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# AI technologie pro GEO

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GeoAI days

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# Co umíme nyní?

- Máme-li dostatek dat, umíme velmi dobře jednotlivé úkoly například strojového vidění (např. z dat dálkového pozorování země), strojové zpracování textu (například shrnutí odborného textu)
- Částečně fyzikální modely a simulace pomocí AI (propojení známe fyziky a AI)
- Nedávno: vylepšení uvažování, rozhodování a syntéza nad daty

# Aplikace AI pro Geo

## Image Scene



**User:** Which scene does this image belong to?

**AI:** **cropland.**

## Image Quality



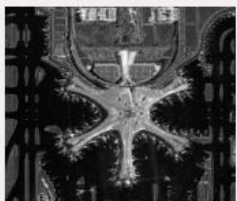
**User:** Please rate the image quality.

**AI:** **bad.**

**User:** Which interference is in the image?

**AI:** **cloud.**

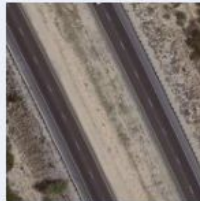
## Image Modality



**User:** Which modality does this image belong to?

**AI:** **SAR.**

## Image Captioning



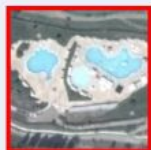
**User:** Could you please provide a detailed description of this image?

**AI:** **There are two straight freeways in the desert.**

## Image Retrieval

**User:** Could you recommend a good place for holidays?

**AI:**



## Change Detection



**User:** Have the trees decreased?

**AI:** **No.**

# Aplikace AI pro Geo

## Object Presence



**User:** Is there a swimming pool?

**AI:** **No.**

## Object Counting



**User:** How many planes are there in this picture?

**AI:** **3.**

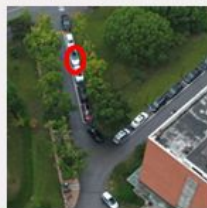
## Spatial Relationship



**User:** What is the relative position between the parking lots and the roundabout?

**AI:** **The parking lots are located on the left side of the roundabout.**

## Attribute Recognition



**User:** What are the attributes of this car in the red circle ?

**AI:** **White, panorama roof, electric, Tesla, Model Y.**

## Open-vocabulary Detection



**User:** Could you detect the white vehicle in the picture?

**AI:** **There are three white cars [60 5 74 12; ...; 77 88 91 95].**

**<Visualization>**

## Referring Expression Comprehension



**User:** Where is the Boeing 747 at the bottom left?

**AI:** **[8 78 34 94].**

**<Visualization>**

# Aplikace AI pro Geo



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## Referring Expression Generation

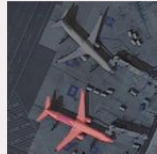


**User:** What object is in this location [8 0 48 13]?

<Visualization>

**AI:** a pier with two boats.

## Referring Expression Segmentation



**User:** Where is the plane at the bottom?

**AI:** [SEG].

## Open-vocabulary Segmentation



**User:** Could you segment the vehicle in the parking area?

**AI:** [SEG].

## Geospatial Localization



**User:** Which county is this remote sensing image taken in?

**AI:** Viru.

## Geometric Measurement



**User:** What is the area covered by buildings?

**AI:** Between 100 and 1000 m<sup>2</sup>.

## Resource Assessment



**User:** What is the population of this urban?

**AI:** About 9,000,000.

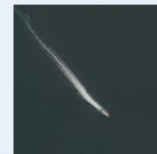
## Sensor Property



**User:** What is the camera's shooting pitch angle of this image?

**AI:** 45.

## Physical Property



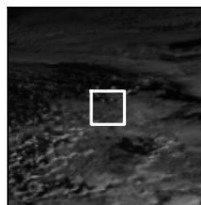
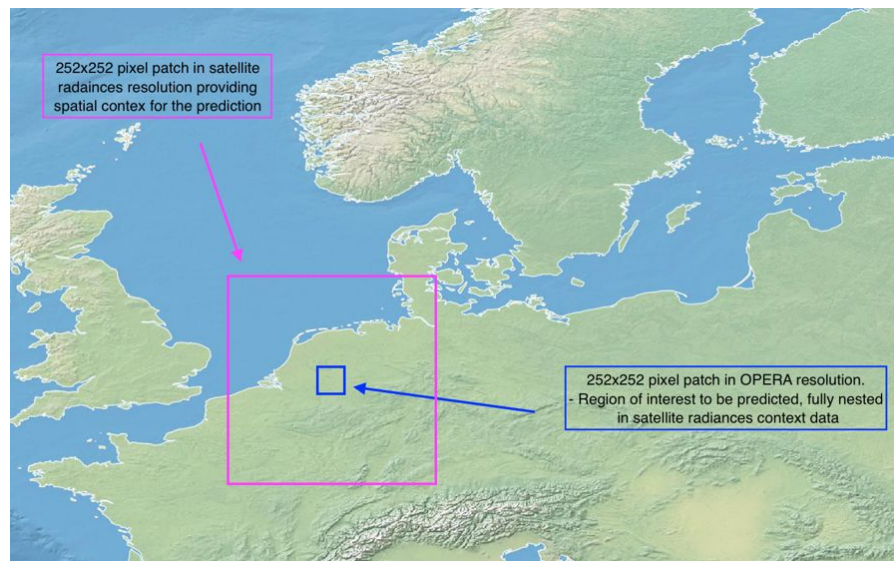
**User:** Is the ship in the image in motion or stationary?

