



# ACTRIS CCRES

## Vertical Structure and Seasonal variability of hydrometeors at different Cloudnet stations

*Anca Nemuc, INOE*

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# Vertical Structure and Seasonal variability of hydrometeors at different Cloudnet stations

Anca Nemuc, J. Vasilescu, A. Ilie, L. Belegante, F. Toanca, V. Nicolae

National Institute of Research and Development for Optoelectronics – INOE 2000

D. Constantin

REXDAN Research Infrastructure, “Dunărea de Jos” University of Galați, Romania

A. Radovici

Faculty of Environmental Science and Engineering, Babeş-Bolyai University, Cluj-Napoca, Romania



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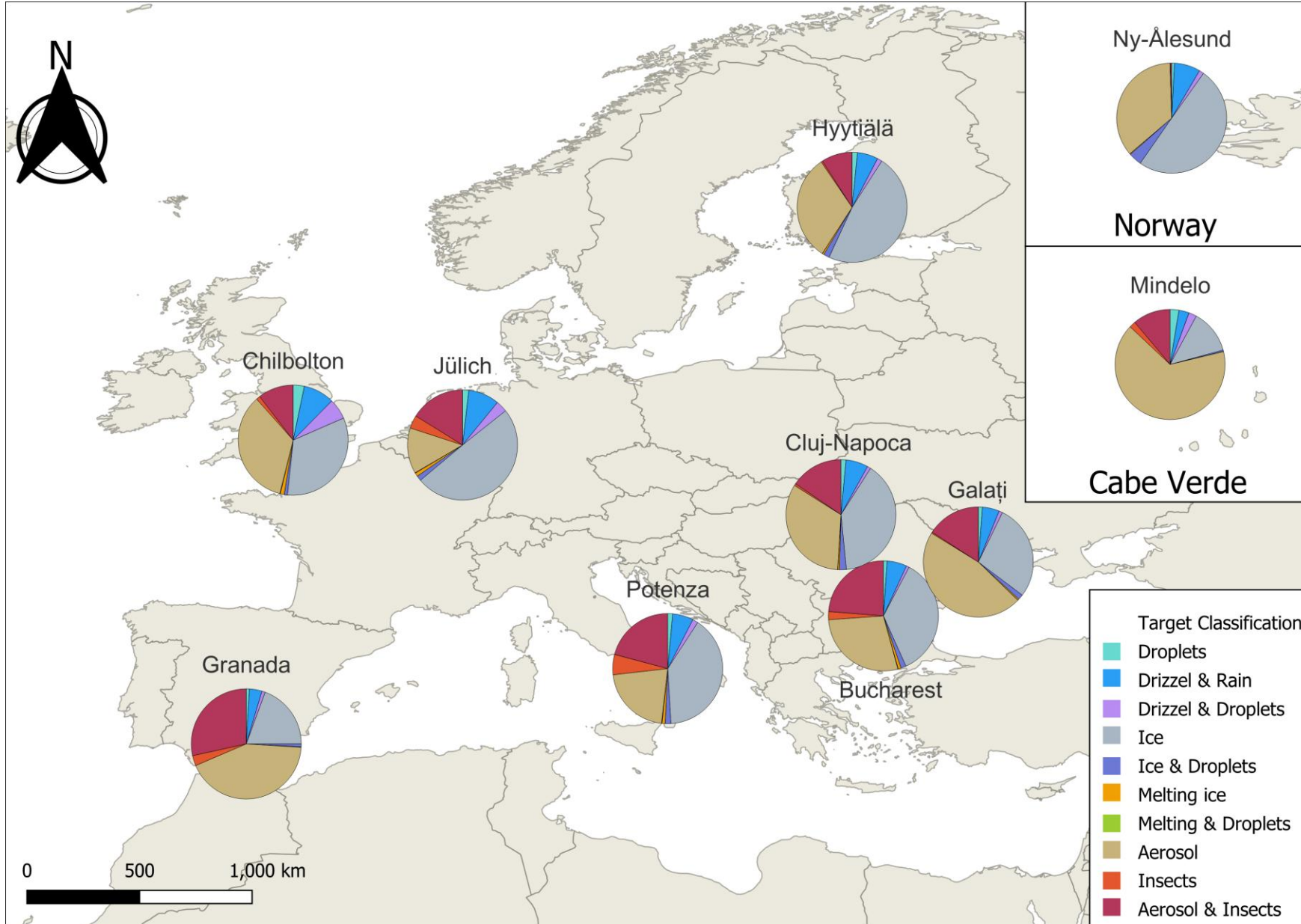
## Objective

To provide a statistical analysis (for 2024) of vertical distributions of hydrometeors at different Cloudnet stations (10) using a synergy of measurements from ground-based remote sensing instruments.

