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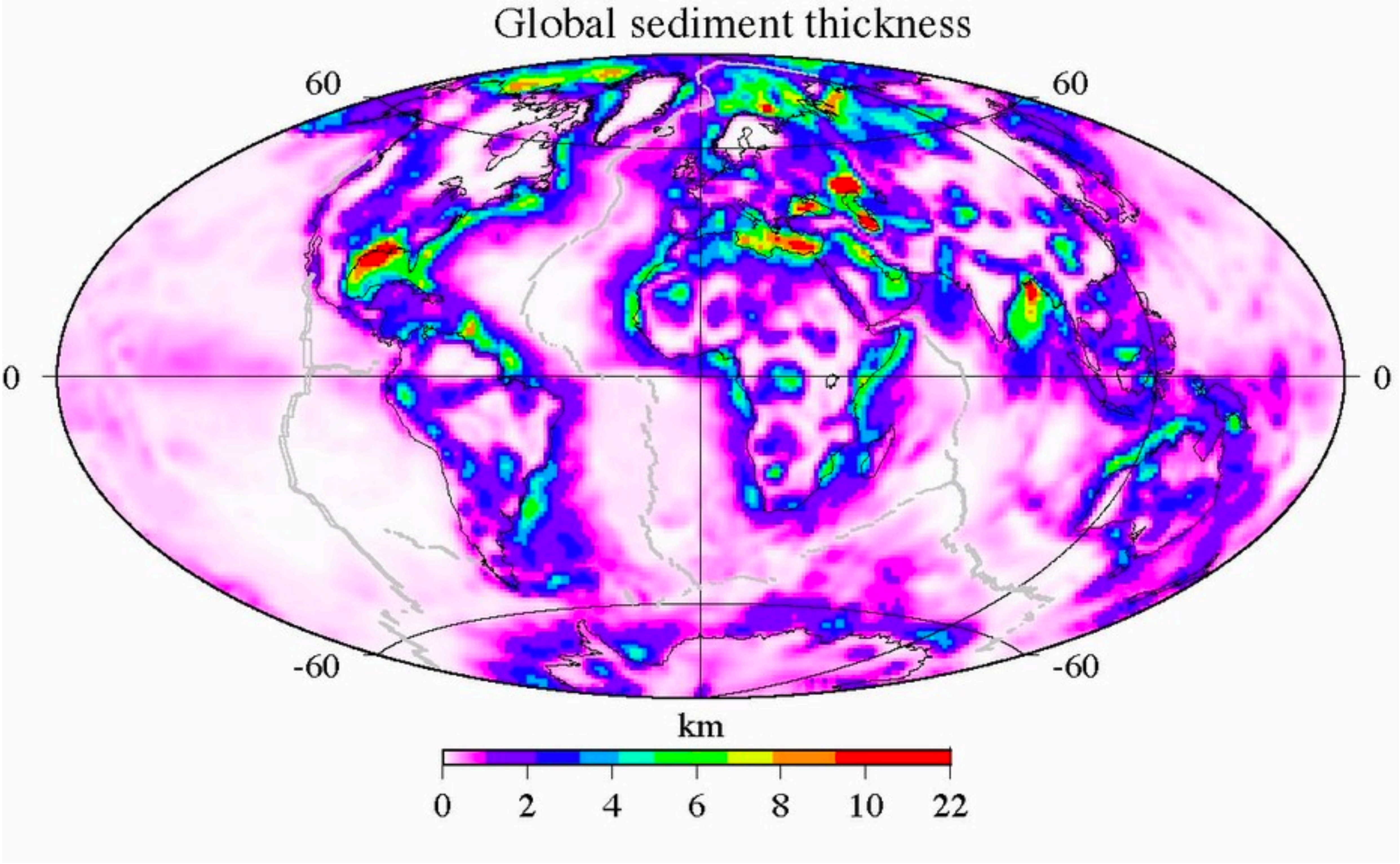
$$\frac{\partial u}{\partial t} = \alpha \nabla^2 u$$

