

## ***Interactive comment on “Tilt error in cryospheric surface radiation measurements at high latitudes: a model study” by W. S. Bogren et al.***

**W. S. Bogren et al.**

arve.kylling@nilu.no

Received and published: 23 September 2015

Response to comments from Referee #1

We thank the referee for the reading of and comments to our manuscript. The referee's comments are repeated below in italic font. Our responses to the comments are shown in roman font.

Comments and responses

- *Currently, one can measured solar radiation with two methods. The first, one can measure total solar radiation with a pyranometer. The second, one can also*

C1705

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper



*measure direct solar radiation with a pyrheliometer and measure diffuse solar radiation with a shaded pyranometer. Total solar radiation can be calculated as a sum of these two measurements. The authors did not mentioned which method they targeted. For the first one, only total solar radiation is measured and its error depends on the received energy by detector of pyranometer. For the second one, the error of observed direct solar radiation is determined by whether the pyrheliometer tracks the sun exactly. For a 5 degree error, the pyrheliometer can totally miss the sun and error of the observed direct solar radiation can be huge. The model simulations did not address none of the above mentioned factors.*

The above mentioned instrument types measure the direct and diffuse radiation. These are the quantities that we have investigated for instrument tilt errors. However, to keep the discussion general we have not addressed specific instruments. We realize that this may be of interest and in the revised manuscript we have included in the discussion section a paragraph about what type of instruments are used for albedo measurements and how our results relate to these.

- *To quantify the tilt errors, the authors should set up instruments with a reference measurements. The errors can be studied by comparing the observations.*

We of course agree that the tilt errors can be studied by comparing observations and greatly value the contribution of observations. However, all measurements may be subject to some degree of error, so pure theoretical modeling studies allow one specific source of error to be closely examined using model simulations; as done in our manuscript.

Both observational and model investigations are needed and complement each other and we agree that a detailed controlled study - such as intercomparison studies with different instruments are done - would be valuable but is beyond the scope of our intended evaluation.

- *To quantify the measurement errors, the authors should know more about the*

*instruments and measurements, and updated references in the field.*

We would like to emphasize that the two first authors have participated in several field campaigns where albedo measurements were made over snow covered surfaces. As such we are familiar with these type of instruments and measurements and the problems associated with them. Indeed, it was while experiencing the problems with these type of albedo measurements that the idea for the present study originated.

The referee does not indicate which references are missing. However, to address the comment we include in the revised manuscript a table of relevant publications.

---

Interactive comment on The Cryosphere Discuss., 9, 4355, 2015.

[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)