Target classification  
Cloudnet Data Portal (<https://cloudnet.fmi.fi/>)

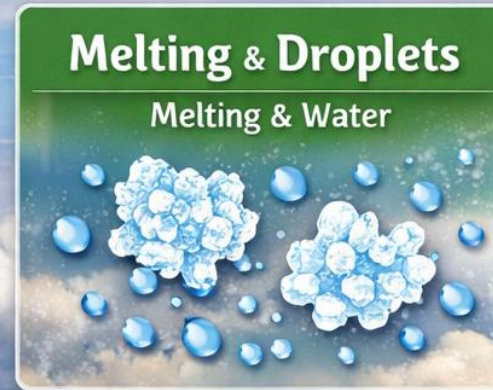
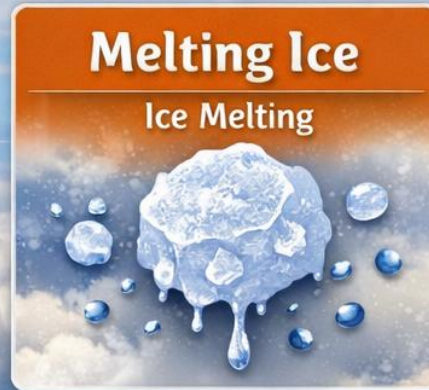
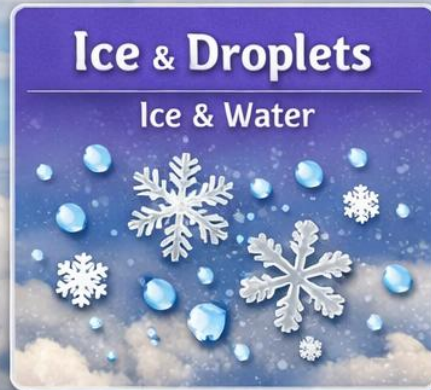
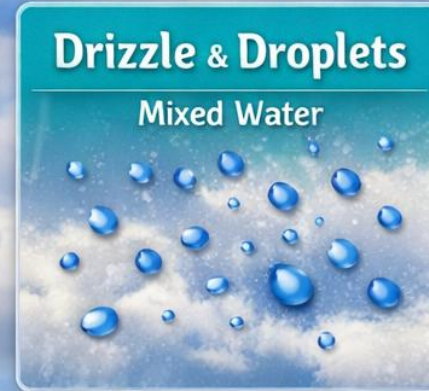
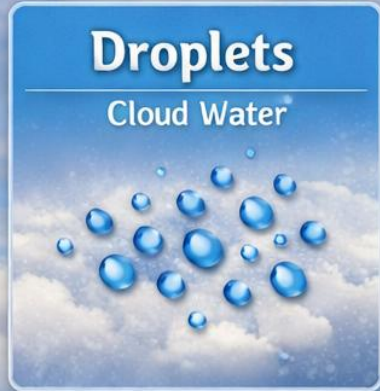


