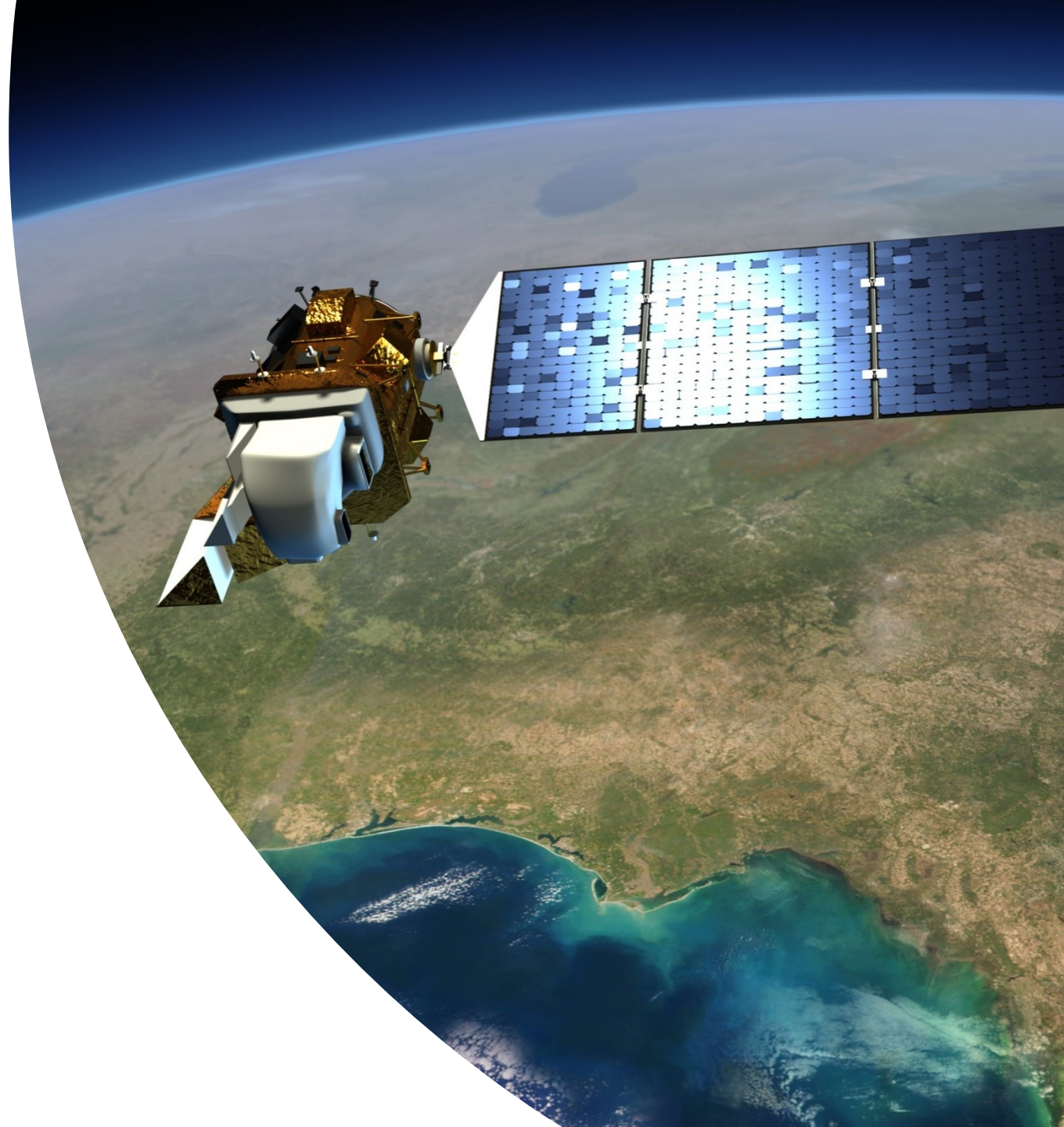


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# Základy diaľkového prieskumu Zeme

– cvičenie 2

Mgr. Katarína Onačillová, PhD.



## Úloha 2 – klimatické zmeny a ústup ľadovca

1. Vyhľadanie alebo zoom na “Jökulsárlón” (ľadovcová lagúna, Island)
2. Stiahnutie 2 scén (bez oblakov nad územím a bez snehu):
  - Súčasná snímka (2016-2017)
  - Snímka z obdobia 2000-2003
  - Snímka z obdobia 1987-1990

*Pozn.:*

- *Využitie „Prídavných kritérií“ pre výber scén s malou oblačnosťou*
- *Ideálne - stiahnutie scén iba z obdobia (pravdepodobnosť čistej snímky)*
- *Predpoklad využívania rozličných datasetov (napr. Landsat 4-5, 7, 8)*

3. Rozzipovanie stiahnutého súboru
4. Skopírovanie potrebných .tif súborov do nového priečinka
5. Skontrolovanie vlastností súboru (uistenie sa, že majú súrad. systém)
6. Usporiadanie súborov od najnovších po najstaršie

Address/Place Path/Row Feature Circle

Jökulsárlón

Show Clear

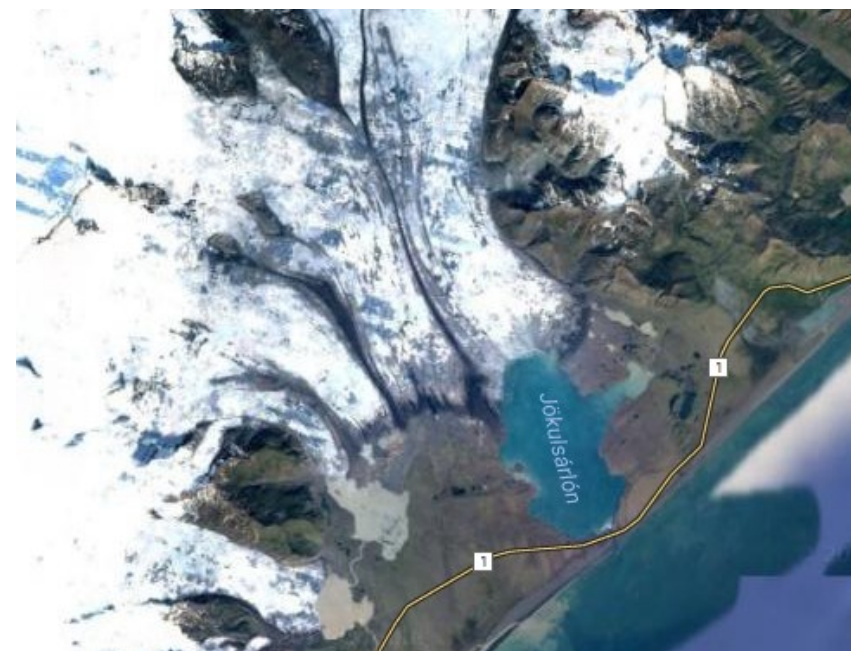
Click on an Address/Place to show the location on the map and add coordinates to the Area of Interest Control.

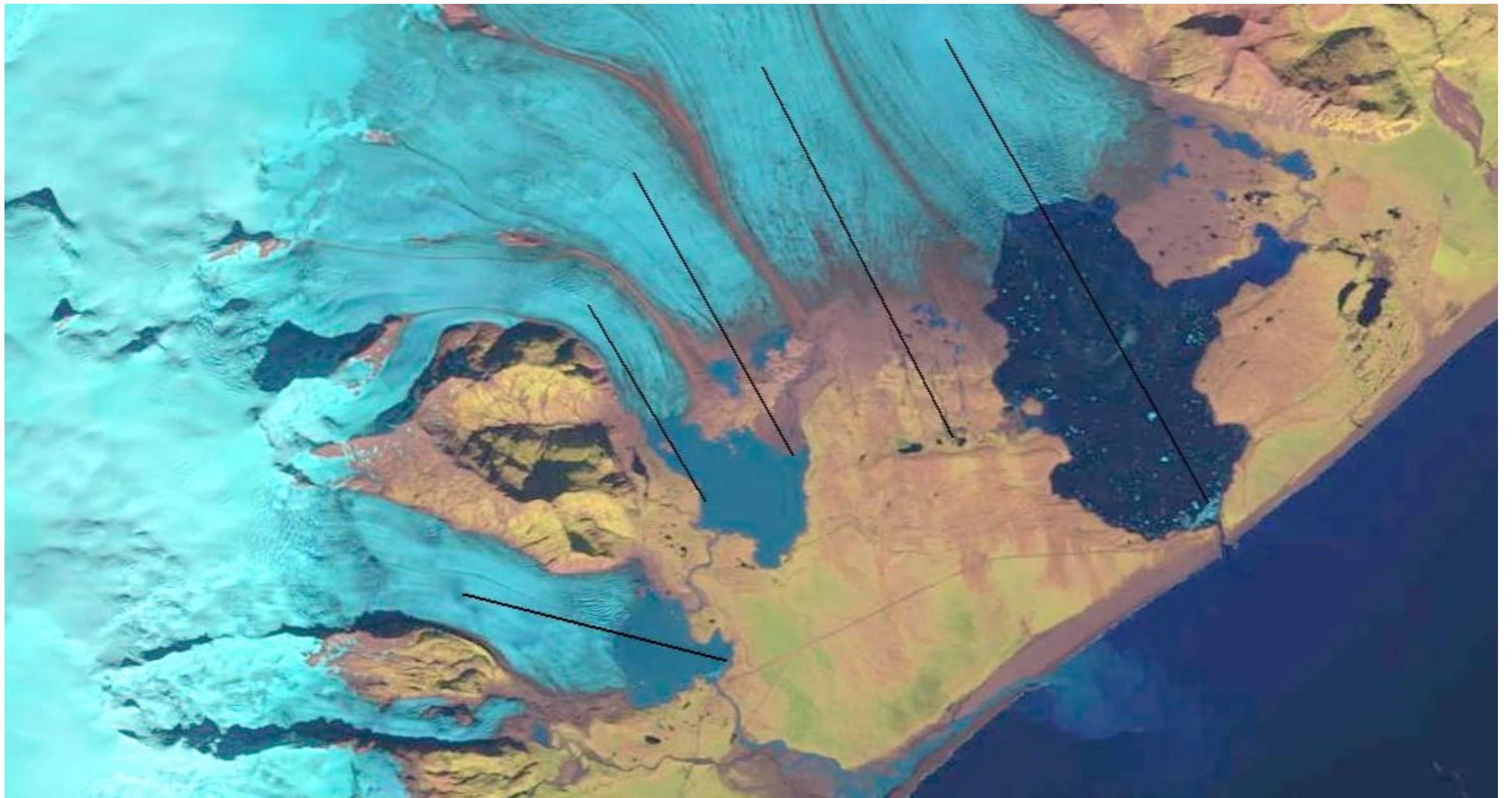
| Num | Address/Place                       | Latitude | Longitude |
|-----|-------------------------------------|----------|-----------|
| 1   | <a href="#">Jökulsárlón, Island</a> | 64.0784  | -16.2306  |

