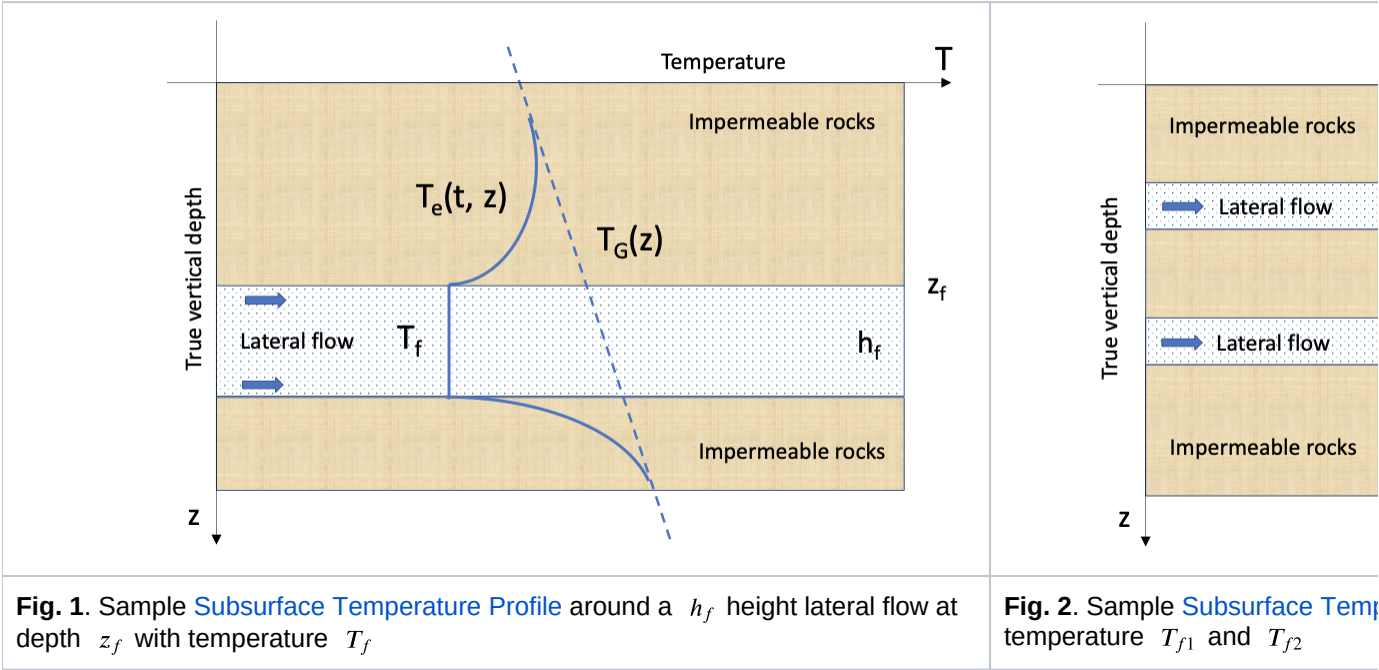


Subsurface Temperature Profile around Lateral Flow

Analytical @model

Motivation

Subsurface Temperature Profile around Lateral Flow makes adjustments to Geothermal Temperature Profile $T_G(z)$ to account for the lateral reservoir flow with a constant temperature (see Fig. 1 and Fig. 2).



Outputs

$T_e(t, z)$	Subsurface temperature distribution
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Inputs

t	Time lapse after the temperature step from $T_e(z = 0) = 0$ up to $T_e(z = 0) = T_f$
z	Spatial coordinate along the transversal direction to constant temperature $T_e(z) = T_f$ plane $z = 0$
z_f	TVDss of the top of the lateral flow unit
h_f	True vertical thickness of the lateral flow unit

T_f	Boundary temperature at $z = 0$
a_e	Thermal diffusivity of the surroundings
$T_G(z)$	Geothermal Temperature Profile

Equations

Driving equation	Initial conditions	Boundary conditions
(1) $\frac{\partial T_e}{\partial t} = a_e^2 \Delta T_e = a_e^2 \frac{\partial^2 T_e}{\partial z^2}$	(2) $T_e(t = 0, z) = T_G(z)$	(3) $T_e(t, z_f \leq z \leq z_f + h_f) = T_f = \text{const}$ (4) $T_e(t, z \rightarrow \infty) = T_G(z)$

Solution

(5)	if $z < z_f \implies T_e(t, z) = T_f + (T_G(z) - T_f) \cdot \text{erf}\left(\frac{z_f - z}{\sqrt{4a_e t}}\right)$
(6)	if $z_f \leq z \leq z_f + h_f \implies T_e(t, z) = T_f$
(7)	if $z > z_f + h_f \implies T_e(t, z) = T_f + (T_G(z) - T_f) \cdot \text{erf}\left(\frac{z - z_f - h_f}{\sqrt{4a_e t}}\right)$

where

$\text{erf}(x)$	Error function
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See Also

[Geology / Geothermal Temperature Field / Geothermal Temperature Profile](#)

[Physics / Fluid Dynamics / Linear Fluid Flow](#)

[[Temperature Flat Source Solution @model](#)] [[Geothermal Temperature Profile @model](#)]

Reference

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