How to average measurements from ground-based radiometers

NDACC Microwave Workshop 2012

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Outline

How long should we average spectra?

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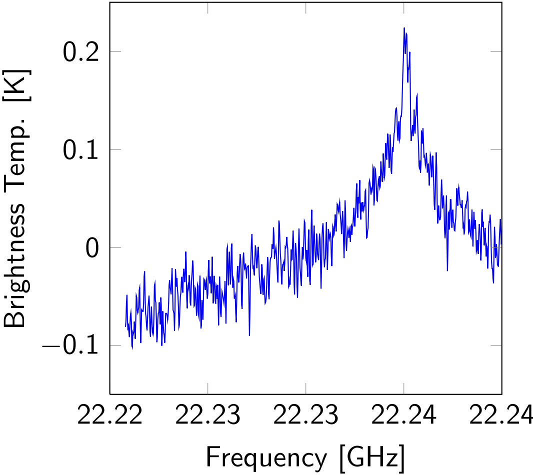
- A day?



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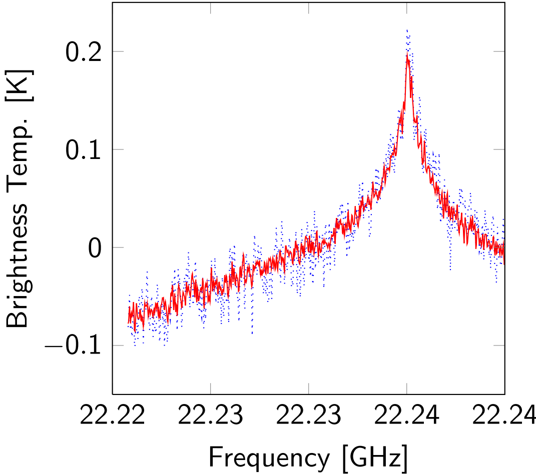

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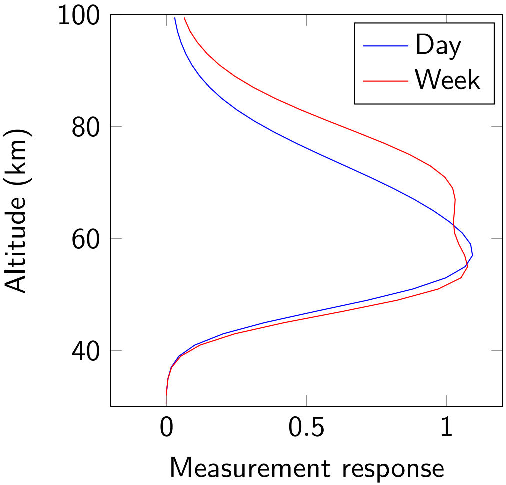

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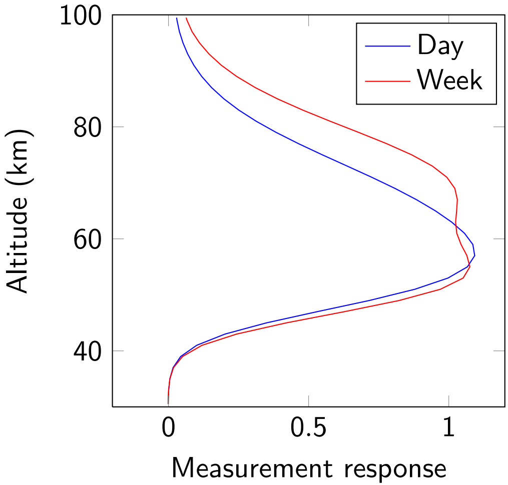
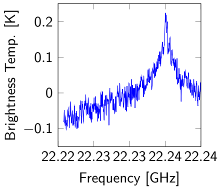
Averaging spectra is not the same as averaging profiles!



