JOURNAL OF WATER AND LAND DEVELOPMENT
e-ISSN 2083-4535
Polish Academy of Sciences (PAN) Institute of Technology and Life Sciences – National Research Institute (ITP – PIB)

JOURNAL OF WATER AND LAND DEVELOPMENT
DOI: 10.24425/jwld.2026.158714
2026, No. 69 (IV–VI): 169–177

Modification of the Horton model in tropical peatland

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RECEIVED 29.09.2025 ACCEPTED 07.01.2026 AVAILABLE ONLINE 16.06.2026

Abstract: This research aims to develop Horton infiltration for tropical peatland using an injection-well approach that relates soil moisture to the infiltration rate. The research was conducted in the peatland of Palangka Raya City – Sebangau District, Indonesia. Soil sampling was carried out to determine the depth of shallow peatland (50–100 cm) and medium peatland (100–200 cm) using an auger and ring samples. The methodology consisted of investigating a simple laboratory-scale injection-simulator model covering dimension, depth, number, and flow velocity, and then developing a Horton infiltration model for tropical peatland using an injection-well approach that relates soil moisture to the infiltration rate. The results show that the modified Horton infiltration analysis, with the addition of moisture in the simple injection-simulator tool, produces a very strong relationship between discharge and modified Horton infiltration, a very strong relationship between discharge and groundwater level, and a very strong relationship between modified Horton infiltration and groundwater level in medium-depth peatland deeper than one metre (>1 m). The modified Horton infiltration development model for tropical peatland is better than the original Horton infiltration model because peatland is porous and infiltration increases with increasing water volume and soil moisture. In addition, the injection well increases the infiltration-capacity system, whereas the original Horton model analyses only natural infiltration.

Keywords: Horton infiltration, infiltration, injection well, injection simulator, peatland, tropical area

INTRODUCTION

Poor water management causes prolonged land fires and flooding (Priyantoro and Limantara, 2017; Lu *et al.*, 2021). Land fires often occur because of drought, particularly in peatland in Central Borneo; these fires damage ecosystems (Harriss *et al.*, 1985; Keller *et al.*, 2004) and cause the extinction of flora and fauna that grow and live in the forest. In addition, they disrupt health, the social environment, transportation, and other sectors in Central Borneo, particularly in Palangka Raya City, and can affect other cities and countries. Tropical peat swamp forests (PSF) are widespread in Southeast Asia, particularly Indonesia, Malaysia, Brunei, and Thailand (Becek *et al.*, 2021). However, in recent decades, forest conversion, mainly for agriculture, has increased. Deforestation and drainage accompanied by land-use change (Bisri *et al.*, 2017; Adjissi *et al.*, 2025) cause peat degradation, which increases fire risk. In 157,000 km^2 of peatland in Peninsular Malaysia, Sumatra, and Borneo, PSF decreased from 119,000 km^2 to 78,000 km^2 in 2015 (Miettinen, Shi and Liew, 2017). Nevertheless, large fires occur repeatedly in this region. In 2015, Indonesia experienced the worst fire in the previous two decades. As a result, smoke-induced smog affected the islands of Southeast Asia for several months (Huijnen *et al.*, 2016).

Another problem is land-use change, which reduces water absorption and increases run-off (Czyżyk and Świerkot, 2017; Łaszewski *et al.*, 2025), causing large-scale flooding in Central Borneo in general and Palangka Raya in particular. This occurred in 2021 on Jalan Trans Palangka Raya towards Banjarmasin, where flooding reached a water depth of 76 cm along 170 m (CNN Indonesia, 2021).

One alternative for reducing water surplus/flooding in peatland is to develop canals along the flow path from agricultural areas to the river (Goldammer, 2007; Hoscilo *et al.*, 2011). Central Borneo is one of the regions with the longest canals; drought occurs in the dry season (Selmani Bouayoune, Boudi and Bachir, 2017), and flooding occurs in the rainy season. Canals in peatland offer hope for solving peat problems, but their large dimensions have changed peat hydrology (Moore and Roulet, 1993; Blodau and Moore, 2003). They cannot retain overflow and flooding because their conventional function is to drain water as quickly as possible to the river, whereas the river cannot store the water volume. Another impact of canal drainage is an increase in poorly quantified fire emissions (Tian, 2012; Brown *et al.*, 2014). Thus, during drought, peatland is easily burned because evaporation around canals reduces the water stored in the peatland.