Equação de difusão

Aplicação de soluções analíticas em problemas de condução de calor

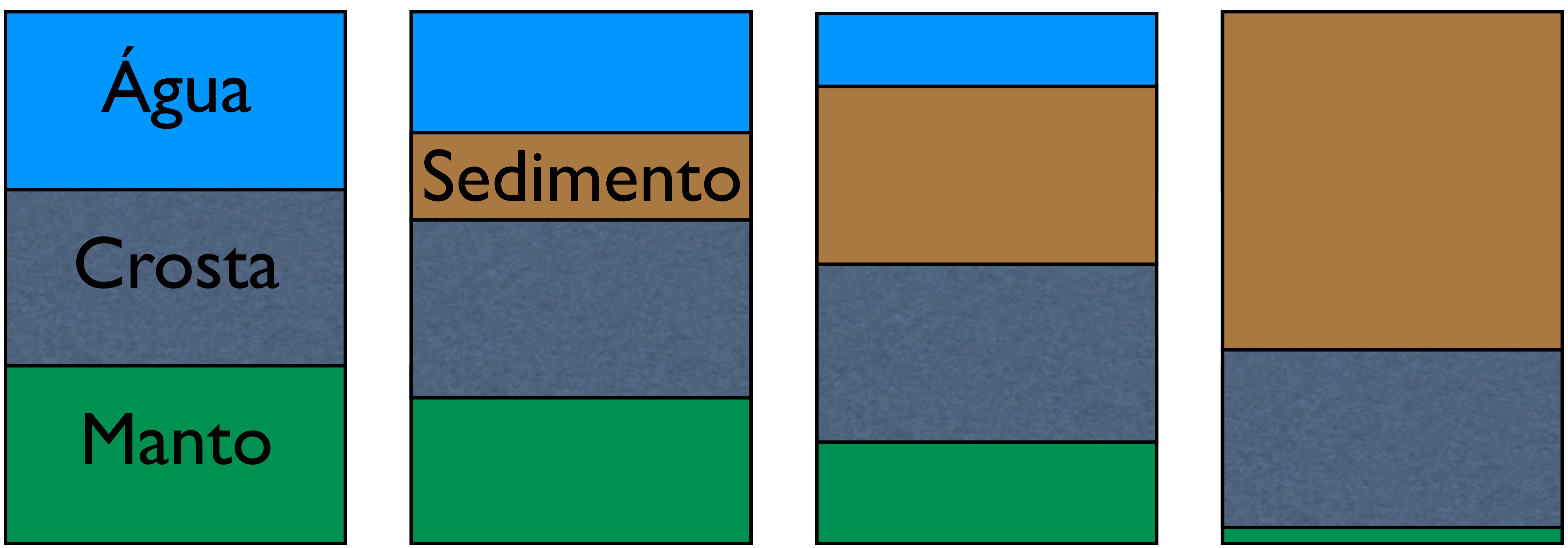
Modelo de McKenzie (1978)



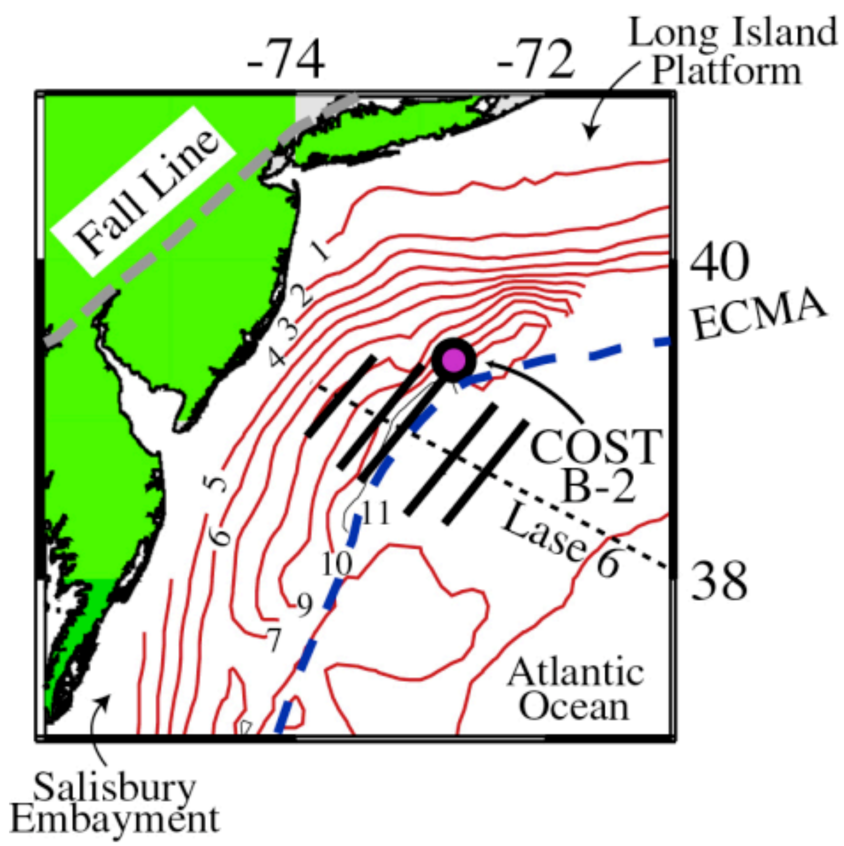
Laske and Masters (1997)

