

## ***Interactive comment on “Retrieval of microphysical cloud parameters from EM-FTIR spectra measured in Arctic summer 2017” by Philipp Richter et al.***

### **Anonymous Referee #1**

Received and published: 18 September 2020

#### General comments:

Using information derived from infrared spectral radiances, Richter et al. developed a new method for retrieving microphysical cloud parameters that characterize optically thin clouds. The method is designed to retrieve cloud water optical depth, total effective droplet radius and condensed water path. The work to compare and validate the retrieval results against different measurements has been carefully and systematically done. The exact amount of total radiative forcing due to clouds remains unclear, therefore additional measurement techniques providing complementary information such as the one presented by Richter et al. are important to shed light on this mechanism. I

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recommend its publication in AMT after the questions, issues and comments outlined below have been addressed.

#### Specific comments:

**Spectrometer:** There is not much known to the reader about the Bruker Equinox 55. At least a chapter dedicated to the characterization of this instrument (instrument line shape, modulation efficiency, etc.), is necessary in my view.

**Averaging Kernels:** There is a discussion on the averaging kernels (AVK), however a presentation of the AVKs of the retrieval itself is lacking. It is not immediately clear to me how much information is coming from the Equinox 55 measurements and how much from the prior information. Therefore, I think it would benefit the manuscript to expand on this topic, show plots of AVKs, etc.

**Error Analysis:** The correlation plots are clear and helpful, but my impression is that the analysis on the error budget could still be improved for the reader. Specifically, I would have liked to see a table outlining the contributions of several variables to the total error budget.

#### Technical corrections:

P1, Line 15: “Cloud Water retrieval is able to retrieve the condensed water path from clouds for optically thin clouds” change to: “Cloud Water retrieval is able to retrieve the condensed water path from optically thin clouds” Or to: “Cloud Water retrieval is able to retrieve the condensed water path from clouds that are optically thin”

P2, Line 29: “takes places” → takes place

P2, Line 32: “performung various campaigns” → performing various campaigns.

P2, Line 34: “Usually microwave radiometer” → Usually, microwave radiometers

P2, Line 35: “also they have the ability to operate continously 24 hours a day” → also, they can continuously operate 24 hours a day

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P2, Line 43: Notholt et al, 2000 missing in references  
P3, Line 64: Please indicate coordinates of Svalbard  
P4, Line 109: LBLDIS has not yet been defined  
P4, Line 103: "either can be set" → can either be set  
P4, Line 113: "Temperature dependend" → Temperature dependent  
P6, Line 169: Please remove "is" in "For example, for spherical ice droplets is"  
P8, Line 202: "Informations" → Information  
P8, Line 208: "interval from" → interval between  
P8, Line 211: I suggest changing "but only about the thin clouds" → but only that of thin clouds  
P9, Line 238-239: Please add comma and change "abilities and limitation" to "the capabilities and limitations", i.e. "From these results abilities and limitation . . ." → "From these results, the capabilities and limitations . . ."  
P9, Line 248: "Also from the spectra it can be seen, that for high optical depths of 6 and larger the response of the spectral radiance to a change in the cloud parameters strongly decreases, so results .. " → "For high optical depths of 6 and above, the response of the spectral radiance to a change in the cloud parameters strongly decreases, so results. . ."  
P9, Line 251: "The condensed water path can retrieved" → "The condensed water path be can be retrieved"  
P11, Line 312: "are retrieved" → were retrieved  
P11, Line 313: remove "measured using a FTIR spectrometer" and end the sentence at the comma.

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P11, Line 317: "with different errors like biases . . ." → with different errors such as biases . . .  
P12, Line 320: "lead" → led  
P12, Line 322: Please mention how much the retrieved  $r_{\text{total}}$  differs from the true  $r_{\text{total}}$ .  
P12, Line 325: Please put comma after "In those cases"  
P12, Lines 344, 349: Please change "informations" to information  
P12, Line 348: "can not" → cannot

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