



# ACTRIS CCRES

Showcases of wind lidar, cloud radar, and  
ceilometer synergy

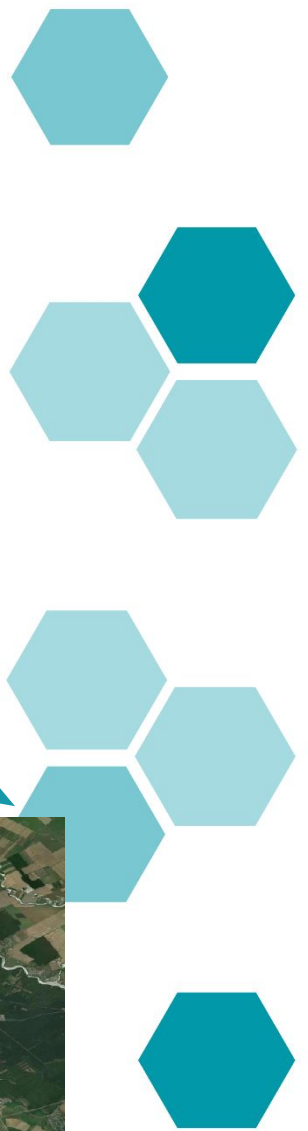
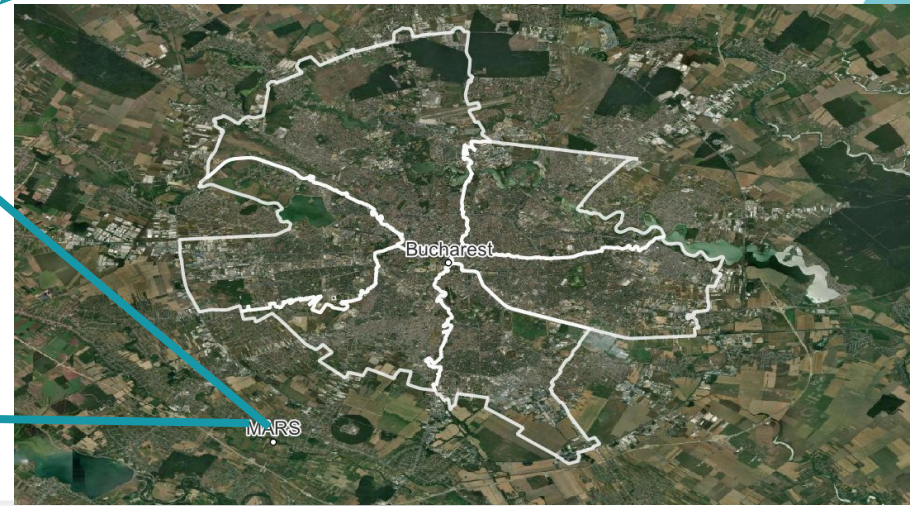
**Authors:**

**Razvan Pirloaga<sup>1</sup>, Mariana Adam<sup>1</sup>, Anca Nemuc<sup>1</sup>, Mirela Voiculescu<sup>2</sup>**

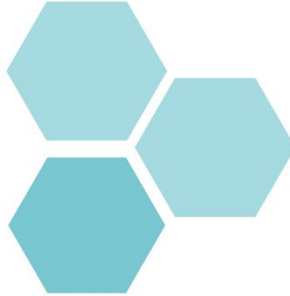
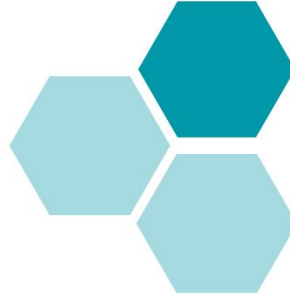
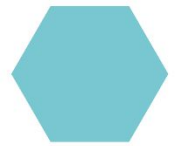
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**CCRES/CLU Workshop, Matera – November 7<sup>th</sup>, 2024**

