

# Potential of Slovakia in Space Research

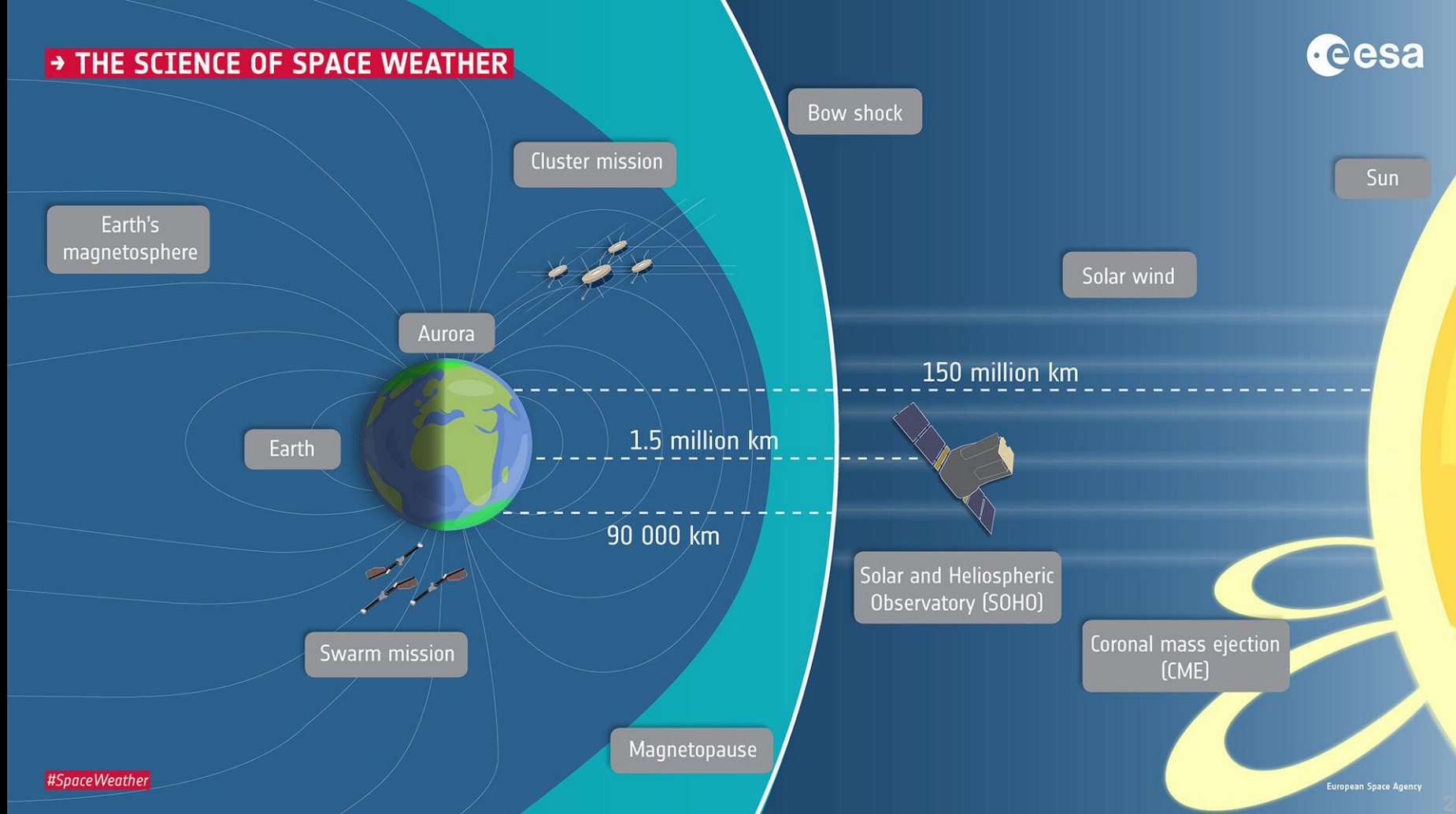
## Space Weather

Šimon Mackovjak

Slovak Academy of Sciences



## → THE SCIENCE OF SPACE WEATHER



# Research on space weather (SWE) has a long-standing history in Slovakia



Milan Rastislav Štefánik,  
~1905

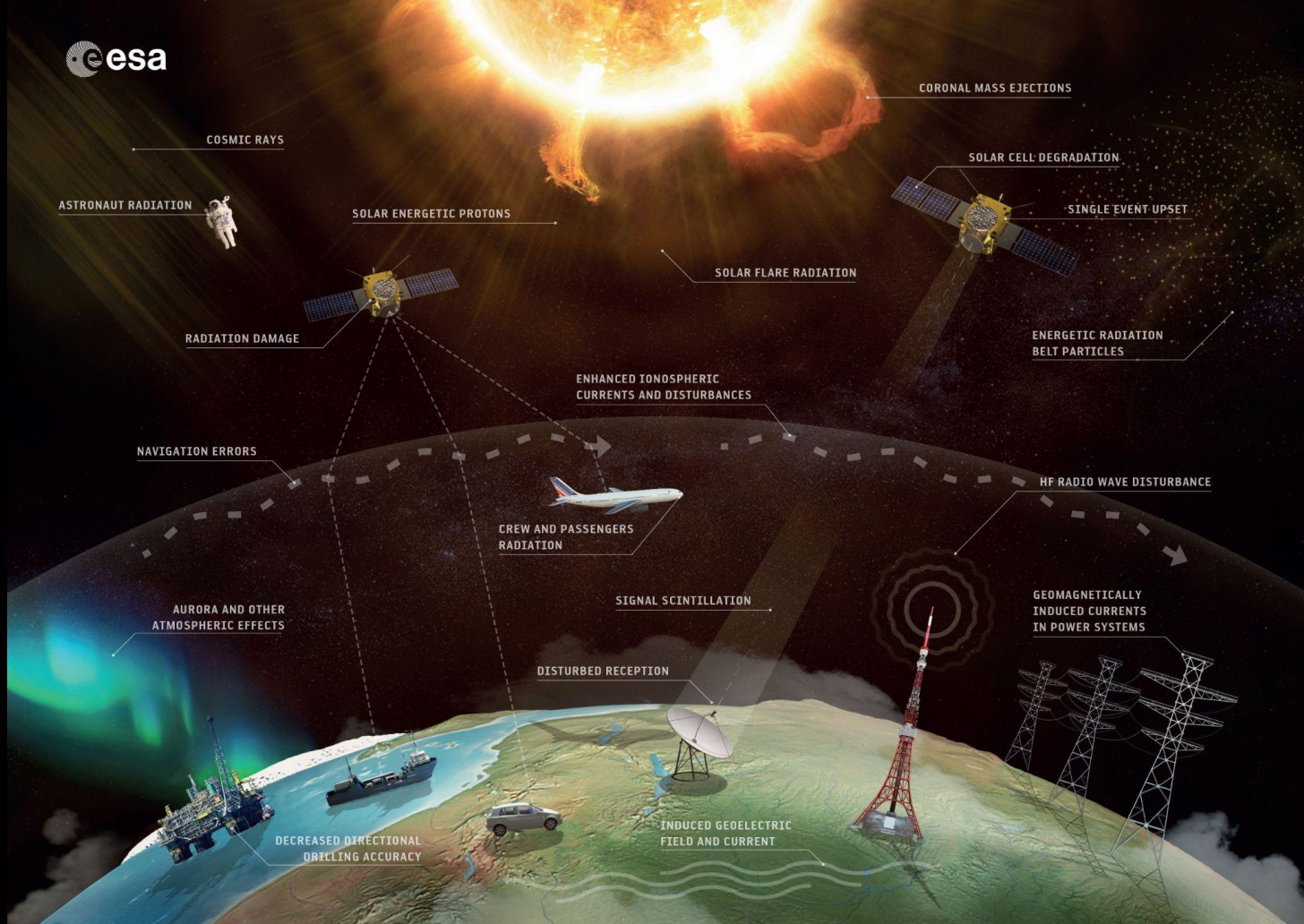


Prof. Juraj Dubinský,  
~1970



Prof. Karel Kudela,  
~2000





## Space Weather Services Network

- Solar Weather ESC
- Heliospheric
- Space Radiation
- Ionospheric
- Geomagnetic Conditions



# Slovak SWE capabilities

## Solar weather

- Expert groups at Department of Solar Physics AI SAS & SUH
- High altitude observatory with two Lyot coronagraphs at the LSO
- Routine observations of photosphere and chromosphere at SUH, AOP, AOH, AOR, RO
- Solar radiospectrometer CALLISTO at SUH

## Space Radiation

- Expert group at Department of Space Physics IEP SAS
- Continuous measurements of secondary cosmic rays at LSO since 1980
- Studies of particles propagation in heliosphere and magnetosphere

