Dear Editor,

Thank you very much for your and reviewers' efforts on our paper submitted to the "Soil" (Manuscript ID soil-2021-118). We have checked the manuscript and revised it according to the comments carefully. The revision has been highlighted in the document by using colored text. We submit here the revised manuscript as well as an itemized response to reviewers' comments.

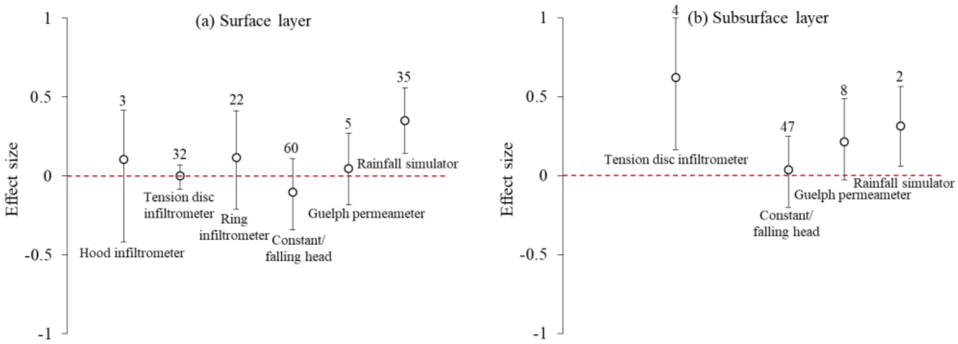
Sincerely yours,

Dr. Kaihua Liao

Response to EC1

1. I think that these have resulted in worthwhile improvements. However, the revisions made are relatively minor. For instance, you have not searched for additional papers employing the rainfall simulation method, but have only considered the three example papers (there are likely to be many more) that I suggested. A meta-analysis should I think be based on the largest, and therefore most representative, set of data that can be assembled. Therefore, I would like to ask you to undertake additional literature searching to more fully include the results of rainfall simulation studies.

Answer: Thank you very much for your suggestion. According to your comment, we have greatly revised the paper. Additional papers employing the rainfall simulation method have been included (Table 1). We applied a global meta-analysis method to synthesize a total of 37 paired observations for soil K_{sat} measured by rainfall simulator.



It is found that when the K_{sat} was measured by rainfall simulator, conversion to CS significantly ($p < 0.05$) increased the surface and subsurface soil K_{sat} by 41.7% and 36.9%, respectively. This is consistent with the findings of previous studies. For instance, Singh et al. (1994) observed that rainfall can reduce surface roughness, especially the first rains after tillage due to breakdown and sloughing of soil clods upon wetting during rainstorms. Lampurlanés and Cantero-Martínez (2006) proposed that if a rainfall simulator had been used, greater infiltration rates would probably have been found on NT, because residues play a role similar to that of surface roughness, i.e., increasing the time for infiltration to take place. However, Gupta et al. (1997) found the lower K_{sat} values of soil measured by rainfall simulator in NT plots compared with those in CT plots, which was attributed to the fact that the NT practice allowed a consolidated layer to form. This was relatively impervious to the infiltrating water on the soil surface. The restricted downward movement of rain water produced lower K_{sat} under NT. Therefore, more data are needed to test the effect of conversion to CS on K_{sat} measured by rainfall simulator in the future (P14L258-271).

Table 1 Rainfall simulator technique used for measuring saturated soil hydraulic conductivity.

Reference	N[a]	Measurement technique[b]	Measurements		OMC[e] (%)	Time interval from tillage conversion to measurement (yr)	General descriptions
			IR[c]	K_{sat}[d]			
Baumhardt et al. (2012)	4	Rainfall simulator	√			3	We applied reverse-osmosis water in lieu of rainwater because of its dispersive characteristics at a rate of 78 mm h^{-1} with a rotating-disk rain simulator that produced impact energy of 22 J mm^{-1} m^{-2} or 80% of natural rain.
Curtis and Claassen (2009)	4	Rainfall simulator		√	0.03~7.00	2 (2003~2004)	
De Almeida et al. (2018)	1	Rainfall simulator	√		2.55~7.28	0.5 (November 2013~May 2014)	We use a portable rainfall simulator calibrated with a constant rain intensity of 60 ± 1.715 mm h^{-1}, mean drop diameter of 2.0 mm and pressure of 32 kPa.
Gómez et al. (1999)	2	Rainfall simulator	√	√	1.00~2.50	16 (1982~1997)	The K_{sat} was calculated at four water tensions; -15, -10, -5 and 0 cm of H_2O.
Gupta et al. (1997)	1	Rainfall simulator		√	0.00~3.40	2 (1992~1993)	The rainfall was applied by the portable rainfall simulator. The infiltration data was analyzed for the saturated hydraulic conductivity determinations.
Jakab et al. (2017)	15	Rainfall simulator	√			15	Rainfall simulation was carried out three times in 2016.
Langhans et al. (2011)	1	Rainfall simulator	√		1.09~1.38		Prior to each experiment, 45 mm h^{-1} of rainfall from 3.25 m height from a nozzle-type simulator was applied to the plot until steady state runoff occurred.