# Target classification of Cloudnet 2024



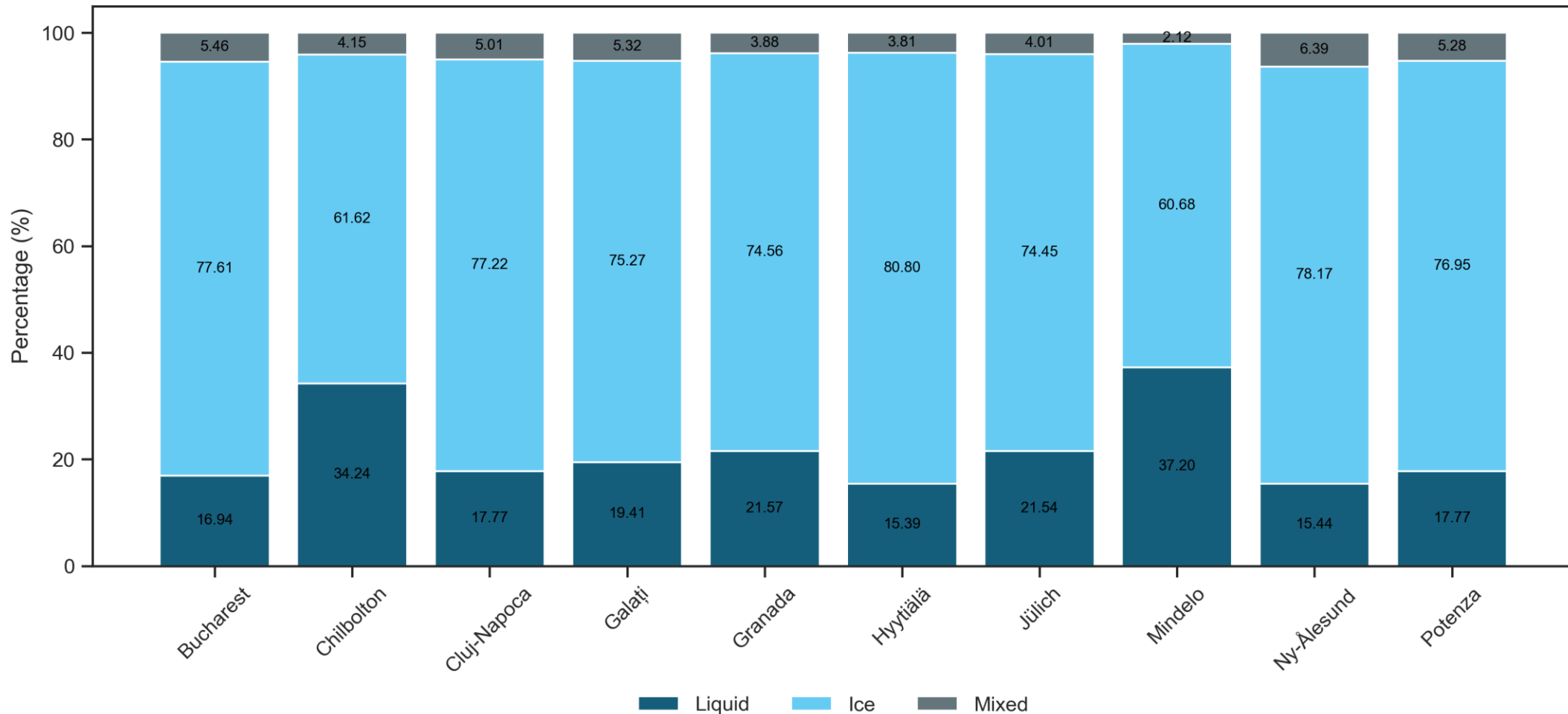
# cloudnet<sup>®</sup>

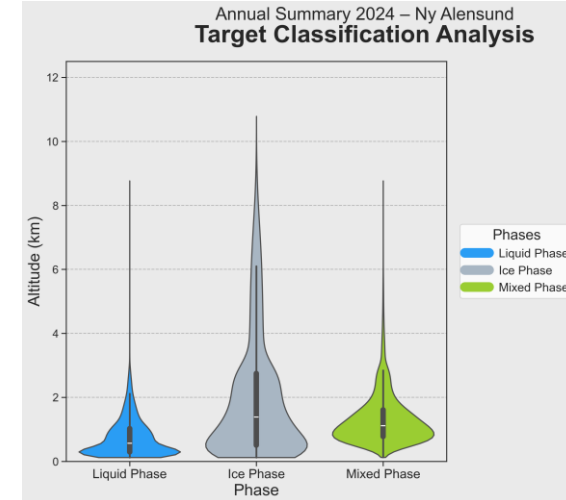
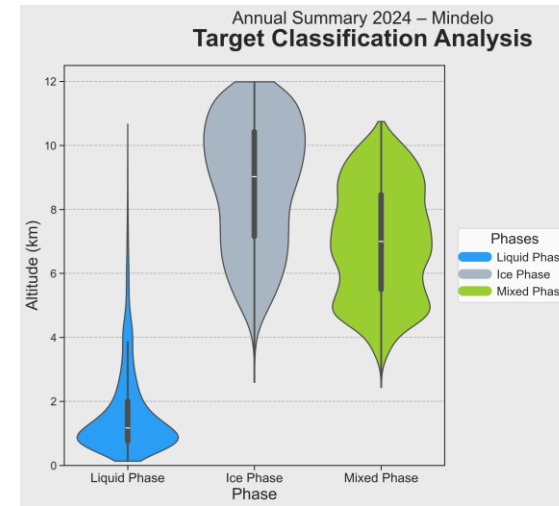
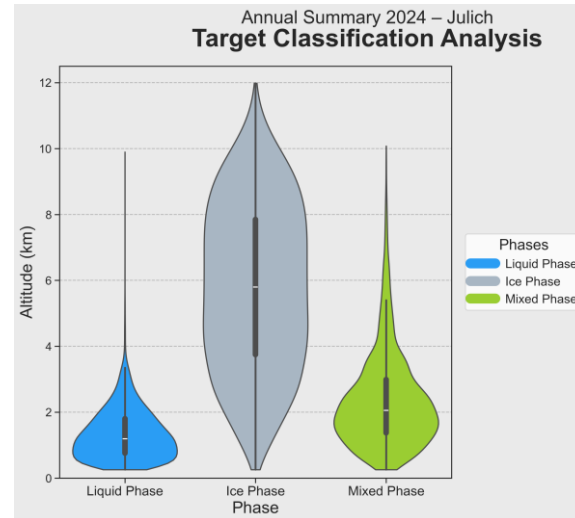