**AI:** In motion.

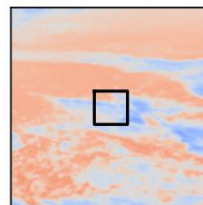


# Předpovídání počasí

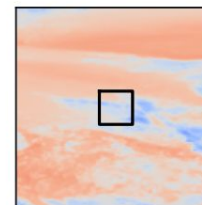
- Kombinace AI a fyziky



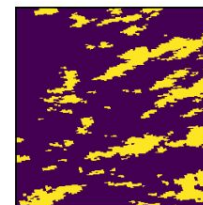
input (VIS008)



input (IR\_134)

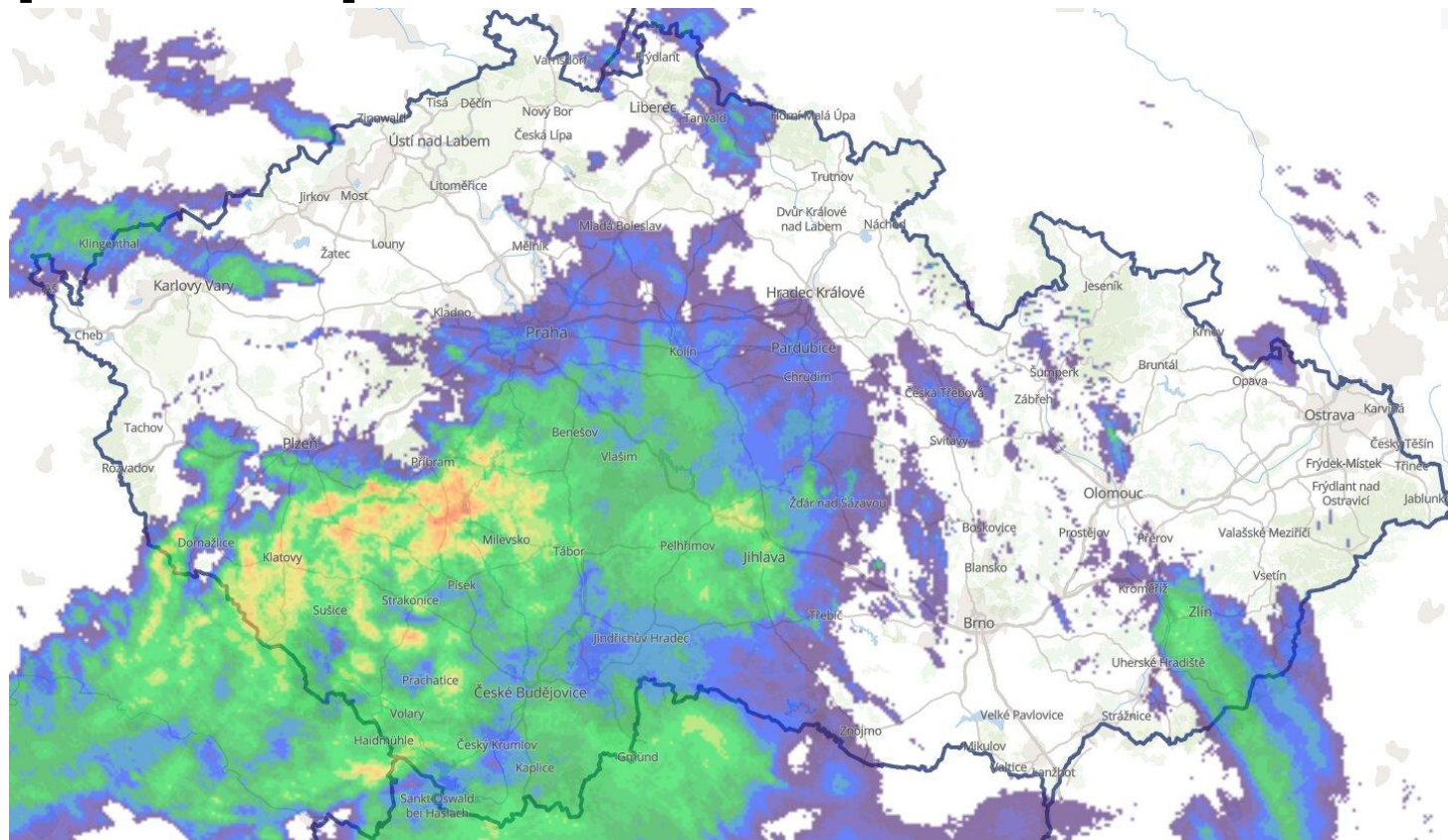


input (WV\_073)



