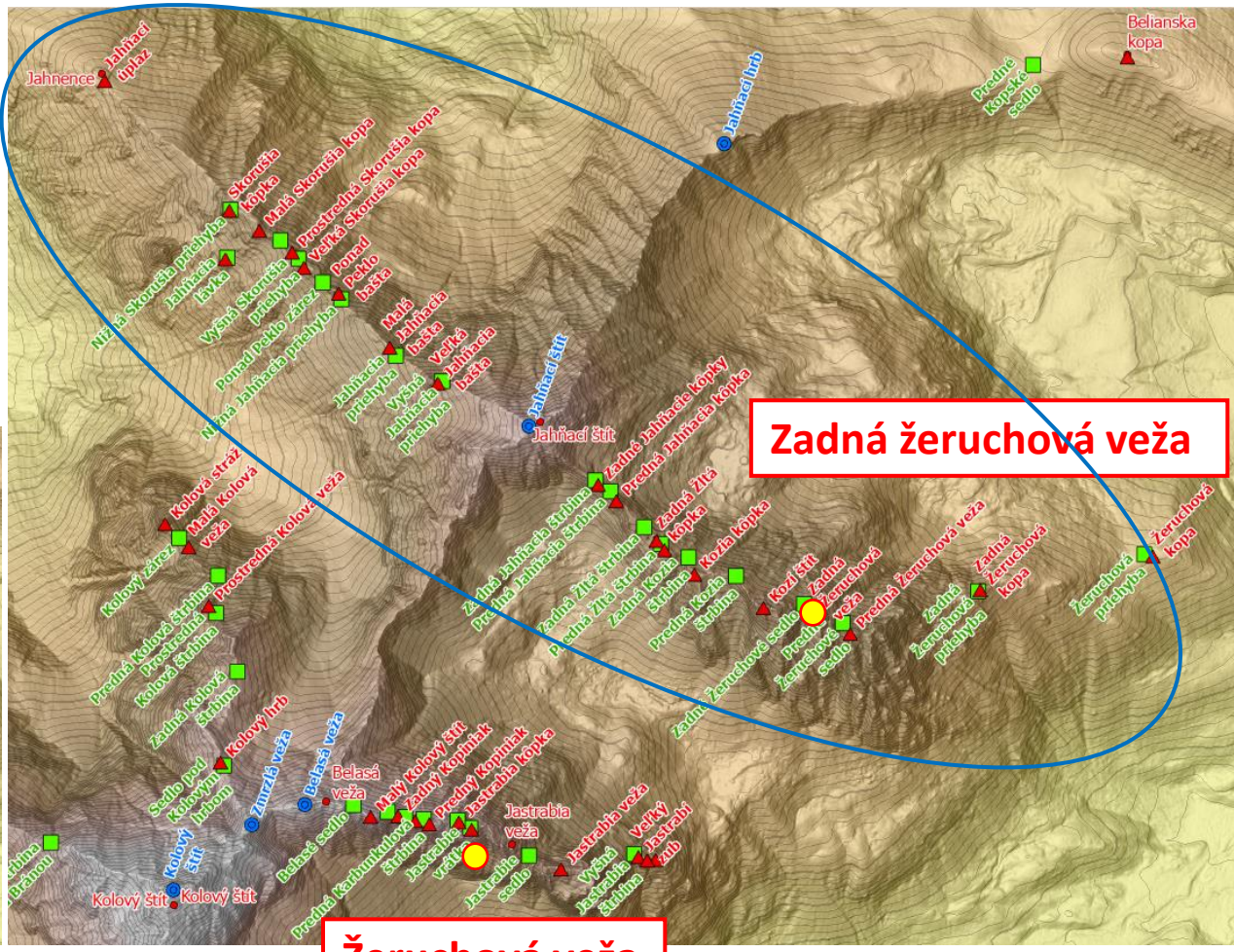
    saddles: 19
  - **Densification:**
    - **peaks: ca 591**
    - **saddles: ca 528**
  - **Side ridges: 35**



Examples - Densification

- **Side ridges: peak:** ***Jahňací štít***
  - **Densification:**
    - **peaks: 19**
    - **saddles: 18**





