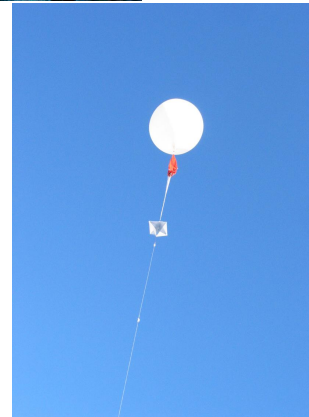
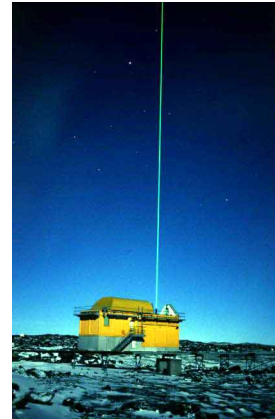


Optimized Combination of Water Vapour Measurements in the Atmosphere

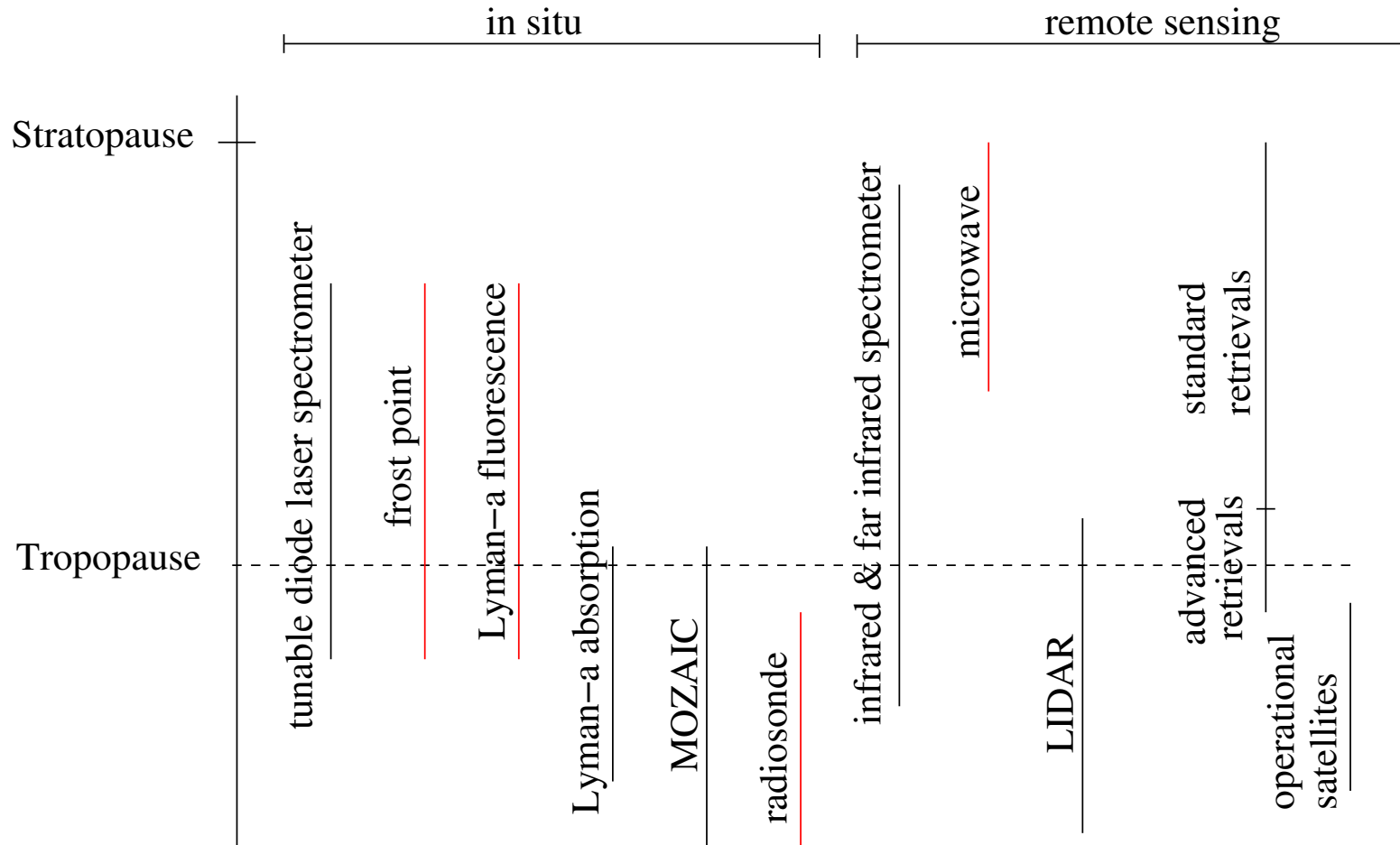


Alexander Haeefele, Dietrich G. Feist, and Niklaus Kämpfer