The failed Indonesian mega-peatland project (PLG), which aimed to convert 10,000 km^2 of peatland into agricultural area at the end of the 1990s in Central Borneo, permanently changed the peatland landscape and increased fire risk in the dry season (Kunarso *et al.*, 2022). Some mitigation efforts to maintain peat and reduce drought have been carried out by the government and the public, including work by the Indonesian Peatland Restoration Agency (BRGM) through canal blocking and backfilling to restore 25,000 km^2 of peatland ecosystems and protect them from fire, including in Central Borneo Province (Dohong, 2017). Besides canal blocking, peatland fire management has been carried out physically and non-physically through pump wells, which are used in the dry season to wet peat and respond to land fires. However, when the range of a land fire is too wide, the fire cannot be extinguished effectively, and helicopters may be used, which requires considerable time and cost. Canal blocking, pump wells, and wetting by helicopter have not fully regulated the overall water flow, so flooding and drought still occur in peatland locations, particularly where there is no absorption between areas. Central Borneo Province covers 153,564.5 km^2 and has the general characteristics of Borneo Island, most of which is peatland (peat swamp). The restoration programme in Indonesia can be regarded as mitigation of one of the largest global carbon fluxes. The assumption is that the number of fires and total emissions will decrease as the groundwater level increases (Dohong, 2017; Putra *et al.*, 2018).

This research aims to develop Horton infiltration for tropical peatland through an injection-well approach that relates soil moisture to the infiltration rate. The traditional Horton equation is based on the infiltration capacity–rainfall time curve. However, infiltration is influenced by groundwater content and not only by rainfall. Total infiltration is estimated to be about 27.0% of total rainfall on a global scale (Oki and Kanae, 2006). The Horton equation is one of the most widely used semi-empirical models. According to Triatmodjo (2008), factors that influence infiltration are as follows: 1) inundation depth and saturated-layer thickness, 2) soil moisture, 3) compression by rain, 4) blockage by fine particles, 5) land cover, 6) topography, and 7) rainfall intensity. An injection well is an environmentally friendly drainage method that can be used in Indonesia and in groundwater protection areas. These wells are used for water or soil conservation and for maintaining soil wetness, mainly in peatland.

MATERIALS AND METHODS

RESEARCH LOCATION

The research location is the peatland of Palangka Raya City – Sebangau District. Soil sampling was carried out to determine the depth of shallow peatland (50–100 cm) and medium peatland (100–200 cm) using ring samples. In addition, a physical model was developed in the laboratory using undisturbed original soil samples. The main research focus was Campus 2 of the University of Muhammadiyah Palangkaraya, Sebangau District, with a research area of 1 km^2 located in peatland in Central Borneo Province. The research location is shown in Figures 1 and 2.

This research also included a field survey in the Sebangau District watershed, Palangka Raya City, for infiltration data sampling at four locations (segments) with 25 points, as presented in Table 1.

EXPERIMENTAL DESIGN

In this research, several stages of data sampling were carried out at peatland points in Sebangau District, Palangka Raya City, in the boundary area between the urban area and the river, and at Campus 2 of UM Palangka Raya for four locations with shallow, medium, and deep peatland. Details are shown in Table 1.

Based on field measurement results, the infiltration rate (F) can be analysed using the following formula:

$$F \cdot f = \frac{\Delta H}{t} 60 \tag{1}$$

where: F = infiltration rate (cm·h^{-1}), ΔH = decrease in water height over a certain time (cm), t = time required for water over ΔH to enter the soil (minute).

According to Dunne and Leopold (1978) (as cited in Asdak, 2020), the infiltration measurement method above is relatively easy to implement. However, with this method, the infiltration-rate result is usually higher than the field condition (infiltration and rainfall), by 2–10 times. The advantage of this method is that horizontal flow does not spread widely because it is limited by the infiltrometer ring.

METHOD OF HORTON

According to Horton (1941), the infiltration rate decreases with time until it approaches a constant value. He stated that the reduction in the infiltration rate is controlled more by factors operating at the soil surface (Harisuseno, Khaeruddin and Haribowo, 2019; Harisuseno and Cahya, 2020) than by flow processes in the ground. Factors that reduce the infiltration rate include land cover, closure of ground cracks, crust formation, destruction of land-surface structures, and transportation of fine particles on the land surface by raindrops (Adidatul, 2015). In Subramanya (2013), Chow (1988), and Horton (1941), it is expressed as follows:

$$f(t) = f_c + (f_0 - f_c)\mathrm{e}^{-kt} \quad \text{for} \quad 0 < t < t_c \tag{2}$$

The constant value can be determined as follows:

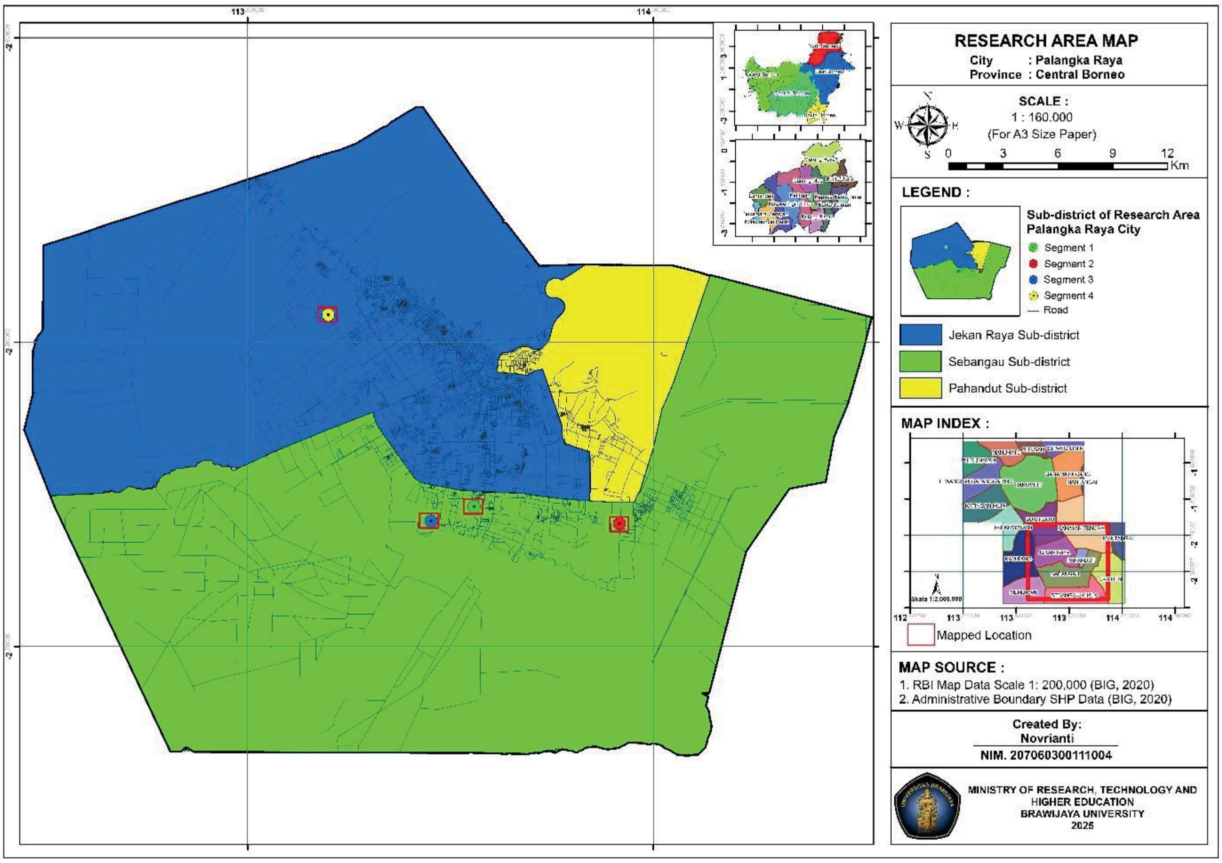


Fig. 1. Research location; source: own elaboration

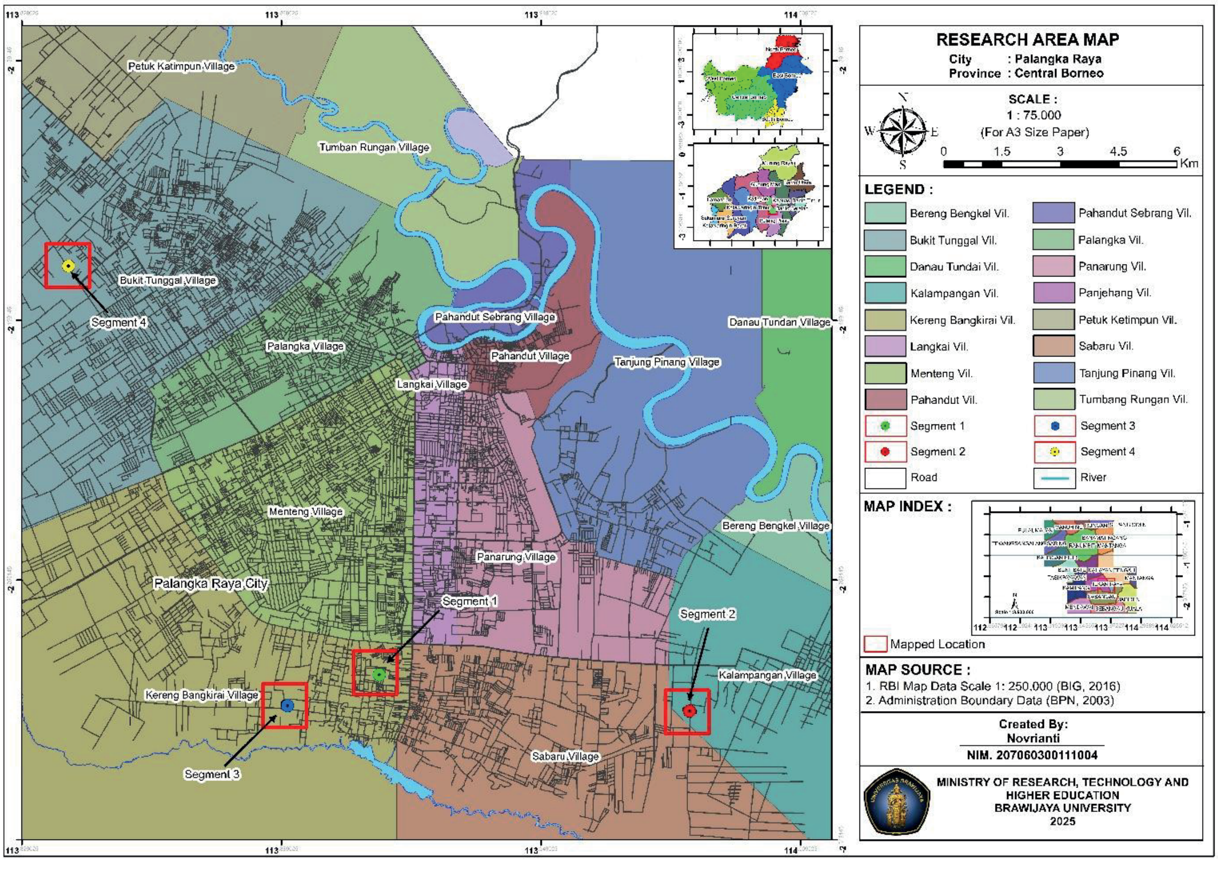


Fig. 2. Research distribution; source: own elaboration

Table 1. Detailed research points and their use

Location of peatland point	Watershed area (ha)	Type of soil texture (from map)	Number of observations point[1)]	Type of utilisation for research	
				calibration point	validation point
Kereng Bengkirai UMPR campus 2	100.00	SP, MP	6	4	2
Kereng Bengkirai regional boundaries DAS 1 – Pulang Pisau	121.86	SP, MP, DP	9	5	4
Kereng Bengkirai regional boundaries DAS 2	256.87	SP, MP	6	4	2
Mahir Mahar	104.77	SP, MP, DP	4	2	2
Total		**42 textures**	**25**	**15**	**10**

[1)] Observation points were determined based on variations in peatland soil maturity level, land-cover slope, and proximity to the main river stream or an affluent stream.
Explanations: SP = shallow peat, MP = medium peat, DP = deep peat.
Source: own elaboration.

$$K = \frac{f_0 - f_c}{f_c} \tag{3}$$

$$f_c = \sum (f_0 - f_c) - f_c \tag{4}$$

where: $f(t)$ = infiltration capacity in each period t since the initial infiltration rate of rainfall (cm·h^{-1} or mm·h^{-1}), LT^{-1}; f_0 = initial infiltration rate (cm·h–1), LT^{-1}; f_c = final infiltration rate at constant conditions (cm·h^{-1}), LT^{-1}; k = constant for soil type, T^{-1}; e = Euler's number as the mathematical constant of the Horton model, e = 2.718; t = time (h).

DARCY LAW

Darcy's law is a constitutive equation that describes fluid flow through porous media. Darcy's law describes the volume of fluid that flows in an aquifer as the product of velocity and the cross-sectional area through which the fluid flows. Darwis (2018) explained that the relationship between fluid flow velocity in soil (v, in cm·s^{-1}) and hydraulic gradient (i) is formulated by Darcy (1956) as follows:

$$v = k \cdot i \tag{5}$$

where: k = coefficient of permeability (cm·s^{-1}), i = hydraulic gradient (–).

By substituting the v value into the Bernoulli equation, Equation (6) is obtained:

$$q = v \cdot A = k \cdot i \cdot A \tag{6}$$

where: q = seepage discharge (m^3·s^{-1}), A = cross-sectional flow area (m^2).