Zadná žeruchová veža

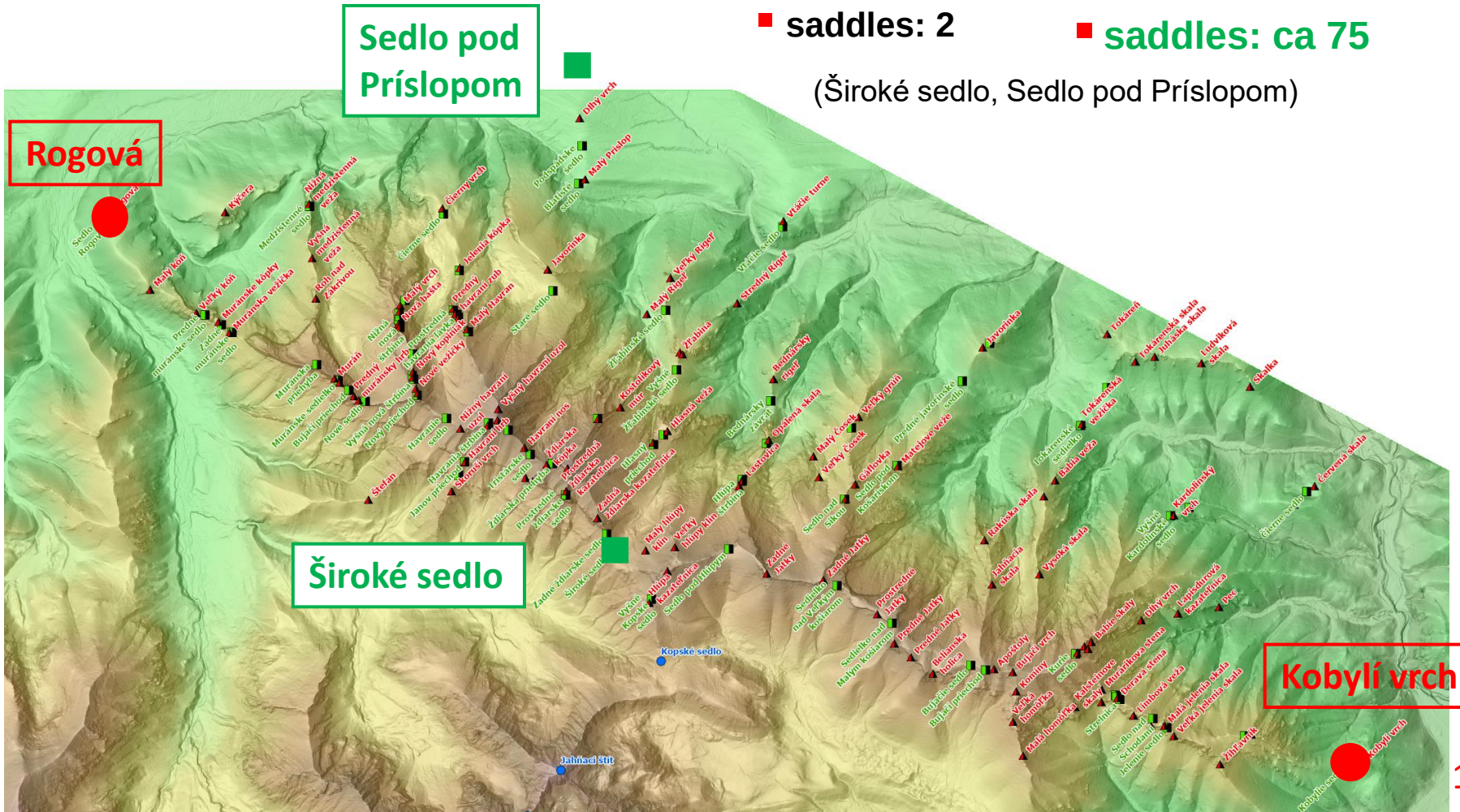
Žeruchová veža

Proposal for new location of GN features

- Densification of **Belianske Tatry**