Date Range Result Options

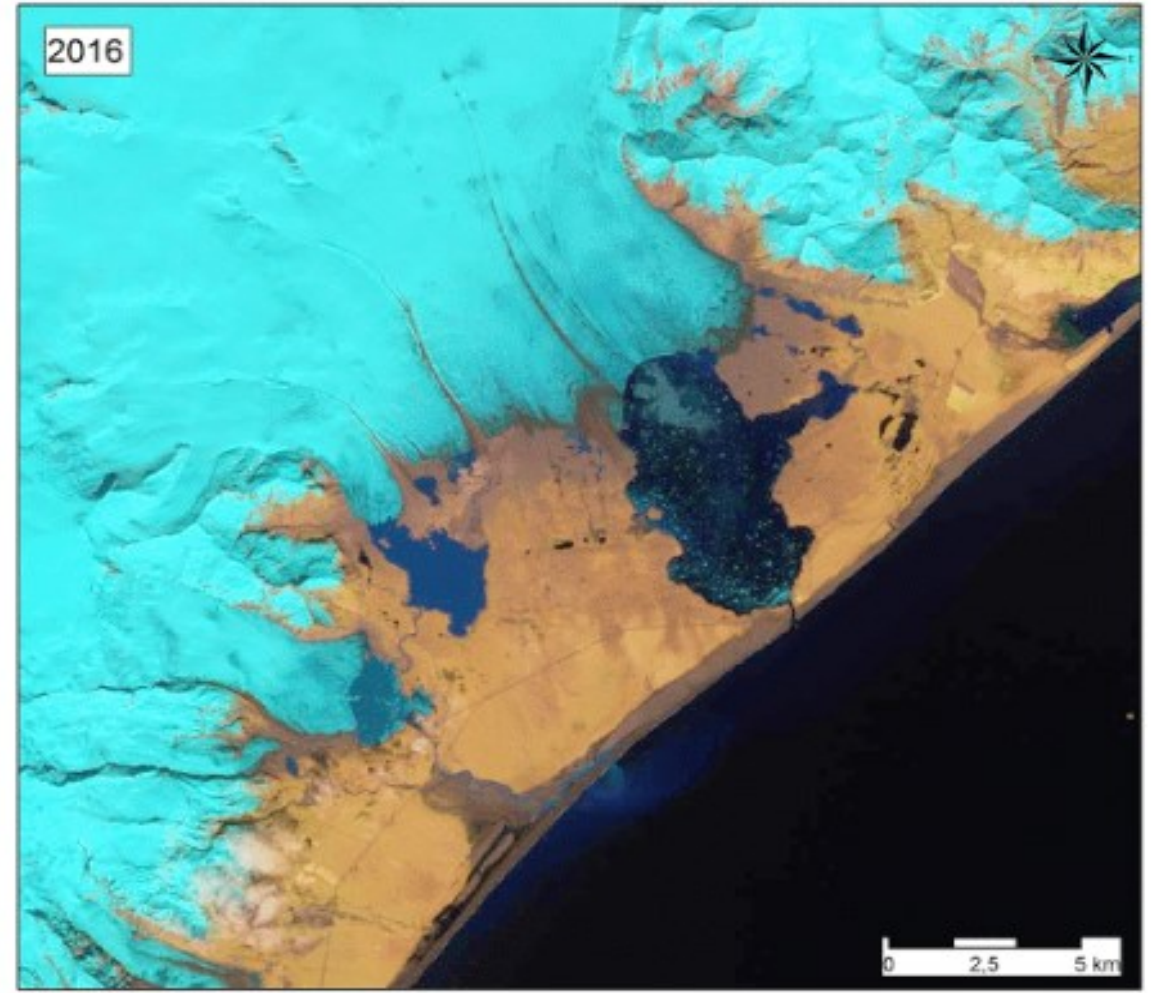
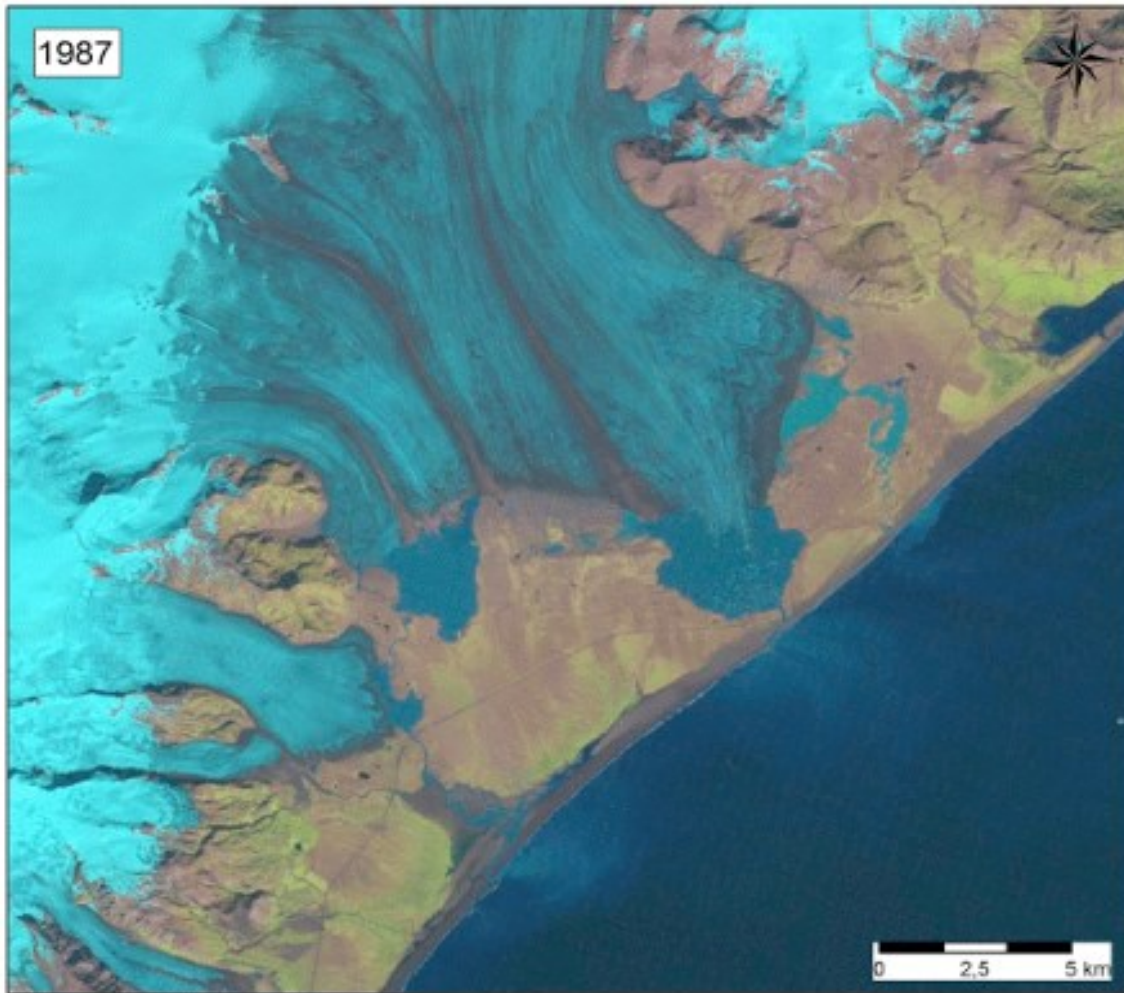
Search from: 08/01/1987 to: 08/31/1990

