

## ***Interactive comment on “Snow observations in Mount-Lebanon (2011–2016)” by Abbas Fayad et al.***

### **Anonymous Referee #1**

Received and published: 5 April 2017

The authors present a meteorological and snow dataset collected over 2011–2016 in Mount-Lebanon. This includes 30-min meteorological observations at three sites, snow course measurements of snow depth, SWE, and density at 30 locations, and 500-m snow covered area and snow covered duration maps from MODIS. Given the lack of snow data in this region of the world, the paper has the potential to make a novel contribution. I could envision these sites being used in a snow model intercomparison study, which are often conducted across diverse sites. That being said, there are many major aspects that require the authors' attention before this should be considered for publication in ESSD.

### **MAJOR COMMENTS**

- In the provided dataset, there are periods when the outgoing shortwave data exceed

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the incoming shortwave data. This may occur during periods when snow is covering the up-pointing pyranometer but the down-pointing pyranometer is snow-free (e.g., see Lapo et al. 2015). While the text suggests that the incoming and reflected shortwave radiation measurements were screened by constraining albedo between 0 and 1, the provided data do not support this claim. The attached figure shows the problem. This needs further attention.

- The provided snow course data exhibit a fundamental inconsistency. The bulk snow density (with respect to water density) is the ratio of SWE by snow depth (as in Equation 5). However, when I compute this value from SWE and snow depth and compare to the density values in the dataset, they do not match (see attached figure). Please revisit the data and correct this issue. Because figures and analysis revolves around these data, it is essential to rectify these problems.

- The sites do not have meteorological data that are gap-free and consequently are not immediately useful to modelers and others looking for sites to run/test models. The convention of many other snow data papers has been to provide data that are complete in time, using various in-filling techniques. The data presented here would be of greater value if the gaps were filled.

### **GENERAL COMMENTS**

- Are the temperature sensors naturally or mechanically ventilated? Please note this in section 3, perhaps in the paragraph on page 4, starting at line 25. To enhance the value of your dataset, you could consider preparing a corrected temperature dataset based on your reflected shortwave dataset based on Huwald et al. (2009).

- While the sites do provide valuable meteorological and snow data in a unique environment, I would advise the authors to note that the sites do not measure incoming longwave radiation, a key variable for the energy balance of warm, Mediterranean climates.

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- Please include the elevation and coordinate (e.g. latitude/longitude) data for each of the 30 snow course sites.
- Some of the figures are difficult to read because of low resolution or text fonts that are too small. These include Figures 4, 7, and 9.
- In numerous places (e.g., P.7, L.21), the authors use the word “weighting” when they should actually be using the word “weighing” (no “t”). These words have different meanings.
- The procedures for measuring snow depth, SWE, and bulk density with the federal sampler (P. 7, L.19-26) are fairly standard, so this section may be providing too much detail and can be greatly reduced.

#### TECHNICAL CORRECTIONS

- P.1, L.15: It should read “Precipitation data were” (data are plural).
- P.2, L.20: Add “an” before “operational snow observation network”.
- P.2, L.24: Replace “were made” with “are”.
- P.2, L.32: This is the first usage of the acronym “AWS” in the paper, but it has not been defined yet. Please define.
- P.3, L.12: Replace “covers” with “and covering”.
- P.4, L.15-16: The sentence is confusing. It can mean that each of the sites have temperature/humidity sensors at three heights above ground, or that these are the heights at the three sites, respectively. I think it is the second meaning. Please rephrase for clarity.
- P.4, L.19: Replace “is being observed” with “has been observed”.
- P.5, L.14: Replace “was adjusted” with “were adjusted” (data are plural).
- P.5, L.17: Replace “was removed” with “were removed” (changes=plural).

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- P.5, L.22: Replace “is greater” with “was greater” (past tense).
- P.5, L.27: Add “event” after “precipitation”.
- P.5, L.31-32: Replace “is” with “was” before “equal”, before “assumed”, and before “preserved” (past tense).
- P.7, L.2: Please use a subscript for the zero on “z0” (first case on this line).
- P.7, L.16: I think you might need to add “SWE” before “were carried”?
- P.7, L.19: Add “a” before “federal snow sampler”.
- P.7, L.22: Replace “recorder” with “recorded”.
- P.8, L.21: Please remove the reference to Fig. 9 here. At this point, Figures 6-8 have not been introduced, so it is confusing to reference Figure 9 before 6-8.
- P.8, L.24-25: Please replace “starting the snow season 2014-2015” with “starting in snow season 2014-2015”.
- P.8, L.28: Considering the measurement precision of the temperature sensors, I think it is appropriate to only reference to the nearest tenth of a degree here (and elsewhere). Please replace “6.93, 4.26, and -1.36” with “6.9, 4.3, and -1.4”. The same comment holds for the wind speed averages (P.9, L.2-3).
- P.9, L.1: Replace “recorder” with “recorded”.
- P.9, L.10: Replace “Rain on snow event is” with “Rain on snow events are”.
- P.10, L.7: The word “supportable” is vague in this sentence. Please select a different word or phrasing.
- P.10, L.9: Add “a” before “few days”.
- P.10, L.10: Change “felt” to “fell”.
- P.10, L.16-17: These are backwards. Fig. 8a shows HS vs. SWE while Fig. 8b shows

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HS vs. density. Please correct.

