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Interactive comment on "A microbolometer-based far infrared radiometer to study thin ice clouds in the Arctic" *by* Q. Libois et al.

Anonymous Referee #1

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This paper describes a new far-infrared radiometer that has been built and preliminarily deployed in support of the TICFIRE satellite project of the Canadian Space Agency.

This discussion paper is generally well-written and has a considerable amount of detail, including demonstration measurements that are very nice to have. It will therefore serve as a very useful resource for future development of far-infrared radiometry.

However, this discussion paper would benefit from a number of relatively minor, but still necessary, changes that should be incorporated prior to publication in AMT. These changes are listed below:

1. The spectral transmittance of the 9 filters needs to be discussed in considerably more detail. What materials were used? Was the choice of spectral response for each filter driven largely by the limitations in the materials, or were they chosen specifically

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Discussion paper

for science value? If it is the former, does more work need to be done to develop exotic (or mundane) materials that can be used for these filters? Can the spectral response for each filter be modified in future versions of this radiometer? Are the spectral responses stable, or will they degrade in unknown ways either on the ground, on an aircraft, or in a space environment? I am confused by the choice of the 10-12 μm band, as this appears to be partially contaminated by O3. Also, a figure is needed for atmospheric transmission to TOA vs height per band as a function of column water vapor.

2. It was not made clear to this reviewer if the plan is for the instrument, as described here, to be flown in TICFIRE, or if this is just a stepping-stone to the instrument that will be flown in TICFIRE. Is the idea to demonstrate this capability on a breadboard and then build something identical that is space-qualified? Are the components of the radiometer described here space-qualified, or is additional technology demonstration required?

3. Can the change in emissivity of the blackbodies over time be estimated? Can this change be estimated on orbit? Is it important, or are there a large number of internal reflections so it doesn't really matter?

4. What is meant by scene temperature for Figure 6? For an observation where each filter is giving a different brightness temperature reading, should the reader expect to use Figure 6 as an estimate of each filter's NETD based on that filter's brightness temperature?

5. The authors should comment on whether TICFIRE will be able to see the effects of surface processes on dehydrated conditions? Recent publications (e.g., Chen et al, GRL, 2014 and Feldman et al, PNAS, 2014) have highlighted the large differences in far-IR surface emissivity between frozen and unfrozen surfaces, with large scientific implications for polar feedbacks. Would any of the filters be able to reliably detect a signal arising from a difference in far-IR surface emissivity of 0.1? of 0.2?

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