Search months: August



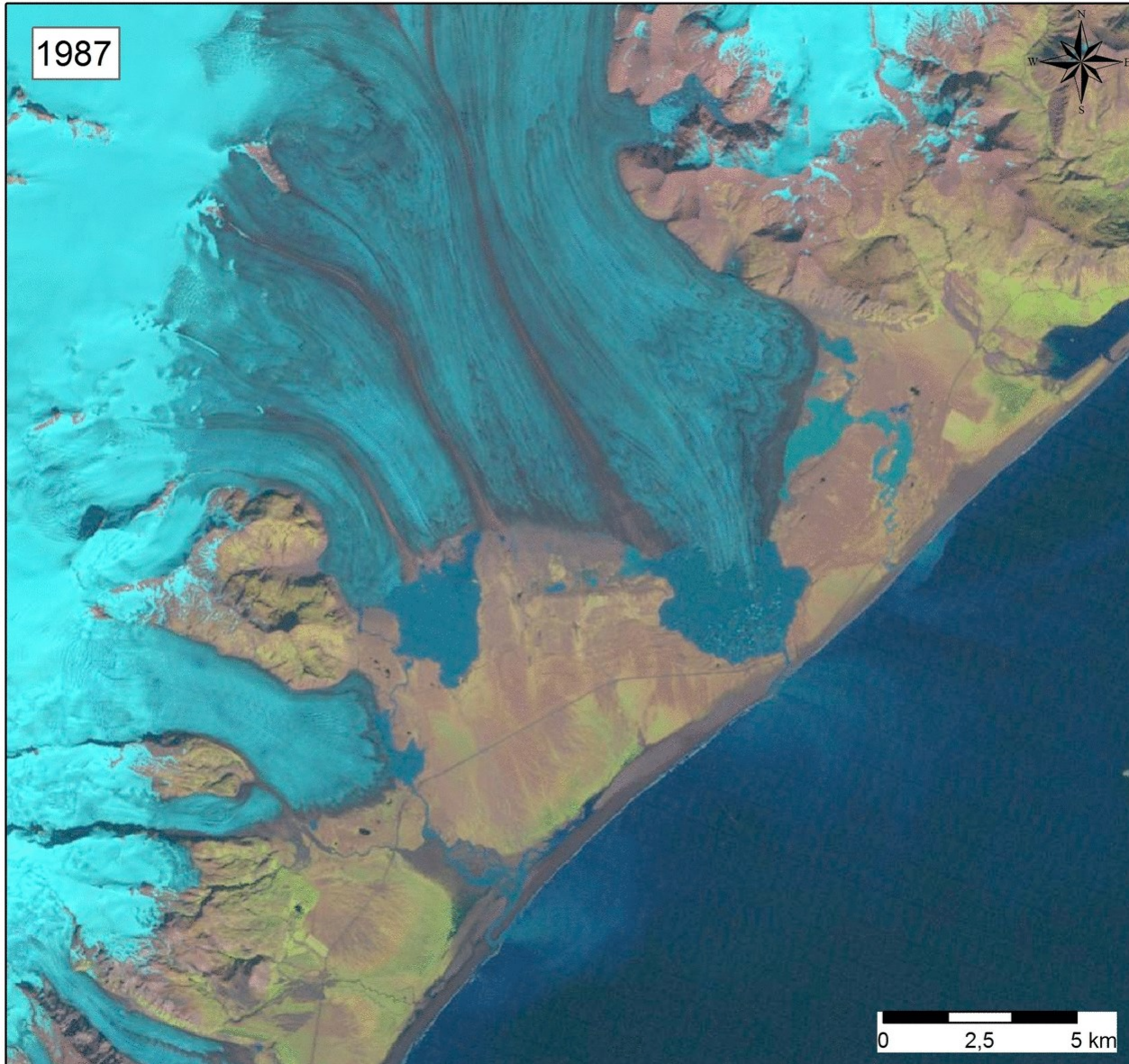


7. Zmeranie šírenia ľadovca pozdĺž 5 profilov (pre každú časť ľadovca a časové obdobie) a spracovanie zistení do tabuľky



8. Vytvorenie kompozície zahŕňajúcej: severku, mierku, rok scény (viď obrázok)

9. Export súborov (jpg): 1 súbor pre každý rok



9. Vytvorenie jednoduchkej animácie (vid' obrázok)

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1

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Interpretácia metadát

#### 4. Search Results

If you selected more than one data set to search, use the dropdown to see the search results for each specific data set.

Show Result Controls

Data Set

Click here to export your results »

L8 OLI/TIRS

« First < Previous 1 > Next > Last »

Displaying 1 - 1 of 1



Entity ID:LC81870262016221LGN00  
Coordinates:48.86645,20.91212  
Acquisition Date:08-AUG-16  
Path:187  
Row:26



### Ľavý klik – Ukážka metadát a prehľadávanie

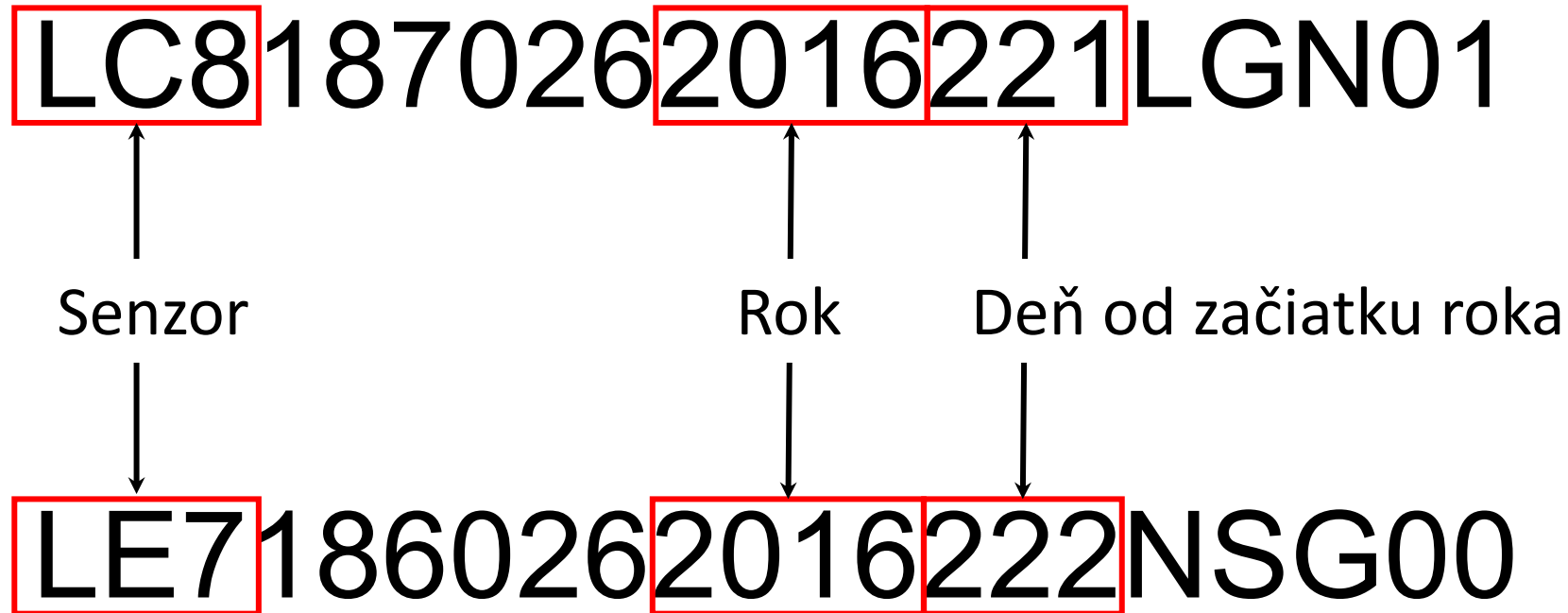
Mapa Satelitné Oświęcim Kraków Wieliczka Bochnia Brzesko Tarnów (47° 51' 53" N, 019° 34' 39" E) Options Overlays

Full Display of LC81870262016221LGN00

| Data Set Attribute                            | Attribute Value                        |
|---|--|
| <a href="#">Landsat Scene Identifier</a>      | LC81870262016221LGN00                  |
| <a href="#">WRS Path</a>                      | 187                                    |
| <a href="#">WRS Row</a>                       | 026                                    |
| <a href="#">Target WRS Path</a>               | 187                                    |
| <a href="#">Target WRS Row</a>                | 026                                    |
| <a href="#">Full or Partial Scene</a>         | FULL                                   |
| <a href="#">Nadir/Off Nadir</a>               | NADIR                                  |
| <a href="#">Data Category</a>                 | NOMINAL                                |
| <a href="#">TIRS SSM Model</a>                | FINAL                                  |
| <a href="#">Bias Parameter File Name OLI</a>  | LO8BPF20160808091941_20160808094158.01 |
| <a href="#">Bias Parameter File Name TIRS</a> | LT8BPF20160803085042_20160818203550.01 |
| <a href="#">Calibration Parameter File</a>    | L8CPF20160701_20160930.02              |
| <a href="#">RLUT File Name</a>                | L8RLUT20150303_20431231v11.h5          |
| <a href="#">Roll Angle</a>                    | -.001                                  |
| <a href="#">Station Identifier</a>            | LGN                                    |
| <a href="#">Day/Night</a>                     | DAY                                    |
| <a href="#">Data Type Level1</a>              | L1T                                    |
| <a href="#">Sensor Identifier</a>             | OLI_TIRS                               |

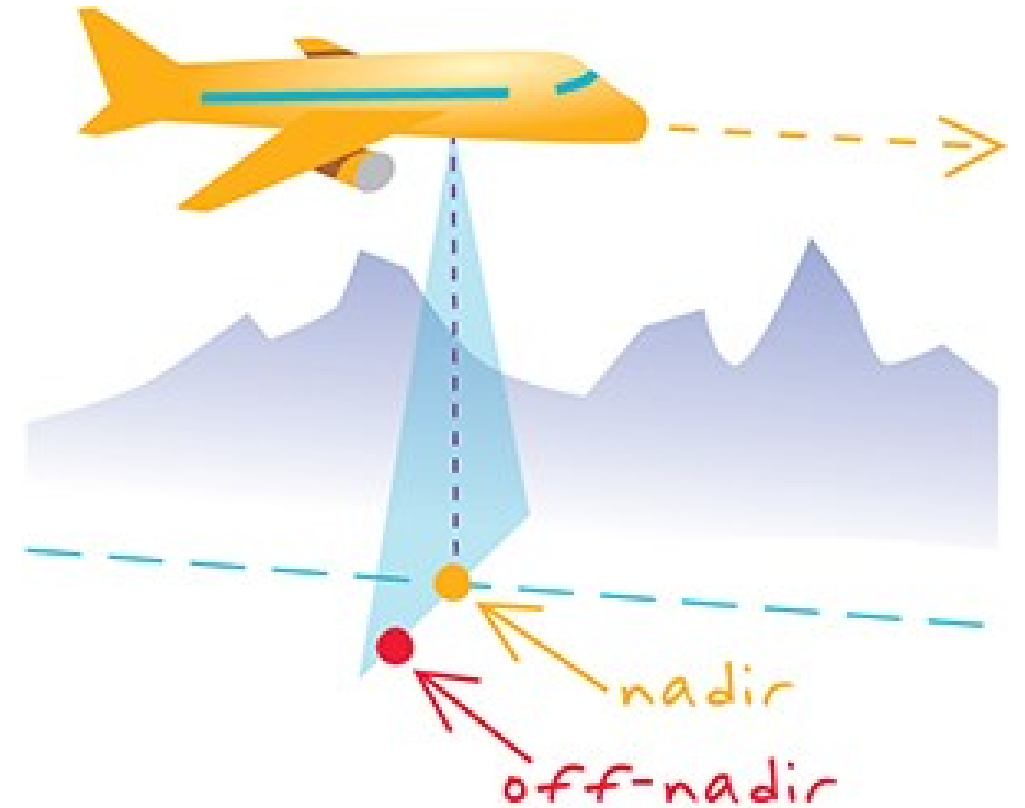
Open New Window Close

# Landsat – označenie súborov





| Data Set Attribute                         | Attribute Value                          |
|--|--|
| <a href="#">Landsat Product Identifier</a> | LC08_L1TP_187026_20160808_20170322_01_T1 |
| <a href="#">Landsat Scene Identifier</a>   | LC81870262016221LGN01                    |
| <a href="#">Acquisition Date</a>           | 2016/08/08                               |
| <a href="#">Collection Category</a>        | T1                                       |
| <a href="#">Collection Number</a>          | 1  |
| <a href="#">WRS Path</a>                   | 187                                      |
| <a href="#">WRS Row</a>                    | 026                                      |
| <a href="#">Target WRS Path</a>            | 187                                      |
| <a href="#">Target WRS Row</a>             | 026                                      |
| <a href="#">Nadir/Off Nadir</a>            | NADIR                                    |
| <a href="#">Roll Angle</a>                 | -.001                                    |
| <a href="#">Date L-1 Generated</a>         | 2017/03/22                               |
| <a href="#">Start Time</a>                 | 2016:221:09:26:25.9597240                |
| <a href="#">Stop Time</a>                  | 2016:221:09:26:57.7297210                |