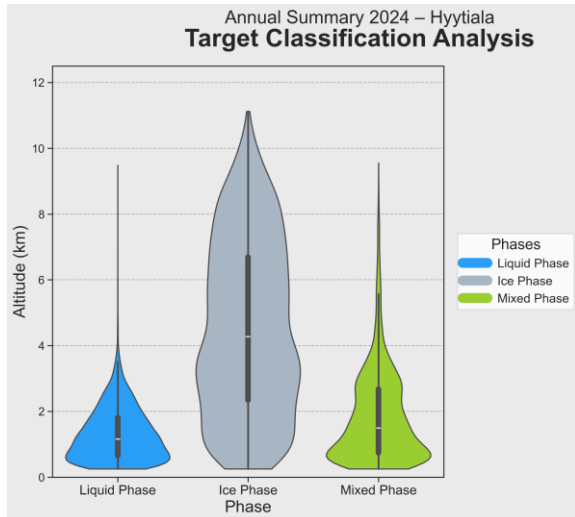
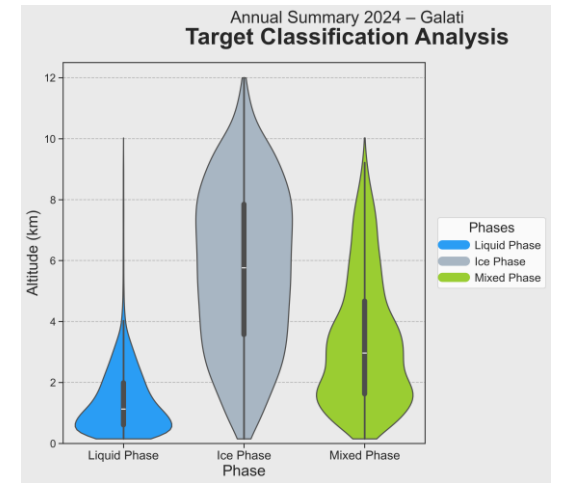
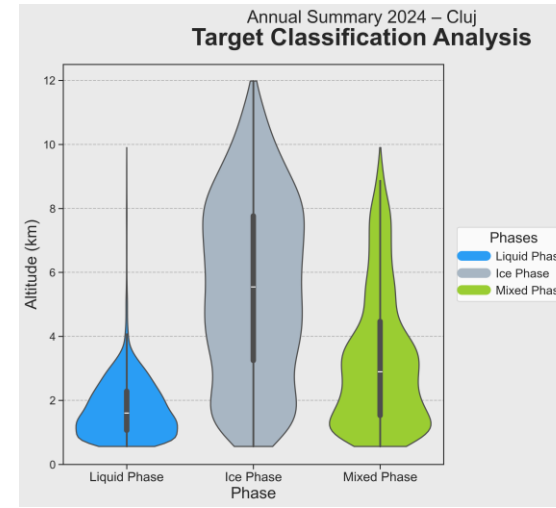
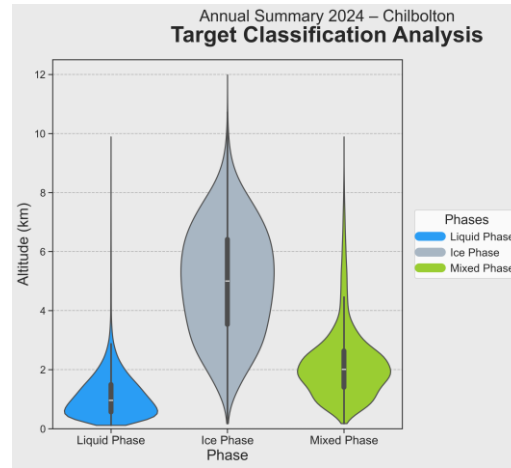
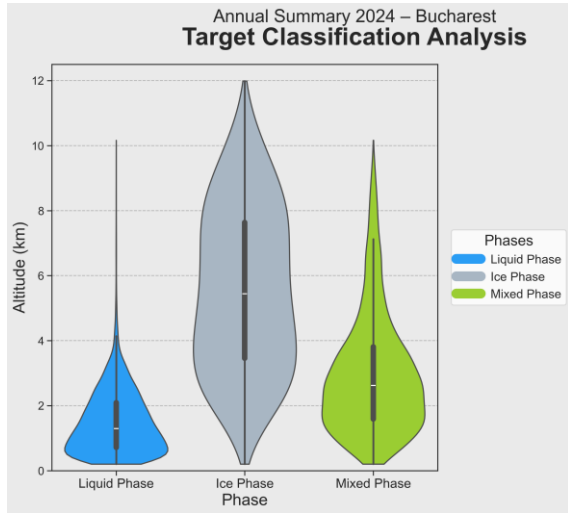
## Hydrometeors





