Response to the comments of referee#1 (Heye Bogena) on the manuscript “A distributed soil moisture, temperature and infiltrometer dataset for permeable pavements and green spaces”

We thank Heye Bogena for reviewing our manuscript, for his positive overall evaluation and for his helpful suggestions for improving the manuscript. In the following, we answer the comments in a point-by-point reply.

R1 C1: *Some of the sensors were installed within an excavated hole, which then was refilled successively with bedding material. What kind of material did you use? If it is different from the site material in terms of soil hydraulic properties this could have led to biased measurements.*

> Thank you for this point, which we will clarify in the manuscript. At the plots, where sensors were installed within the excavated hole, we used bedding material (material used for the construction of the bedding layer) to refill these holes. The refilling and compaction was done professionally by municipal construction workers. Within the bedding layer, soil hydraulic properties between refilling and original soil material should therefore be comparable. Soils found within the underlying base and subbase layers were characterized by a strong variability. We think that the hydraulic properties of the refilling lie within this variability.

R1 C2: *You applied the CRIM model by also considering the temperature dependency of permittivity. The same procedure was applied to the SMT100 sensor by Bogena et al. (2017) and they found that the derived soil moisture from the permittivity measured by the SMT100 did not show temperature effects. This indicated that the temperature effect was only due to the temperature dependence the permittivity and that the sensor electronics were not affected by temperature. Please discuss reasons for the remaining diurnal soil water content oscillations*

> Indeed, this is a very interesting issue. Diurnal soil water content oscillations present in our data are most pronounced at sensors near the ground surface and are characterized by an increase in soil moisture with rising soil temperature.
>
> Temperature effects electromagnetic soil moisture measurements in various ways. Wraith and Or (1999) showed that temperature effects may depend on soil type and soil moisture content. This is explained by the effect of bound water, which gets partially released when temperatures increase (Or and Wraith, 1999). While the effect of bound water may be negligible at high soil moisture contents, it might play an important role at low soil moisture contents. In our data, the diurnal soil moisture oscillations occur at low soil moisture contents. In contrast, the study of Bogena et al. (2017) took place at much

higher soil moisture contents and therefore the effect of bound water may be less present in their observations.

R1 C3: *You removed data from frozen soils with the argument that freezing hinders vertical water movement within the profile. However the main reason should be that the dielectric properties of frozen water are different from the liquid water for which reason soil water content measurements with electromagnetic sensor of frozen soils are not reliable.*

Thank you for this remark, which we will consider in the manuscript. Note that although times with freezing conditions were removed in the soil moisture data, these times are still present in the permittivity data. Augmenting the CRIM model by the permittivity of frozen water (e.g. applied by Demand et al. (2019) and by Roth and Boike (2001)) enables to calculate the liquid water content even for frozen conditions. We will add a corresponding remark in the manuscript.

R1 C4: *Some remarks on the transferability of the data to other urban areas would be helpful for potential users of the data*

We agree that such information will improve the manuscript. We will therefore add the following remarks to the manuscript:

Urban areas are characterized by strong spatial heterogeneities concerning surface coverage but also in regard to urban soils. Thereby, the heterogeneity of the urban surface coverage leads to a variable input at the ground surface (e.g. insolation and precipitation). In combination with the pronounced variability of urban soil composition, this aggravates the transferability of the data to other urban sites.

Nevertheless, the soil layers underneath PPs consist of technical substrates with defined hydrological properties. Therefore, we expect that soil moisture patterns underneath PPs are similar and that the observed patterns could be transferred to other field sides. This is also the case for the parameters derived from soil moisture measurements (θ_s and θ_{fc}).

In contrast, various authors highlighted the variability of the infiltration capacity of PPs (e.g. Illgen (2009)). Therefore, the transferability of the infiltrometer data is limited.

Literature

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