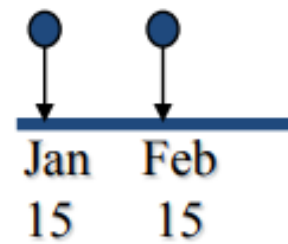
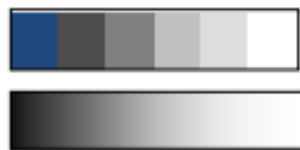
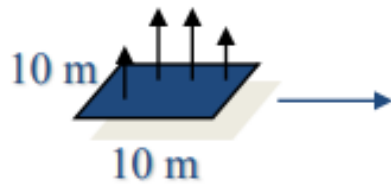
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# 2

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Rozlíšenie záznamu DPZ

# 4 zložky rozlíšenia záznamu / Rozlíšenie záznamu



- **1. priestorová** (mm, cm, dc, m, km)
- **2. spektrálna** (spektrálny rozsah)
  - VID, IČ, termálne, radar
- **3. rádiometrická** (rozdelenie toku radiácie)
  - elementárna jednotka <0, 255>
- **4. temporálna** (časový interval 2 záznamov)
  - operatívnosť nosičov – lietadlá, družice

# Multispektrálne skenovanie – priestorové rozlíšenie

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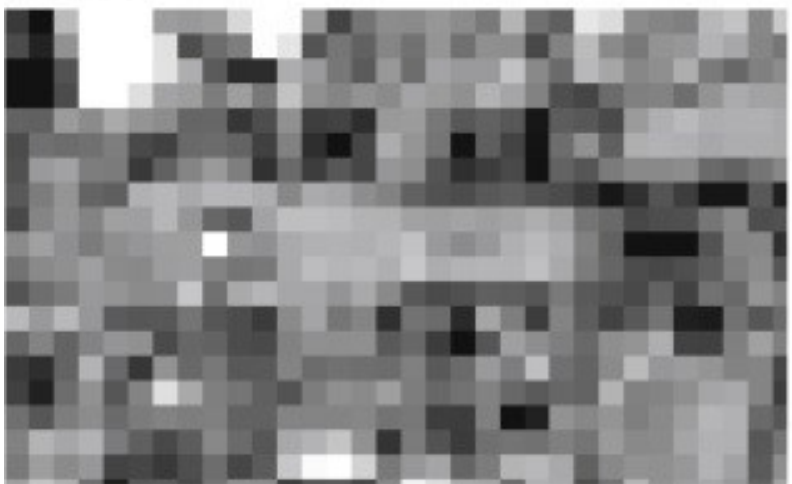
**(A)** 1 m



**(B)** 10 m



**(C)** 30 m

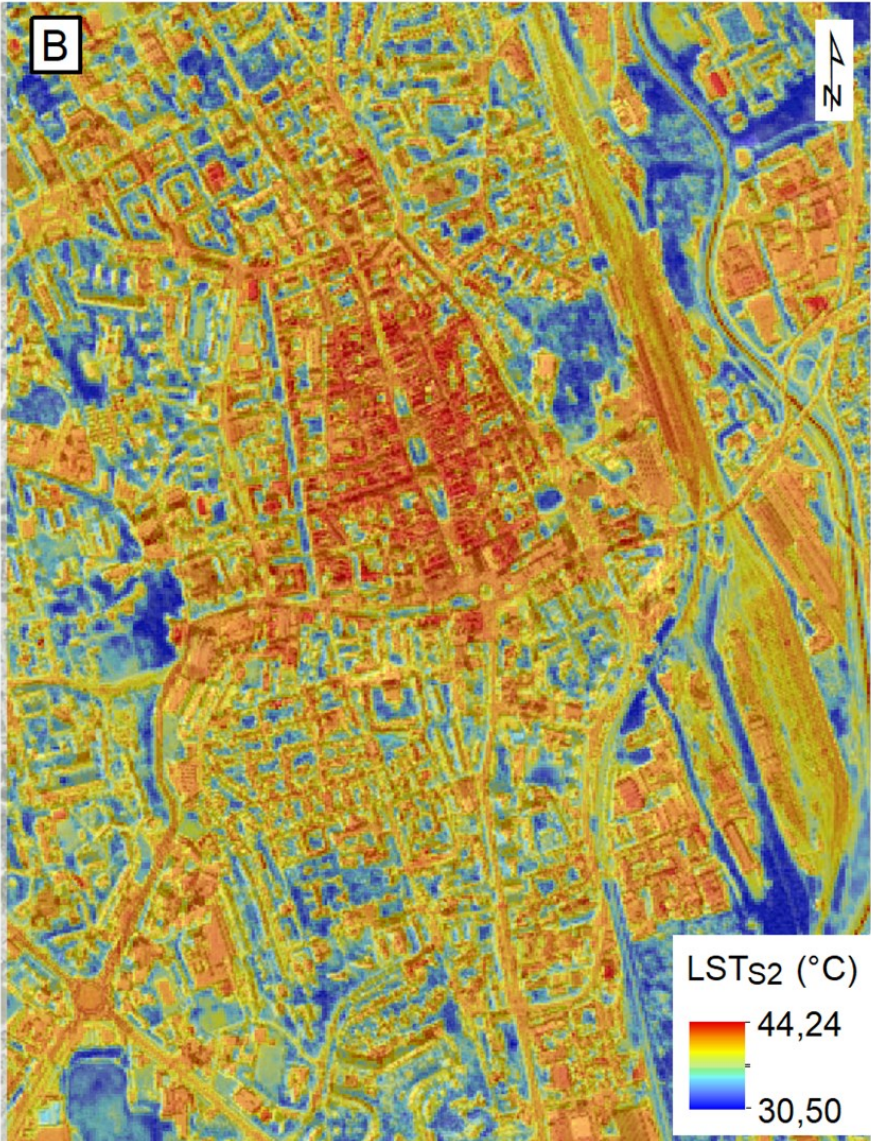
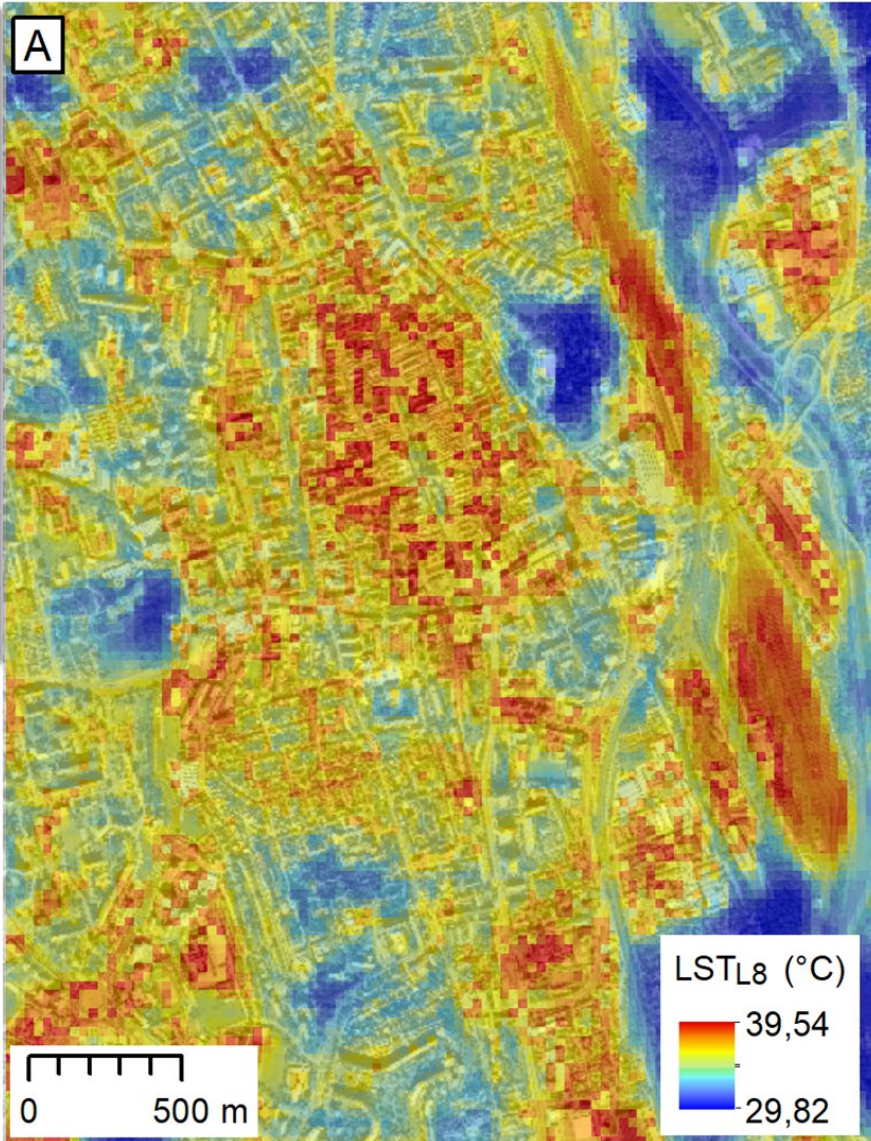