METHOD OF HORTON MODIFICATION

In the modified Horton method (Yuan *et al.*, 2021), using a simulator, infiltration is substituted as follows:

$$f(\theta) = (f_0 - f_c)e^{-\frac{k}{n}\left(\frac{\theta-\theta_0}{\theta_c-\theta}\right)} = [f_c + (f_0 - f_c]e^{-k'\left(\frac{\theta-\theta_0}{\theta_c-\theta}\right)} \tag{7}$$

where: k' = parameter of soil-specific decay from the increased Horton equation.

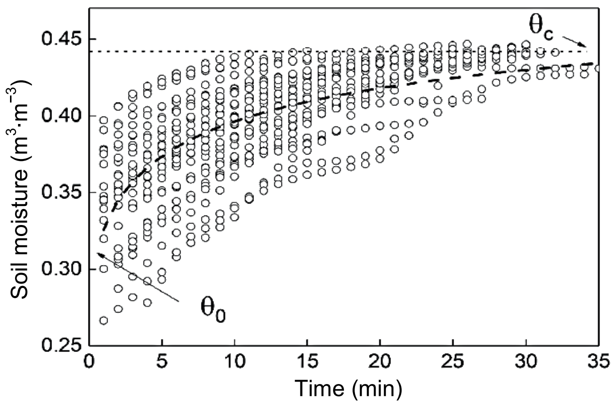


Fig. 3. Experimental observation of soil moisture vs time during the event, which can be ignored because of the short duration; rainfall and the soil moisture–time curve (power function): θ_0 = initial groundwater content, θ_c = saturated groundwater content (Yuan *et al.*, 2021); source: own elaboration

RESULTS AND DISCUSSION

MODEL OF LABORATORY SCALE SIMPLE INJECTION SIMULATOR

The simple injection-simulator experiment was carried out in 10 trials from among many other trials that were not analysed because of leakage and other issues.

The results from the 10 trials show data on soil moisture, soil depth, soil pH, water velocity, water depth in the injection pipe, etc. The analysis was then carried out by calculating infiltration using the original Horton method according to Equation (2). The conclusion of this analysis is presented in Table 2.

ANALYSIS BY USING ORIGINAL HORTON METHOD

The conclusion for infiltration using the original Horton method during the 10 trials is presented in Table 2.

ANALYSIS BY USING DARCY METHOD

The analysis using Darcy's law is presented in Table 3.

Table 2. Summary of original Horton infiltration (*F*Horton) during 10 trials

Name of trial	f_0	*F*Horton
	cm·h^{-1}	
Simulation of injection-1	55.88	−9.84E+70
Simulation of injection-2	69.28	−2.62E+44
Simulation of injection-3	77.08	−4.31E+38
Simulation of injection-4	73.23	−1.57E+33
Simulation of injection-5	68.08	−1.54E+33
Simulation of injection-6	63.50	−2.87E+44
Simulation of injection-7	69.42	−1.53E+33
Simulation of injection-8	41.82	−9.70E+63
Simulation of injection-9	75.52	−2.96E+44
Simulation of injection-10	79.56	−1.65E+28

Explanations: f_0 = initial infiltration rate (cm·h^{-1}).
Source: own study.

Table 3. Summary using Darcy's law during 10 trials

Name of trial	*t*(min)	End volume (m·s^{-1})	Area (m^2)	Discharge (m^3·s^{-1})
Simulation of injection-1	80	70.43	0.032	3.65
Simulation of injection-2	60	84.07	0.032	4.24
Simulation of injection-3	55	70.74	0.032	5.66
Simulation of injection-4	50	69.82	0.032	4.38
Simulation of injection-5	50	63.40	0.032	4.56
Simulation of injection-6	60	67.45	0.032	4.49
Simulation of injection-7	50	76.36	0.032	5.40
Simulation of injection-8	75	84.58	0.032	3.95
Simulation of injection-9	60	87.33	0.032	4.75
Simulation of injection-10	45	84.21	0.032	5.64

Source: own study.

ANALYSIS BY USING MODIFICATION OF HORTON METHOD

The analysis using the modified Horton method (Yuan *et al.*, 2021) according to Equation (7) is shown in Table 4.

RELATION BETWEEN DISCHARGE, MODIFICATION OF INFILTRATION, AND GROUND WATER LEVEL

In this research, three variables are considered: discharge (*Q*, in m^3·s^{-1}), modified infiltration ($f_c$mod, in cm·h^{-1}), and groundwater level (*GWL*, in cm). Based on this analysis, the correlations among the three variables can be summarised as follows:

a) relationship between discharge and infiltration using the modified Horton method;
b) relationship between discharge and groundwater level;
c) relationship between infiltration using the modified Horton method and groundwater level.