Expanding the retrievals into the temporal dimension

- Retrievals perfomed on single spectrum

$$\mathbf{y} = \mathbf{K}\mathbf{x}$$



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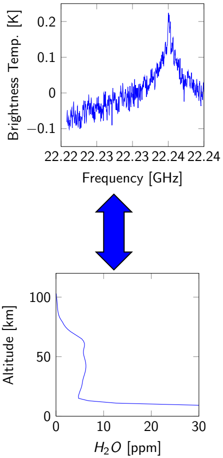

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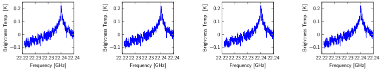

- But we can do several spectra simultaniously

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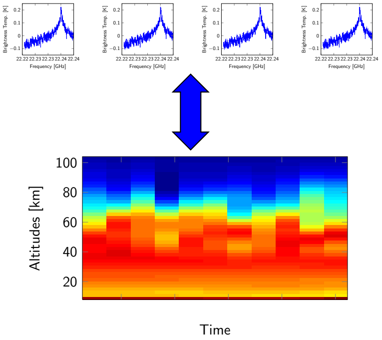


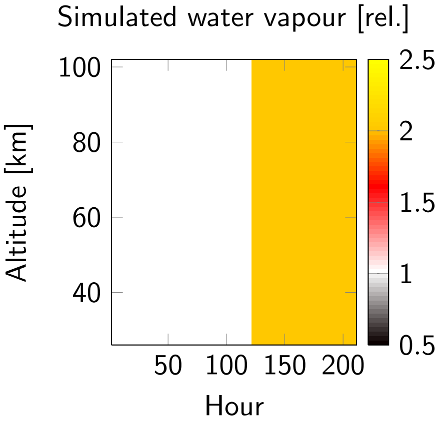
A simulation of an abrupt change in the atmosphere

- To test the properties of the retrieval a simulation i run.
- Atmosphere is constant equal to a priori until the 120^{th} hour, when it is doubled.

$$\hat{\mathbf{x}} = \mathbf{x_a} + (\mathbf{K}^T \mathbf{S}_\epsilon^{-1} \mathbf{K} + \mathbf{S_a}^{-1})^{-1} \mathbf{K}^T \mathbf{S}_\epsilon^{-1} (\mathbf{y} - \mathbf{K} \mathbf{x_a})$$

Instrument

ν_0=22 GHz, Bandwidth = 1 GHz, $\Delta\nu$ = 25KHz, 83 Channels, Noise T = 100 K, Opacity 0.5, Integration time 3 hours, Calibration time 50%



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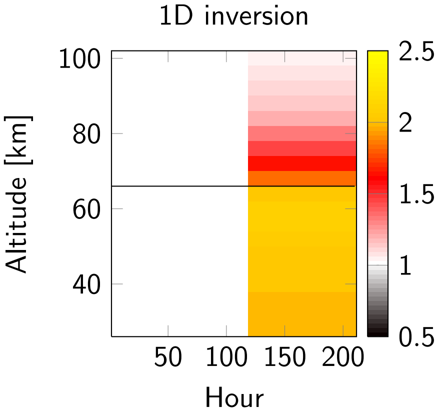

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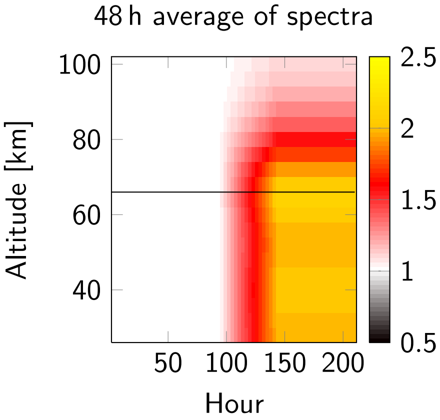

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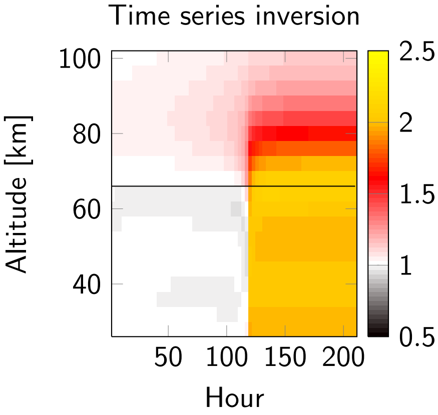

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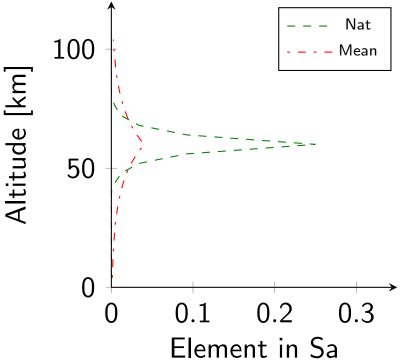

