

Towards the Automatic Analysis of Ceilometer Backscattering Profiles using Unsupervised Learning

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Tackling Climate Change with Machine Learning
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1

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



2



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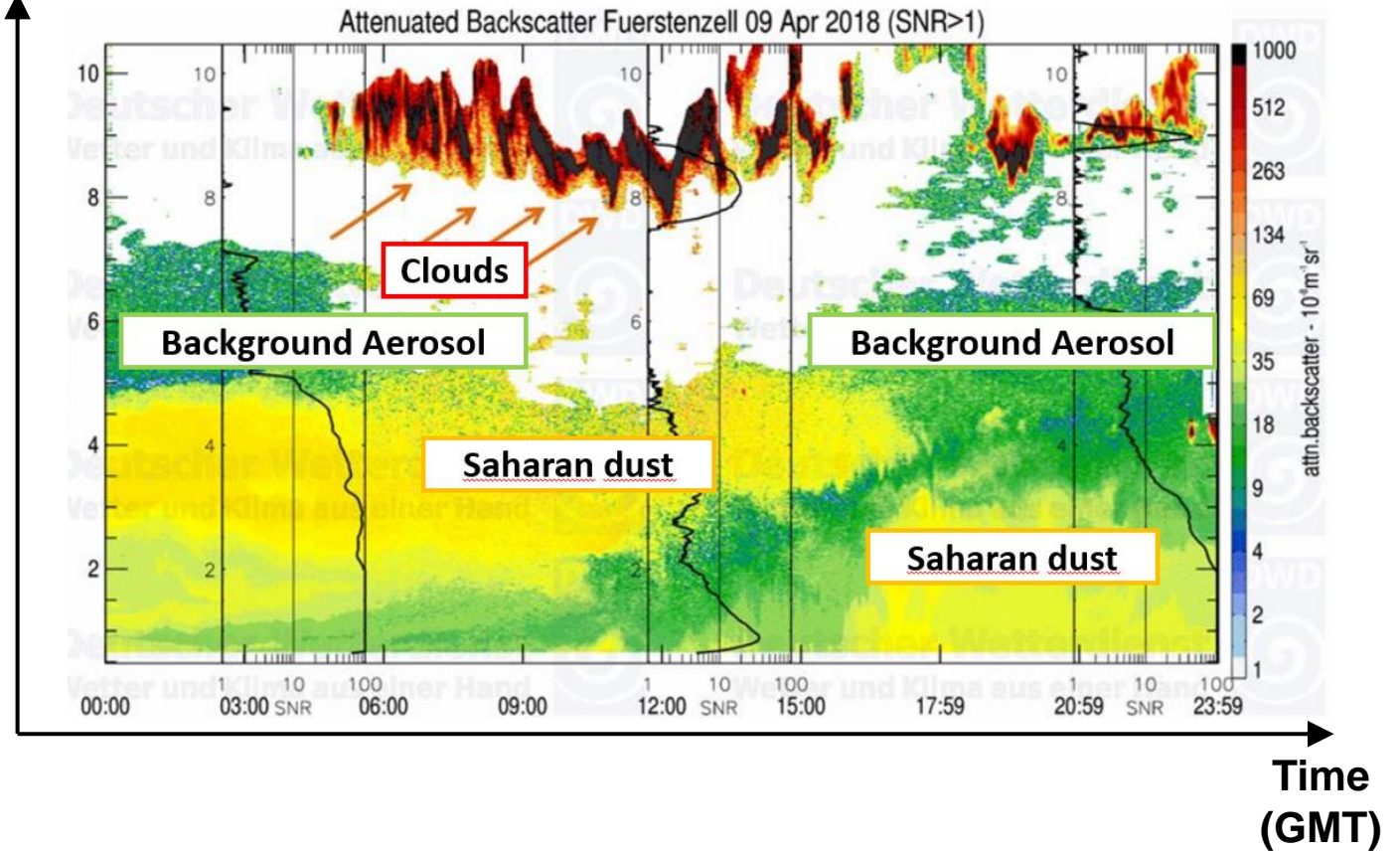
3

Ceilometers



Altitude
[km]