University of Bern

Outline

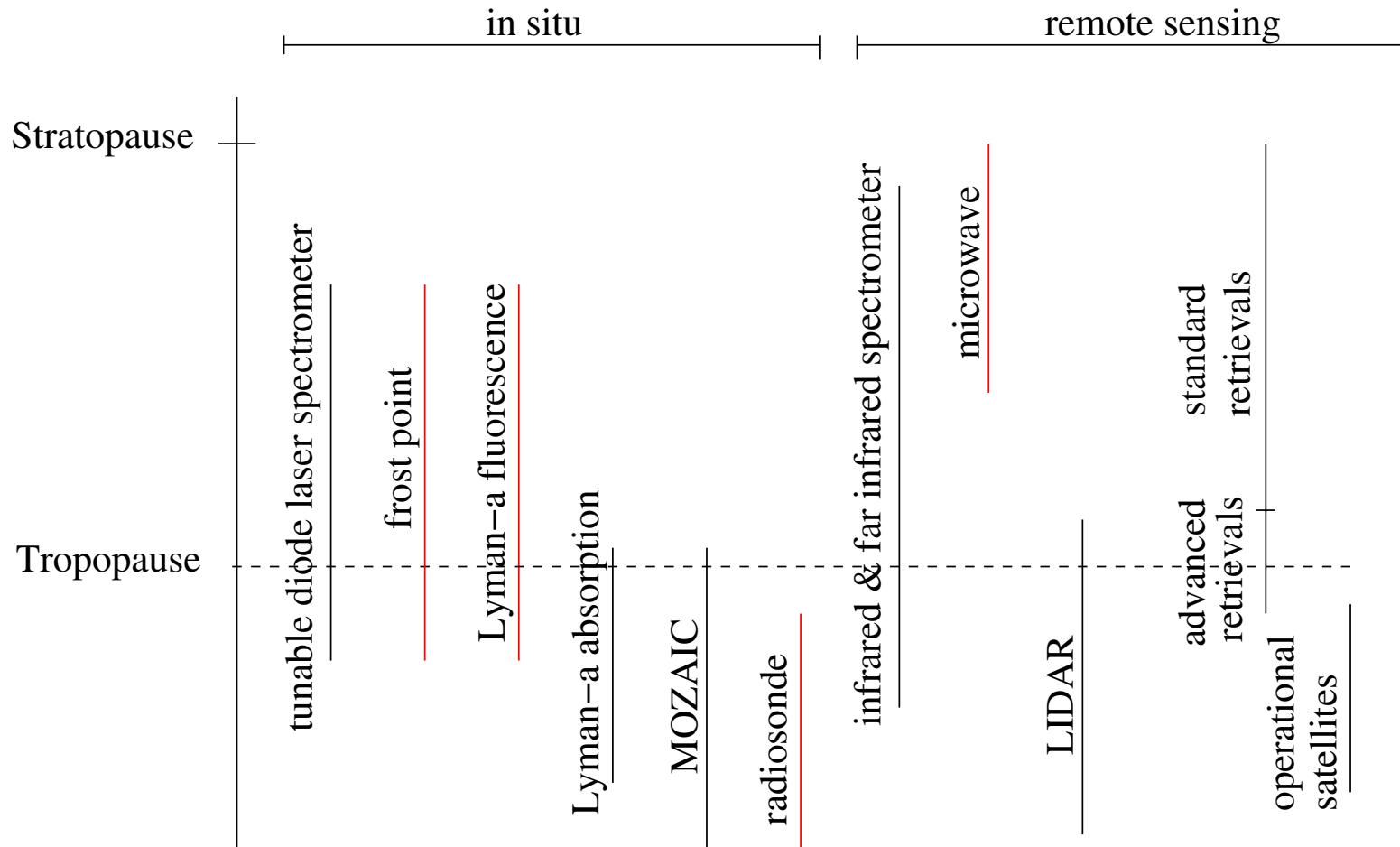
- H₂O Measurements in the Atmosphere
 - The MW's Perspective
 - I. Improved a priori Information
 - II. Modeling the Troposphere
 - Conclusions
-