**(D)** 250 m



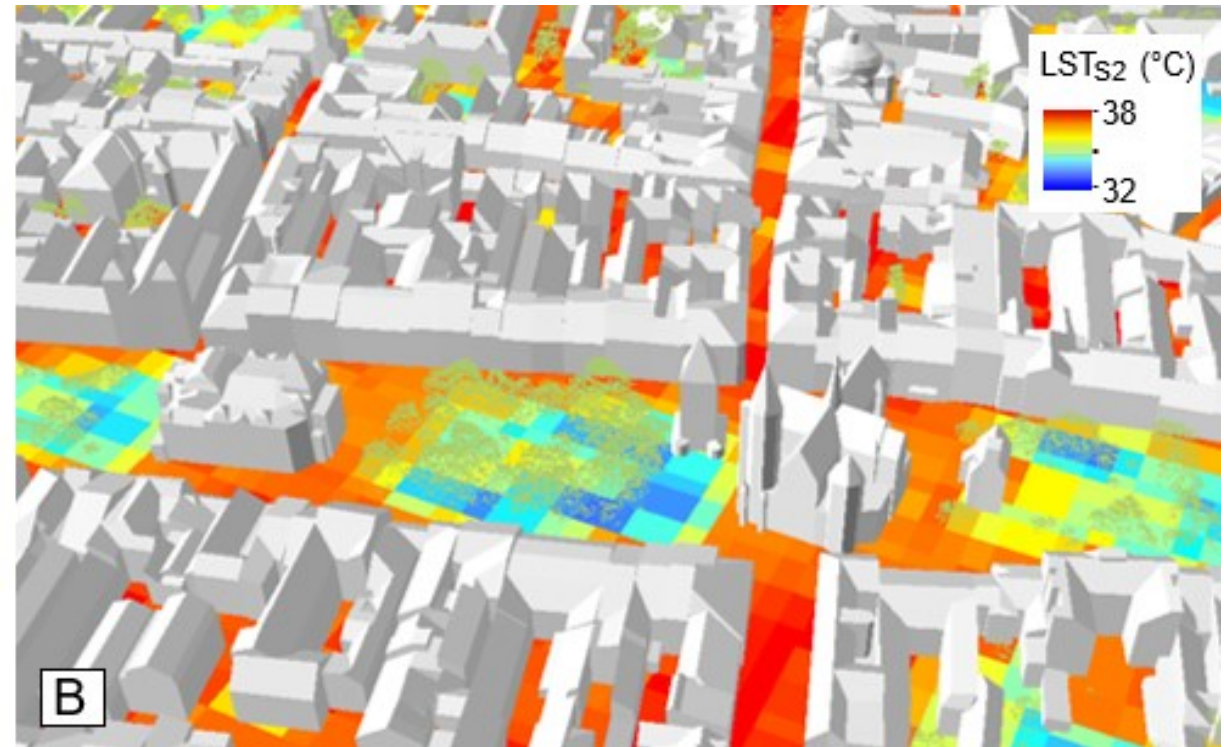
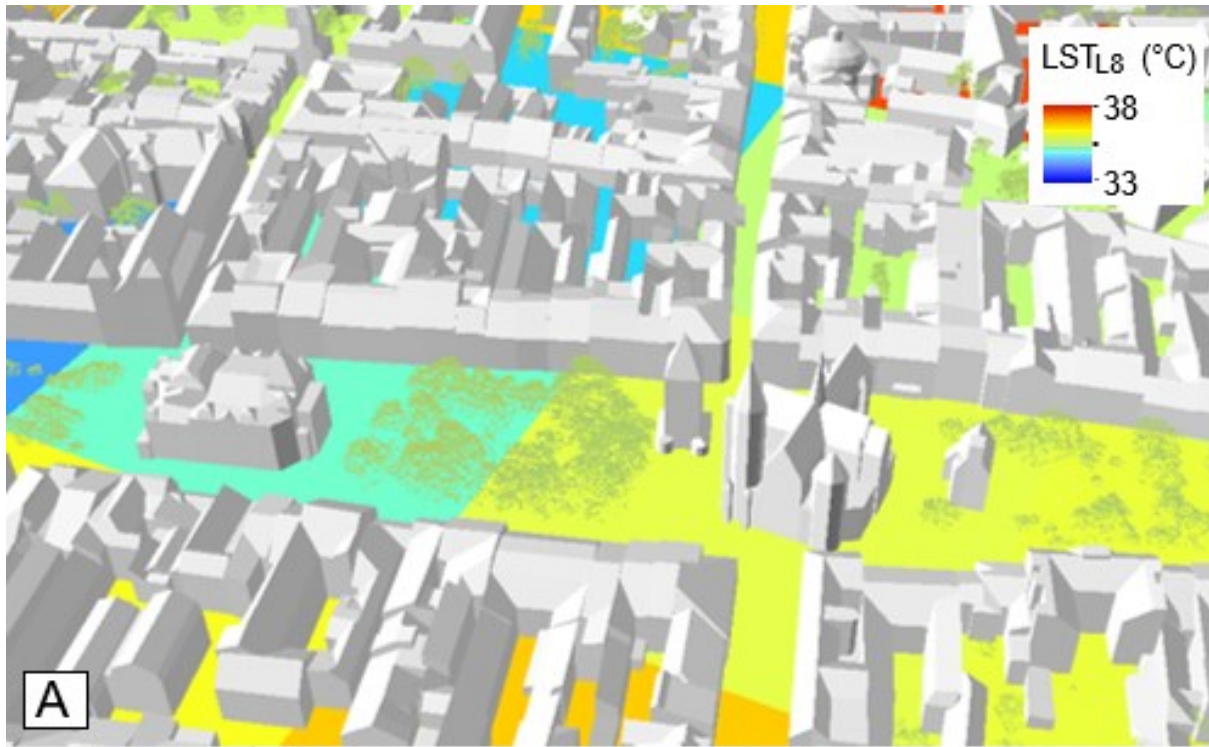
# Multispektrálne skenovanie – priestorové rozlíšenie