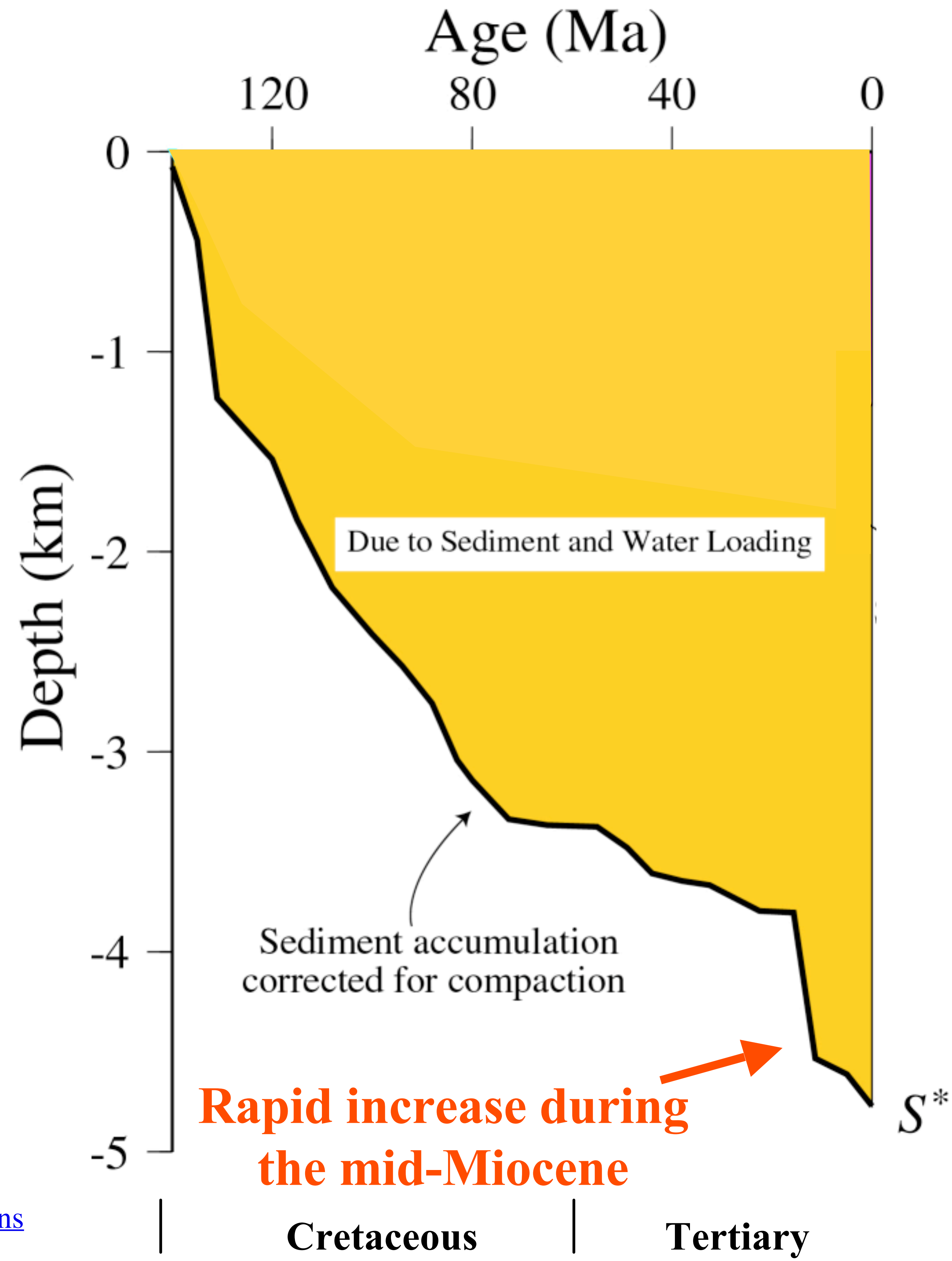
https://wattsgeophysics.co.uk/research/sedimentary-basins

Subsidência das bacias sedimentares



Subsidência observada





https://wattsgeophysics.co.uk/research/sedimentary-basins

Dan McKenzie

https://www.bl.uk/voices-of-science/interviewees/dan-mckenzie?mobile=off

SOME REMARKS ON THE DEVELOPMENT OF SEDIMENTARY BASINS

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Received December 14, 1977
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Modelo de Mckenzie (1978)

