Atmos. Meas. Tech. Discuss., 4, C2696–C2700, 2012
www.atmos-meas-tech-discuss.net/4/C2696/2012/


Atmospheric Measurement Techniques Discussions

AMTD

4, C2696–C2700, 2012

Interactive Comment

# *Interactive comment on* "Infrared emission measurements in the Arctic using a new extended-range AERI" *by* Z. Mariani et al.

**Z. Mariani et al.**

zmariani@atmosp.physics.utoronto.ca

Received and published: 23 January 2012

Thank you for your comments, which have helped us improve the manuscript. We have responded to all comments below.

-The paper "Infrared emission measurements in the Arctic using a new extended-range AERI" provides a useful description of a ground-based emission FTIR spectrometer and includes a discussion of first results achieved with this instrument. The paper is well written and fits within the AMT scope. List of minor comments: Title: I'm not fully happy with the title, as important parts of the first results presented depend on the P-AERI already available at the site (e.g. Section 4.2, 4.4) (It is not just used to calibrate the new E-AERI).

->We have changed the title to ‘Infrared Measurements in the Arctic using Two Atmospheric Emitted Radiance Interferometers’.

-The abbreviation "UW blackbody" is not introduced. UW again stands for University of Wisconsin?

->UW stands for University of Wisconsin. This has been added in parenthesis the first time UW is introduced on p. 6415 (Section 1, 3rd paragraph) to increase clarity.

-Section 2.1 it does not become clear to me which components constitute the "back-end" of the setup. First, a "back-end electronics" is mentioned, further down in the text it is revealed that "electronic modules are also mounted in the back-end". Finally, it is stated "the back-end, where the interferometer is located..."?? Please improve this text section, a drawing of the setup would also be of great help to the reader (Which optical and electronic components comprise the front-end optics, the interferometer, and the back-end? Where is the field stop located?)

->The first and second paragraphs of Section 2.1 have been expanded to clarify what components make up the back-end and which components make up the front-end. Figure 1 provides photographs of the instrument's setup.

->Section 2.2 (Instrument Scan Sequence) and 2.3 (Instrument Enclosure) were swapped to help increase clarity.

->The caption in Fig. 1 has been changed to clarify these two components: “Figure 1: Exterior [left, red arrow] and interior [right] views of the E-AERI installed on the roof of the PEARL Ridge Lab using the thru-wall configuration. [left]: Front-end portion of the E-AERI instrument housing the optics; the hatch is closed during precipitation events (photo: Stephane Lantagne). [right]: The back-end portion of the E-AERI instrument with its internal protective enclosure removed, showing the MR-300 series interferometer housing and electronic modules (photo: Zen Mariani).”

-Questions concerning the 45 scene mirror: A) Which reflectivity of the mirror can be achieved and maintained? B) Table 1 lists among the E-AERI instrument performance "Polarization < 0.1%". What does this mean? Is this the degree of polarization the scene mirror imposes on unpolarized radiation? C) How the mirror is kept free from e.g. ice crystals under the harsh polar conditions. Is a steady hot air flow applied? Is there an IR transmitting optical window between the inside of the lab and the scanning mirror outside?

->A more detailed explanation outlining the mirror's maintenance and performance has been provided in the first two paragraphs of section 2.1: "The E-AERI is composed of three distinct parts: the front-end (housing the optics), the back-end (housing the electronic modules and interferometer), and the computer (standard off-the-shelf laptop). The front-end optics consists of two blackbodies and the scene mirror. The scene mirror has a gold reflecting surface and is mounted at 45° to the motor rotation axis, which is in turn positioned coincident with the interferometer input optical axis. This configuration allows different views: nadir, zenith (sky), Ambient Blackbody (AB) and Hot Blackbody (HB). Steady air flow is provided by a fan within the front-end enclosure to push dust and dirt particles away from the scene mirror. Seasonal cleaning of the scene mirror is performed by on-site operators to remove any accumulated dust and dirt. The scene mirror directs IR radiation through an IR-transmitting optical window into the interferometer at the back-end portion of the instrument."

->In Table 1, this is the degree of polarization the scene mirror imposes on incident unpolarized radiation. The description in Table 1 has been changed to clarify this.

-Section 2.4 Please provide the estimated emissivity of the blackbody sources.

->The blackbody emissivity of > 0.999 + 0.1% is now quoted in the first paragraph of Section 2.4. The emissivities for both blackbodies were measured at UW-SSEC to ensure the blackbodies meet the required specification.

-Both blackbody sources (hot and ambient T) provide significantly higher radiance than the cold dry polar atmosphere in the window region. This might impact the calibration,



AMTD
4, C2696–C2700, 2012

Interactive Comment

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

especially if the beam-splitter self-emission is not negligible?

->The beam-splitter self-emission is accounted for by the calibration methodology outlined in Revercomb et al. [1988]; this reference is provided at the end of Section 2.4, p. 6420. We feel that because this issue has been discussed in detail in Revercomb et al. [1988], we avoid duplication by directing the reader to this publication for more information. The initial calibration and performance evaluation performed at UW-SSEC (outlined in Section 3.1) uses an ice-body to simulate the lower signal encountered in Arctic. Additional tests were performed at Eureka using a liquid nitrogen body to ensure that the calibration remains accurate even at extremely low signal.

->We agree that having blackbodies that are warm compared to the range of atmospheric temperatures will impact the calibration. The uncertainty is smaller for spectral data points with brightness temperatures close to that of the AB and larger for spectral data points with much lower brightness temperature. Although it would be preferable to have an ambient temperature blackbody and a below-ambient blackbody, the challenges of maintaining a below-ambient temperature blackbody in the Arctic outweigh the benefits. Because it is also important to have a relatively large difference in temperature between the blackbodies, we instead heat the HB. This topic is beyond the scope of this work, but see for example Eq. (6) of Rowe et al. 2011b and references therein.

-Section 2.6 Table 2 is very technical and requires additional explanations (e.g. additional column with explanations) to be useful for the reader. What is e.g "LW HB NEN"?

->We have added a third column that explains each item in Table 2.

-Section 4.3 Is the CKD2.4 continuum compatible with the HITRAN 2008 line list?

->A more detailed explanation is provided in p. 6426: “The CKD2.4 continuum is compatible with HITRAN86; the addition of new $H_2O$ spectral lines in updated versions of



AMTD

4, C2696–C2700, 2012

Interactive Comment

HITRAN are generally very weak and do not affect the end result, particularly for a lower-resolution instrument." Because of this, the version of HITRAN has little effect.

---

Interactive comment on Atmos. Meas. Tech. Discuss., 4, 6411, 2011.