- P.10, L.20: Add “an” before “approach”.
- P.10, L.23: Add “a” before “nonlinear”.
- P.10, L.24: Change from “account” to “accounts”.
- P.10, L.30: Please use a subscript for “i” in “hi”.
- P.11, L.12: Replace “snow falls “ with “snow storm events”.
- P.12, L.13: Delete “are” after “AWS data”.
- P.12, L.14: Change “potentials” to “potential”.
- P.16, L.18: Replace “show” with “shown”.
- P.16, L.23: Replace “till” with “until” to avoid slang.
- P.19, L.12: Start a new sentence after the parentheses, i.e.: “No correction for the accumulation. . .”.
- P.24, L.21: Correct the spelling error. Replace “Tabel” with “Table”.

TABLE AND FIGURE COMMENTS - Figure 2: Please add “(a)” and “(b)” to the panels of this figure.

- Figure 4: For clarity, please add either a legend to differentiate the different datasets or a note in the caption to identify which data pair with each vertical axis.
- Figure 5: Please add “(a)” and “(b)” to the panels of this figure.
- Figure 6: Please add “(a)”, “(b)”, and “(c)” to the panels of this figure.
- Figure 7: Please add “(a)”, “(b)”, and “(c)” to the panels of this figure. You may need to include “(d)”, “(e)”, and “(f)” as these are referenced in the text.
- Figure 7: The caption says that (b) is the snow density, but the middle plots show

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SWE. Please correct either the caption or the ordering of the panels.

#### REFERENCES

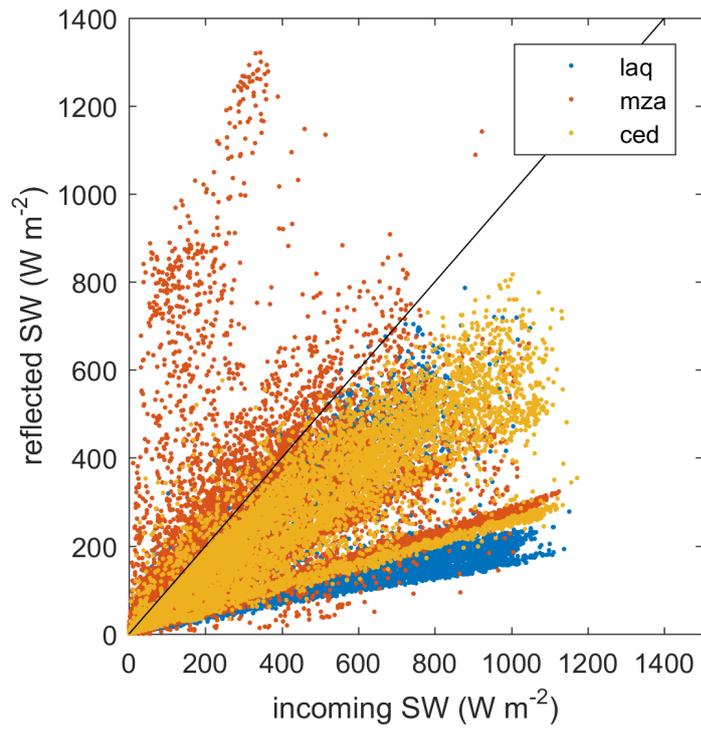
Huwald, H., C. W. Higgins, M.-O. Boldi, E. Bou-Zeid, M. Lehning, and M. B. Parlange (2009), Albedo effect on radiative errors in air temperature measurements, *Water Resour. Res.*, 45(8), W08431, doi:10.1029/2008WR007600.

Lapo, K. E., L. M. Hinkelman, C. C. Landry, A. K. Massmann, and J. D. Lundquist (2015), A simple algorithm for identifying periods of snow accumulation on a radiometer, *Water Resour. Res.*, 51(9), 7820–7828, doi:10.1002/2015WR017590.

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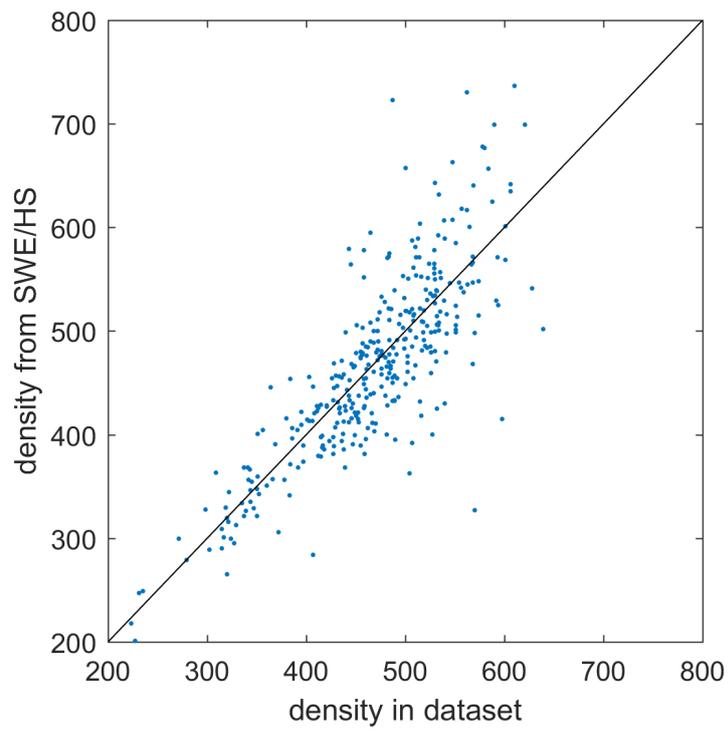
Interactive comment on *Earth Syst. Sci. Data Discuss.*, doi:10.5194/essd-2017-3, 2017.

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**Fig. 1.** Comparison of incoming and reflected shortwave data at the sites

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**Fig. 2.** Comparison of provided and computed snow density

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