H₂O Measurements in the Atmosphere



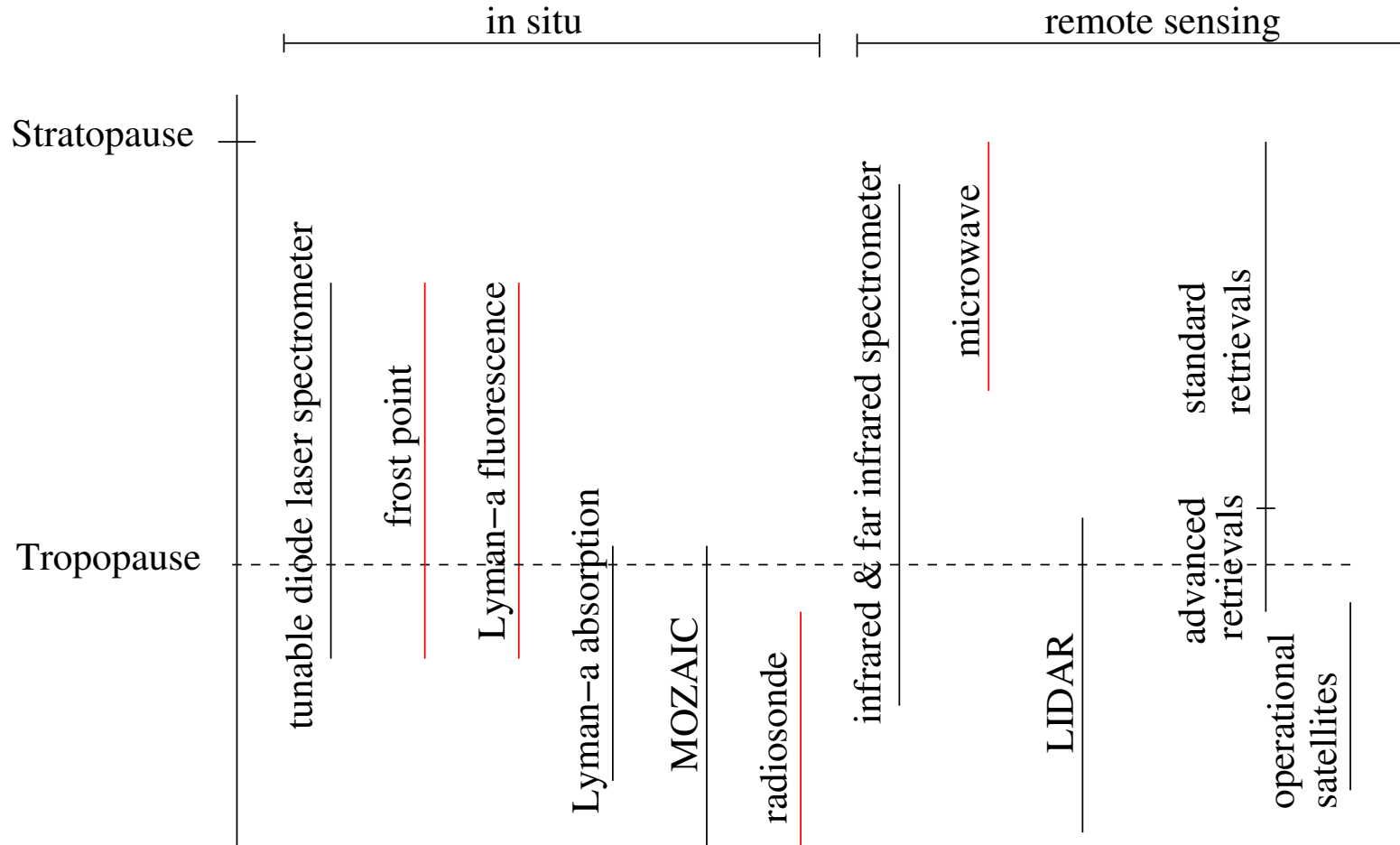
- How can different measurements be combined ?
- Can measurement *A* take advantage of measurement *B* ?