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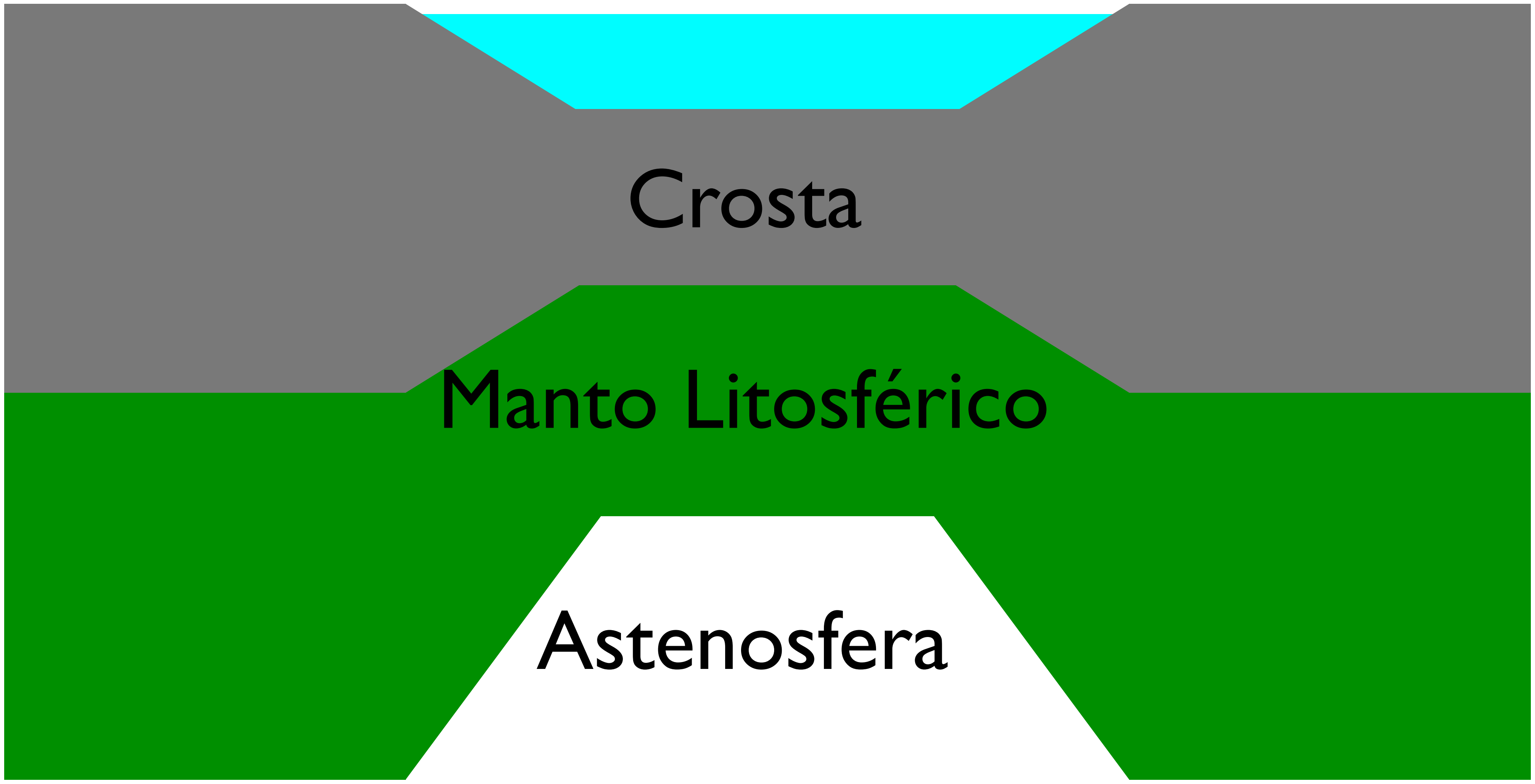