target

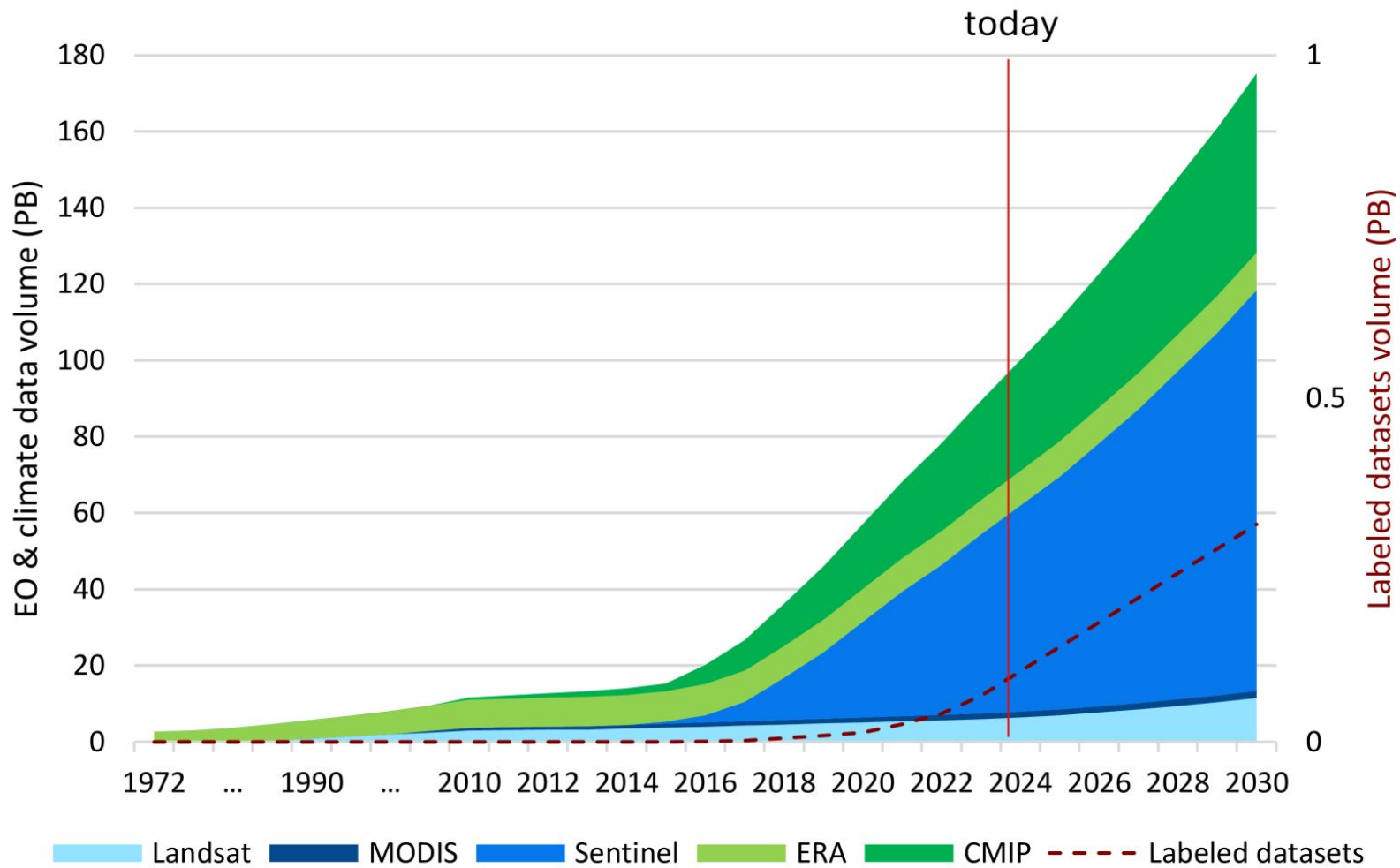
# Předpovědání počasí



# Co bude (možná) možné v (možná) blízké budoucnosti?

- Jednoduše kombinovat různé zdroje dat
- Provádět komplexní analýzy bez nutnosti náročné přípravy dat
- Provádět přesnější predikce (i bez hluboké znalosti matematických metod)



