

Interactive comment on “ISMAR: an airborne submillimetre radiometer” by Stuart Fox et al.

Anonymous Referee #1

Received and published: 4 October 2016

This manuscript describes a new airborne submillimetre-wave radiometer instrument, and is thus highly relevant for AMT. The description of the instrument is mostly complete and well structured. The manuscript discusses in detail important topics concerning the calibration of heterodyne radiometers and provides estimates of bias and random errors, which are often omitted from similar instrument articles. One major issue with the manuscript is that the majority of the receiver components (e.g. the front-end) is barely discussed. Another significant flaw is that only zenith viewing flight data are shown and compared with radiative transfer modeling, while nadir viewing data are much more relevant for the future goals of ISMAR. Note: This referee is not a microwave engineer, but an atmospheric scientist with some experience using airborne microwave radiometer data.

Specific Comments

1. The introduction should reference previous submillimetre-wave passive remote

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sensing instruments of similar design and purpose.

2. In section 2, are all the beam widths the same? Can you be more precise than "less than 4 degrees"?

3. Can you be more specific than "Laboratory testing has shown that there are no adverse radiometric effects attributable to the window" (in reference to the heated calibration target)? Is there any measurable loss, which would affect the calibration?

4. There should be much more description of the front-end (local oscillators, multipliers, and mixers) and IF amplifiers. Obviously, these components are an important part of the ISMAR instrument.

5. Why is the term "video amplifier" used when it "acts as a low-pass filter with a cut-off frequency of 1kHz"?

6. In section 3, does the 60 second calibration window uniformly weight the calibration looks around the time of the scene view? It would be useful to clarify here, although this is discussed in section 5.

7. In section 4, you might mention that zenith viewing biases due to calibration target temperature extrapolation, though larger, are probably less important than the nadir viewing biases because ISMAR is a demonstrator for the Ice Cloud Imager satellite instrument.

8. In section 5, equation 14 appears to be incorrect because the units of $(NEdT)^2$ and $T_{sys}/(\tau \cdot \Delta\nu)$ don't match. Considering only the first term on the right hand side, the equation normally would read $(NEdT)^2 = T_{sys}^2/(\tau \cdot \Delta\nu)$.

9. In section 6, it is disappointing that no nadir viewing flight data from the 17 flights are analyzed. If this is because another manuscript is in preparation, then this should be mentioned. Please give a justification for comparing ISMAR measurements with radiative transfer simulations for zenith views. Comparing ISMAR brightness temperatures with nadir views would be more interesting and relevant and definitely feasible using

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temperature and water vapor measured by radiosondes or dropsondes.

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