

# Geothermal Temperature Field @model

@wikipedia

## Motivation

In some specific subsurface applications which require the knowledge of subsurface temperature distributions the assumption of the Constant Areal Geothermal Temperature Profile is not valid and the problem requires a proper 3D modelling solution.

## Outputs

$T_G(t, \mathbf{r})$	Along-hole Geothermal Temperature Profile
$G_T(\mathbf{r})$	Geothermal Temperature Gradient

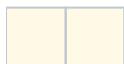
## Inputs

$t$	Local Calendar Time
$\mathbf{r}$	Position vector
$z(l)$	Wellbore trajectory True Vertical Depth Sub-Sea (TVDss)
$\mathbf{j}(x, y, z = z_{ref})$	Earth's Heat Flux at some reference depth $z = z_{ref}$ as function of $(x, y)$
$q(\mathbf{r})$	Volumetric density of heat sources distributed throughout the subsurface rock volume
$T_s(t, x, y)$	Surface temperature based on weather reports
$\lambda_e(\mathbf{r})$	Subsurface Thermal Conductivity profile as function of position vector
$a_e(\mathbf{r})$	Subsurface Thermal diffusivity profile as function of position vector

where

$l$	Measured Depth of wellbore trajectory with reference to Earth's surface ( $l = 0$ )
$z_s = z(l = 0)$	TVDss of the Earth's surface in a given location. In case the Earth's surface is at sea level then $z_s = 0$

## Assumptions



# Equations

(1) $\rho_e c_e \frac{\partial T_G}{\partial t} + \nabla (\lambda_e \nabla T_G) = q(\mathbf{r})$	(2) $T_G(t, x, y, z = z_s) = T_s(t, x, y)$	(3) $\left[ \lambda_e \nabla T_G \right]_{z=z_{ref}} = \mathbf{j}(x, y, z = z_{ref})$
(4) $G_T(\mathbf{r}) = \frac{j_z(\mathbf{r})}{\lambda_e(\mathbf{r})}$		

## See Also

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[Geology / Geothermal Temperature Field](#)

[ [Constant Areal Geothermal Temperature Profile @model](#) ] [ [Geothermal Temperature Gradient](#) ]

## References

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