LST Landsat 8 – 30 m rozlíšenie

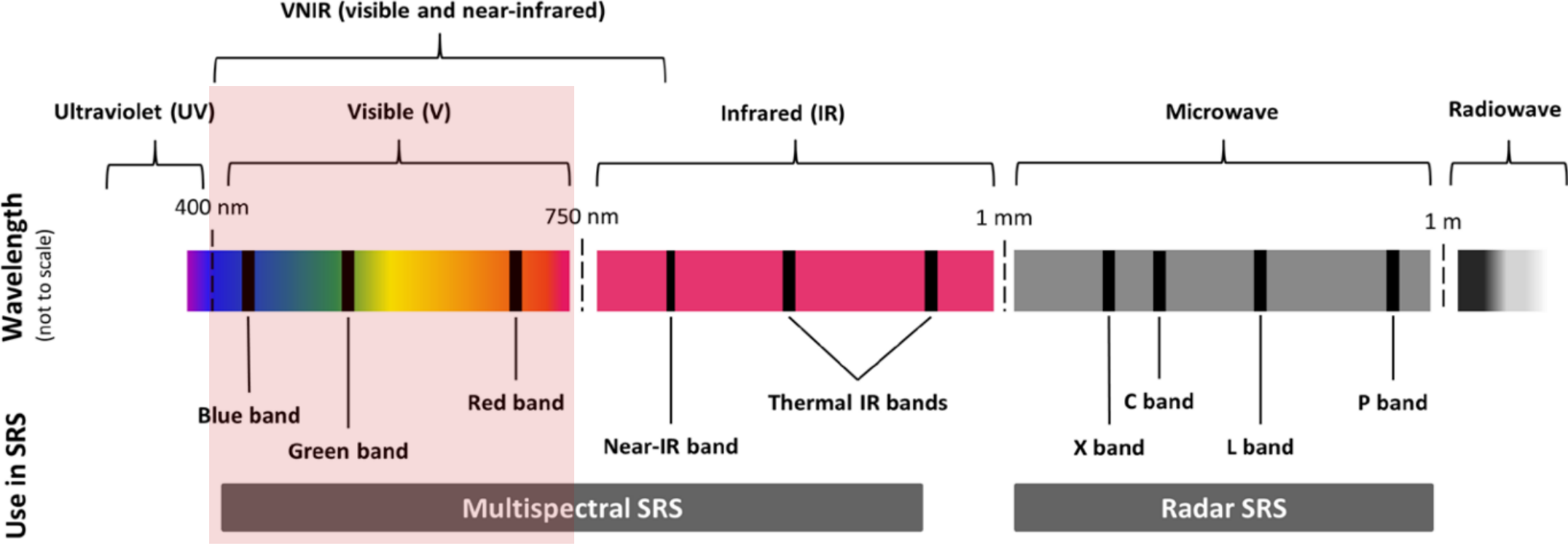


LST po downscalingu – 10 m rozlíšenie

# Multispektrálne skenovanie – priestorové rozlíšenie

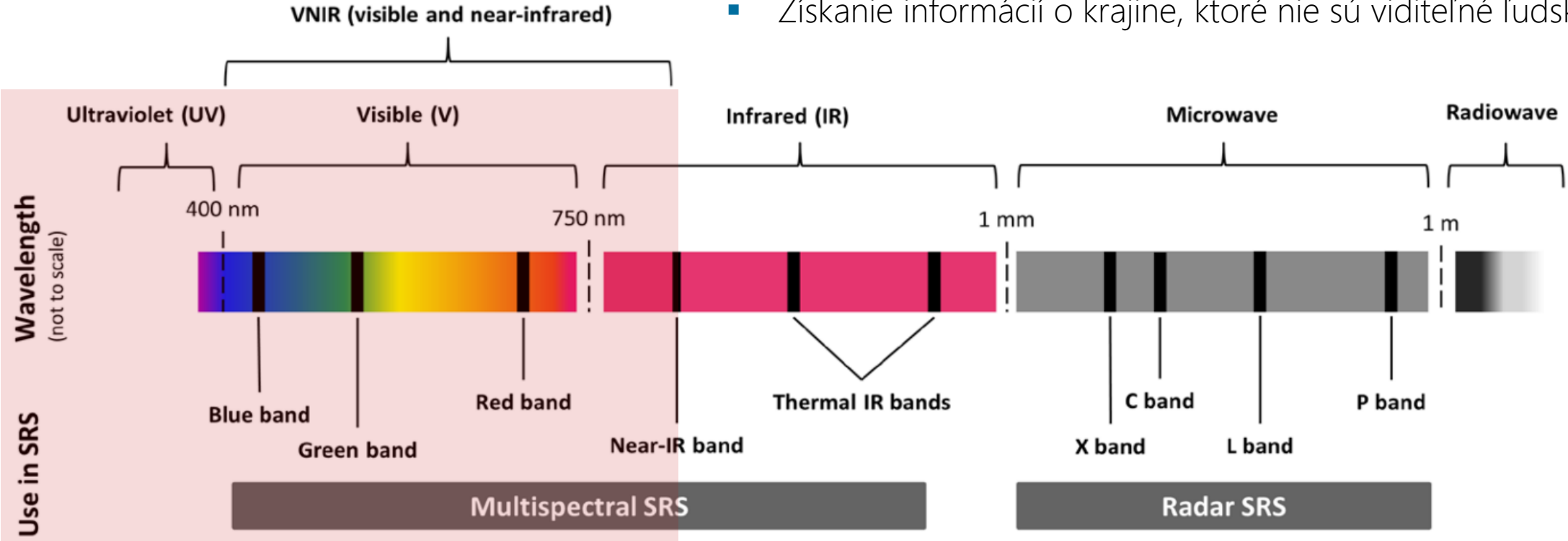


# Multispektrálne skenovanie – spektrálne rozlíšenie



# Multispektrálne skenovanie – spektrálne rozlíšenie

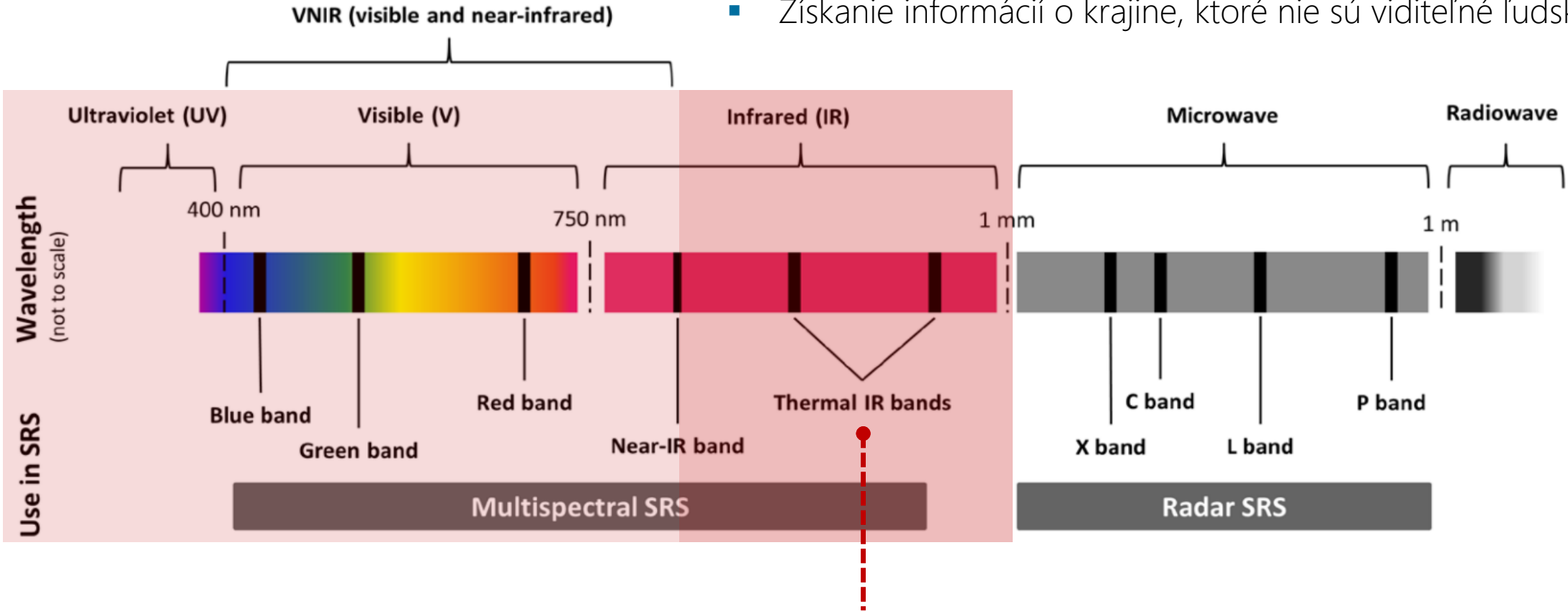
- Získanie informácií o krajine, ktoré nie sú viditeľné ľudským okom





# Multispektrálne skenovanie – spektrálne rozlíšenie

- Získanie informácií o krajine, ktoré nie sú viditeľné ľudským okom



- Odvedenie teploty povrchu (LST)

# Multispektrálne skenovanie – rádiometrické rozlíšenie



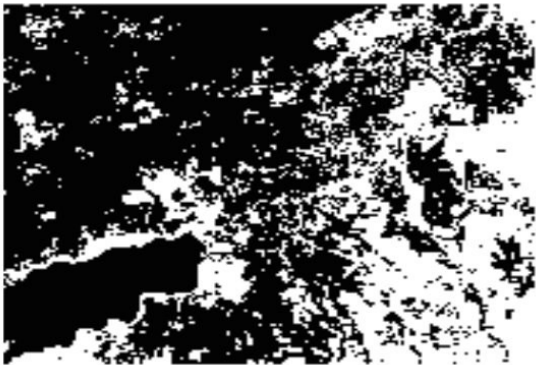
16 Values (4 bit)



8 Values (3 bit)



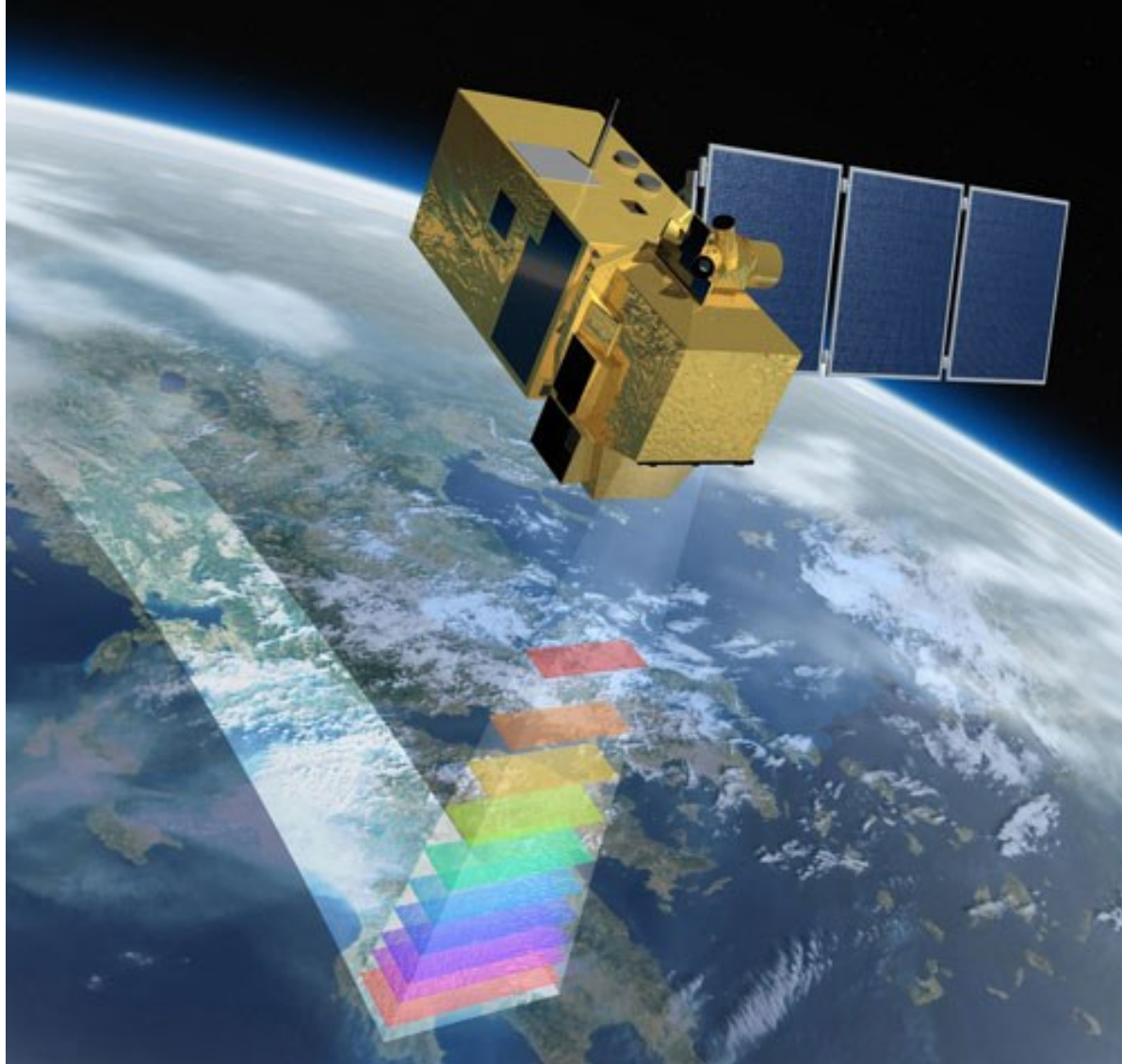
4 Values (2 bit)