MW's perspective



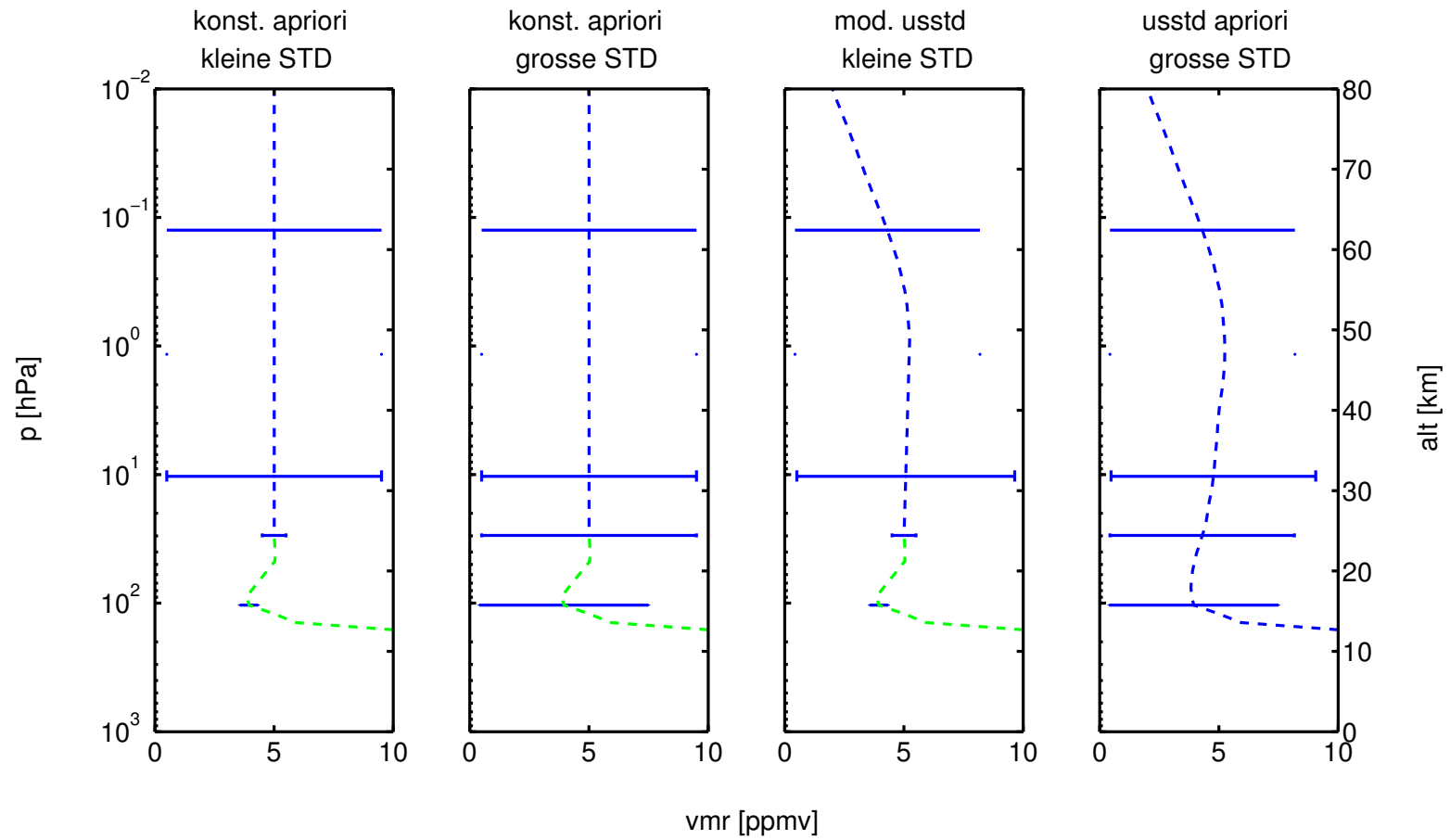
1. Use other measurements as a priori information
2. Use other measurements to characterize the troposphere