Maulé and Reed (1993)	3	Rainfall simulator		√		13	The rainfall occurred over a 1.6 m x 2.3 m area on the ground, but infiltration was determined from a 1.5 m^2 area directly under the simulator.
McGarry et al. (2000)	1	Rainfall simulator		√		8	Water infiltration parameters were measured with an oscillating nozzle rainfall simulator.
Ndiaye et al. (2005)	6	Rainfall simulator		√	< 0.5		The rainfall simulator was a 4 m high tower equipped with a Laechler nozzle (# 461.008.30) mounted at 3.86 m above the soil surface.
Nyamadzawo et al. (2007)	5	Rainfall simulator	√		~1.72	2 (2001~2002)	Rainfall simulations were done at the centre of the plots at a rainfall intensity of 35 mm h^{-1} on 1 m^2 experimental plots surrounded by a 50 cm buffer zone.
Park et al. (1992)	4	Rainfall simulator		√		7 (1981~1987)	Rainfall simulation studies were conducted on each tillage treatment using a rotating disk simulator.
Potter et al. (1995)	3	Rainfall simulator		√		8	A rainfall simulator was used to determine water infiltration characteristics of a Houston Black clay.
Ramos et al. (2019)	6	Rainfall simulator	√		0.57~4.31	3	The susceptibility to sealing of each soil and the steady infiltration rates were evaluated in the laboratory subjecting the soils to rainfall simulation applied at an intensity of 25 mm h^{-1}.
So et al. (2009)	1	Rainfall simulator		√	2.88	14	A rainfall simulator with an intensity of 80 mm h^{-1} was used to determine the infiltration characteristics of the bare soil using plots of 2 m x 1.5 m
TerAvest et al. (2015)	2	Rainfall simulator	√		0.29~2.79	3	Rainfall simulations were conducted 6–7 weeks after planting, between crop rows, when soils were at or near field capacity.
Xin et al. (2005)	4	Rainfall simulator		√		4 (2001~2004)	The swing sprinkler rainfall simulator produced by

							Queensland Department of primary industries is adopted. The sprinkler model of rainfall simulator (RFs) is Veeject 80100, with a total of 3 nozzles.

[a] Number of paired observation for K_{sat}; [b] The numbers in parentheses indicate the diameter (cm) of the device. For double ring method, the diameters of inner and outer rings are provided; [c] Infiltration rate; [d] Saturated hydraulic conductivity; [e] Organic matter content. If the literature only provided the organic carbon content, the organic matter content was estimated using the 1.724 conversion factor.

2. A second issue is the scale of measurement, which I raised initially. The various methods examine the properties of different areas of the soil surface: from plots to small core samples. How can this be addressed, so as to understand the potential influence of the scale of measurement? The issue of the diameter of cylinder infiltrometers is just one instance of this effect. You have chosen to rely on a rather old paper or two, and ignore the wider body of evidence that suggests that scale effects are important, and that large diameter rings must be used. What I would like to ask you to do is to actually consider this literature, and acknowledge more adequately that 15 cm diameter is regarded as far too small by many authors. A key issue is to acknowledge that there is a scale effect, and that this may exert an influence on the results.

Answer: Thank you very much for your suggestion. Indeed, scale effects are very important. A total of 12 articles were retrieved from the Web of Science database, using an inner ring of more than 80 cm. However, most of the articles only discussed the influence of the size of double ring on the measurement results of K_{sat}, while only one article investigated the influence of tillage conversion on K_{sat}.

In the revised manuscript, we have indicated that for ring infiltrometer, the diameter of a single ring, or the diameter of the inner ring of a double ring, should be greater than 50 cm in this study (Table 2), although inner and outer ring diameters of about 30 and 60 cm have been widely applied to measure the soil infiltration process (e.g., Ronayne et al., 2012; Zhang et al., 2017). A recent study (Li et al., 2019b) have demonstrated that the ring infiltrometer with an inner diameter of 40 cm is not enough to completely overcome the scale effect (P8L139-145).

After using the inner ring with longer diameter, it is found that the analysis results are different from those before. In the revised paper, we observed that conversion to CS had no significant effect on the soil K_{sat} measured by ring infiltrometer.