# RADO Bucharest National Facility, Romania

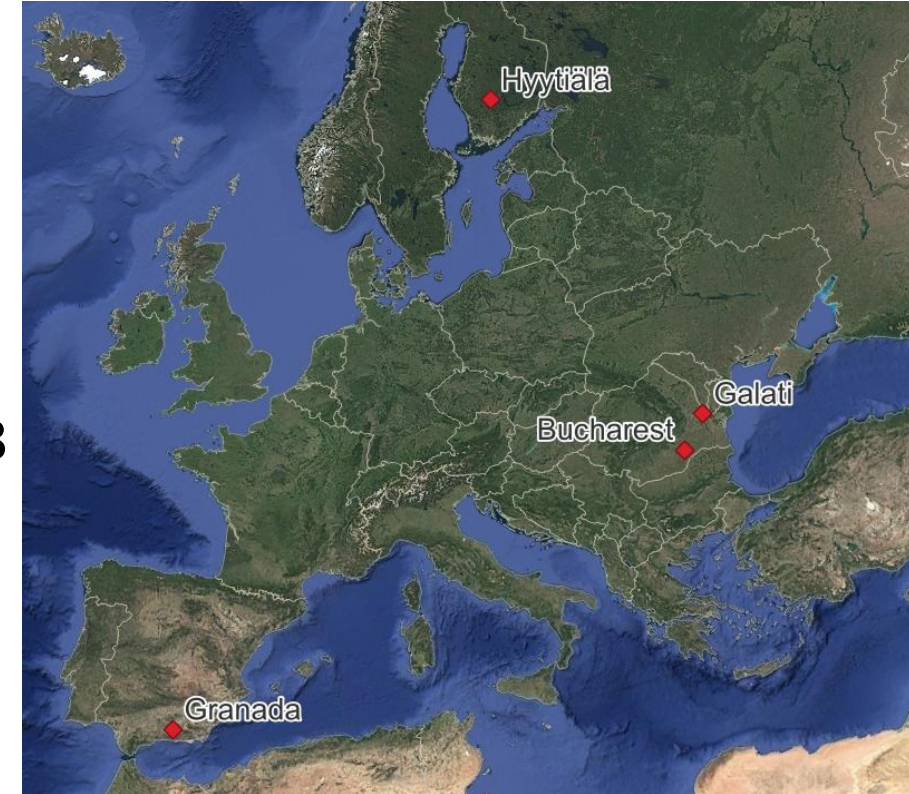


# RADO Bucharest National Facility, Romania



# Details of the analysis

- Cloudnet Data Portal (<https://cloudnet.fmi.fi/>)
- ACTRIS stations:
  - RADO-Bucharest-Romania
  - RADO-Galati-Romania
  - Granada-Spain
  - Hyytiälä-Finland
- One-month analysis: 01.05.2023—31.05.2023
- Target classification products\* using
  - DCR- Doppler Cloud Radar
  - ceilometer
  - microwave radiometer
- Wind data
  - DWL datasets-continuous vertical measurements+VAD scanning scenarios\*\*
  - Datasets are further used in an **adapted processing algorithm based on Halo toolbox\*\*\*** to obtain wind characteristics.


























\*Hogan and O'Connor, 2004 "Facilitating cloud radar and lidar algorithms: the Cloudnet Instrument Synergy/Target Categorization product. "Cloudnet documentation"

\*\*Päschke et al., 2015 <https://doi.org/10.5194/amt-8-2251-2015>

\*\*\* Manninen et al., 2018 <https://doi.org/10.1029/2017JD028169>

# Target classification classes
























Class 0:	Clear sky (not shown in the analysis)			
Class 1:	Cloud liquid droplets only			
Class 2:	Drizzle or rain			
Class 3:	Drizzle or rain coexisting with cloud liquid droplets			
Class 4:	Ice particles			
Class 5:	Ice coexisting with supercooled liquid droplets			