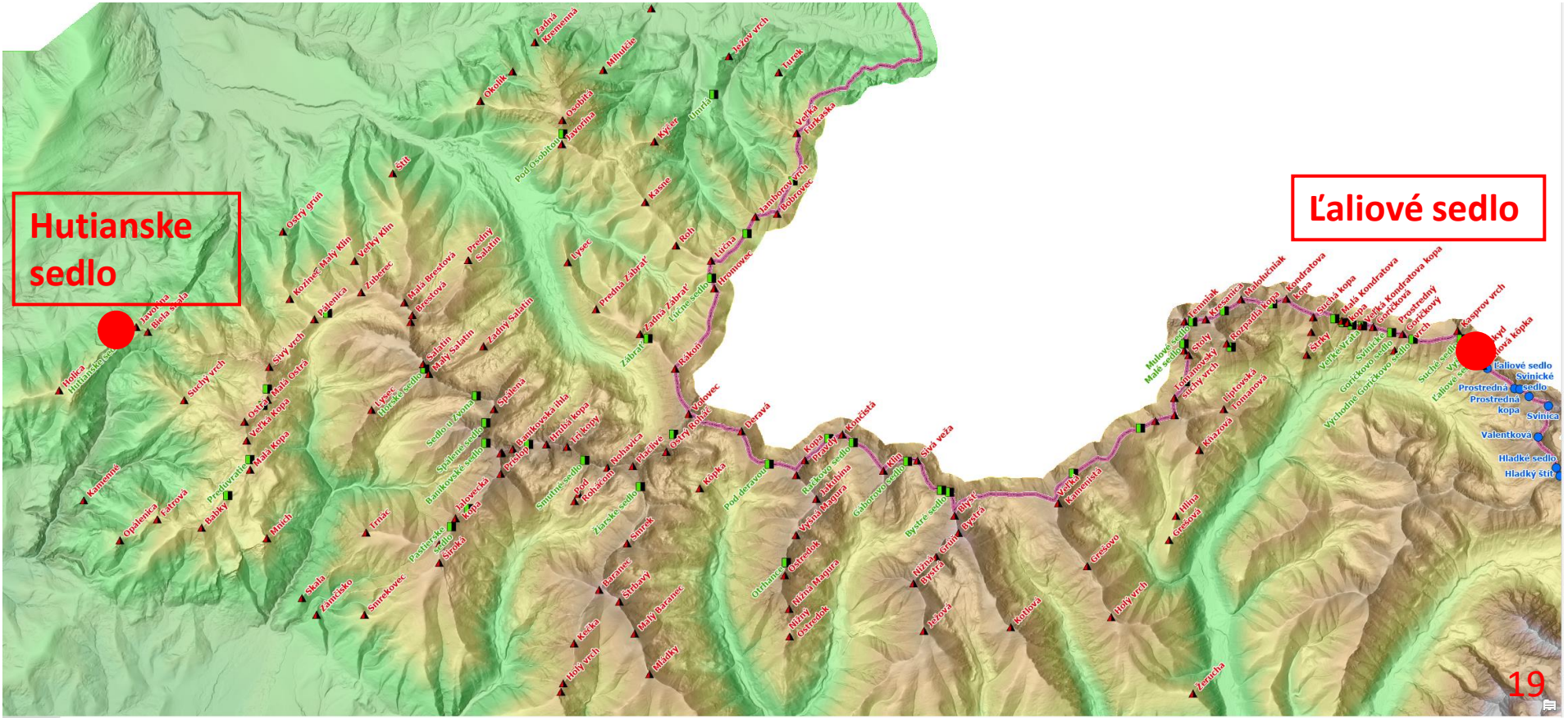
- **SGN:**
  - **peaks: 22**
  - **saddles: 2**
- **Densification:**
  - **peaks: ca 117**
  - **saddles: ca 75**

(Široké sedlo, Sedlo pod Príslopom)