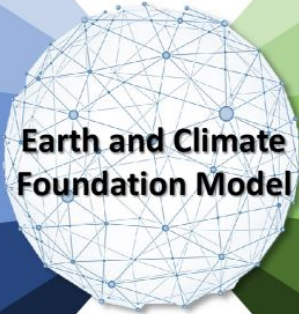


# Data Sources

# Downstream Tasks

$$\rho \frac{du}{dt} = -\nabla p + \mu \nabla^2 u + \mathbf{F}$$
$$\nabla \cdot u = 0$$

Physical consistency

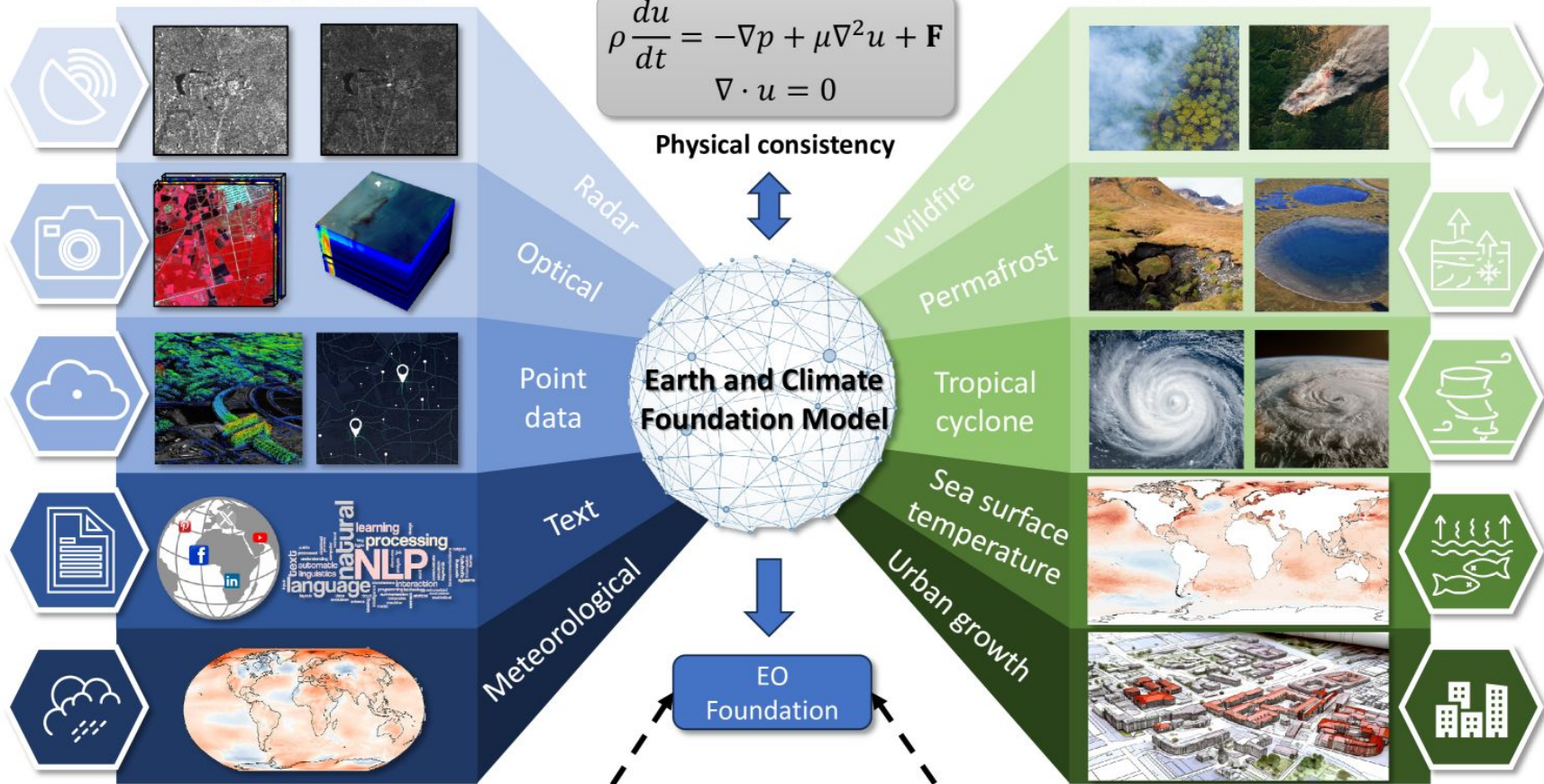


EO Foundation

Weather Foundation

Climate Foundation

LLMs



# Naše současné zaměření

- Propojení fyziky a AI v geo aplikacích
- Predikce počasí, analýza satelitních snímků
- Použití velkých jazykových modelů pro rozhodování v Geo
  - Deepseek
  - Kombinace jazykových modelů s libovolným dalším nástrojem

**Díky** za pozornost.