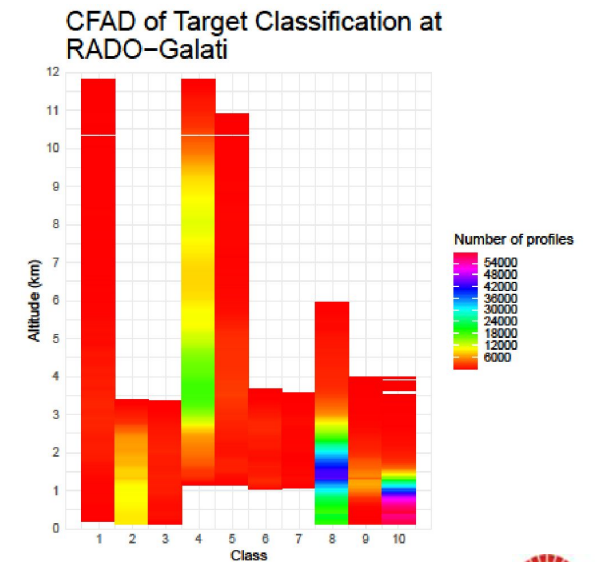
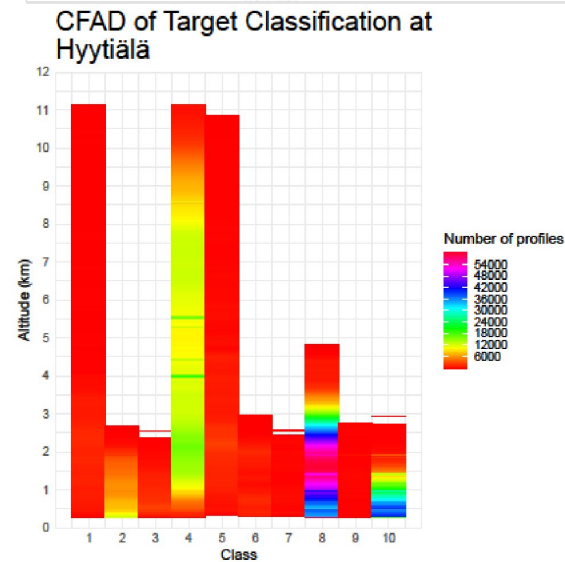
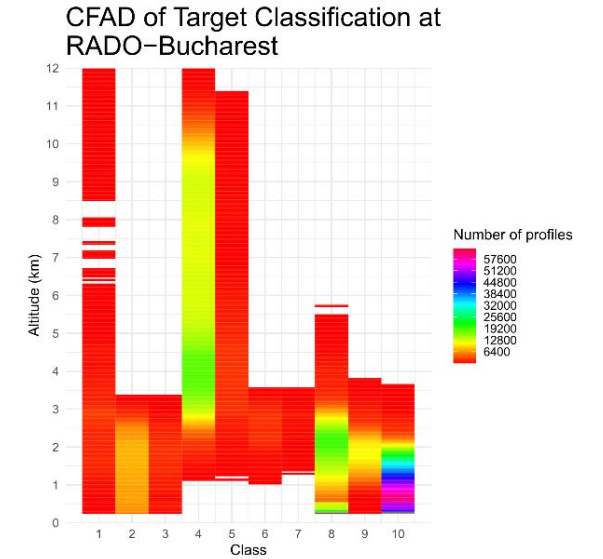
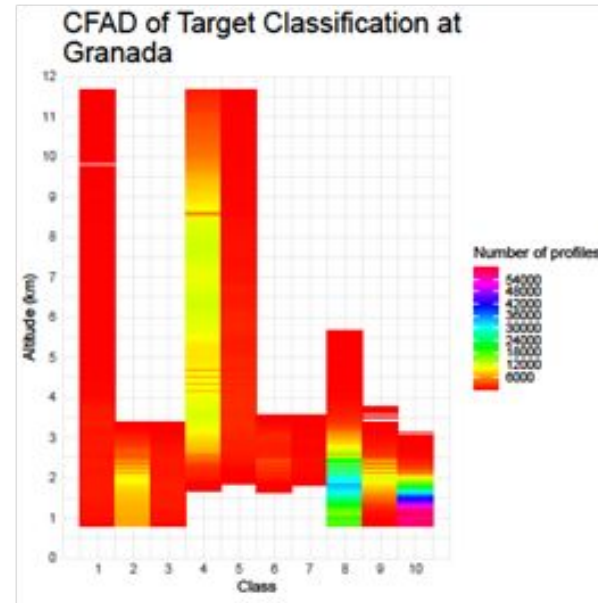
Class 6:	Melting ice particles				
Class 7:	Melting ice particles coexisting with cloud liquid droplets				
Class 8:	Aerosol particles, no cloud or precipitation				
Class 9:	Insects, no cloud or precipitation				
Class 10:	Aerosol coexisting with insects, no cloud or precipitation.				