ANALYSIS OF TRIAL DAY 1

Trial day 1 shows an increase in discharge (*Q*) followed by an increase in $f_c$mod from about 99.38 cm·h^{-1} until $f_c$mod stabilises at about 115.50 cm·h^{-1}, with a correlation (*r*) of 0.97 (very strong positive). In addition, the groundwater level (*GWL*) increases almost linearly with *Q*, indicating a strong hydraulic relationship, with r = 0.99 (very strong positive). The relationship between $f_c$mod and *GWL* is also very strong, with r = 0.99. However, $f_c$mod becomes saturated rapidly because the initial increase is greater. After infiltration stabilises, the groundwater level continues to increase because *Q* continues to enter, not because the infiltration rate increases.

ANALYSIS OF TRIAL DAY 2

Trial day 2 shows an increase in *Q* followed by an increase in $f_c$mod from about 130.61 cm·h^{-1} until $f_c$mod stabilises at about 146.70 cm·h^{-1}, with r = 0.95 (very strong positive). The *GWL* increases almost linearly with discharge, showing a strong hydraulic relationship, with r = 0.82 (very strong positive). The relationship between $f_c$mod and *GWL* is also very strong, with r = 0.82. However, $f_c$mod becomes saturated rapidly because the initial increase is greater. After infiltration stabilises, the groundwater level continues to increase because discharge continues to enter, not because the infiltration rate increases.

ANALYSIS OF TRIAL DAY 3

Trial day 3 shows an increase in *Q* followed by an increase in $f_c$mod from about 121.33 cm·h^{-1} until $f_c$mod stabilises at about 149 cm·h^{-1}, with r = 0.98 (very strong positive). The *GWL* increases almost linearly with *Q*, showing a strong hydraulic relationship, with r = 0.97 (very strong positive). The relationship between $f_c$mod and *GWL* is also very strong, with r = 0.97. However, $f_c$mod becomes saturated rapidly because the initial increase is greater. After infiltration stabilises, the groundwater level continues to increase because *Q* continues to enter, not because the infiltration rate increases.

Table 4. Summary of the modified Horton method according to Yuan *et al.* (2021) during 10 trials

Name of trial	t (min)	θ_0	θ_c	f_0	f_c	n	k'	$f(\theta)$ ($cm \cdot h^{-1}$)
		(%)		(cm)				
Simulation of injection-1	80	42.5	50.0	25	90.5	30	−2.6073	114.81
Simulation of injection-2	60	100.0	100.0	60	86.7	26	−2.1641	145.94
Simulation of injection-3	55	76.0	96.5	52	97.0	25	−2.0462	147.45
Simulation of injection-4	50	86.5	92.0	53	96.0	24	−1.9283	147.75
Simulation of injection-5	50	56.0	90.0	33	94.0	24	−1.9283	124.72
Simulation of injection-6	60	85.0	99.5	6	95.0	26	−2.1641	99.87
Simulation of injection-7	50	87.5	97.0	30	93.5	24	−1.9283	122.23
Simulation of injection-8	75	60.0	60.5	1	100.0	29	−2.5025	100.41
Simulation of injection-9	60	56.5	57.0	60	98.0	26	−2.1641	157.12
Simulation of injection-10	45	34.0	61.0	65	99.0	23	−1.8132	160.55
$f(\theta)$ average								**132.09**

Explanations: t = time, θ_0 = initial ground water content, θ_c = saturated ground water content, f_0 = initial infiltration rate, f_c = end infiltration rate when constant, $f(\theta)$ = infiltration (Horton modification).
Source: own study.

ANALYSIS OF TRIAL DAY 4

Trial day 4 shows an increase in discharge (Q) followed by an increase in $f_c$mod from about 125.59 $cm \cdot h^{-1}$ until $f_c$mod stabilises at about 149 $cm \cdot h^{-1}$, with r = 0.97 (very strong positive). In addition, the *GWL* increases almost linearly with Q, showing a strong hydraulic relationship, with r = 0.98 (very strong positive). The relationship between $f_c$mod and *GWL* is also very strong, with r = 0.97. However, $f_c$mod becomes saturated rapidly because the initial increase is greater. After infiltration stabilises, the groundwater level continues to increase because Q continues to enter, not because the infiltration rate increases.

ANALYSIS OF TRIAL DAY 5

Trial day 5 shows an increase in discharge followed by an increase in $f_c$mod from about 90.06 $cm \cdot h^{-1}$ until $f_c$mod stabilises at about 127 $cm \cdot h^{-1}$, with r = 0.98 (very strong positive). The *GWL* increases almost linearly with discharge, showing a strong hydraulic relationship, with r = 0.97 (very strong positive). The relationship between $f_c$mod and *GWL* is also very strong, with r = 0.97. However, $f_c$mod becomes saturated rapidly because the initial increase is greater. After infiltration stabilises, the groundwater level continues to increase because discharge continues to enter, not because the infiltration rate increases.

