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Discussions

Interactive comment on "Precipitation measurement intercomparison in the Qilian Mountains, Northeastern Tibetan Plateau" *by* R. Chen et al.

R. Chen et al.

crs2008@lzb.ac.cn

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Interactive comment on "Precipitation measurement intercomparison in the Qilian Mountains, Northeastern Tibetan Plateau" by R. Chen et al. Anonymous Referee #1 Received and published: 21 April 2015

GENERAL COMMENTS (I also produced a JPG version of this comments due to the lost of subscripts I used in my review) The focus of the paper is the quality assessment of manual precipitation observations made with CSPG gauge, which is the standard manual gauge in China. It is placed into four different environments: put into a PIT reference, applied DFIR and Single Alter (SA) shield and in an environment without

any shields. After describing the data and methodologies, the connection between the four installations are presented using scattered graphs and ratio vs wind speed graphs. Based on the results the authors suggest areas for the applicability of reference installment (PIT vs DFIR). Discussion Paper This publication deals with only one precipitation gauge (CSPG), so the applicability of the results is limited. The analysis is based on 4 years of observation record, which is the bare minimum for similar analysis. The applied ratio vs wind speed fitting equations are always linear in the paper. While this may be satisfactory, the WMO recommendation should also be mentioned and possibly tried out. The wind speed was converted to the 10 m value, the WMO recommendation is to use the wind speed value at the gauge heights – this should be corrected or the reason behind it should be explained further. Some of the results will be affected by this suggested change.

Answer: Thank you very much for your good advices. I have gone to field for observation during April 22 to May 3. I am sorry for the delayed reply. The WMO recommendation equations (eqs.2-4) are applicable widely. It needs daily maximum and minimum air temperatures and wind speed at gauge height. We have tried them out before (not published) and find that their empirical parameters should be locally revised. For convenient application in China, here we analyze the precipitation event data and wind speed value at the 10m heights. Considering your good advices, in the Chapter 3.4, we would add equations and comparison results of the original and revised WMO recommendation equations for daily precipitation in the revised paper. In these equations, the daily maximum and minimum air temperatures and wind speed at gauge height are used. The results shown in the present version are also reserved. The four-year data is too short exactly. The observation is still continued. In the revised paper, we would add the new data till April 2015 or later if it is permitted by editors. All the results would be changed if the new data are added.

It is hard to read the paper, since the terminology used is often confusing. The words "Alter", "Pit" and "DFIR" are often refer to gauges, when the authors meant the

shield/gauge configuration with the CSPG gauge in the middle. The authors reference the SPICE experiment. I suggest using the shield notations used in the related literature: UN for UNshielded gauge, SA: for Single Alter shield, PIT and DFIR (no change required). So the four types of precipitation observations made with the CSPG gauge would be: (1) CSPGPIT , (2) CSPGDFIR , (3) CSPGSA , (4) CSPGUN.

Answer: Thank you very much for your good advices. All the related terminology in the text, tables and figures will be revised in the revised paper.

The abstract contain the comparative results of (1)-(2), (1)-(4) and (2)-(4). For completeness, the results for the missing (1)-(3), (2)-(3) and (3)-(4) relations should also be mentioned.

Answer: The abstract will be completed.

Also, the word "shelter" should be replaced at each occurrence with the alternate and term "shield", which is widely used in the literature.

Answer: It will be replaced.

SPECIFIC COMMENTS:

P2203/L9: Correct 30.5 m to 30.5 cm

Answer: It will be corrected in the revised paper.

P2203/L25: Please correct: the WMO SPICE reference is DFIR shield.

Answer: It will be corrected in the revised paper.

P2204/L4: Add more recent reference

Answer: ok.

P2204/L5: Please reword: the CSPG and Hellmann gauges placed in to a DFIR shield was compared (if I understand correctly). DFIR is not a gauge, it is a shield.

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Answer: Yes.

P2204/L11: Please add distance between the two sites

Answer: It has been added. The distance is about 1.7~3.5km away. The difference of elevation is about 140m~490m.

P2204/L23: Instead of Alter shield (ALTER) please use the generally used term (reference: SPICE) of Single Alter (SA) shield here and in the future

Answer: ok.

P2204/L27: First appearance of mixed precipitation – please define it.

Answer: ok.

P2205/L10: The value of 447 mm is quite precise – I suggest rewording the sentence like: Annual average precipitation is 447 mm for the test period of: : :

Answer: ok.

P2205/L17: Delete etc.

Answer: ok.

P2205/L18: I suggest replacing "shown" with "summarized".

Answer: ok.

P2205/L22: Not clear, what type of gauge is in the middle of the DFIR shield: CSPG or Tretyakov gauge? Please specify. I assume it is also a CSPG gauge with a wind shield described in the Goodison et al. (1998) WMO reference guide. Answer: yes. It is a CSPG gauge with a wind shield (Tretyakov shield and double fences).

P2207/L11: The terminology is mixed up here. CSPG is the gauge, placed into different environment. I suggest to use the terminology I explained earlier for these two cases: CSPGPIT , CSPGSA

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Answer: ok.