## Heliospheric Weather

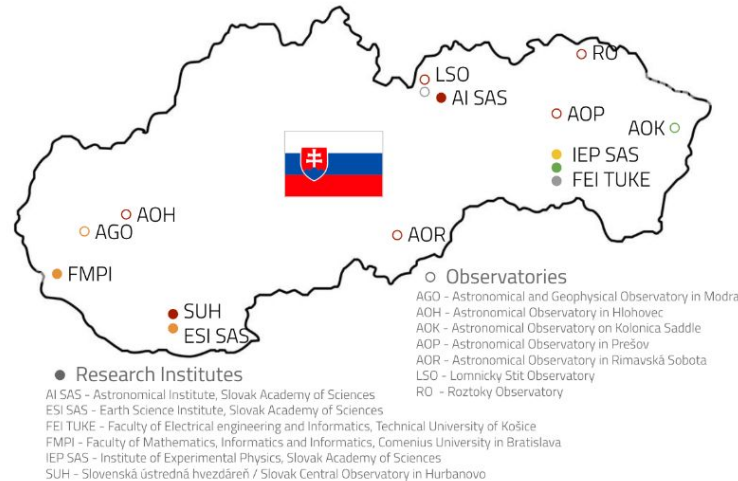
- Engineering group at Department of Space Physics IEP SAS
- Participation on development of space missions (e. g., Double Star, Radioastron, BepiColombo, JUICE)

## Ionospheric Weather

- Expert group at Department of Space Physics IEP SAS & FEI TUKE
- Observation of Airglow and Ionospheric parameters at AOK
- Feasibility studies within ESA / PECS projects

## Geomagnetic Conditions

- Expert groups at Geophysical Division ESI SAS & FMPI
- Geomagnetic observations at GMO ESI SAS & AGO
- Research of geomagnetic conditions in Central Europe region and historical extreme magnetic storms





## Own measurements

Lomnický štít Observatory (2634 m)

1957

## Cooperation in Space

Our instruments: DOK-S

Space missions: MAGION 2, 3, 4, 5

1989

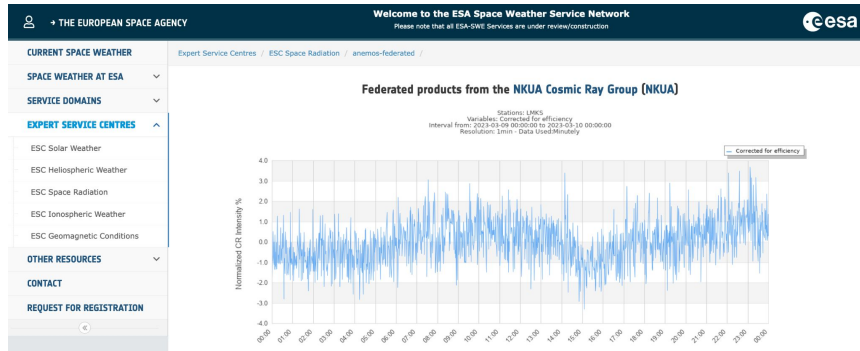
## Digital solutions

Our deep learning model for automatic segmentation of solar corona

SDO/AIA 193 2021-07-05 10:27:29 UT

# Own measurements

- Contribution to Space Weather Services Network (SWESNET) by own products
- Renting of infrastructure for sensors from European partners
- Testbed facilities for new instruments at the high altitude conditions



## - Slovak SWE opportunity

Observatory at Lomnický štít 2634 m a.s.l.