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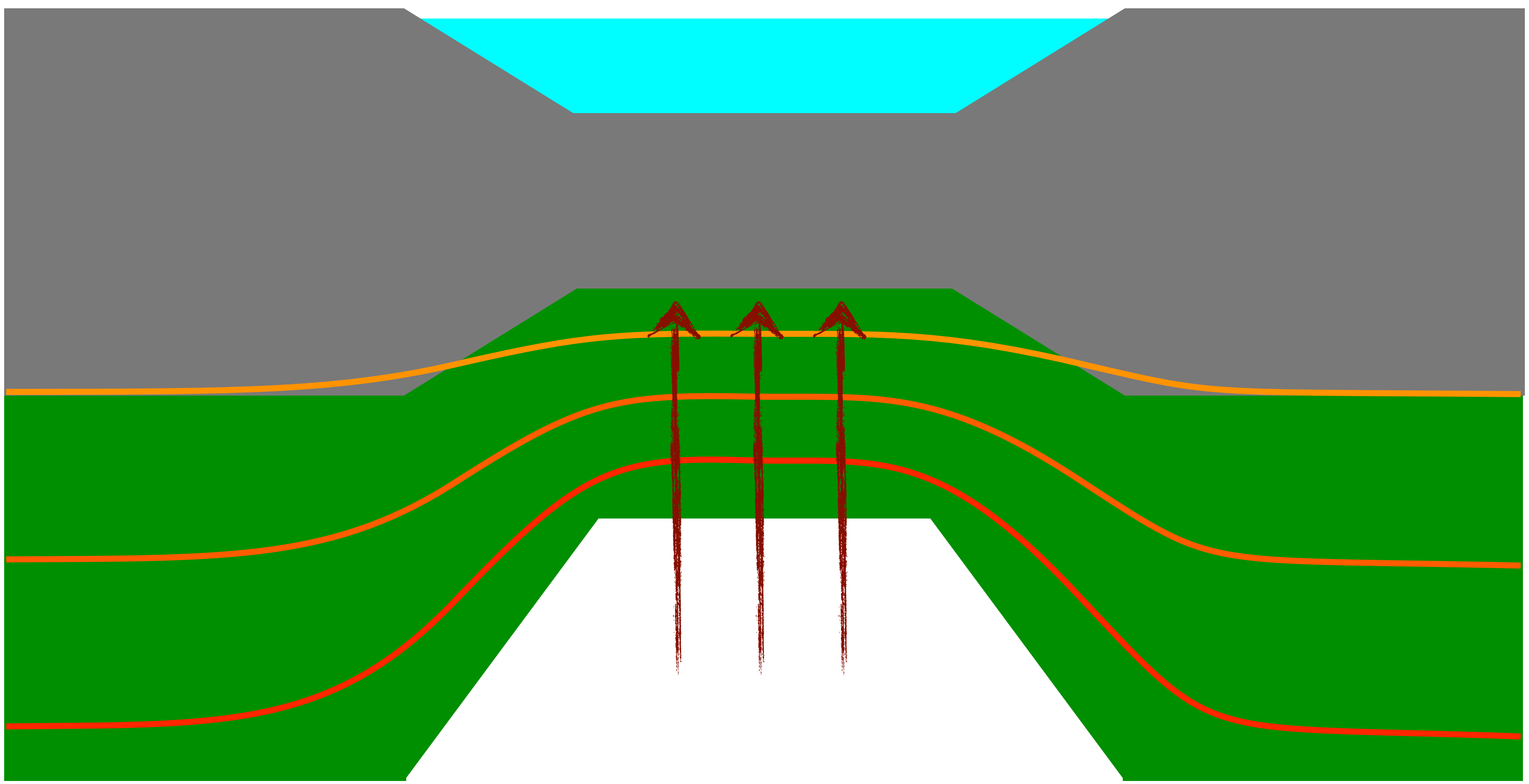
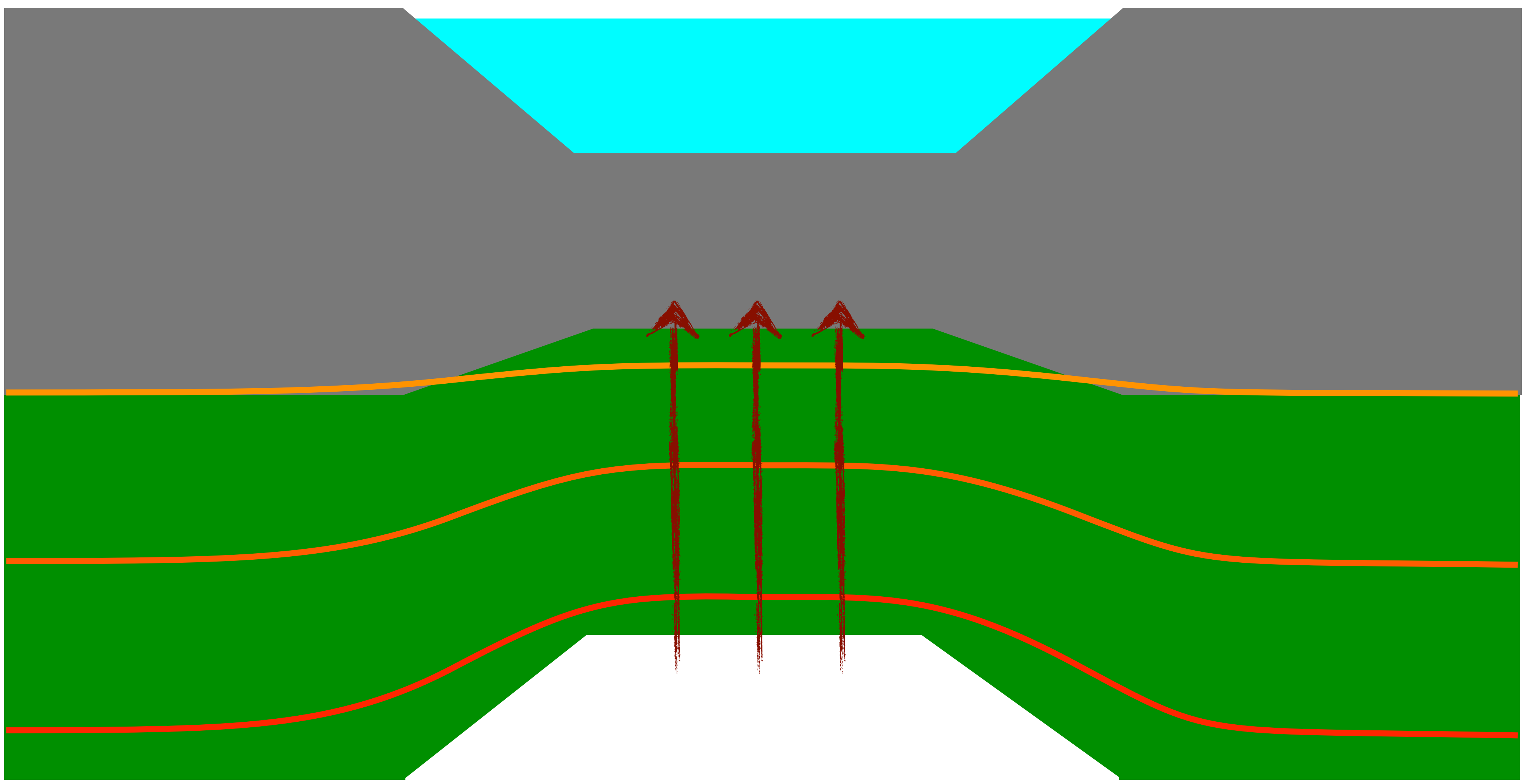
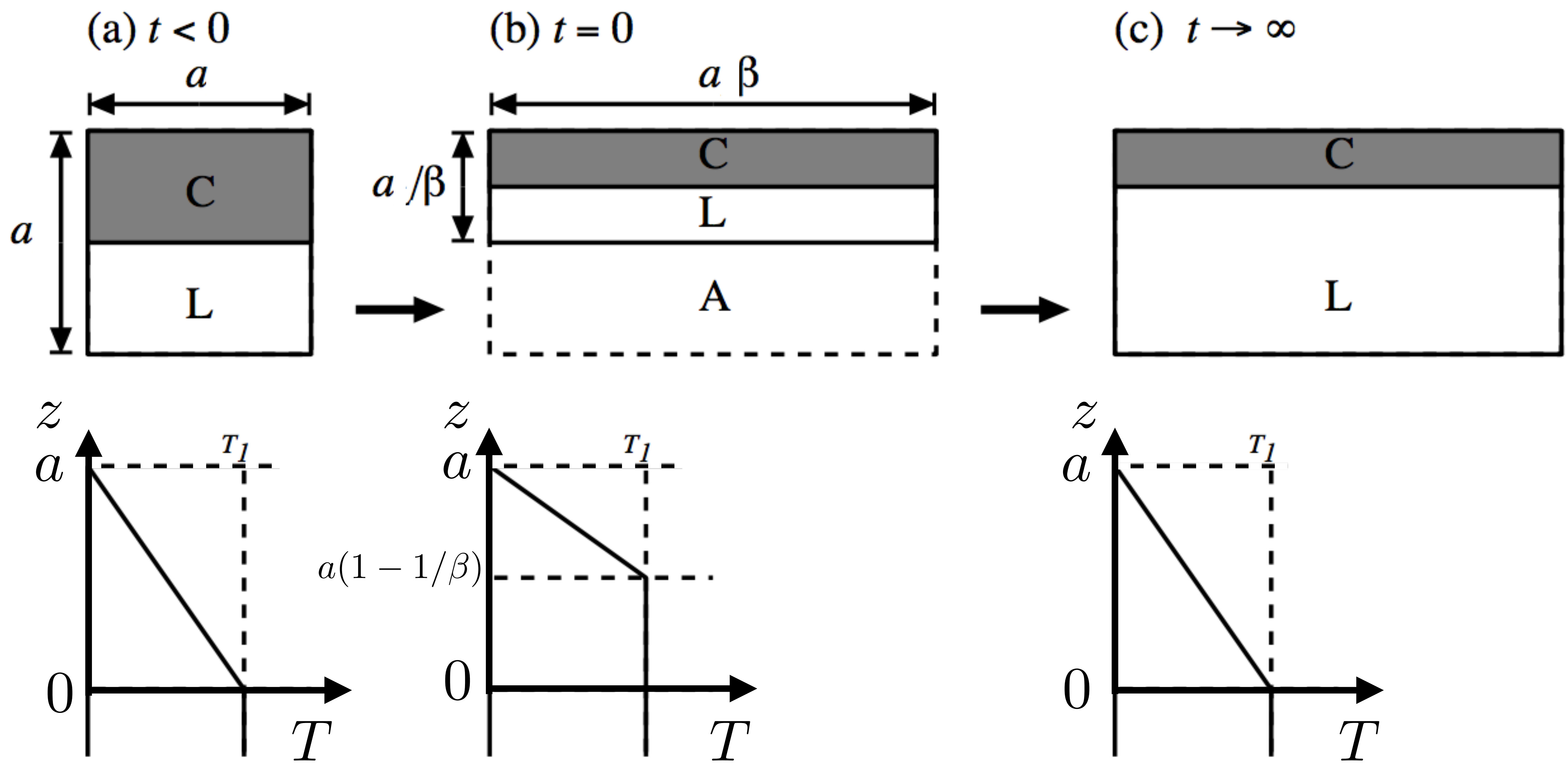
Modelo de Mckenzie (1978)