2 Values (1 bit)



# Multispektrálne skenovanie – príklad rozlíšení

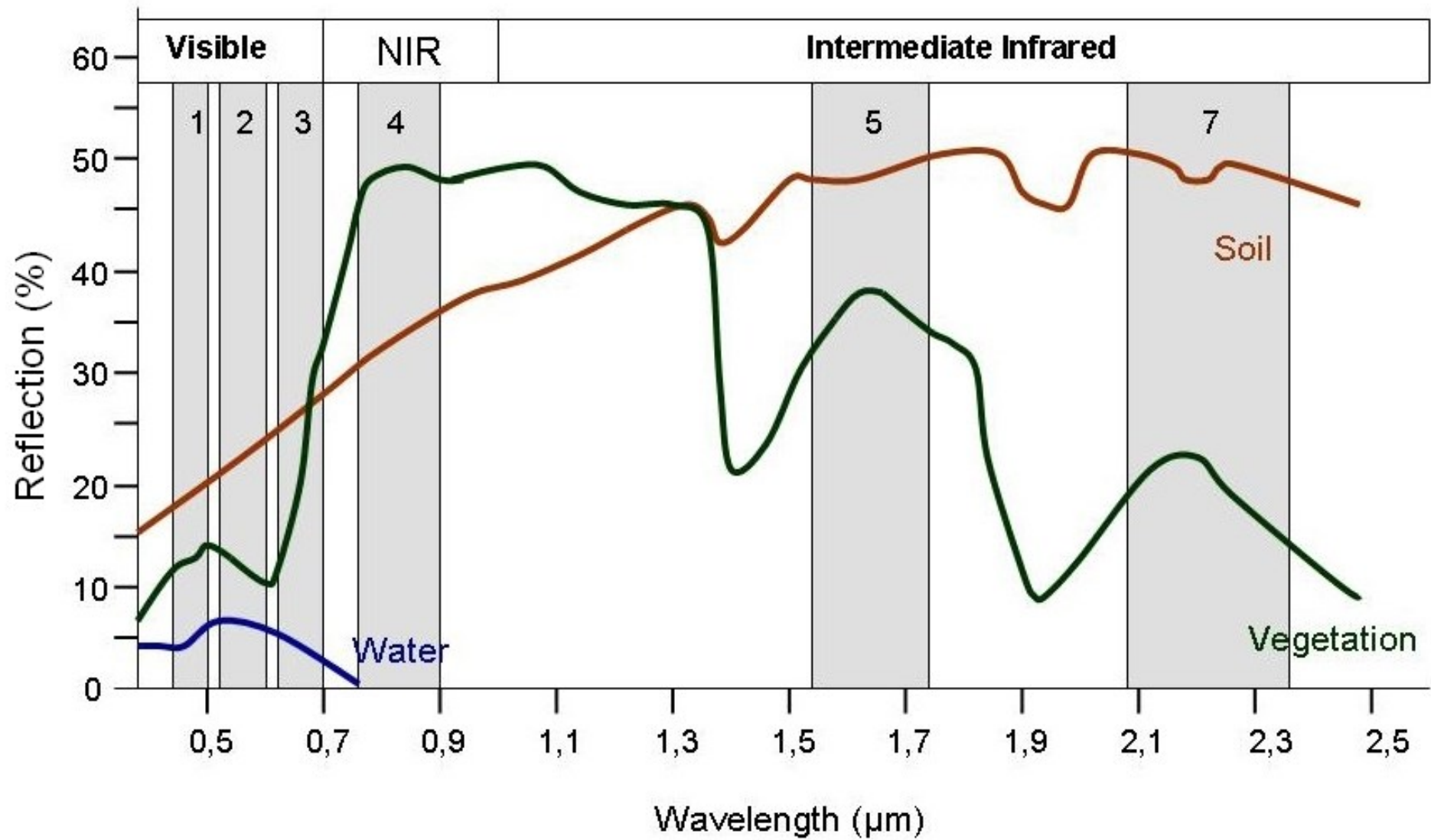


## Landsat 8

- snímkovanie v 16-dňových intervaloch
- senzor aj pre termálne snímanie
- 30 m rozlíšenie

## Sentinel-2A (ESA)

- snímkovanie v 10-dňových intervaloch
- senzor MSI (z ang. Multi-Spectral Instrument)
- 10 m rozlíšenie



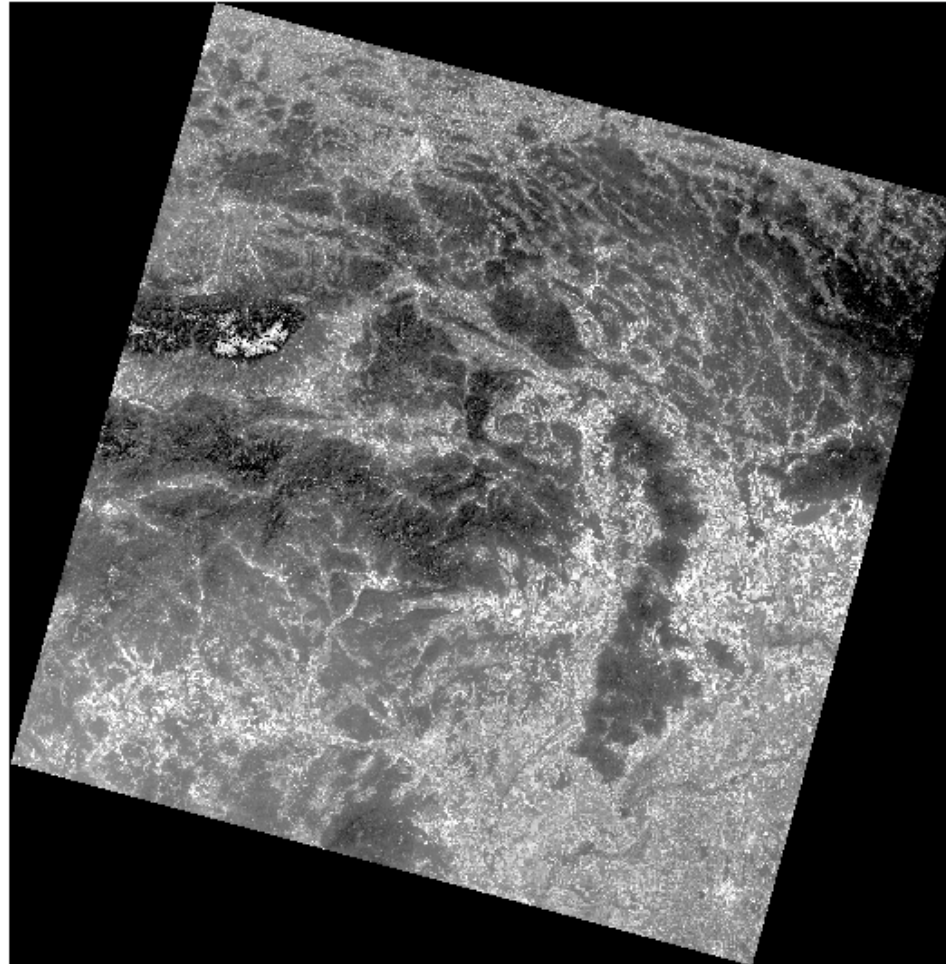
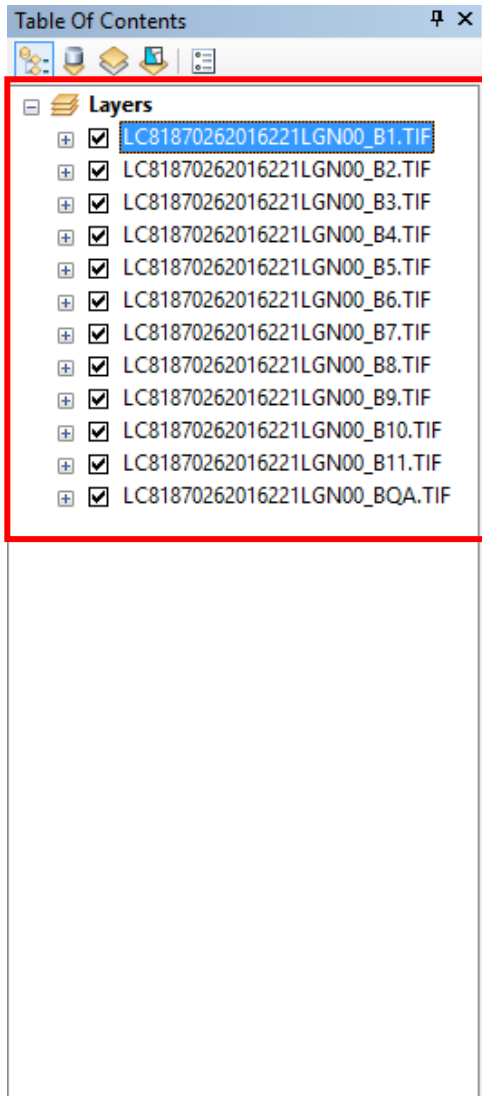
| <b>Landsat 7<br/>Enhanced<br/>Thematic<br/>Mapper<br/>Plus<br/>(ETM+)</b> | <b>Bands</b>                         | <b>Wavelength<br/>(micrometers)</b> | <b>Resolution<br/>(meters)</b> |
|---|--------------------------------------|-------------------------------------|--------------------------------|
|   | Band 1 - Blue                        | 0.45-0.52                           | 30                             |
|   | Band 2 - Green                       | 0.52-0.60                           | 30                             |
|   | Band 3 - Red                         | 0.63-0.69                           | 30                             |
|   | Band 4 - Near Infrared (NIR)         | 0.77-0.90                           | 30                             |
|   | Band 5 - Shortwave Infrared (SWIR) 1 | 1.55-1.75                           | 30                             |
|   | Band 6 - Thermal                     | 10.40-12.50                         | 60 * (30)                      |
|   | Band 7 - Shortwave Infrared (SWIR) 2 | 2.09-2.35                           | 30                             |
|   | Band 8 - Panchromatic                | .52-.90                             | 15                             |

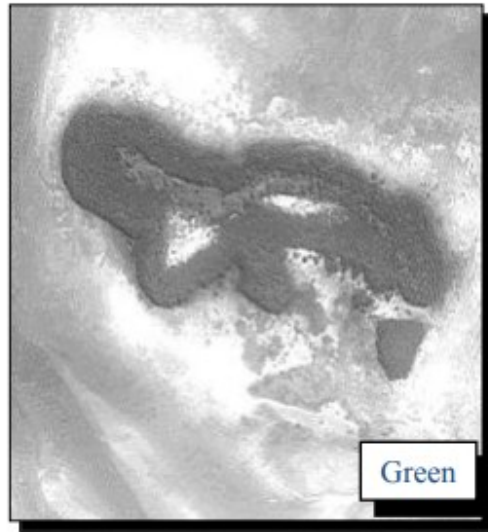
\* ETM+ Band 6 is acquired at 60-meter resolution, but products are resampled to 30-meter pixels.

| <b>Landsat 8<br/>Operational<br/>Land Imager<br/>(OLI)<br/>and<br/>Thermal<br/>Infrared<br/>Sensor<br/>(TIRS)</b> | <b>Bands</b>                          | <b>Wavelength<br/>(micrometers)</b> | <b>Resolution<br/>(meters)</b> |
|---|---------------------------------------|-------------------------------------|--------------------------------|
|   | Band 1 - Ultra Blue (coastal/aerosol) | 0.435 - 0.451                       | 30                             |
|   | Band 2 - Blue                         | 0.452 - 0.512                       | 30                             |
|   | Band 3 - Green                        | 0.533 - 0.590                       | 30                             |
|   | Band 4 - Red                          | 0.636 - 0.673                       | 30                             |
|   | Band 5 - Near Infrared (NIR)          | 0.851 - 0.879                       | 30                             |
|   | Band 6 - Shortwave Infrared (SWIR) 1  | 1.566 - 1.651                       | 30                             |
|   | Band 7 - Shortwave Infrared (SWIR) 2  | 2.107 - 2.294                       | 30                             |
|   | Band 8 - Panchromatic                 | 0.503 - 0.676                       | 15                             |
|   | Band 9 - Cirrus                       | 1.363 - 1.384                       | 30                             |
|   | Band 10 - Thermal Infrared (TIRS) 1   | 10.60 - 11.19                       | 100 * (30)                     |
| Band 11 - Thermal Infrared (TIRS) 2   | 11.50 - 12.51                         | 100 * (30)                          |                                |

\* TIRS bands are acquired at 100 meter resolution, but are resampled to 30 meter in delivered data product.