# Target classification

## Contoured frequency by altitude diagrams (CFAD)

Class 0:	Clear sky (not shown in the analysis)				
Class 1:	Cloud liquid droplets only				
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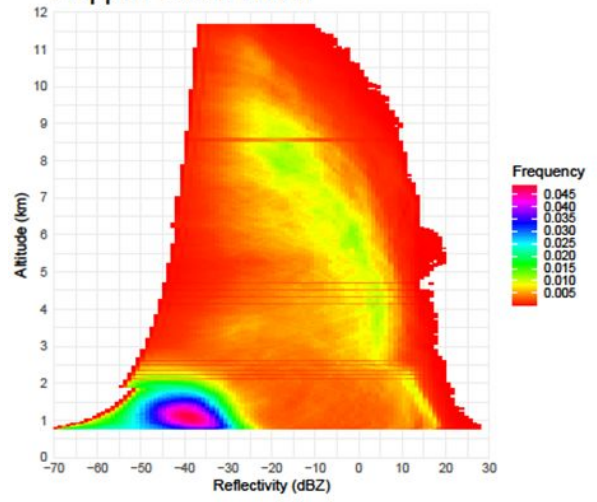




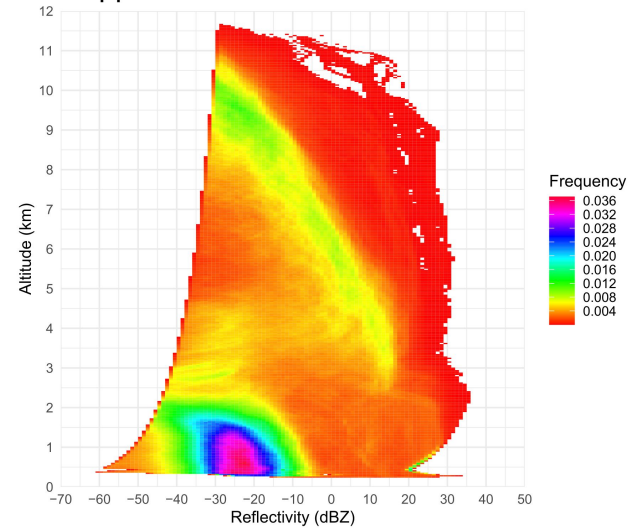
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# CFAD of radar reflectivity from DCR

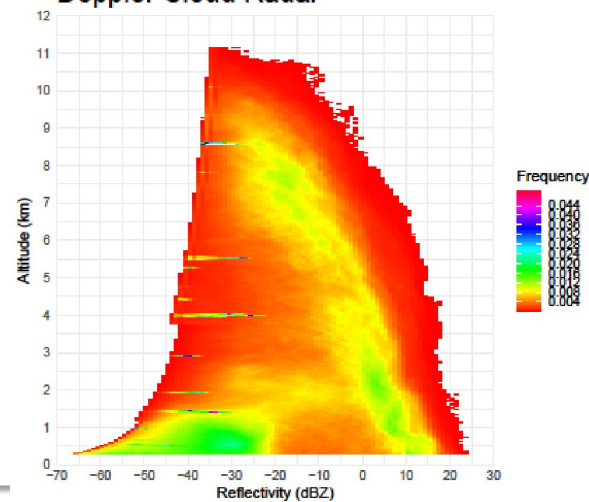
CFAD of Reflectivity at Granada from Doppler Cloud Radar



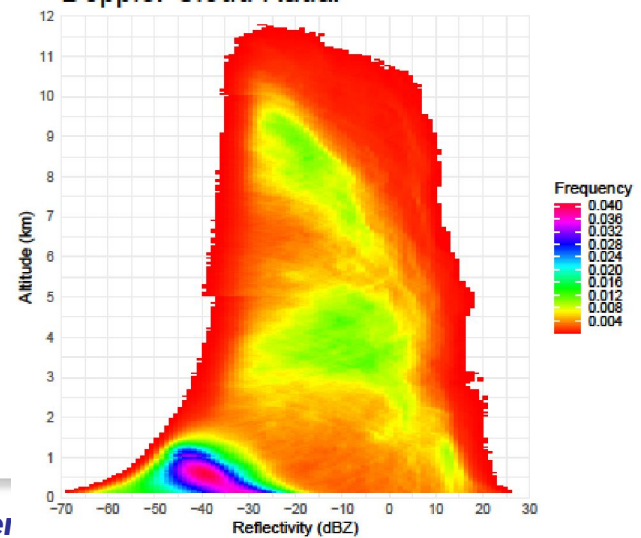
CFAD of Reflectivity at Rado-Bucharest from Doppler Cloud Radar



CFAD of Reflectivity at Hyttiälä from Doppler Cloud Radar



CFAD of Reflectivity at RADO-Galati from Doppler Cloud Radar



# Results-Target classification

## RADO-Bucharest and Galati stations

- distinct pattern with classes 1, 4 and 5 reaching up to approximately 11 km altitude, class 8 reaching a maximum of approximately 5 km and all the rest of the classes (2, 3, 6, 7, 9 and 10) are predominant below 4 km altitude..

