

Green & Ampt equation

At any time, t , the penetration of the infiltrating wetting front will be Z . Darcy's law can be stated as follows:

$$\frac{dI}{dt} = -K_s \left[\frac{h_f - (h_s + Z)}{Z} \right]$$
 where K_s is the hydraulic conductivity corresponding to the surface water content, and $I(t)$ is the cumulative infiltration at time t , and is equal to $Z(\theta_s - \theta_0)$.

Using this relation for $I(t)$ to eliminate Z and performing the integration yields,

$$I = K_s t - (h_f - h_s) (\theta_s - \theta_0) \log_e \left(1 - \frac{I}{(h_f - h_s)(\theta_s - \theta_0)} \right)$$

```
\centering
\begin{tabular}{ l l l l }
```

with $I(t)$ & infiltration amount $[cm]$

& K_s & hydr. conductivity & $[cm/h]$ \\
& h_f & wetting front pressure head (negative) & cm \\
& h_s & water pressure at surface (ponding) & cm \\
& θ_s & moisture content at saturation & $-$ \\
& θ_0 & antecedent moisture & $-$ \\

$\end{tabular}$ In order to solve this equation, we need to bring $I(t)$ to one side of the equation:

$$\frac{1}{K_s} \left[I - (h_f - h_s)(\theta_s - \theta_0) \log_e \left(1 - \frac{I}{(h_f - h_s)(\theta_s - \theta_0)} \right) \right] = t$$

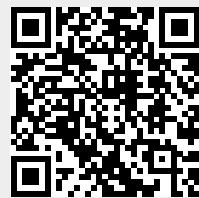
The R-program to calculate infiltration amounts with Green & Ampt looks like this:

|Greem-Ampt.R

```
<<GreenAmpt, fig=TRUE, height=4.0, echo=FALSE>>=
I      <- seq(0,100,by=1.0)
t0    <- 0.05
ts    <- 0.25
hs    <- 0.0 # cm
hf    <- -12.0 # cm
Ks    <- 8.0 # cm/hour
t     <- 1/Ks*((I-(hf-hs)*(ts-t0))*log(1-(I/((hf-hs)*(ts-t0)))))

# hours
plot(t,I,xlim=c(0,6),ylim=c(0,25),xlab="t [hour]", ylab="I in
[cm]")
```

From:
<https://hydro-wiki.de/> -



Permanent link:
<https://hydro-wiki.de/en/hydro/greenampt?rev=1508874655>

Last update: **2024/04/10 10:14**