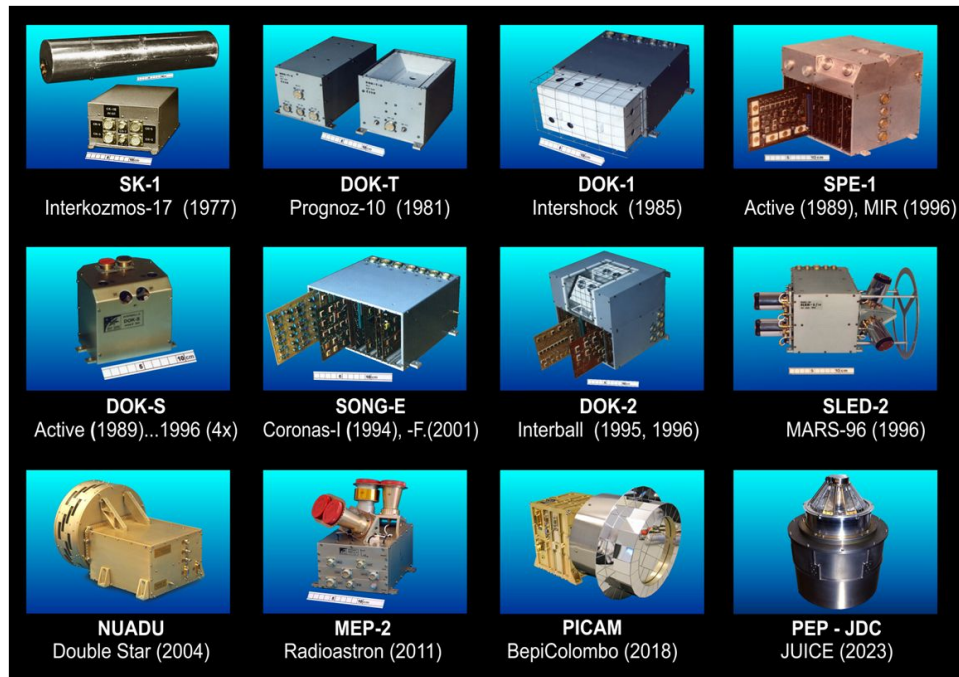


# Cooperation in Space

- **Participation in Distributed Space Weather Sensor Systems (D3S)**
- Utilization of space R&D facilities for space-based energetic particles detectors:
  - ◆ design
  - ◆ development
  - ◆ construction
  - ◆ testing

## - Slovak SWE opportunity

List of instruments with direct participation of IEP SAS

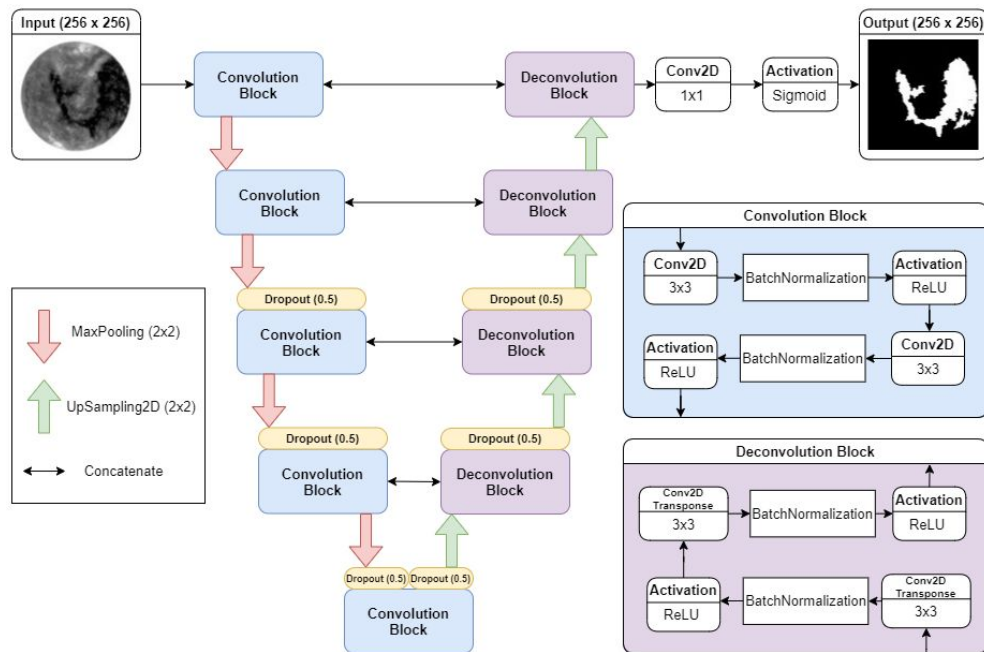


# Digital Solutions

- Development of Machine Learning techniques for **Vigil mission**
- Automated processing and Data-driven prediction services for SWESNET
- Data center for SWE products and services to assure their storage, management, and presentation - own 'golden mine' for SWE research

## - Slovak SWE opportunity

SCSS-Net model - [Mackovjak et al. \(2021\)](#)



# Slovak SWE challenges

- **Closer Collaboration**

ESA, UN COPUOS – ISWI, COSPAR

- **New International Projects**

6 ESA / PECS activities in SWE

- **Prepared Young Generation**

Transfer of the research heritage



# Summary

- Utilize capabilities we already have
- Focus on unique opportunities

Follow us:



**SPACE::LAB**