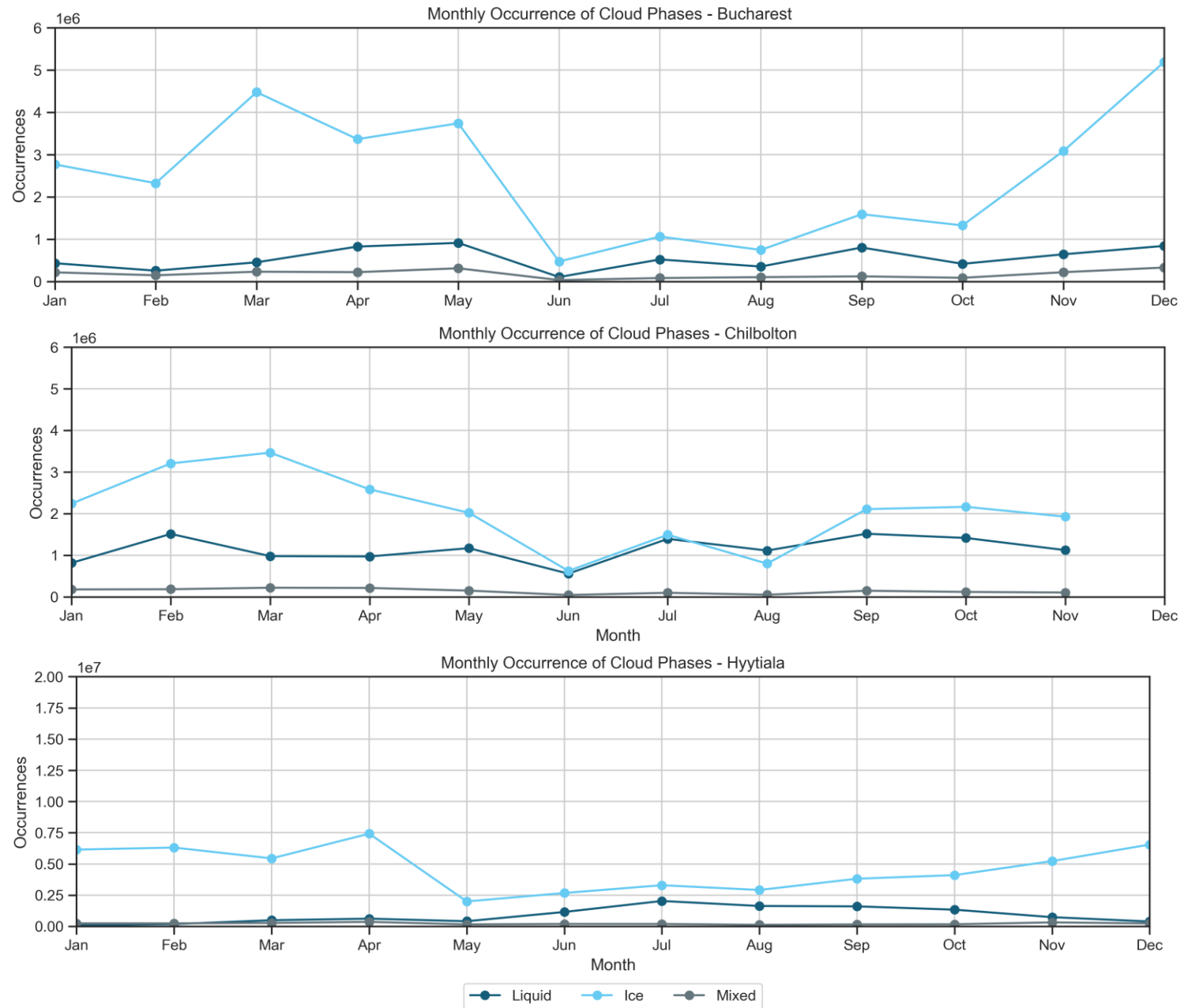
Hydrometer Phase distribution by Station