ANALYSIS OF TRIAL DAY 6

Trial day 6 shows an increase in Q followed by an increase in $f_c$mod from about 78.47 $cm \cdot h^{-1}$ until $f_c$mod stabilises at about 101 $cm \cdot h^{-1}$, with r = 0.97 (very strong positive). The *GWL* increases almost linearly with Q, showing a strong hydraulic relationship, with r = 0.94 (very strong positive). The relationship between $f_c$mod and *GWL* is also very strong, with r = 0.97. However, $f_c$mod becomes saturated rapidly because the initial increase is greater. After infiltration stabilises, the groundwater level continues to increase because Q continues to enter, not because the infiltration rate increases.

ANALYSIS OF TRIAL DAY 7

Trial day 7 shows an increase in discharge (Q) followed by an increase in $f_c$mod from about 99.36 $cm \cdot h^{-1}$ until $f_c$mod stabilises at about 123.5 $cm \cdot h^{-1}$, with r = 0.96 (very strong positive). In addition, the *GWL* increases almost linearly with Q, showing a strong hydraulic relationship, with r = 0.94 (very strong positive). The relationship between $f_c$mod and *GWL* is also very strong, with r = 0.94. However, $f_c$mod becomes saturated rapidly because the initial increase is greater. After infiltration stabilises, the groundwater level continues to increase because Q continues to enter, not because the infiltration rate increases.

ANALYSIS OF TRIAL DAY 8

Trial day 8 shows an increase in discharge followed by an increase in $f_c$mod from about 86.51 $cm \cdot h^{-1}$ until $f_c$mod stabilises at about 101 $cm \cdot h^{-1}$, with r = 0.95 (very strong positive). The *GWL* increases almost linearly with discharge, showing a strong hydraulic relationship, with r = 0.97 (very strong positive). The relationship between $f_c$mod and *GWL* is also very strong, with r = 0.97. However, $f_c$mod becomes saturated rapidly because the initial increase is greater. After infiltration stabilises, the groundwater level continues to increase because discharge continues to enter, not because the infiltration rate increases.

ANALYSIS OF TRIAL DAY 9

Trial day 9 shows an increase in Q followed by an increase in $f_c$mod from about 139.55 $cm \cdot h^{-1}$ until $f_c$mod stabilises at about 158 $cm \cdot h^{-1}$, with r = 0.96 (very strong positive). The *GWL* increases almost linearly with Q, showing a strong hydraulic relationship, with r = 0.97 (very strong positive). The relationship between $f_c$mod and GWL is also very strong, with r = 0.97. However, $f_c$mod becomes saturated rapidly because the initial increase is greater. After infiltration stabilises, the groundwater level continues to increase because Q continues to enter, not because the infiltration rate increases.

ANALYSIS OF TRIAL DAY 10

Trial day 10 shows an increase in discharge (Q) followed by an increase in $f_c$mod from about 118.92 cm·h^{-1} until $f_c$mod stabilises at about 164 cm·h^{-1}, with r = 0.98 (very strong positive). In addition, the GWL increases almost linearly with Q, showing a strong hydraulic relationship, with r = 0.90 (very strong positive). The relationship between $f_c$mod and GWL is also very strong, with r = 0.90. However, $f_c$mod becomes saturated rapidly because the initial increase is greater. After infiltration stabilises, the groundwater level continues to increase because Q continues to enter, not because the infiltration rate increases.

ANALYSIS OF COMBINATION FROM DAY 1 UNTIL DAY 10

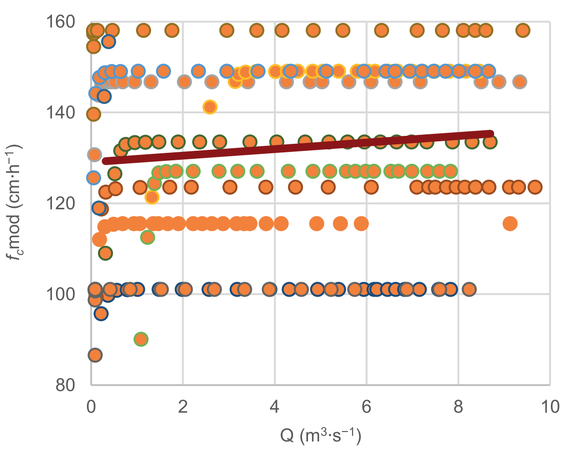
Analysis of the combination from day 1 to day 10 is presented graphically as the relationship between discharge, infiltration, and groundwater level (Montesinos-Lopez *et al.*, 2018), as shown in Figure 4.

