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Correlating Lidar Range with atmospheric parameters

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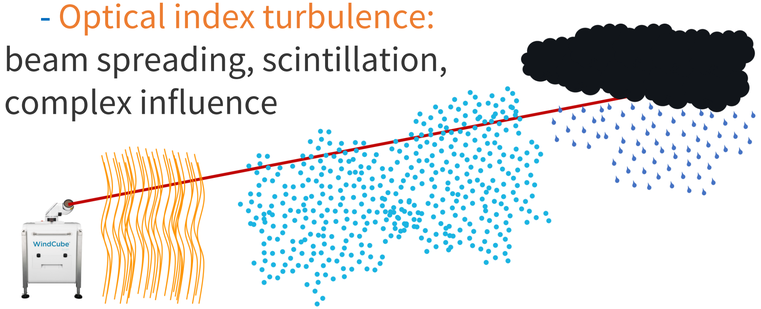
Atmospheric variables

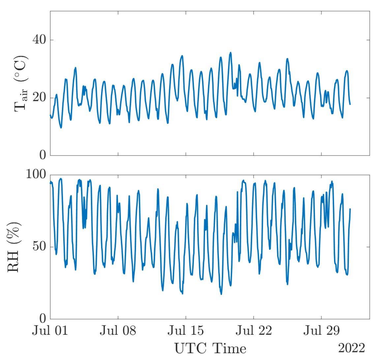
The performance of wind lidars depends on many atmospheric conditions. Their influence is complex and intertwined.

- Clouds, precipitation, fog: reduce measurement range
- Aerosol type, amount, properties: affects backscattering, complex influence
- Optical index turbulence: beam spreading, scintillation, complex influence



Experiments

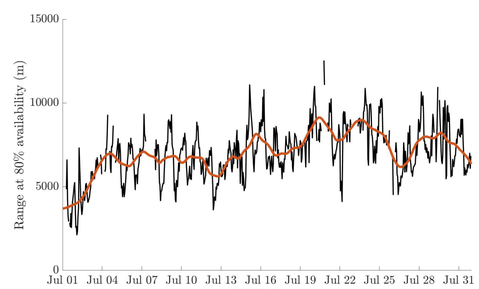
Experimental campaign at Meteoswiss site in Payerne. Lidar range is measured with a PPI scan at 3° elevation. **1 month** of data acquired in July 2022. High visibility and low precipitation during the campaign.

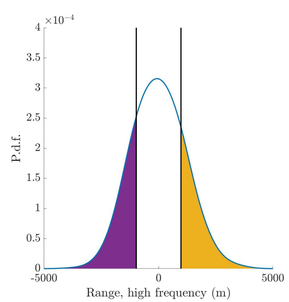


Lidar performance

Some of the range fluctuations have an oscillation period of about 24h.
The measurement range is decomposed into a high and a low frequency components:

- **low frequency:** 48h moving average
- **high frequency:** full signal – low frequency





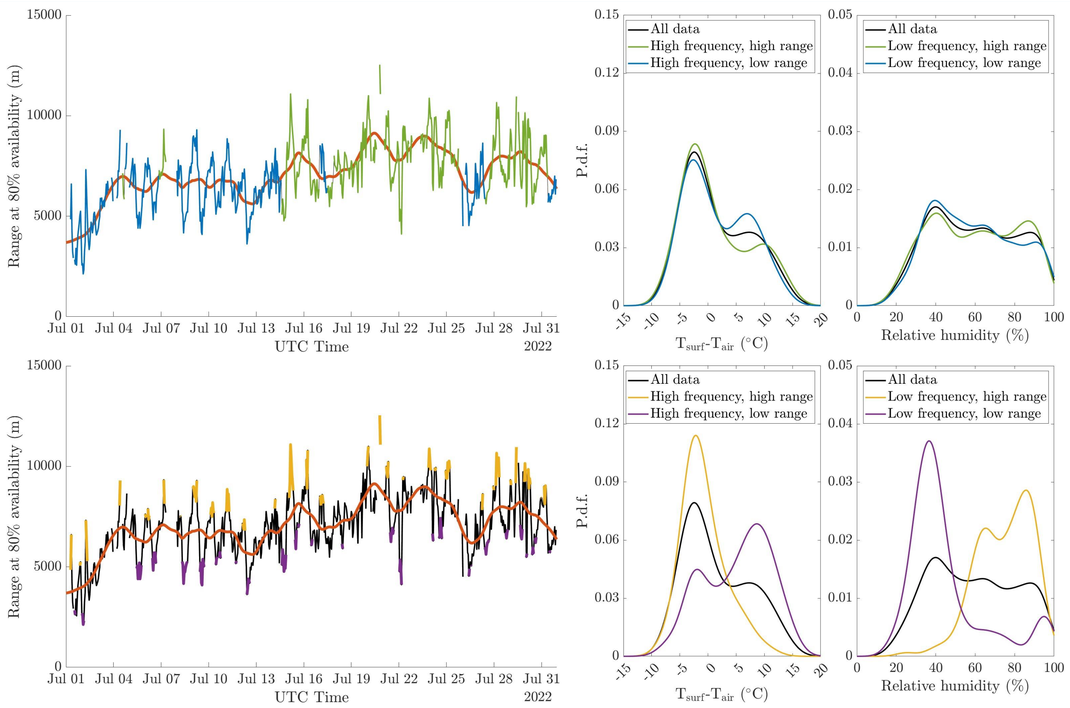
Conditional statistics

The atmospheric conditions observed for certain values of the range are investigated.

4 different conditions are studied:

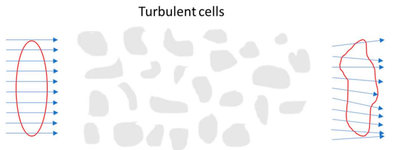
- High range at high frequency
- Low range at high frequency
- High range at low frequency
- Low range at low frequency

Temperature gradient & **relative humidity** are linked to high-frequency oscillations.

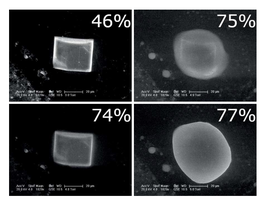


Conclusions

The performance of wind lidars is affected by several atmospheric variables.
Temperature gradients induce optical index variations, and **relative humidity** can change the aerosol properties. These two variables are subject of daily fluctuations and influence the performance of wind lidars. Their respective influence can be difficult to disentangle because their evolution is linked.



Fahey et al., *Atmosphere*, 2021



Haarig et al., *Atmos. Chem. Phys.*, 2017