MW's perspective

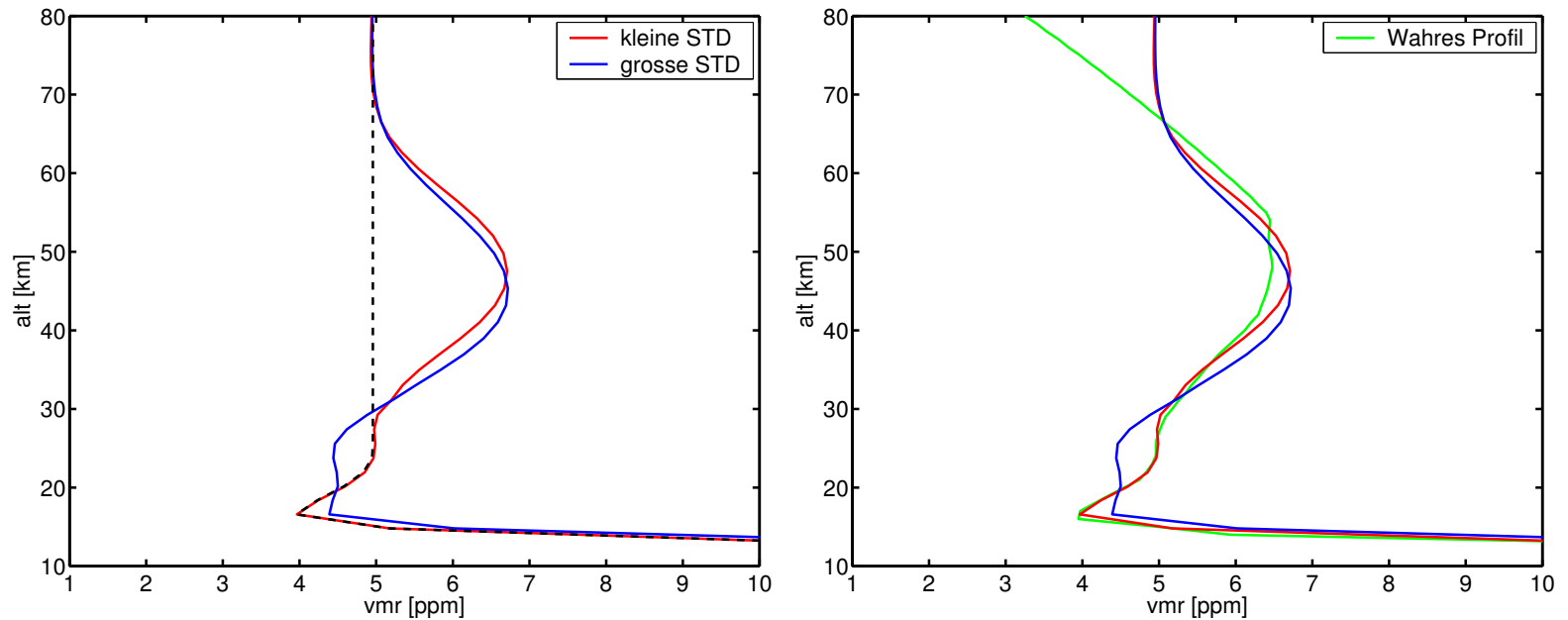


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I. Improved a priori Information