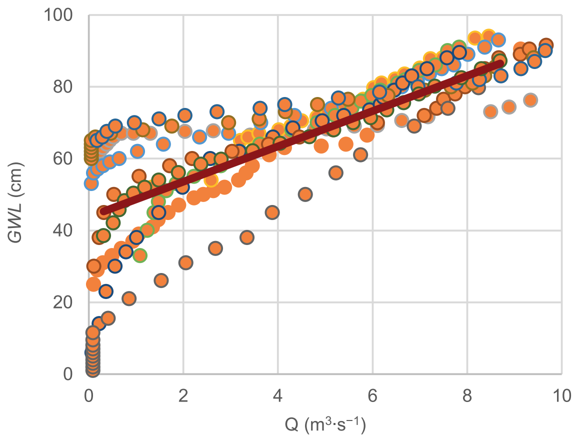
Results of the 10-day experiment show that the increase in discharge (Q), followed by an increase in $f_c$mod, stabilises at values >78.47 cm·h^{-1}, with r > 0.94 (very strong positive). The groundwater level (GWL) is nearly linear with discharge, indicating a very close hydraulic relationship, with r > 0.82 (very strong positive). Meanwhile, the relationship between $f_c$mod and GWL is also very strong, with r > 0.82, but $f_c$mod is easily saturated as GWL increases because of the continuous increase in Q, not because the infiltration rate increases.

ANALYSIS OF THE INFILTRATION DEVELOPMENT MODEL USING THE MODIFIED HORTON METHOD IN PEATLAND BY THE INJECTION-WELL APPROACH

The injection-well approach is presented in Table 5 with Pearson correlations. The pattern interpretation is presented below.

1) The relationship between discharge and infiltration is very strong; discharge increases as infiltration increases. However, infiltration increases rapidly and then reaches a relatively constant value (for example, 115.50, 149.00, or 101.00 cm·h^{-1}), so the increase in discharge is also rapid.





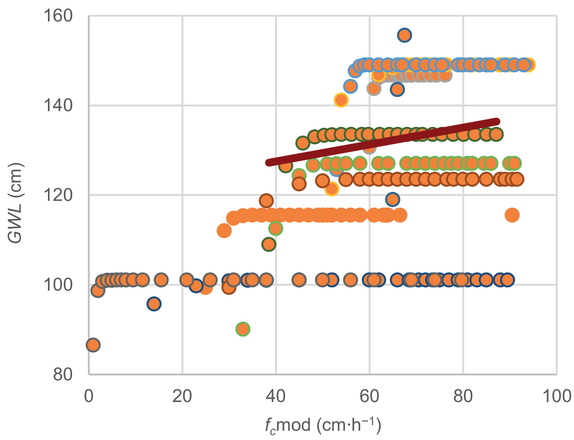


Fig. 4. Relationship between discharge (Q), infiltration ($f_c$mod), and groundwater level (GWL); source: own study

Table 5. Pearson correlation

Pairs of variables	Correlation (r)	Interpretation
Discharge (Q) – infiltration ($f_c$mod)	0.98	very strong positive relationship – the increase in discharge tends to be followed by an increase in infiltration, but the infiltration value rapidly reaches maximum capacity
Discharge (Q) – groundwater level (GWL)	0.99	very strong positive relationship – greater discharge causes the groundwater level to rise
Infiltration ($f_c$mod) – groundwater level (GWL)	0.99	very strong positive relationship – high infiltration is followed by a rise in groundwater level

Source: own study.

2) The relationship between discharge and groundwater level (GWL) is very strong; high discharge tends to occur when the groundwater level is high. This shows that the groundwater system responds quickly to water supply.
3) The relationship between infiltration and GWL is very strong. There is a trend whereby high infiltration fills the groundwater and increases the GWL, but the effect is limited once infiltration is saturated.

CONCLUSIONS

Analysis using modified Horton infiltration with the addition of moisture in the simple injection-simulator tool produced a very strong relationship between discharge and simulated infiltration by the modified Horton method, a very strong relationship between discharge and groundwater level, and a very strong relationship between modified Horton infiltration and groundwater level at moderate peat depth (>1 m).

The infiltration development model of the modified Horton model in tropical peatland is better than the original Horton infiltration model because peat is porous, infiltration increases with increasing water volume, and the soil moisture increases. In addition, the injection well increases the infiltration-capacity system, whereas the Horton model calculates only natural infiltration.

CONFLICT OF INTERESTS

All authors declare that they have no conflict of interests.

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