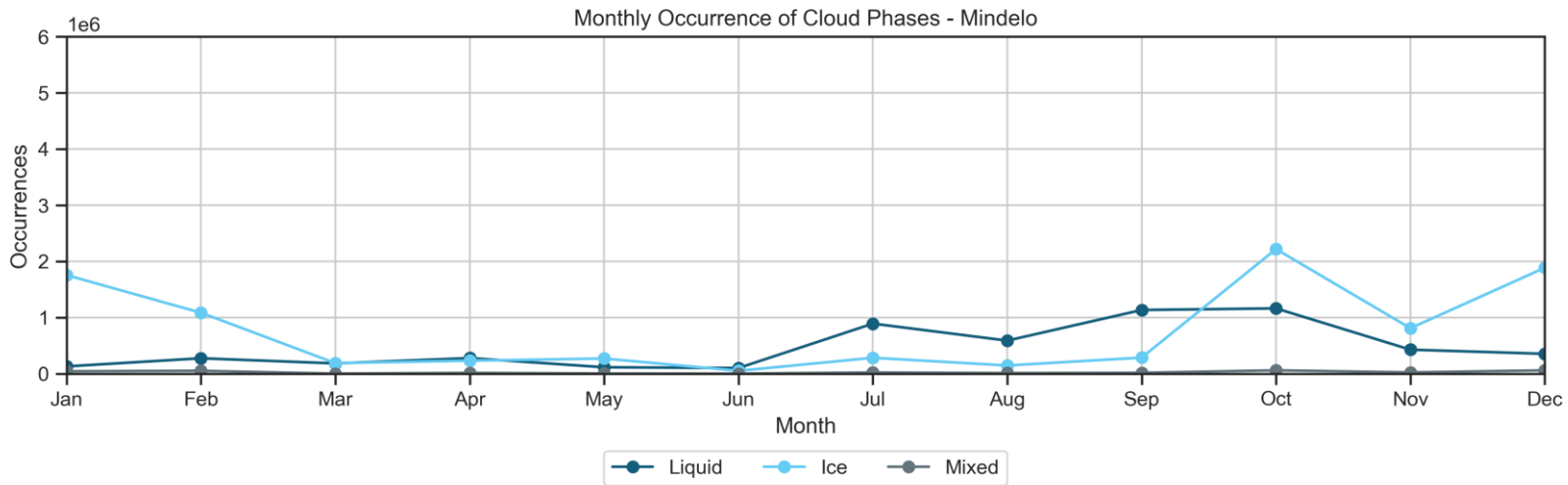
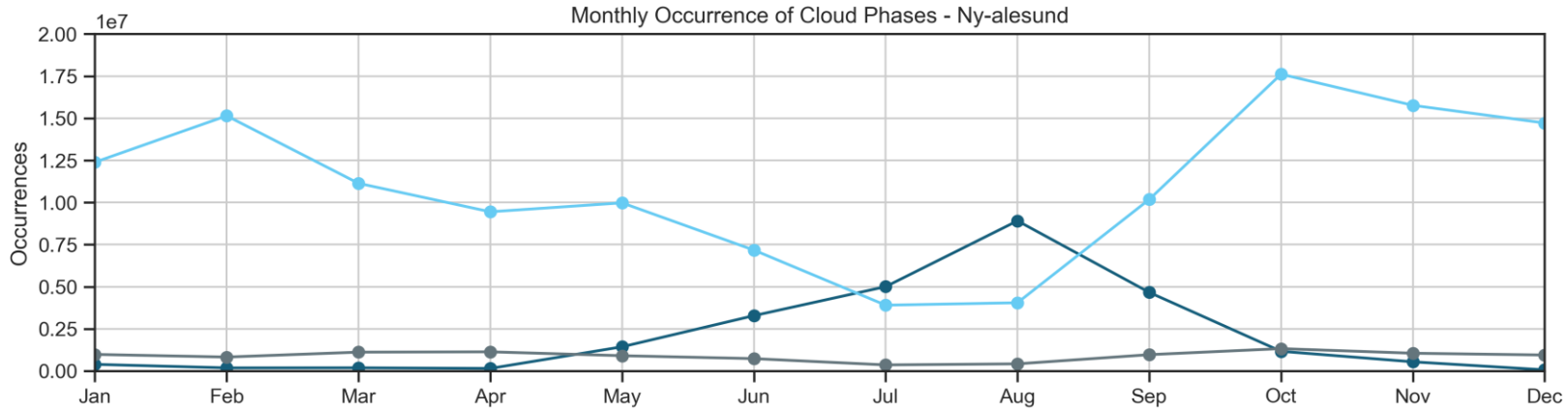
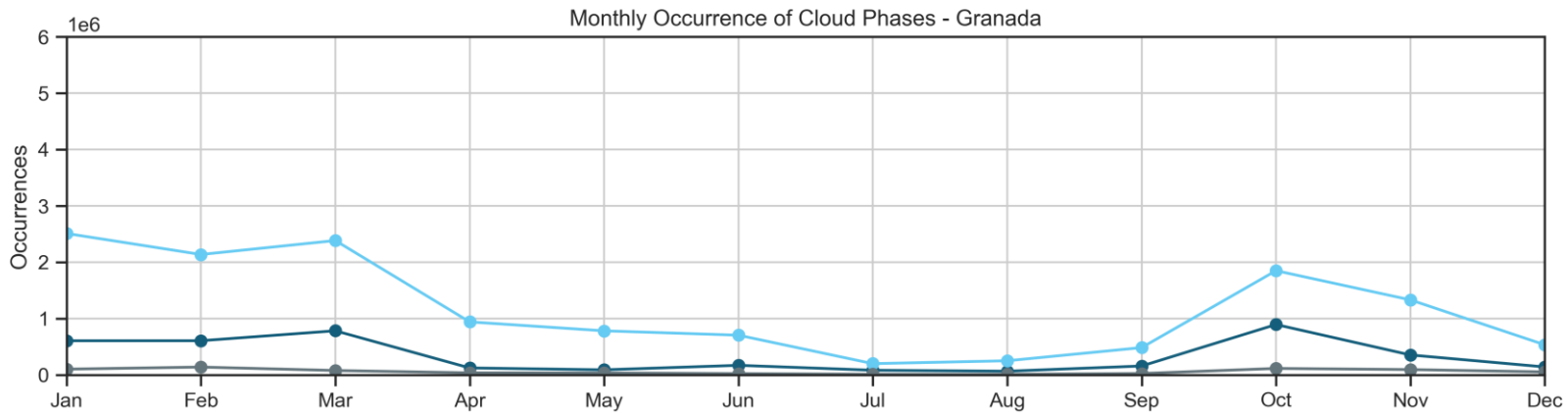




