General comments

- I found this study to be succinct, and it did not try to overreach its goals. However, there were some problems with the methodology that should be cleared up before it is published. Particularly, the authors used the relationship between SNR phase and soil moisture from the work presented in Chew et al. (2014) to convert SNR observations to soil moisture for their own sensors. But, the relationship that we developed in that work is ONLY applicable to the Trimble NetRS receiver and choke ring antenna. Different antennas and receivers could have vastly different relationships between SNR phase and soil moisture. For example, the Zephyr antenna actually has a negative relationship between phase and soil moisture, not a positive one. So, using this conversion factor with the particular hardware used in this study is not appropriate. Instead, the authors should just present the correlations between phase and gravimetric soil moisture for the different antennas/receivers and constellations used, and they should derive their own relationships (and put these in a table). The mistake in methodology erases their conclusions about the relative performances in terms of RMSE of the different constellations and geodetic-quality versus mass market receivers. The conclusions should be re-thought after the methodology is revised.

Answer:

Thank you very much for the comment. We followed the methodology explained in Zhang et al. (2017) considering the satellites with a correlation higher than 80% with the reference soil moisture observations. The linear relationship (in degrees) we found is summarized in the following table:

	Geodetic antenna	*Mass-market antenna*
GPS constellation	*157.97*	*330.50*
GALILEO constellation	*60.97*	*144.93*
GLONASS constellation	*22.18*	*33.33*

However, as in the case of the paper by Zhang et al. (2017), we obtained good results (those presented in the manuscript) by applying the linear relationship of 65.1 degrees in all cases, so we thought that generalizing to this value can simplify the methodology since no reference values are needed (that is what we expressed at the end of the discussion section of the manuscript).
We think that the idea is still valid since the only problem would be the change of sign in the value of the linear relationship, so we would like to continue with the generalization of the method, although the last sentence of the discussion section should be changed accordingly to what the reviewer suggests, recommending that the linear relationship should be calculated based on soil moisture reference values in order to know the sign of the linear relationship and, in case of positive sign, 65.1 can be used as a mean valid value to obtain accurate results.

- If you do not have residual soil moisture values, you can usually estimate them based off of the soil type (as was done for the PBOH2O GNSS-IR network). Though, that

requires having a long enough time series to make the assumption that, at some point during the time series, soil moisture was low enough to hit the residual value.

Answer:

This comment will be added in the theoretical background section and the reference included: (https://www.unavco.org/data/gps-gnss/derived-products/pbo-h2o/documentation/documentation.html#soil)

- It is too bad that during the entire experiment, there was only one dry down. It would be a much stronger paper if the experiment could be redone during a more interesting time of year (in terms of soil moisture variability), though perhaps this is not possible.

Answer:

We agree with the reviewer at this point, we had to remove all the equipment since the Cajamar center scientists needed to start with a planting cycle.

- The figures showing the time series of soil moisture retrievals are very difficult to see. The black versus grey dots, and how clustered they are together, make it difficult to distinguish any relative differences.

Answer:

Color figures will be included in the final version of the manuscript:

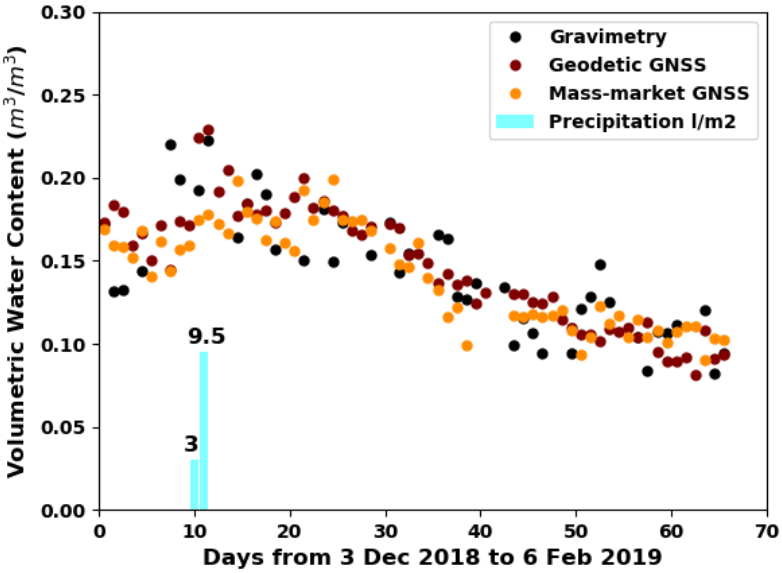

Figure 11. GPS comparison of daily soil moisture. The results of the geodetic and mass-market antennas are compared with the reference gravimetric data set.