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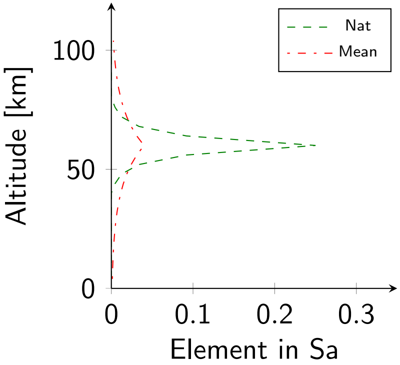

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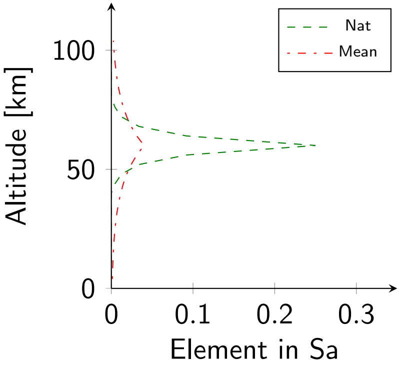

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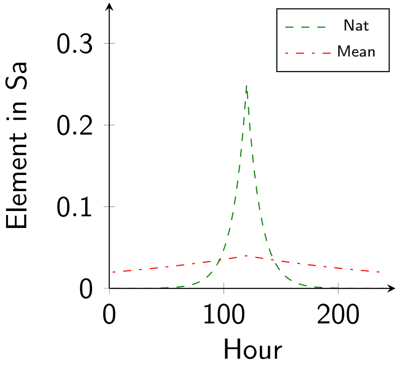

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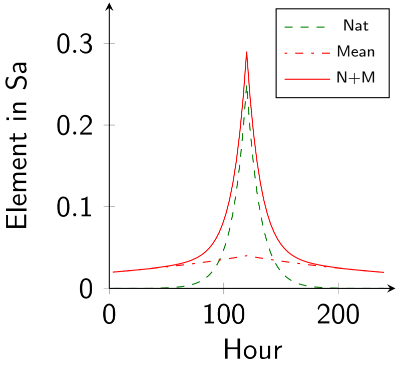

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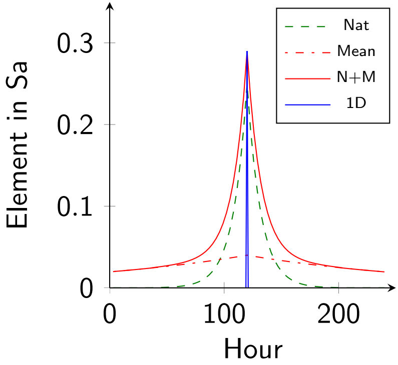

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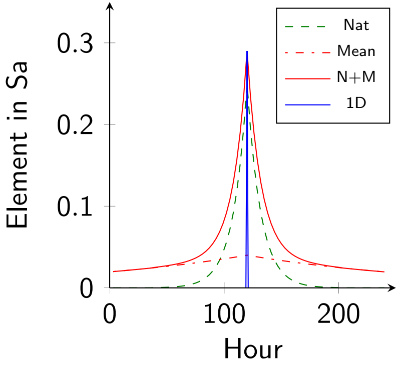

It is the temporal correlation that allows us to improve the retrievals!

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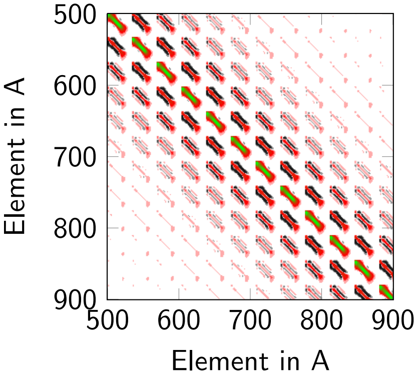

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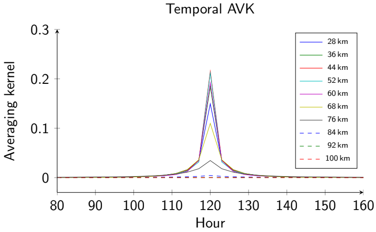

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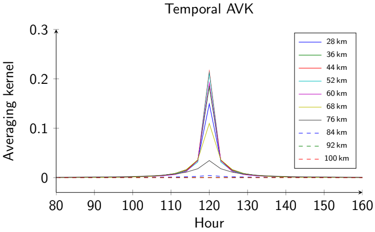