## Granada & Hyytiälä stations

- Similar with RADO-Bucharest: 5 peaks of number of profiles: class 2 under 2 km altitude, class 4 in the 2,5-10 km altitude, class 8 under 3 km altitude, class 9 under 2,5 km altitude and class 10 with a maximum of 57000 profiles under 2 km altitude.

## Hyytiälä station

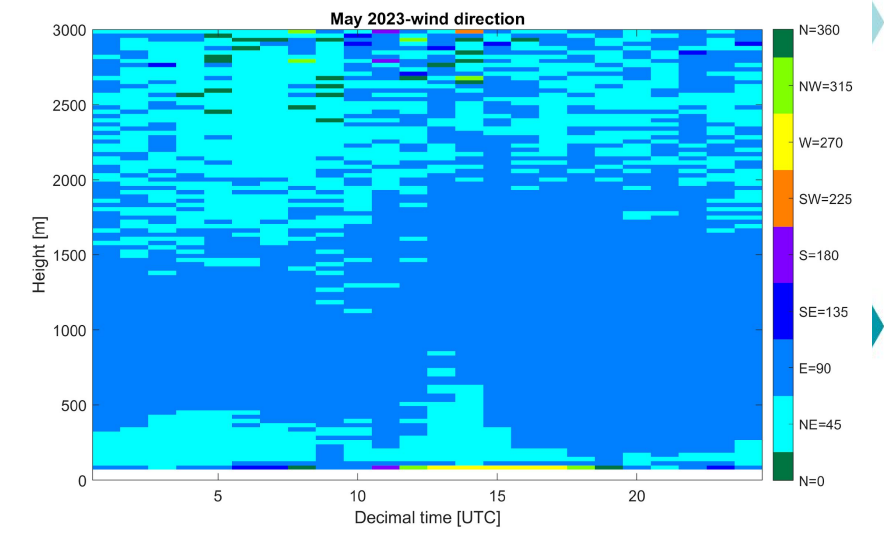