Proposal for new location of GN features

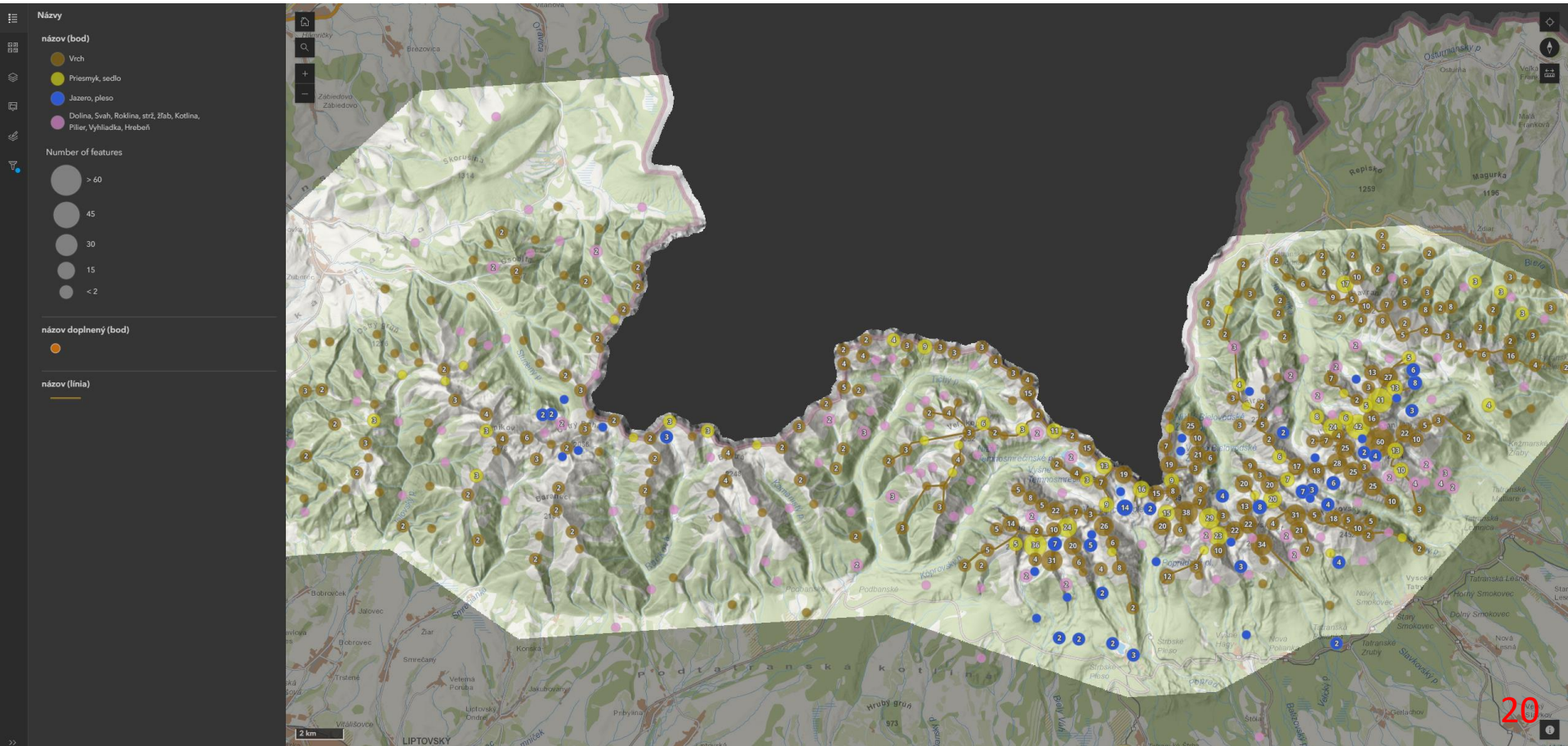
- Densification of **Západné Tatry**
  - **Parts:** Osobitá, Sivý vrch, Liptovské Tatry, Roháče, Červené vrchy, Liptovské kopy
  - **SGN:**
    - **peaks: 88**
    - **saddles: 23**
  - **Densification:**
    - **peaks: ca 148**
    - **saddles: ca 58**



Verification of proposals

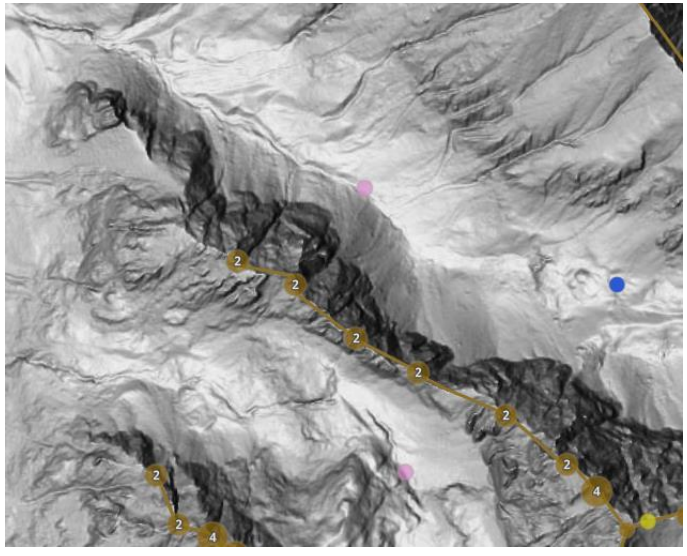
- online Arc GIS portal application
- editing of our location and name proposals by selected experts via the online Arc GIS portal application