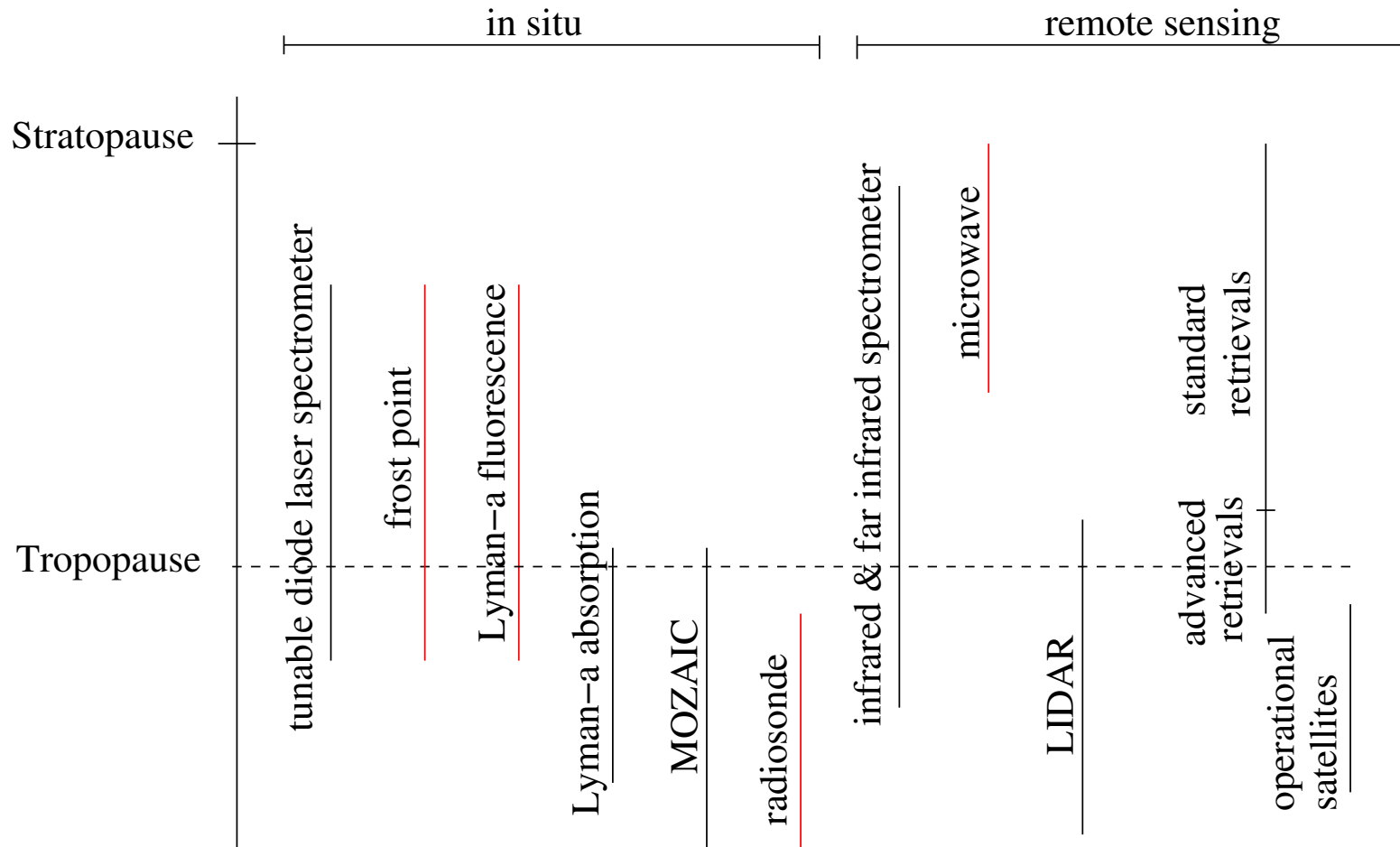


I. Improved a priori Information



- Smooth transition between measurement A and the MW profile
- General improvement of the MW profile

