

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

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The author seem not understood my words. I know the WMO procedure could be improved, but it was just relating to the wind speed in theoretically. Generally, the equ. must be suitable for anywhere you using similar data. As well, I knew the the equ. was gained in Tianshan region by huge field observations and improved many times. Surely, you can improve it too. But it theoretically not local! What you should improve is that classification for precipitation-type, that is local due to the parameter in the emu. is variable. There is new publication by K Yang (may not 1st author), a new method has been developed. The author no need explain your classification again. Frankly the

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reviewer knew that very well. I note one of the co-author of manuscript is E Kang, I would like to suggest you discuss my words with E Kang. Again, my comment: what you should pay attention is classification, for the other, you can do your work but it is not so necessary theoretically.

Answer: (The .pdf version is also uploaded as the supplement)

Thank you very much for your revision.

We have discussed your advices with all the authors including E Kang. This paper is badly written at present. From your advices and the reviewer 1's comments, the paper would revised majorly as follows:

1) This paper is submitted to the special issue "The World Meteorological Organization Solid Precipitation InterComparison Experiment (WMO-SPICE) and its applications (AMTD/ESSDD/HESDD/TCD Inter-Journal SI)". From this point of view, we would pay more attention to the Intercomparison experiment results and their applications.

2) Although the Precipitation InterComparison Experiment for Chinese standard precipitation gauge (CSPG) had been conducted from 1987 to 1992 in Tianshan, and many valuable data have been acquired, the wind data are lack owing to the contemporary economy condition (Yang et al., 1991; Goodison et al., 1998). From Goodison et al.(1998), there is no calibration equations like Eqs. (2-4) for CSPG. Yang et al. (1991) gave the Eqs. (5-7) by using wind data at Daxigou station, which is about 1.7 km far away from the experimental site. Ren and Li (2007) have observed 29,000 precipitation events data from 30 stations all over China, whereas the DFIR has not been used. After that, from the literatures, several reports have provided the precipitation bias-error correcting method in China such as Ye et al. (2004, 2007), Ma et al. (2014), they also used the Eqs. (5-7) for CSPG. At present, the Precipitation InterComparison Experiment for CSPG is rare by using DFIR as reference.

Therefore, the wind-induced error of CSPG has not been well tested. Here we firstly

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compare the precipitation measured by CSPG with different shields, then we would use our observation data till to April 2015 to establish two kinds of calibration equations for CSPG. One is for easy application by using 10m-height wind speed in China, another is similar to the Eqs. (2-4) on daily scale. From the WMO procedure and your advices, this kind of equations could be widely used. It may be the improvement of Eqs. (5-7).

The third paragraph of "Introduction" is revised as follows: The DFIR has been operated as a reference at 25 stations in 13 countries around the world (Golubev, 1985), but deviations from the DFIR measurements vary by gauge type and precipitation type (Goodison et al., 1998; Sevruk et al., 2009). In China, the Chinese standard precipitation gauge (CSPG) and the Hellmann gauge were firstly compared by using DFIR shield as reference in valley site of Tianshan (43°7'N, 86°49'E, 3720 m) during the third WMO precipitation measurement intercomparison from 1987 to 1992. The wetting, evaporation losses and trace precipitation of CSPG were well quantified based on the huge observation data (Yang, 1988; Yang et al., 1991). Because there are not wind data at the intercomparison site (Yang et al., 1991; Goodison et al., 1998), for the wind-induced undercatch, the derived CSPG catch ratio equations were based on the 10m height wind speed at open Daxigou Meteorological Station (43.06°N, 86.5°E, 3540 m; Yang, 1988; Yang et al., 1991). The distance is about 1.7 km between the Daxigou site and the Tianshan valley site thus their wind speeds are different, inducing uncertainty in the catch ratio equations established by Yang et al. (1991) for CSPG. Before the year 1993, Ren and Li (2007) had conducted an intercomparison experiment at 30 sites (altitude varies from about 4.8 m to 3837 m) over China, and they used the pit as reference shield. Total 29,000 precipitation events had been observed. However, the DFIR was not used as reference and there were only 3 stations located in the West Cold Regions of China (Chen et al., 2006) where the solid precipitation often appeared. Blowing snow and thick snow cover have traditionally limited the pit's use as a reference shield for snowfall and mixed precipitation (snow with rain, rain with snow). Ye et al. (2004, 2007) developed a bias-error correcting method based on the observed data from 1987 to 1992 at the Tianshan valley site, and they found a new precipitation trend

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according to the calibration precipitation data over the past 50 years in China (Ye et al., 2012). The new corrected precipitation would output new knowledge on water balance in many basins in China (Tian et al., 2007). Although adjustment procedures and reference measurements were developed in several WMO international precipitation measurement intercomparisons (Goodison et al., 1998; Yang, 2014), the wind-induced error of CSPG has not been well tested especially in the cold and high regions such as the Tibetan Plateau, China. Although precipitation is concentrated in warm season on the Tibetan Plateau, solid precipitation often occurs and additional attention must be paid to wind-induced errors of gauge measured precipitation. Because of the limited intercomparison observation data in China, Ma et al. (2014) used the corrected equations from around countries except for the results from Tianshan China to correct the wind-induced errors on Tibetan Plateau. However, their precipitation gauges are Tretyakov, MK2, Nepal2003, Indian and U.S. 8" in the around countries. As the third pole in the world, the Tibetan Plateau is an ecologically fragile region and the source of several large rivers in China and neighborhood countries, accurate precipitation data is urgently needed. Here it presents nearly five-year gauge intercomparison experiment in the Qilian mountains at northeastern Tibet Plateau, China, to establish calibration equations for the widely used unshielded and single Alter shield (Struzer, 1971) around CSPGs (CSPGUN and CSPGSA).

3) Precipitation type classification is very important especially in the distributed hydrological models. In the several precipitation bias-error correcting methods, the precipitation type is firstly classified then the calibration equations for different precipitation type is used. As you have recommended, K Yang's (2014) method is widely accepted. They have used observed data all over China. Our observation data are just from one site which is located near the Qilian and Yeniugou station that have been used by K Yang et al (2014). I am not sure whether the parameter from one site is so important.

Please also note the supplement to this comment:

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<http://www.the-cryosphere-discuss.net/9/C797/2015/tcd-9-C797-2015-supplement.pdf>

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

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