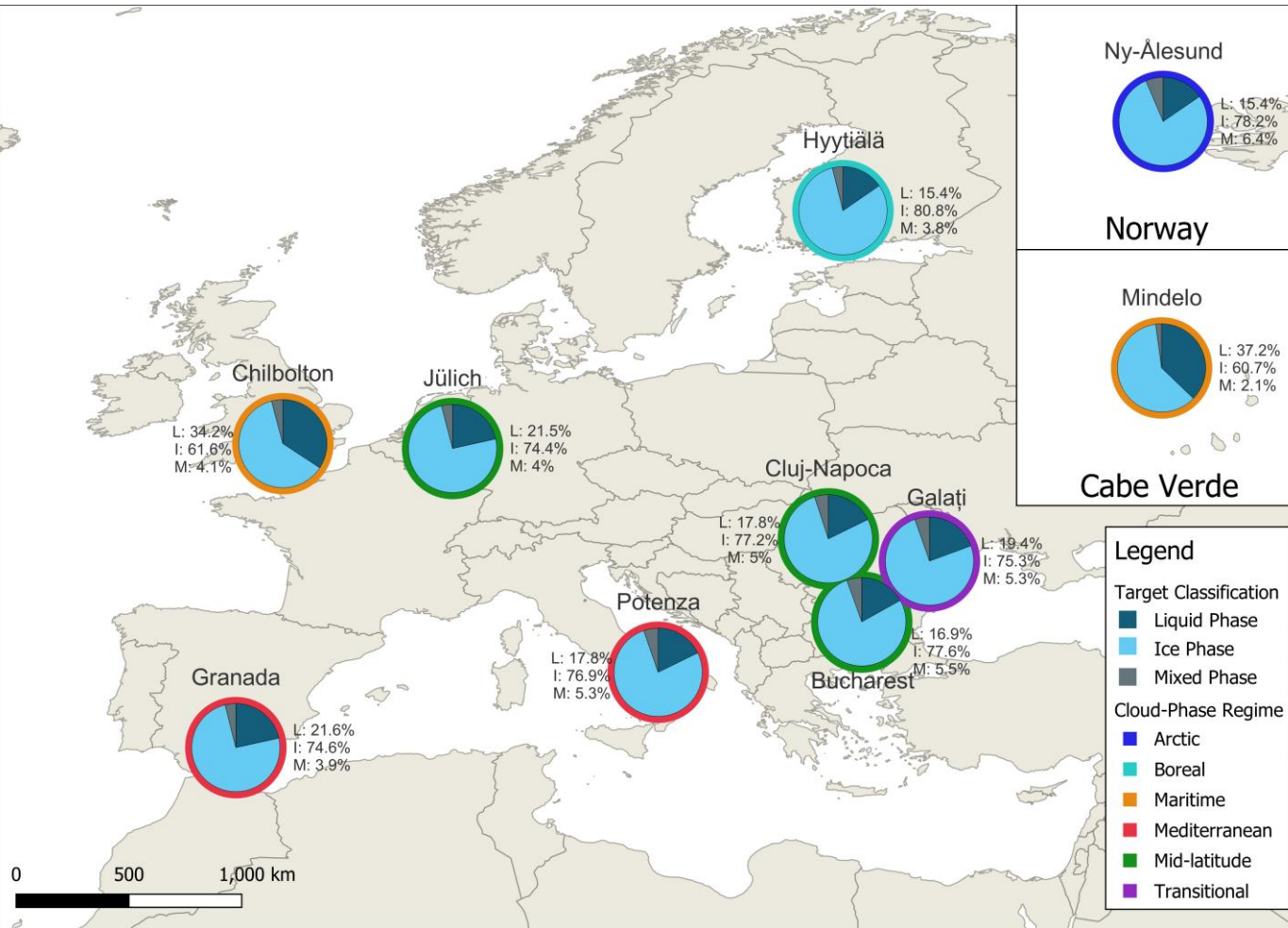
# Vertical distribution of the cloud phases 2024