Finally, the Figure 1 has also been revised since the selected literature has changed.

Table 2 The ring infiltrometer technique used for measuring saturated soil hydraulic conductivity.

Reference	N[a]	Measurement technique[b]	Measurements		OMC[e] (%)	Time interval from tillage conversion to measurement (yr)	General descriptions
			IR[c]	K_{sat}[d]			
Kennedy and Schillinger (2006)	9	Single ring (76)	√		1.28~2.88	20	A 76-cm-diameter single-ring infiltrometer was pushed into the soil to a depth of 5 cm.
Khorami et al. (2018)	1	Double ring (50~70)	√		1.48~1.98	3 (2014~2016)	The double-ring infiltrometer test procedure involved inserting two rings into the 5-cm depth of the soil.
Merwin et al. (1994)	3	Single ring (70)		√	5.30	8	A 70-cm-diameter single-ring infiltrometer was pushed into the soil to a depth of 8 cm.
Sartori et al. (2022)	1	Double ring (an inner ring of 60 cm in diameter)		√	1.41	3	An inner ring of 60 cm in diameter was used to measure both the row and inter-row areas in the tillage radish plots.
Smith et al. (2007)	1	Double ring (50~90)		√		1	A double-ring infiltrometer with two concentric metal rings were co-located with tensiometers placed at depths of 15, 30 and 60 cm in the soil profile located just outside the inner ring.
Starr and Glotfelty (1990)	4	Double ring (75~150)	√		2.40~3.00	13 (1974~1986)	Each microplot was instrumented with a double-ring infiltrometer that was pushed into the soil to a depth of about l0 cm.
Steenhuis et al. (1990)	1	Single ring (70)		√		3	A 70-cm-diameter single-ring infiltrometer was pushed into the soil to a depth of 5 cm.
Stone and Schlegel (2010)	2	Double ring (92~124)	√		1.90	12 (1989~2000)	Rings were positioned to avoid vehicle traffic paths, driven 13 cm deep, and filled twice with water. At

sunup 2 d later, water was added to the infiltrometers, and ponding was maintained at a depth of ~3 to 10 cm.

[a] Number of paired observation for K_{sat}; [b] The numbers in parentheses indicate the diameter (cm) of the device. For double ring method, the diameters of inner and outer rings are provided; [c] Infiltration rate; [d] Saturated hydraulic conductivity; [e] Organic matter content. If the literature only provided the organic carbon content, the organic matter content was estimated using the 1.724 conversion factor.

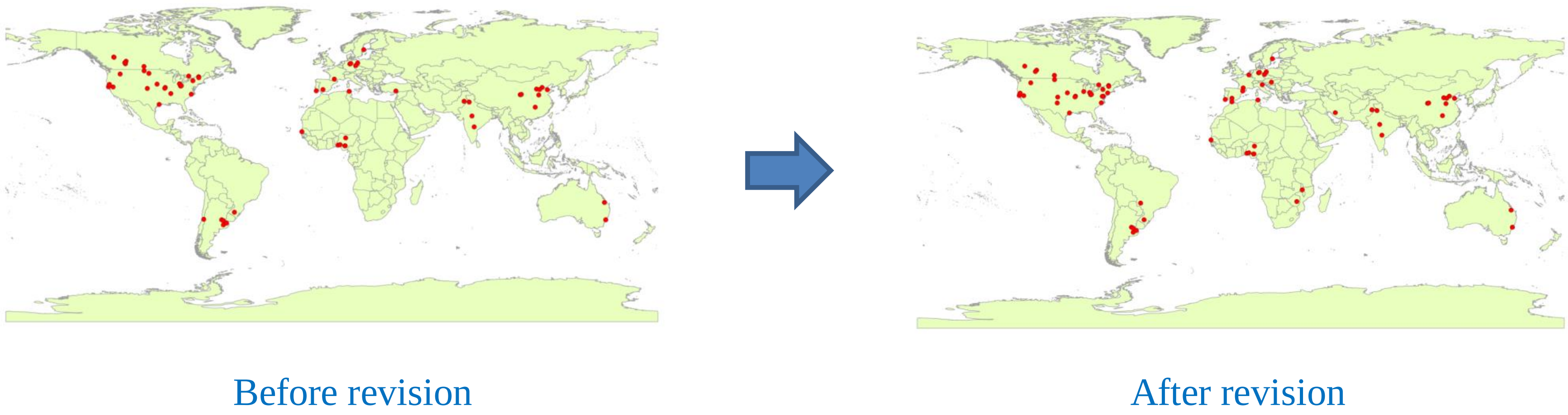


Figure 1: The geographical coverage of the studies used in the meta-analysis.