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Interactive comment

Interactive comment on "Measurement of the water balance components of a large green roof in Greater Paris Area" *by* Pierre-Antoine Versini et al.

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Dear Referee,

First of all, we would like to thank you for the interest you have shown to our manuscript and your detailed review. Here are our answers and some proposals to improve our paper regarding your comments and suggestions.

Regarding your specific comments (1), (4), (5) and (6), Figure 1 will be modified by: (i) separating photographs and the blurred engineering (the useless part will be removed), (ii) adding a scale, (iii) adding some indications about the monitored area and flow path lengths, (iv) indicating the location of areas with plants, (v) adding a profile of the section where the water content sensors were implemented (with the slopes).

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Discussion paper

Regarding your specific comments (2) and (3), some information will be added to better describe the green roof, including: (i) a figure presenting the vertical profile, (ii) more physical properties of the substrate. It is recalled that most of these properties and grain size distribution, water retention and hydraulic conductivity curves are available in Stanic et al., 2019.

Stanic, F., Cui, Y.J., Versini, P.-A., Schertzer, D., Tchiguirinskaia, I., 2019. A device for the simultaneous determination of the water retention properties and the hydraulic conductivity of an unsaturated green-roof material. Geotech. Test. J., 43(3), https://doi.org/10.1520/GTJ20170443 (https://compass.astm.org/DIGITAL_LIBRARY/JOURNALS/GEOTECH/PAGES/GTJ20170443.htm)

Specific comments (7): Indeed Topp equation (Eq. 3) has been defined for natural soil. Moreover it gives the link between the dielectric constant and the volumetric water content which is strongly related to the bulk density (compaction of the substrate). Here it can be assumed that the BGW substrate was coarse enough to not clearly show the dielectric behaviour of a typical volcanic media, and do not reveal a dielectric constant–volumetric water content relation significantly different from the Topp equation (see Palla et al., 2009 for a similar assumption). Nevertheless such assumption can conduct to the under-estimation of water content. Additional study was done to assess this relationship in lab. Two different calibration curves were obtained: (i) without applying any compaction force (lower bulk density, higher porosity), (ii) with compaction obtained by applying vibrations (this causes the segregation of the material similar to what occurs in situ during a long period of time). When comparing with the Topp equation, these curves show that the transformation from dielectric constant into the volumetric water content is not straightforward. For this reason, we provide the dielectric constant data, letting free the reader to use another relationship to convert this data in water content. Additional relationships can be added in the manuscript.

The statement “The sensors show a significant spatial variability in terms of absolute values. These differences illustrate the heterogeneousness of the substrate, due to its granular composition and its wavy-form" means the sensors were accurate enough to measure different water content behaviours generating by some different hydrological behaviours (due to the slope and different vertical profiles). By using Topp equation or another relationship, the sensors provide some relevant information about this spatial variability.

Specific comments (8): Concerning the water level sensor, the uncertainly represents +/- 1% of the measured value. The resulting uncertainty for discharge estimate could be assessed from general formula of uncertainty propagation.

Specific comments (9): Here, the rainfall events have been defined by analysing both rainfall and discharge data. Following the standard inter-event dry period of 6 hours, 6 rainfall events characterized by a total amount higher than 5 mm can be defined: 7th March (9 mm), 11th March (9.7 mm), 17th March (7.5 mm), 27th and 28th March (13.9 mm), 9th April (9.6 mm), 29 and 30th April (23.5 mm). This can be modified in the manuscript.

Specific comments (10): In Paris region (temperate climate), evapotranspiration can be neglected in the water balance during a rainfall event. Hot temperature can occur in summer, but storms are very short in such situation. We completely agree that evapotranspiration represents a key information to assess the retention capacity of the substrate during dry periods. In reality, the monitoring set-up of the BGW has been recently extended to the energy balance components measurement and particularly to the evapotranspiration flux. It is explained in the last paragraph of the manuscript dedicated to perspectives. For now, the evolution of the retention capacity of the substrate during dry periods is assessed by the water content sensors.

Specific comments (11): It is possible to add a particular rainfall event to present the mentioned discharge (the reader can do it with the python script). Indeed, green roof impacts (runoff coefficient, lag and attenuation of the peak runoff) differ from one event to another depending on the precipitation but also the initial conditions. Specific comments (12): Concerning the discharge measures inside the pipe, only one data is missing (2018-04-28 14:58:33). The slope is equal to 0.74% (it was indicated in the Python script, it should also be the case in the manuscript). It is true that Manning-Strickler equation is valid under the assumption of uniform flow. Here the very low slope (inducing low water velocities) and the absence of connection before and after the location of the sensor makes relevant the use of the Manning-Strickler formula (the flow profile is close to uniform). This assumption is usually done in stromwater management (see SMWW model developed by the Environmental Protection Agency in USA for instance).

Concerning the discharge measures from the storage units, there are 74 time steps characterized by NaN values in the file (19/02/18 at 17:06 and the following for instance). As mentioned in Section 3.1 the 15s-signal produced by the sensor is very erratic. In order to smooth this signal, the data can be averaged on a moving window (whose number of time steps can be modified in the Python script).

The Authors

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