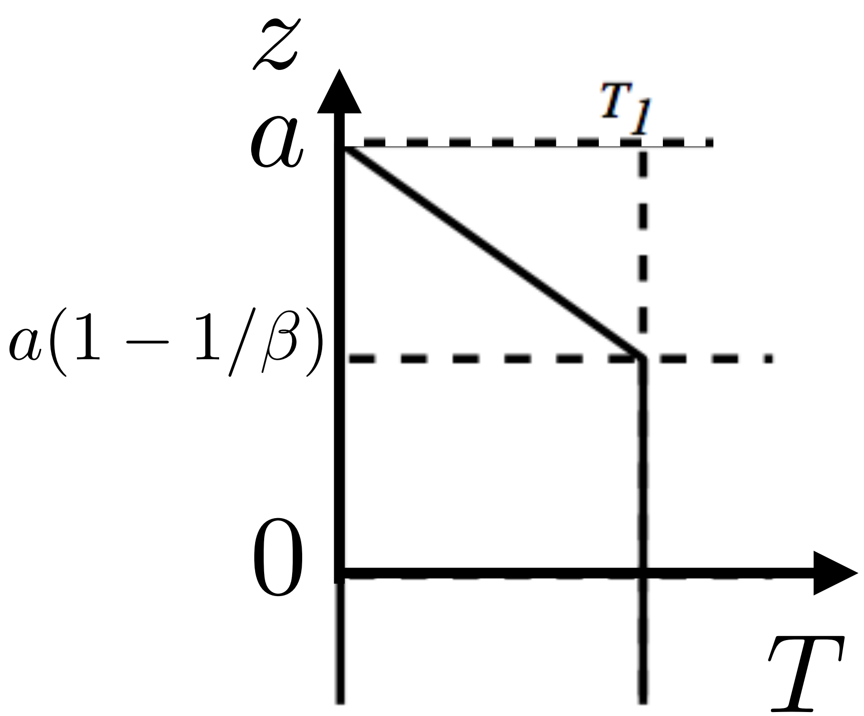
Modelo de Mckenzie (1978)