MW's perspective



1. Use other measurements as a priori information
2. Use other measurements to characterize the troposphere

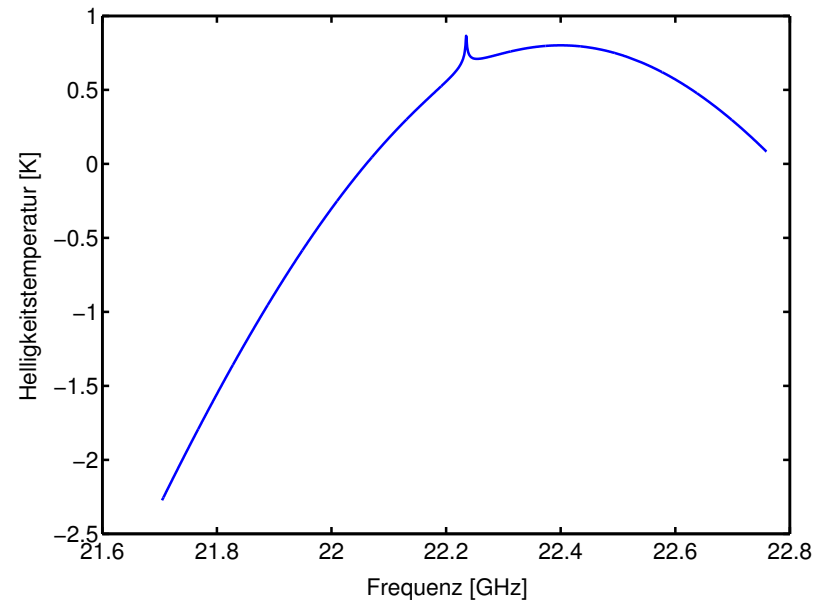
The Correction for the Troposphere

$$\Delta T_b = \frac{S_{line} - S_{reference}}{S_{hot} - S_{cold}} (T_{hot} - T_{cold})$$
$$T_b(z_T) \approx c \cdot \Delta T_b$$

Y=F(

- observed molecule
- atmospheric state
- receiver
- polynom coefficients

) + noise



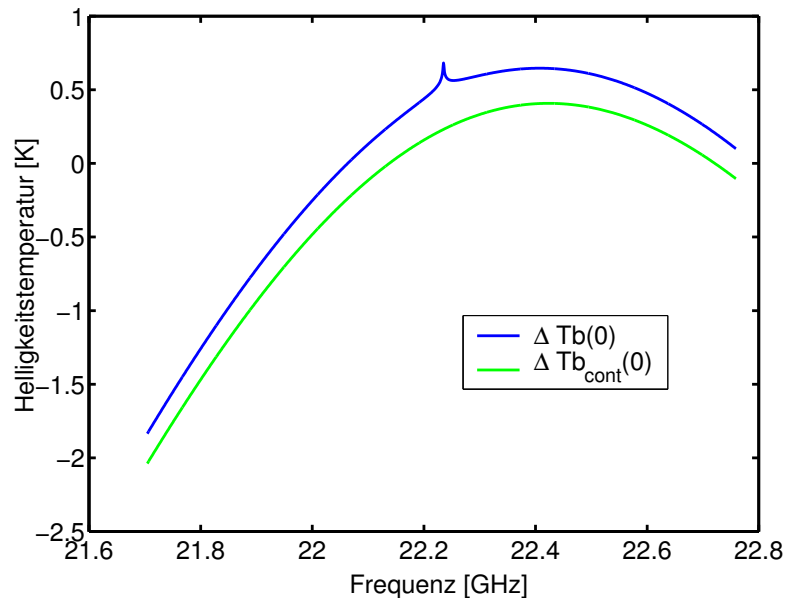
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Y=F(

- observed molecule
- atmospheric state
- receiver
- **polynom coefficients**

) + noise



The polynom coefficients account for everything in the spectrum, that is not known.

II. Modeling the Troposphere

$$\Delta T_b = \frac{S_{line} - S_{reference}}{S_{hot} - S_{cold}} (T_{hot} - T_{cold})$$
$$T_b(z_T) \approx c \cdot \Delta T_b$$