### 3.1 Súbor rozzipujeme a otvoríme v ArcMap. Spektrálne pásma zoradíme podľa poradia.

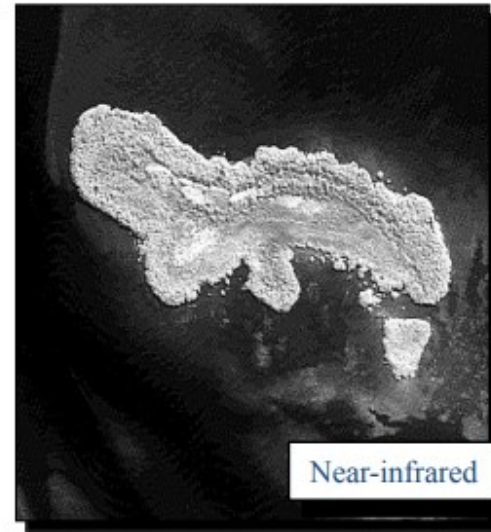




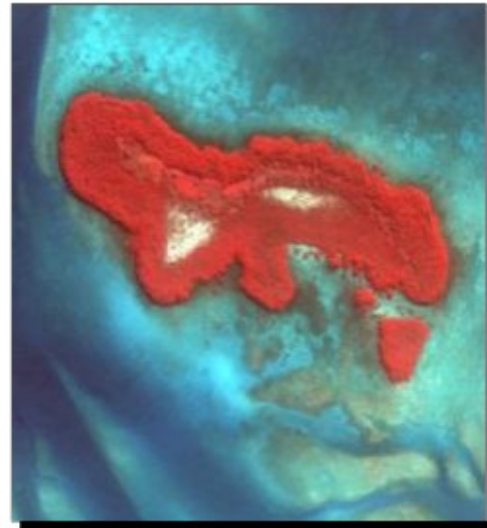
Green



Red



Near-infrared



Color composite  
RGB = green, red, near-  
infrared

Jensen, 2007

Landsat Thematic Mapper (TM) and Enhanced Thematic Mapper Plus (ETM+) Bands

| Band | Name           | Band Width ( $\lambda$ , $\mu\text{m}$ ) | Spatial Resolution |
|------|----------------|--|--------------------|
| 1    | Blue           | 0.45-0.515                               | 30 m               |
| 2    | Green          | 0.525-0.605                              | 30 m               |
| 3    | Red            | 0.63-0.69                                | 30 m               |
| 4    | Near Infrared  | 0.75-0.90                                | 30 m               |
| 5    | Shortwave IR-1 | 1.55-1.75                                | 30 m               |
| 6    | Thermal IR     | 10.4-12.5                                | 60 m / 120 m*      |
| 7    | Shortwave IR-2 | 2.09-2.35                                | 30 m               |
| 8*   | Panchromatic   | 0.52-0.9                                 | 15 m               |

3.2 Sledovanie vlastností jednotlivých spektrálnych pásem, viac: <https://landsat.gsfc.nasa.gov/landsat-8/landsat-8-bands/>

### 3.3 Zistíme rozlíšenie záznamu pre jednotlivé pásma.

The screenshot displays the ArcGIS interface. On the left, the 'Table Of Contents' window shows a list of layers, with 'LC81870262016221LGN' selected. A context menu is open over this layer, and the 'Properties...' option is highlighted with a red rectangle. The main window shows the 'Layer Properties' dialog box for the selected layer. The 'General' tab is active, showing the following properties:

| Property                  | Value            |
|---------------------------|------------------|
| <b>Raster Information</b> |                  |
| Columns and Rows          | 7881, 7991       |
| Number of Bands           | 1                |
| Cell Size (X, Y)          | 30, 30           |
| Uncompressed Size         | 120, 12 MB       |
| Format                    | TIFF             |
| Source Type               | Generic          |
| Pixel Type                | unsigned integer |
| Pixel Depth               | 16 Bit           |

The 'Data Source' section shows:

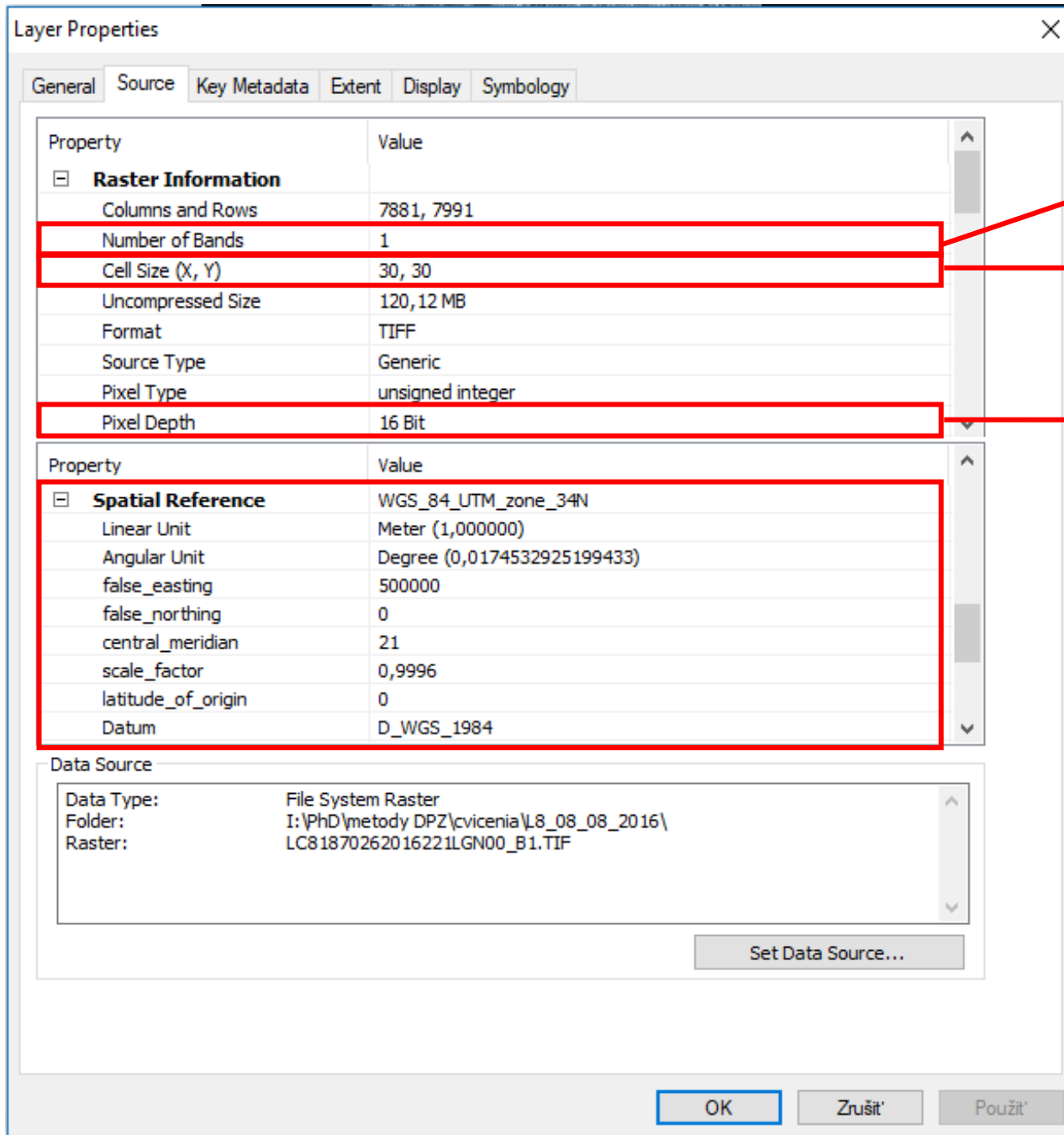
|            |   |
|------------|---|
| Data Type: | File System Raster                        |
| Folder:    | I:\PhD\metody DPZ\cvicenia\L8_08_08_2016\ |
| Raster:    | LC81870262016221LGN00_B1.TIF              |

Buttons for 'OK', 'Zrušit', and 'Použiť' are visible at the bottom of the dialog box. A 'Set Data Source...' button is also present in the 'Data Source' section.

470774,741 5287048,577 Meters

Viac info: <https://landsat.usgs.gov/what-are-best-spectral-bands-use-my-study>

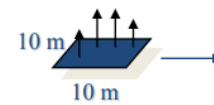




Spektrálne rozlíšenie

Priestorové rozlíšenie

Rádiometrické rozlíšenie



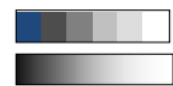
- 1. priestorová (mm, cm, dc, m, km)

- 2. spektrálna (spektrálny rozsah)



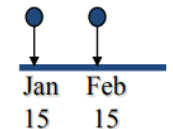
- VID, IČ, termálne, radar

- 3. rádiometrická (rozdelenie toku radiácie)



- elementárna jednotka <0, 255>

- 4. temporálna (časový interval 2 záznamov)



- operatívnosť nosičov – lietadlá, družice

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Ďakujem za  
pozornosť 😊

Mgr. Katarína Onačillová