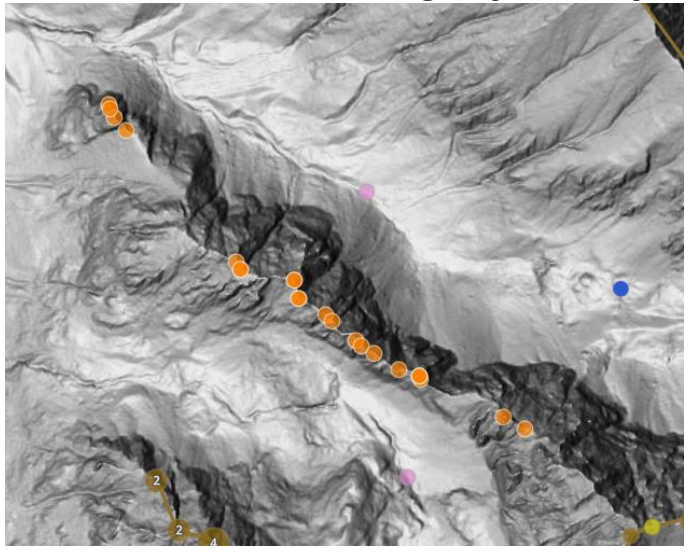
Number of features: ca **2 300**



Working group GN_TATRY

- **Requirements:**
  - verification of **proposals** for locations, names form and categories of features:
    - location editing – position shift,
    - proposal of name form,
    - verification of the classification in the GN category,
    - justification,
  - addition of other new features:
    - fill in the required items - name, category and justification.





- Personal replica
- **Modified features: 18**

Food for thought – standardisation of GN

- The issue of details - if it is a two and three peaks named composite object (possibly with saddles or slits) we can determine the position and height of each component of the composite feature

568	**Krátka (SGN)**	**Peak**	**Composite: Východná, Prostredná a Západná Krátka**
569	Krátka, V. (Východná Krátka)	Peak	
570	Východná krátka štrbina	Saddle	
571	**Krátka, prost. (Prostredná Krátka)**	**Peak**	**SGN Krátka**
572	Západná Krátka štrbina	Saddle	
573	Krátka, Z. (Západná Krátka)	Peak	

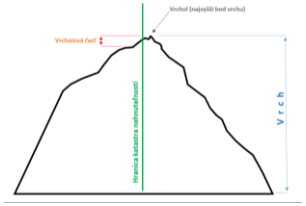
To what extent is **standardization** of such particulars necessary?

- The issue of upper- and lower-case letters in names

- **Linguistic assessment -** consulted with representatives of the Ľudovít Štúr Institute of Linguistics, members of the names commission

- new location of features - on or behind the **state border** (Endonymum, Exonymum), outside the cadastral boundary

If the names do not go through the standardization process, they will not be lost, they will be listed next to the standardized name as variant names.



Interesting facts

- **Related task:**
  - Working group - refinement and update of geomorphological unit (GMU) boundaries of the whole Slovakia above DTM 5.0

Volovské vrchy:
the highest peak - Zlatý stôl
pillar height ca 640 cm
1 322 m (ca 1 316,2 m)

Čergov:
the highest peak - Minčol
pillar height ca 550 cm
1 157 m (1 152,6 m)

Vihorlatské vrchy:
the highest peak - Vihorlat
pillar height ca 620 cm
1 076 m (1 073,0 m)

https://www.geoportal.sk/en/zbgis/als/interesting-facts/

- For the needs of the Statistical Yearbook - update **T 2-8. Mountains**
  - Height determination of the highest peaks in individual GMUs above DTM 5.0
- According to the Tatra Mountains project - continue to refine features in other GMUs

ÚGKK SR
Úrad geodézie, kartografie a katastra Slovenskej republiky

GKÚ
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Thank you for your attention.

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