P2207/L17 and 20: These are not the actual observations taken. I assume the "observations"meant "precipitation events" here.

Answer: Yes, they are precipitation events.

P2207/L21: Again, the "Alter, Pit and DFIR" are not gauges but shield. Suggest to use CSPGUN (no shield around the gauge = Unshielded), CSPGSA , CSPGPIT CSPGDFIR in the text and also in the tables.

Answer: ok.

P2207/L24: There are no "three different gauges" but one gauge with different shields / different installments.

Answer: ok.

Chapters 3.1, 3.2 and 3.3 and Figures 2-6: Same comment then before: the Alter, Pit eand DFIR are not gauges but shields. I suggest to use CSPGUN (no shield around the CSPG gauge = Unshielded), CSPGSA (Single Alter SA shield around the CSPG gauge), CSPGPIT (CSPG gauge in a PIT) and CSPGDFIR (DFIR shield around the CSPG gauge) in the text and also in the tables.

Answer: ok.

Table 3 should also include all the percent values (ratios) mentioned in the text. It would be easier to follow then.

Answer: ok.

Chapter 3.1 (rain): Please include the comparison of unshielded and single alter shield gauge performance CSPGUN and CSPGSA

Answer: ok.

Chapter 3.2 (mixed): Again, there is only one type of gauge in different setup. Also, the

C700

longer 2010-2014 period ratios (Pit vs other) are missing from this chapter.

Answer: ok.

P2208/L12: replace "liner" with "linear"

Answer: ok.

Chapter 3.3 (snow): Missing CSPGPIT and CSPGDFIR comparison. Here the analysis for all events is added. To be consistent, please add all event results to the rain and snow chapters as well.

Answer: ok.

Chapter 3.4: Why do we need the 10 m wind speed? From Goodison et al, 1998: "To adjust gauge measurements for any wind induced bias, wind speed at gauge height during the time of precipitation is required."

Answer: Because the wind speed is measured at 10m heights in all the national stations (also use CSPG) in China, here the 10m wind speed data are used. In the revised paper, we will add the WMO recommendation equations (eqs.2-4) for daily precipitation. The wind speed data at gauge height will be used.

Chapter 3.41: The assumption used here is that the gauge ratios for rain vs wind relation is linear. In the Goodison et al (1998) WMO reference the suggested form is 3rd order relationship with wind. Answer: We will try the 3rd order equations and find the best relationships.

Chapter 3.41 Also, different notations would be also required: I suggest using the indexes from previous chapters as CRUN/PIT in eq 10 and CRSA/PIT in eq 11. Answer: ok.

Chapter 3.42: The assumption used here is that the gauge ratios for mixed precipitation vs wind relation is linear. In the Goodison et al (1998) WMO reference (page 28) the relationship can be much more complex for different types of snow events (dry, wet).

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Answer: In our field, the dry or wet event are not observed. We will try the relationships like shown in Goodison et al (1998).

Chapter 3.42: The suggested notations are CRUN/DFIR in eq 12 and CRSA/DFIR in eq 13.

Answer: ok.

Chapter 3.43: The assumption used here is that the gauge ratios for snowfall vs wind relation is linear. In the Goodison et al (1998) WMO reference the relationship can be.

Answer: We will try the equations like eq.(2).

Chapter 3.43: The suggested notations are CRUN/DFIR in eq 12 and CRSA/DFIR in eq 13.

Answer: ok.

Chapter 4.2 In the given experiment CSPGPIT > CSPGDFIR was true for rain and mixed precipitation, the catch ratio is only a consequence of this fact. The CSPGPIT can be used as reference, but it is not better than CSPGDFIR observations.

Answer: It's true. Because the CSPGDFIR data is short, for rainfall, it is used as reference here. We would revised the paper majorly. The CSPGDFIR is used as the only reference to calculate CR.

P2213/L8: Sentence "Scarcity: : :" it is not true generally, please remove sentence.

Answer: ok.

P2213/L9: What is the final suggestion for reference? CSPGPIT or CSPGDFIR ? Under which circumstances Please clarify.

Answer: CSPGDFIR is undoubtedly the reference. But it is expensive and should be installed far from the Chinese national meteorological stations, or it will affect the meteorological observation. In the most regions in China, the snowfall and blowing

snow is little relatively, the CSPGPIT may be a good choice. Whereas in other regions, it should use CSGPDFIR.

P2213/L15: The authors compare the configurations from most to least rain and mixed precipitation (not the catch ratio), so the relation should be: CSPGPIT > CSPGDFIR > CSPGSA > CSPGUN . (What would CRDFIR mean otherwise?)

Answer: yes.

P2213/L17: Similarly, from most to least snowfall the relation should be: CSPGDFIR > CSPGPIT > CSPGSA > CSPGUN .

Answer: yes.

Please also note the supplement to this comment:
http://www.the-cryosphere-discuss.net/9/C696/2015/tcd-9-C696-2015-supplement.pdf

Interactive comment on The Cryosphere Discuss., 9, 2201, 2015.