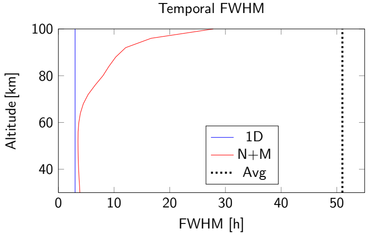

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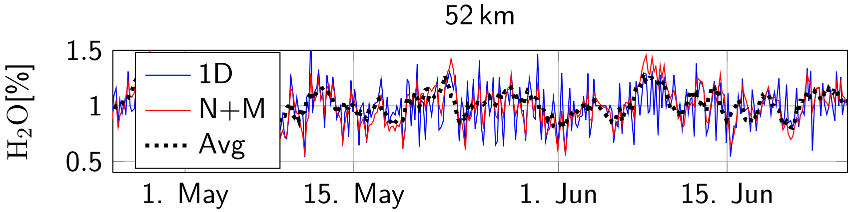

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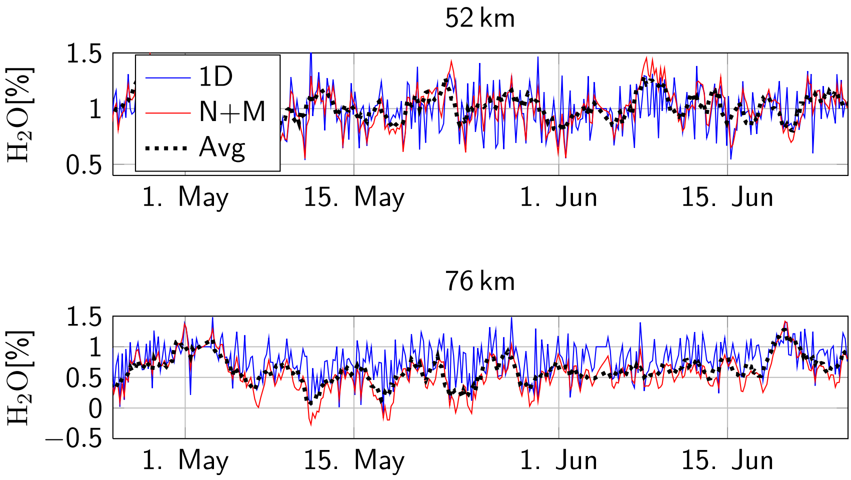

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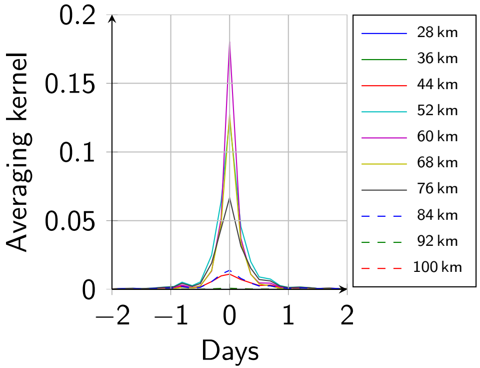

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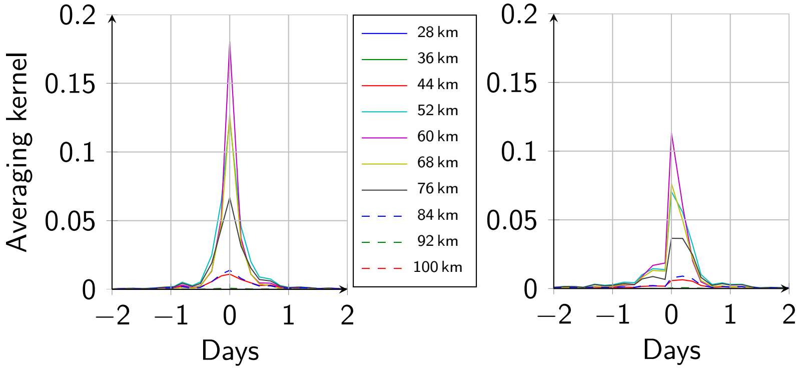

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Ideas

The method also allows for seamless optimal interpolation for filling data gaps or regridding the data.

Can be used to retrieve instrumental data like baselines.