

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:

$$q = \frac{dI}{dt} = -K_s * \left[\frac{h_f - (h_s + Z)}{Z} \right]$$
 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	& $[-]$	\\

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

[\[Green-Ampt.R\]](#)

```
<<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=1508874718>

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

