



Comment on **essd-2020-377**

Anonymous Referee #2

Referee comment on "Observations of the downwelling far-infrared atmospheric emission at the Zugspitze observatory" by Luca Palchetti et al., Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2020-377-RC2>, 2021

This manuscript gives a nice overview of this Zugspitze deployment, its associated suite of measurements, and potential applications. It gives a good flavor of the clear sky measurements, showing a number of relevant figures and describing, although briefly, comparisons between the FIR instrument and the well-known E-AERI instrument. Given that this paper is meant to provide a review and roadmap for other scientists who might be interested in using this dataset, this brevity is fine and, even, expected.

The paper provides less extensive information with respect to how the dataset "can be used to constrain radiative properties of... cirrus ice particles, and snow/ice emissivity over almost all the infrared emission, including the under-explored FIR spectral range." Figure 5 and the related description in the text are passable for the snow/ice emissivity, although showing an observed spectrum would be even better. However, the level of detail with respect to cloudy observations should really be increased. I'll leave it to the authors to determine what other information should be included, but a figure showing contemporaneous measurements of FIRMOS and E-AERI would be helpful and welcome.

Minor corrections:

line 3 – Remove first comma.

6 - Remove comma.

7 – Remove both commas.

15 – “in the FIR that are not ...”

20 – Since this first sentence is more of a definition, it probably should be combined with the next sentence, which has more content. i.e. “The Far-InfraRed (FIR), defined here as the longest wavelength region of the infrared spectrum covering the wavenumber range from 667 cm^{-1} (or equivalently $15\text{ }\mu\text{m}$ wavelength) down to 100 cm^{-1} ($100\text{ }\mu\text{m}$), contains more than 50% of the energy emitted by the Earth toward the space. This region ...”

24 – Since “FIR” is already mentioned in this sentence, perhaps change the second “FIR” to “gaseous”.

26 – “allow a better understanding of”

33 – “in preparation for”

40 – “wintertime”

41-42 – Perhaps change to “to the lowest wavenumber with potential semi-transparency, 250 cm^{-1} . The sounding of the remainder of the FIR, below 250 cm^{-1} , is ...”.

50 – Remove comma.

75 – The values given for the shortwave end of the E-AERI measurements in wavenumber and wavelength are inconsistent. 1800 cm^{-1} is correct for the first channel of this instrument, while 3.3 microns is correct for the second channel. Probably the discussion here should explain this, and specify (if correct) that only the channel 1 radiances were used.

78 – Remove second comma.

114 – “100 km north of the Summit”. “north” and “southeast” should not be capitalized.

124 – “allowed operations”

163-164 – “which causes a not-compensated phase error in FIRMOS measurements.”

170 – “form” should be “from”.

165-171 – I think this is implying that the E-AERI retrieval also used the 400-600 cm⁻¹ region. Please make this more clear.

Figure 5 – Please write the meaning of “SSA” here since in atmospheric science it usually means something other than its meaning here.