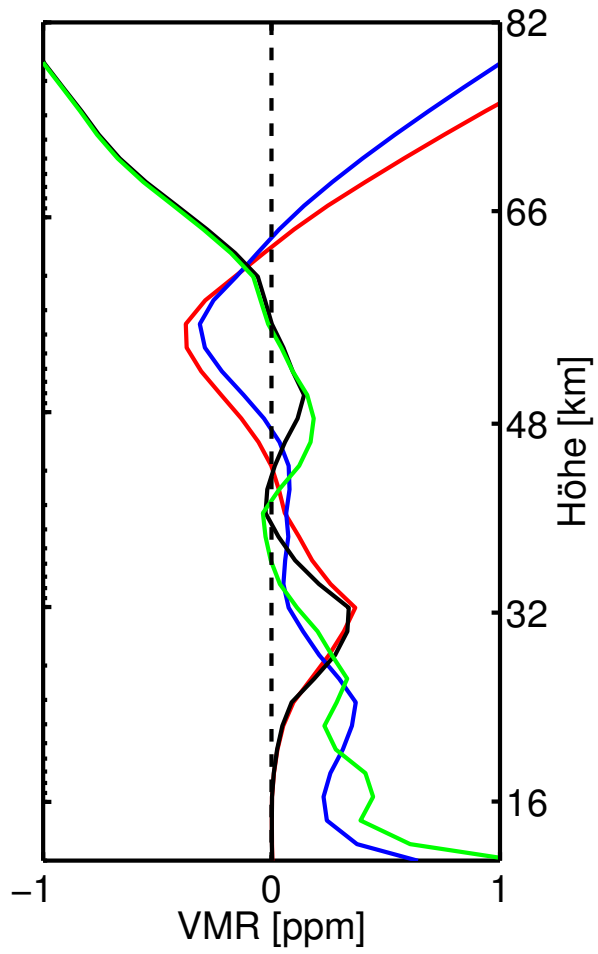
- Place your virtual sensor on the ground.
- Include the troposphere in the radiative transfer calculation.

$$\mathbf{y} = \mathbf{K}\mathbf{x} + \epsilon$$
$$\Delta \mathbf{y} = \underbrace{(\mathbf{K}_{line} - \mathbf{K}_{ref})}_{\Delta \mathbf{K}} \mathbf{x} + \epsilon$$

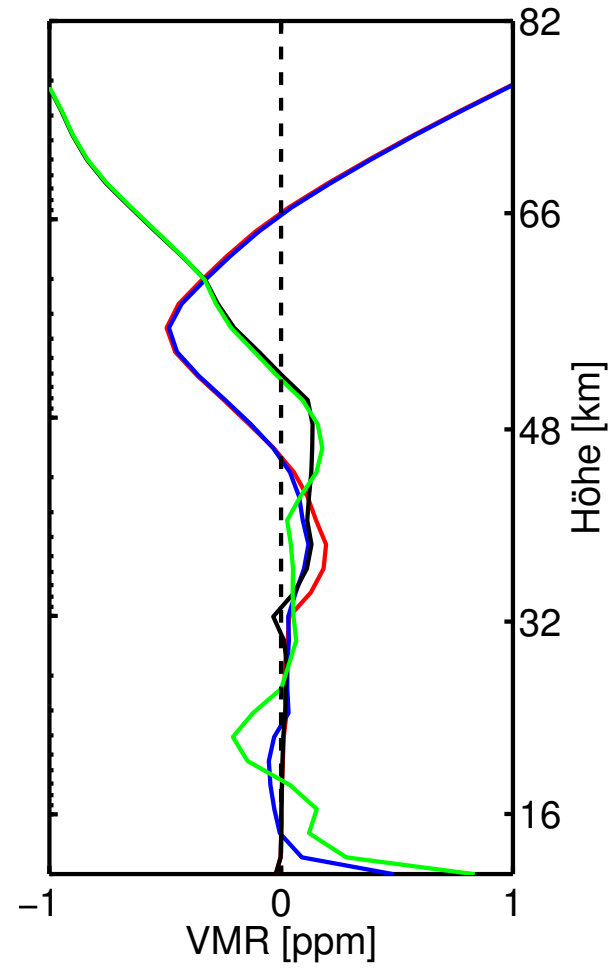
With $\Delta \mathbf{K}$, ΔT_b can be directly inverted. No Troposphere correction needed!

II. Modeling the Troposphere

Polynom coefficients



ΔK



Conclusions

- Better a priori information taken from other measurements generally improves the MW retrieval.
 - The modeling of the troposphere leads to a more stable retrieval.
 - The number of polynom coefficients can be reduced \Rightarrow better sensitivity
 - The assimilation of all kind of measurements in the MW retrieval gives a smooth and well characterized profile from the ground to the mesopause based on the best information source at every altitude level.
-

Conclusions

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Thank you ...