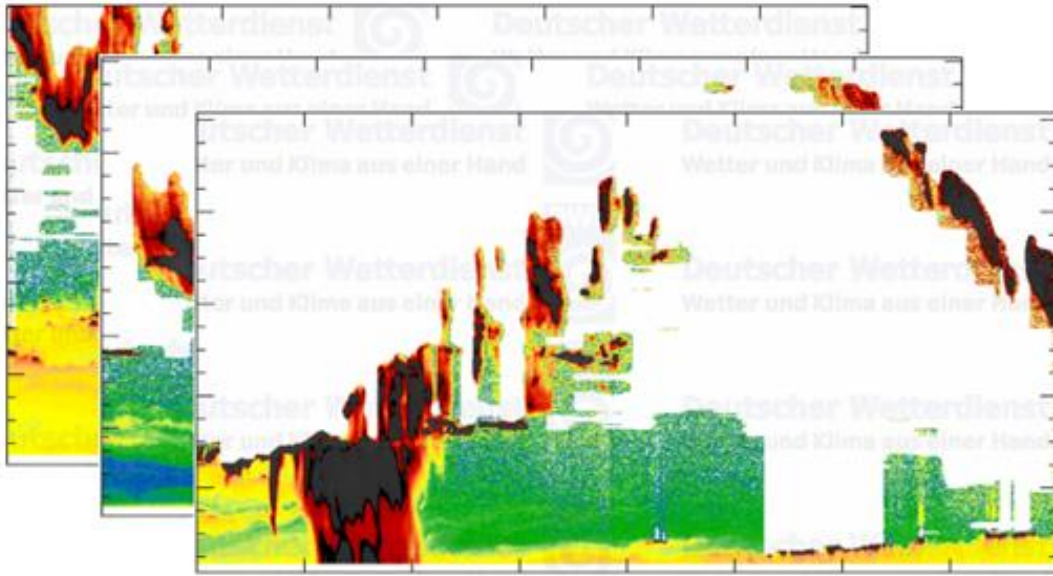
Example measurement - “Quick Look”



Simple LIDAR system
Vertical laser beam
Continuously measuring backscattered light

<https://www.dwd.de/DE/service/lexikon/Functions/glossar.html?lv2=100510&lv3=100538>
https://www.dwd.de/DWD/forschung/projekte/ceilomap/files/Saharan_dust_example_en.pdf