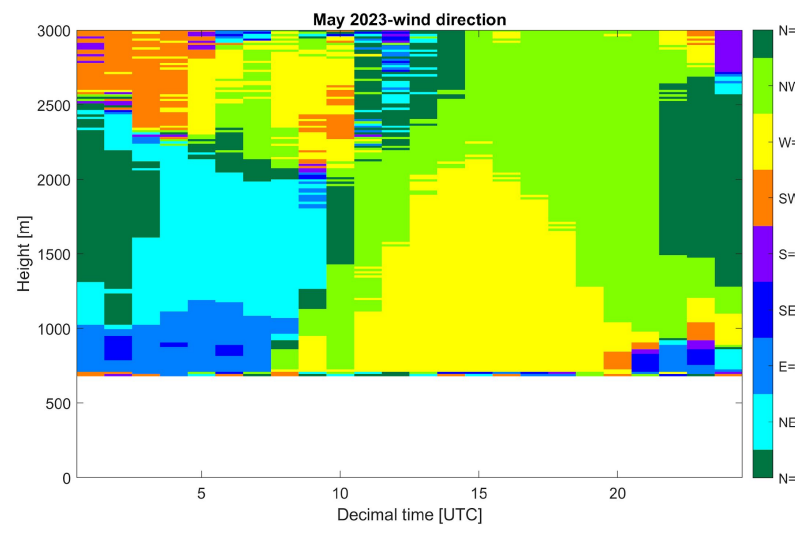
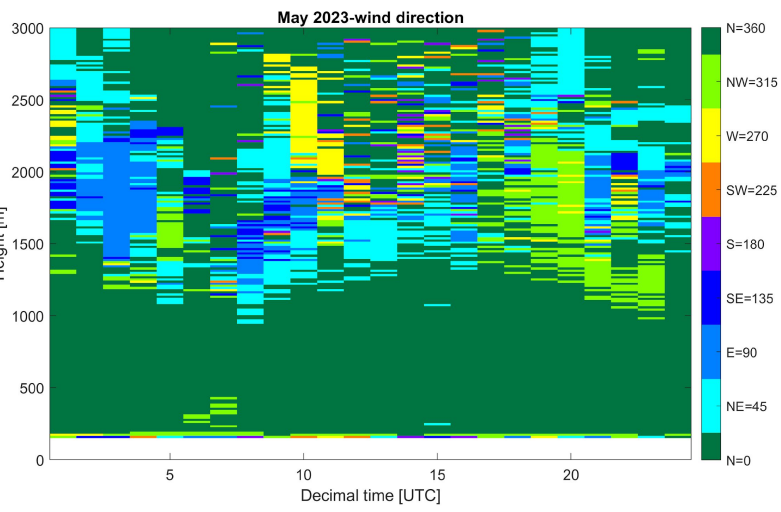
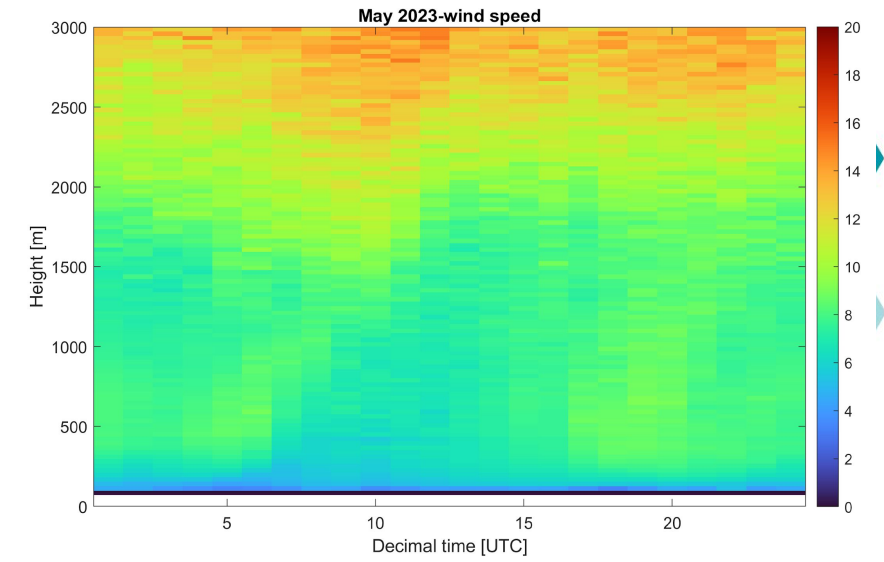
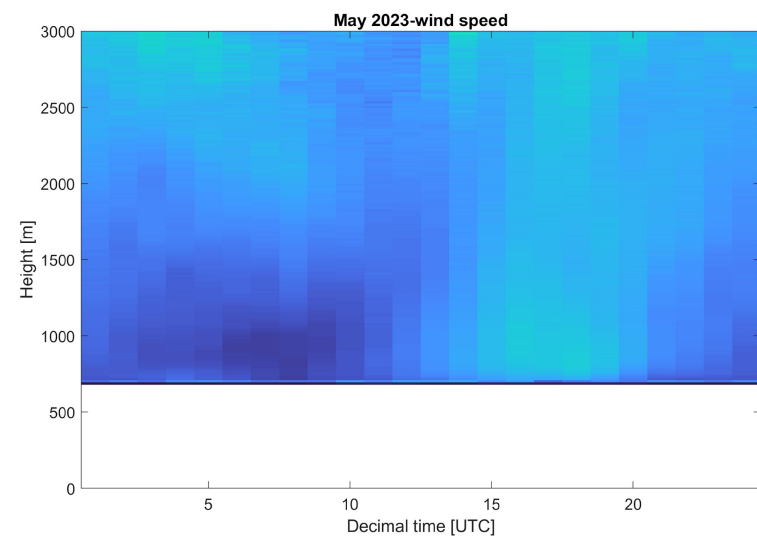
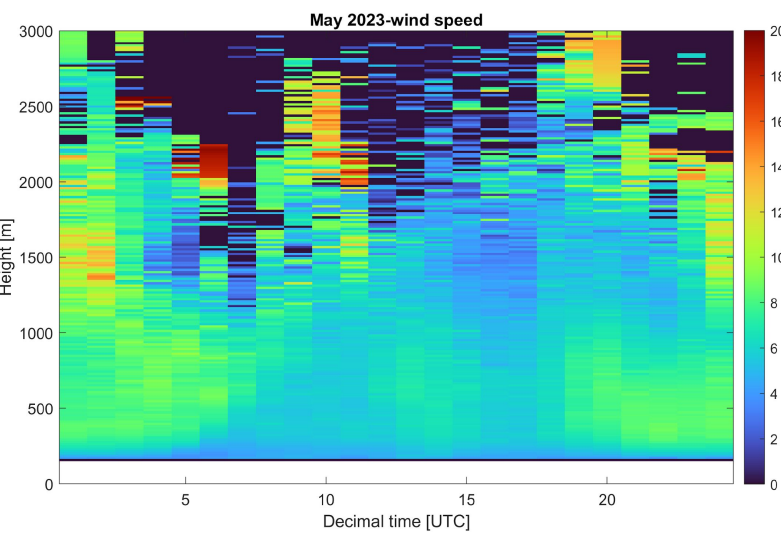
- Less profiles involving insects
- All classes are present in the lower part of the atmosphere up to 3 km