Modelo de McKenzie (1978)

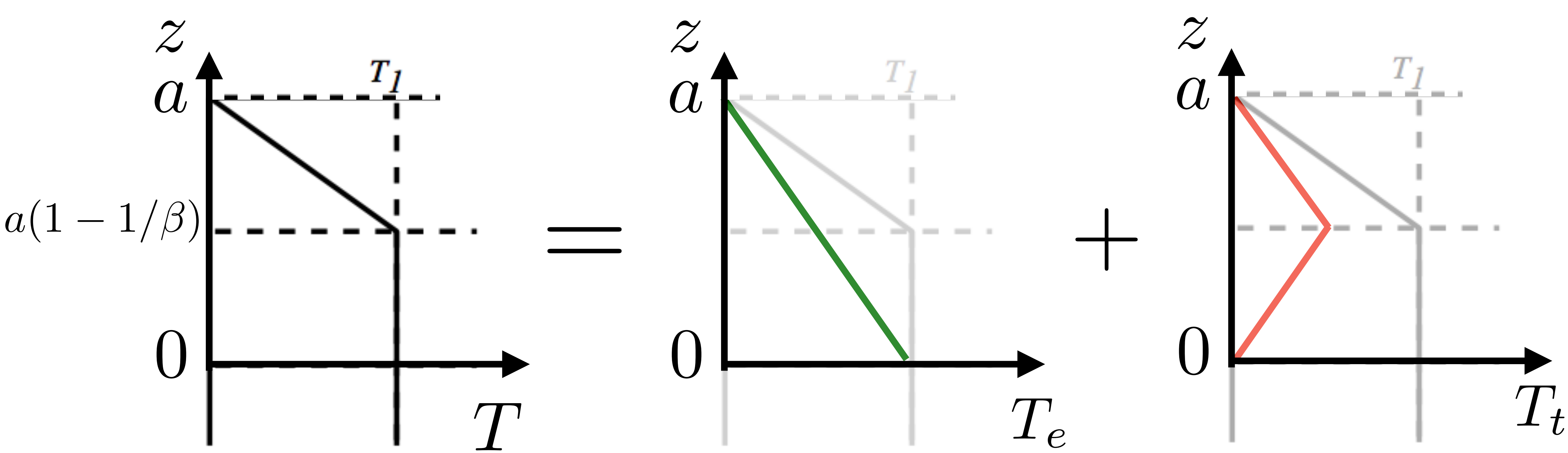


Modelo de McKenzie (1978)



$$T = T_1\beta\left(1 - \frac{z}{a}\right) \qquad a\left(1-\frac{1}{\beta}\right) < z < a$$