The Problem



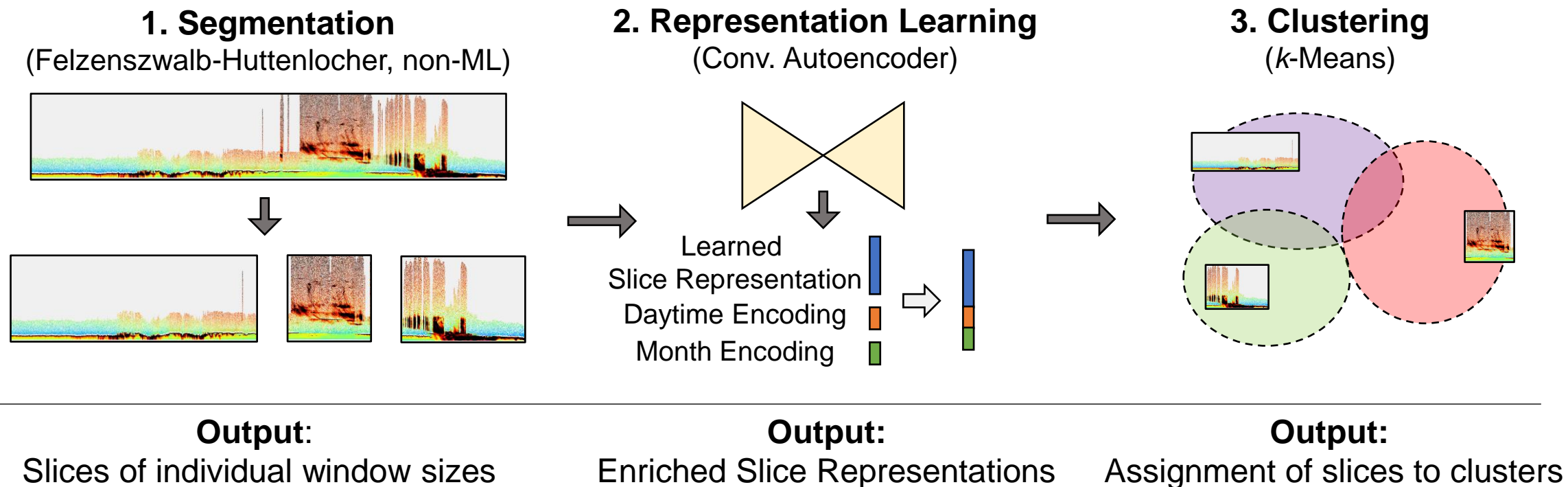
Data is unlabeled

At the moment:
analyzed manually by meteorology
experts

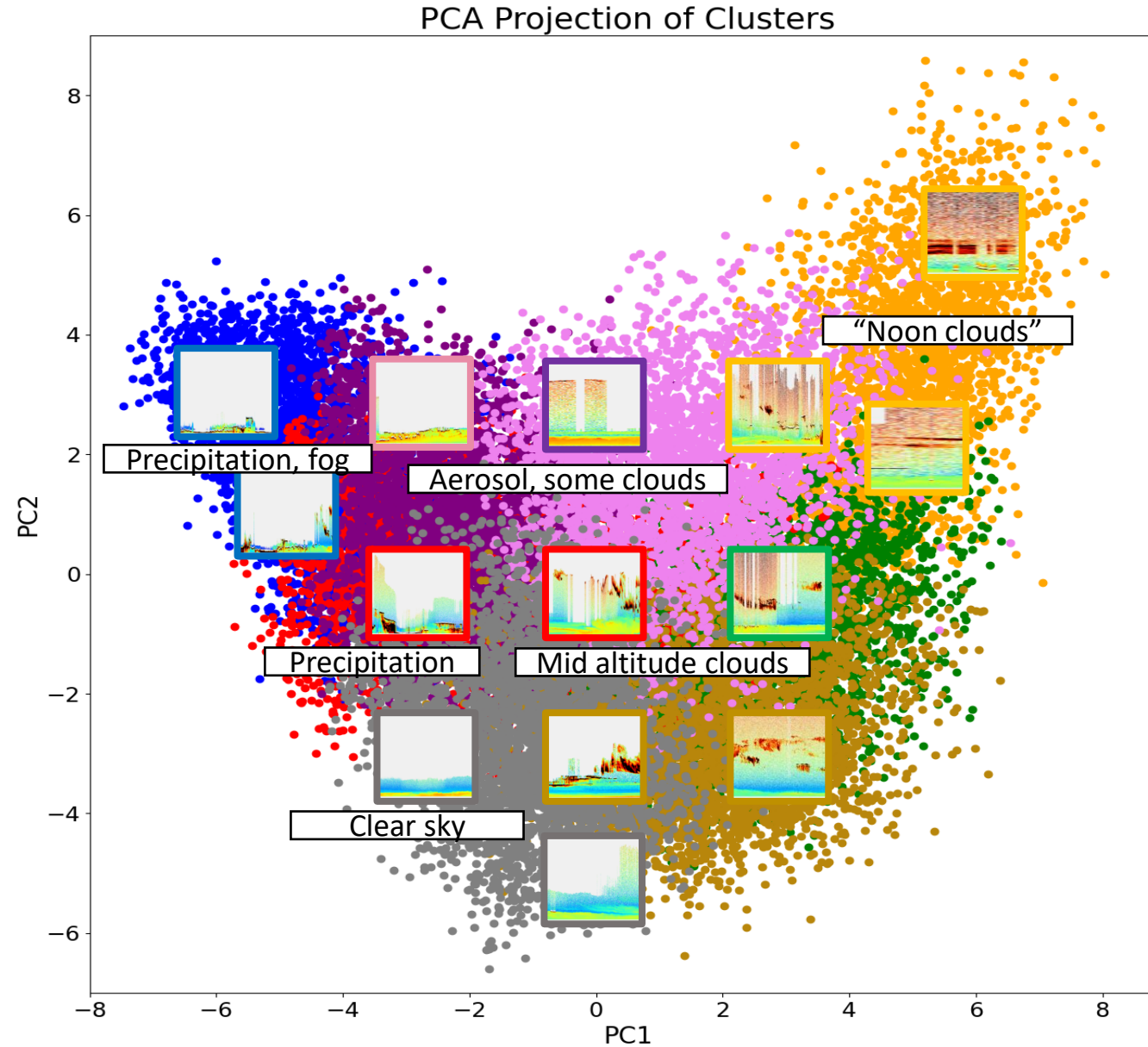
→ Unsupervised Machine Learning

- **Climate science insights**, like frequent, but not necessarily obvious, phenomena
- Automatic detection of situations with specific meteorological conditions for more detailed case studies, e.g., on **aerosol-cloud interactions**

The Approach



Proof of Concept: Results



Conclusion and Outlook

- First proof of concept is considered successful
- Reasonable meteorological phenomena in each cluster
- Approach presents general framework for future
- Fine-tune, change and/or connect the steps
- Acquire partially labeled dataset, new options:
 - semi-supervised learning
 - better evaluation (used as test data), introduce external metrics