Interactive comment on "Unshielded precipitation gauge collection efficiency with wind speed and hydrometeor fall velocity. Part I: modelling results" *by* Jeffery Hoover et al.

Anonymous Referee #1

Received and published: 4 January 2021

This study proposes that fall speed influences the collection efficiency of unshielded gauge using computation fluid dynamics (CFD). The authors claim that they are using a new method to study gauge collection efficiency and, with this method, that they are the first to demonstrate the impact of fall speed on the gauge collection efficiency. In fact, these have already been done with a similar approach:

1) Theriault et al. (2012), Colli et al. (2016a,b) used CFD to study gauge collection efficiency for snow.

2) Colli et al. (2016a) were the first to compute the flow field near an unshielded gauge as performed in this manuscript.

3) Theriault et al. (2012) found a strong dependence between the gauge collection efficiency and fall speed. Indeed, it was conducted with a shielded gauge but the physical reasons are the same. The updraft upstream of the gauge tends to deviate the slow-falling particles to fall in the gauge. For the same horizontal wind speed, slow-falling snowflakes have lower collection efficiency than faster-falling ones.

4) Colli et al. (2020) used the precipitation intensity as done in this manuscript to adjust the collection efficiency.

Colli, M., Stagnaro, M., Lanza, L. G., Rasmussen, R. and Theriault, J. M. (2020). Adjustments for wind-induced undercatch in snowfall measurements based on precipitation intensity, Journal of hydrometeorology, 21, 1039-1050.

The impact of precipitation intensity on the collection efficiency was also suggested by Chubb et al. (2015) using field measurements.

Chubb, T., Manton, M. J., Siems, S. T., Peace, A. D., & Bilish, S. P. (2015). Estimation of Wind-Induced Losses from a Precipitation Gauge Network in the Australian Snowy Mountains, Journal of Hydrometeorology, 16(6), 2619-2638.

In particular: Section 1: The introduction is very long and the goal is not stated clearly. The literature review is incomplete. What are the authors trying to do exactly? If it is showing that CFD can be used to show the dependence of the collection efficiency on the fall speed, it has already been done before.

Section 2: The simulations described in section 2.1 were already done in Colli et al. (2016a). The collection efficiency computed in section 2.3 were first used in Colli et al. (2020).

Sections 3 and 4: Most results/discussion are not new and/or should be improved for clarity. For example: 1) Sections 4.1, 4.2: Same key findings as in previous studies. 2) Section 4.3: The threshold fall speed value is directly related to the minimum diameter of the size distribution discussed in Theriault et al. (2012) and Colli et al. (2016a, b) and

Colli et al. (2020). Small particles falling slower are deflected by the updraft upstream of the gauge. 3) Section 4: Lines 565-569: It should be corrected as previous studies by Theriault et al. and Colli et al. also used a horizontal plan. Lines 573-577: The volumetric approach is what the gauge measures. When using the fall speed, it is the precipitation intensity as proposed in Colli et al. (2020). Sections 4.4.2, 4.4.3 and 4.4.4: Most of the content are not new findings and are repetitive.

Given those, there is not enough novelty in this manuscript to be published. Since some of the results are needed for Part 2, I recommend merging both manuscripts. A methodology section that explains the CFD simulations should be added to Part 2.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2020-553, 2020.