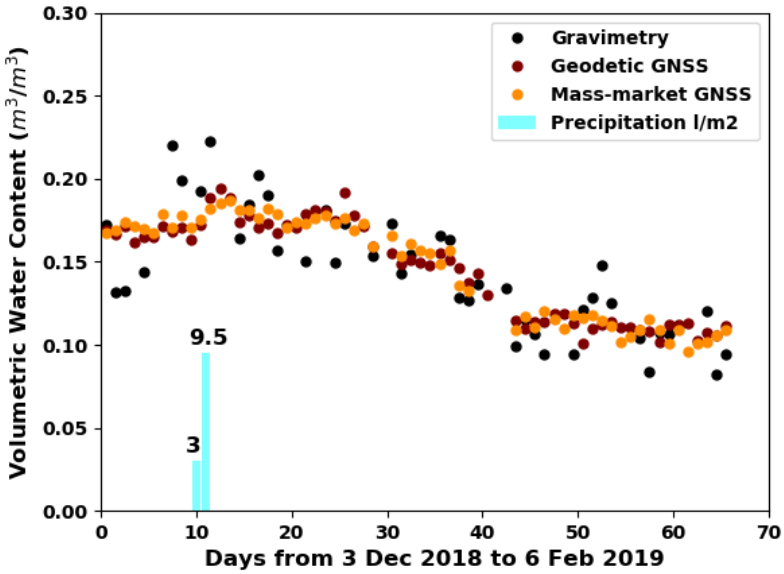

Figure 12. GLONASS comparison of daily soil moisture. The results of the geodetic and mass-market antennas are compared with the reference gravimetric data set.

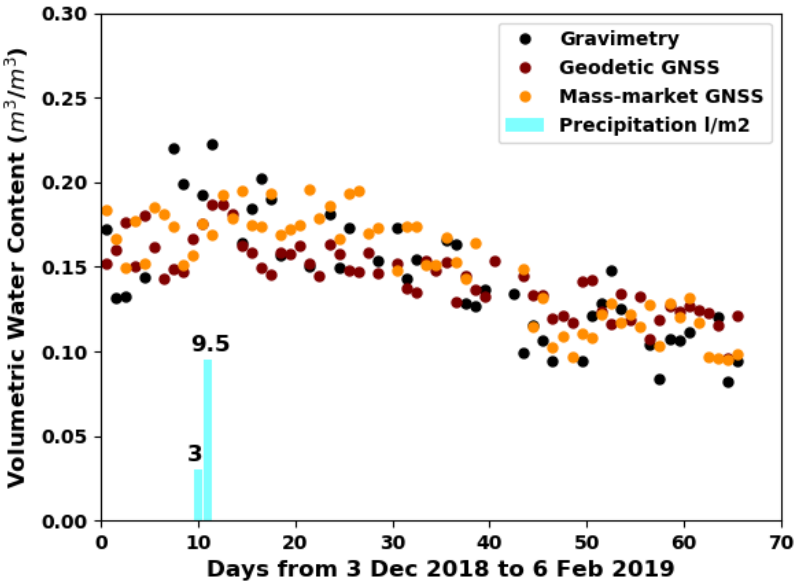

Figure 13. GALILEO comparison of daily soil moisture. The results of the geodetic and mass-market antennas are compared with the reference gravimetric data set.

- The spatial resolution of SMAP is actually 40 km (gridded to 36 km) since the radiometer is the only instrument onboard that works.

Answer:

Thank you very much for the comment, the introduction section will be changed accordingly.