\*Ortiz Amezcua et al., 2022, <https://doi.org/10.3390/rs14102321>

\*\*Pîrloagă et al., 2023 Ground-Based Measurements of Wind and Turbulence at Bucharest–Măgurele: First Results. *Remote Sens.* **2023**, *15*, 1514. <https://doi.org/10.3390/rs15061514>



# Hourly horizontal wind speeds m/s (upper panels) and wind direction (lower panels) from DWL at Hyytiälä station Granada Bucharest



# Results

Hourly averaged horizontal wind speeds and horizontal wind directions from DWL

## Granada station\*

- a pattern with low speeds (<5 m/s) for all altitudes and all time-*different* May pattern than in previous studies
- a highly turbulent horizontal wind direction is presented

## RADO-Bucharest station

- a *typical spring wind pattern* for this area\*\* : high wind speeds as altitude increases reaching a maximum of approximately 13 m/s while
- horizontal wind direction- predominantly from East and Northeast.

## Hyytiälä station

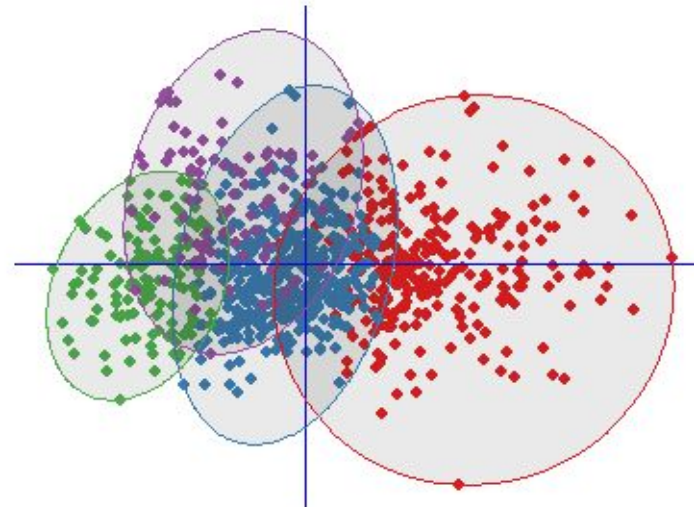
- a pattern with low speeds (approximately 5 m/s) in the lower part of the atmosphere all time intervals; higher speeds as altitudes increases (similar with RADO-Bucharest).
- horizontal wind direction- predominantly from the North.

\*Ortiz Amezcua et al., 2022, <https://doi.org/10.3390/rs14102321>

\*\*Pîrloagă et al., 2023 Ground-Based Measurements of Wind and Turbulence at Bucharest–Măgurele: First Results. *Remote Sens.* **2023**, *15*, 1514. <https://doi.org/10.3390/rs15061514>

# Plans

- We intend to perform this analysis on longer time periods, annually, seasonally or even on a multiyear period for several ACTRIS CCRES stations trying to find an unique “fingertip” for each station or to cluster stations with similarities
- If you are interested in collaborating, please contact us.





# ACTRIS

# CCRES

**Thank you for your attention**  
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