Thank you Dr. Bardsley for reviewing the manuscript and offering some insightful and helpful comments for improvements. We have addressed each below and will incorporate these changes.

Comments on:

Measuring precipitation with a geolysimeter

By C.D. Smith et al.

General:
The paper is a useful contribution to the literature, in this case with the novelty aspect of using the area-integrating capabilities of geolysimeters as a snow measure to offset in part the high spatial variability of snow amount.

My comments are all of a minor nature related to the rainfall aspect, but might be taken into consideration in a revision.

Page 2 line 25

However, the precipitation comparisons done so far have been more qualitative than quantitative due to the spatial separation of the geolysimeter and the measuring precipitation gauges.

As noted in the independent comment, for the Bardsley-Campbell geolysimeter there was never at any time a spatial separation of the geolysimeter and the rain gauge. Is it really the case that in all other cited geolysimeter studies there was spatial separation between rain gauge and geolysimeter?

We thank the reviewer for providing an example of a quantitative intercomparison. Much of the literature cited as examples of intercomparisons have been largely qualitative which result from a spatial separation between the measurements. We have now used the Bardsley and Campbell (2007) example in New Zealand as an exception. The statement on page 3 of the manuscript has been updated to read: "Both Bardsley and Campbell (2007) and Barr et al. (2000) report a close correspondence between co-located geolysimeter and precipitation gauge measurements but do not include detailed quantitative analysis of this correspondence. Previous intercomparisons also do not include a discussion on measurement of snowfall. "

Top of page 7.

Were the 30 minute well water levels recordings of the well water levels every 30 minutes, or the average of higher time resolution monitoring from the previous 30 minutes?

The water level was sampled at the beginning of every 30 minute period and were not an average of high frequency measurements made over the previous 30 minute period, as a temperature measurement would be made. The text in the Methods section was updated to read “The raw 30 min deep well observations, sampled at the beginning of each 30 minute period, require an adjustment for the effects…” to clarify.

Fig. 2

The slope change in water level following the rain event in Fig. 2a is certainly a good argument for site discharge loss being the cause of the evident slight under-estimation of the rain event. However, is this possibly a time resolution effect? That is, the pore water pressure increase from surface loading is instantaneous for practical purposes but there will be some finite time (a few minutes?) before the site rainwater starts to depart as discharge after a sudden event. What was the duration of the rainfall event in Fig. 2a? If it was less than 30 minutes and water levels were recorded every 30 minutes, is it possible for the maximum rise of water level to have been missed due to the relatively coarse sampling interval?

This is a very good point and we will make a note of this in the Discussion as a source of error. We could also suggest higher frequency measurements in future intercomparisons to try to quantify this error. Unfortunately, these measurements were not available here.

The text added on page 11 is as follows: “Another consideration that has a potential impact on the timing and magnitude of the precipitation geolysimeter estimates as shown in Fig. 2b is the temporal resolution of the geolysimeter observations. Because the response of the geolysimeter to rainfall loading is nearly instantaneous, the minimum or the peak water level in the well may have been missed by the water level readings that were taken once every 30 minutes thus resulting in an under estimate of precipitation. This effect would only be significant if water losses from the geolysimeter response area by runoff or evapotranspiration were significant during the 30 minutes before or after the beginning or end of the precipitation event. Considering the low relief of the study area, runoff is slow (cf Fig 2a) and the error due to the sampling interval is likely to be much smaller than 1 mm.”

Some comment might also be added as to the likely effect (or not) of 1 km spatial variation of rainfall, given that precipitation is a point measure and the geolysimeter is a spatial average. It is a pity that at least one more precipitation gauge was not in operation at the site, but presumably other measurements of closely spaced gauges in similar environments might be mentioned in this respect.

This was a point raised by another reviewer and is addressed in more detail in our comments posted there.

Some comment should be made about the cause of the declining trend in water level prior to the rain event – evaporation and / or net groundwater export from the site?

Certainly. Although it is difficult to ascertain if the decline in water level is a result of evaporation or groundwater loss from the response area, this decline largely occurs between noon and 10pm local time so we can assume that most is evaporation. The following sentence on page 8 in the Results section was modified to read: “Evapotranspiration was likely very small since relative humidity during the night and following the precipitation event was 100 %. The decline in water level in the well from 18:00 UTC (12:00 local) to 4:00 UTC (22:00 local) prior to the event is likely indicative of evapotranspiration. “

The zero point of the rainfall plot should be set to correspond with the start of the rainfall event

This is a good suggestion and we have updated Fig 2 accordingly.

The rainfall representation in both plots of Fig 2 is confusing and should be converted to cumulative rainfall (no negative slopes).

The raw cumulative gauge data may at times show negative slope, as shown in Fig 2. However, the smoothed and filtered cumulative gauge record does not have negative slopes, because, as pointed out by the reviewer, cumulative rainfall can only increase, by definition. Fig 2 has been updated accordingly. To clarify these plots further, we have also added the filtered and accumulated well data. Now the graphs show both the raw well data (which illustrates the evaporation) but also the filtered and accumulated data which is used for intercomparison with the filtered and accumulated precipitation data.