$$T = T_1 \qquad 0 < z < a\left(1-\frac{1}{\beta}\right)$$



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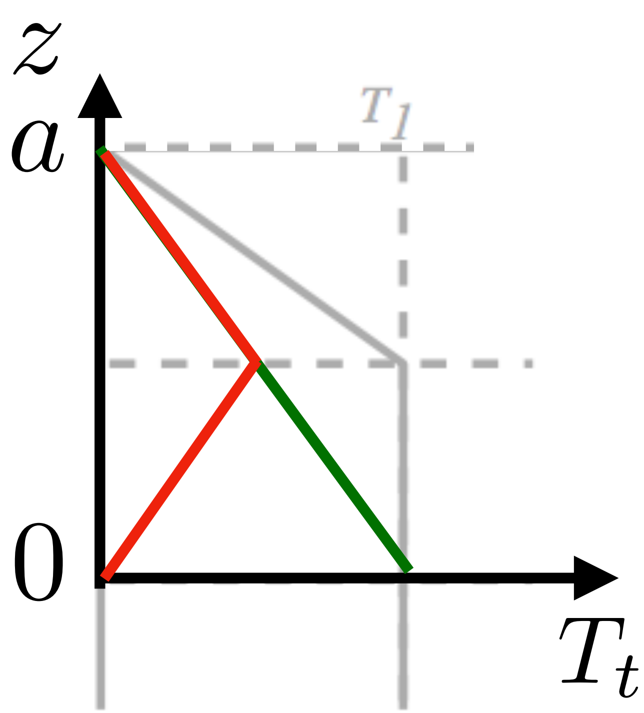
Modelo de McKenzie (1978)

$$T = T_e + T_t$$



$$T = T_1 \qquad 0 < z < a\left(1 - \frac{1}{\beta}\right)$$

$$T = T_1\beta\left(1 - \frac{z}{a}\right) \qquad a\left(1 - \frac{1}{\beta}\right) < z < a$$

$$T_e = T_1\left(1 - \frac{z}{a}\right)$$

$$T_t = T_1\frac{z}{a} \quad 0 < z < a\left(1 - \frac{1}{\beta}\right)$$

$$T_t = T_1(\beta - 1)\left(1 - \frac{z}{a}\right) \qquad a\left(1 - \frac{1}{\beta}\right) < z < a$$

Equação de difusão $$\frac{\partial u}{\partial t} = \alpha \frac{\partial^2 u}{\partial x^2}$$

Condição inicial $$u(x,0) = f(x) \;\; \forall\, x \in [0, L]$$

Condição contorno $$u(0,t) = u(L,t) = 0 \;\; \forall\, t \geq 0$$

$$u(x,t) = \sum_{k=1}^{\infty} D_k \sin \frac{k\pi}{L} x \cdot e^{-\alpha \frac{k^2 \pi^2}{L^2} t}$$

$$D_k = \frac{2}{L} \int_0^L f(x) \sin \frac{k\pi x}{L} dx$$

$$T_t(z,t) = \sum_{k=1}^{\infty} D_k \sin \frac{k\pi}{a} z \cdot e^{-\alpha \frac{k^2 \pi^2}{a^2} t}$$

$$D_k = \frac{2}{a} \int_0^a T_i(z) \sin \frac{k\pi z}{a} dz$$

$$
\begin{aligned}
D_k &= \frac{2}{a}\int_0^a T_i(z)\sin\frac{k\pi z}{a}dz \\
&= \frac{2}{a}\left[\int_0^{a(1-1/\beta)} T_1\frac{z}{a}\sin\frac{k\pi z}{a}dz + \int_{a(1-1/\beta)}^{a} T_1(\beta-1)\left(1-\frac{z}{a}\right)\sin\frac{k\pi z}{a}dz\right] \\
&= \frac{2}{a}\left[\frac{aT}{\pi^2k^2}\left(\sin\cancel{\frac{\pi(\beta-1)k}{\beta}} - \cancel{\frac{k\pi}{\beta}(\beta-1)\cos\frac{\pi(\beta-1)k}{\beta}}\right) + \right. \\
&\quad \left. + \frac{aT}{\pi^2k^2}(\beta-\cancel{1})\left(\sin\frac{\pi(\beta-1)k}{\beta} + \cancel{\frac{k\pi}{\beta}\cos\frac{\pi(\beta-1)k}{\beta}}\right)\right] \\
&= \frac{2T_1\beta}{k^2\pi^2}\sin\frac{\pi(\beta-1)k}{\beta}
\end{aligned}
$$

$$D_k = \frac{2T_1\beta}{k^2\pi^2} \sin \frac{\pi(\beta - 1)k}{\beta}$$

$$T_t(z,t) = \sum_{k=1}^{\infty} D_k \sin \frac{k\pi}{a} z \cdot e^{-\alpha \frac{k^2\pi^2}{a^2} t}$$

$$T = T_e + T_t$$

$$T_e = T_1 \left(1 - \frac{z}{a}\right)$$

$$T(z,t) = T_1 \left(1 - \frac{z}{a} + \sum_{k=1}^{\infty} \frac{2\beta}{k^2\pi^2} \sin \frac{\pi(\beta - 1)k}{\beta} \sin \frac{k\pi}{a} z \cdot e^{-\alpha \frac{k^2\pi^2}{a^2} t}\right)$$