# Seasonal distribution of cloud phases





# Hydrometers-Phase Fingerprints Across Stations



- **Arctic / Boreal** (Ny-Ålesund, Hyytiälä):  
Strong persistent ice dominance at high altitudes → cold-cloud regimes
- **Mid-latitude** (Jülich, Bucharest, Cluj):  
Pronounced seasonal cycle → winter ice maxima, summer minima
- **Maritime** (Chilbolton, Mindelo):  
Enhanced liquid contribution → boundary-layer cloud influence
- **Mediterranean** (Granada, Potenza):  
Lower liquid occurrence, strong seasonal contrast → dry radiative regimes
- **Transitional** (Galați):  
Mixed characteristics → continental–marine influence

# Summary and Conclusions

- By employing a suite of state-of-the-art instruments operating within Cloudnet, we were able to derive comprehensive statistics on the vertical distribution of distinct classes of hydrometeors within the atmosphere.
  - The monthly evolution of cloud phase occurrence across all stations reveals a **clear and consistent dominance of ice-phase hydrometeors throughout the year**, confirming that upper-level and cold-cloud processes play a major role in atmospheric conditions across diverse climatic regions. **Ice occurrence shows distinct seasonal patterns depending on latitude of the station**
  - Most stations exhibit **reduced total cloud occurrence in early summer** (June–July), followed by a recovery toward autumn and a peak in winter months. This suggests a seasonal modulation driven by large-scale atmospheric circulation and thermodynamic structure
  - When mapping the stations according to their cloud-phase fingerprints, a **clear geographical structure emerges**.
    - Arctic and boreal stations are located at high latitudes and show persistent ice dominance.
    - Mid-latitude continental stations cluster over central and eastern Europe with strong seasonal variability
    - Maritime and tropical stations, such as Chilbolton and Mindelo, show enhanced liquid contributions
    - Mediterranean stations reflect drier regimes.
    - Galati appears as a transitional case between continental and maritime influences



**Thank you for your attention**

Anca Nemuc  
anca@inoe.ro

