

# MELEF

Un modelo numérico para el análisis integral de los recursos hídricos

Agua salada

Agua dulce

Agua subterránea

Agua superficial

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## MELEF

Funcionalidades para todos los tipos de cuencas hidrográficas, componentes del ciclo hidrológico y usos del agua

# Modelo MELEF

Modelización conjunta de las aguas subterráneas y superficiales (*horizontal*)

Flujo subterráneo libre

agua dulce

agua salada

$$n_f \frac{\partial h_f}{\partial t} - n_s \frac{\partial s}{\partial t} = \frac{\partial}{\partial x} \left( K_{xx}(h_f - s) \frac{\partial h_f}{\partial x} \right) + \frac{\partial}{\partial x} \left( K_{xy}(h_f - s) \frac{\partial h_f}{\partial y} \right) + \frac{\partial}{\partial y} \left( K_{yx}(h_f - s) \frac{\partial h_f}{\partial x} \right) + \frac{\partial}{\partial y} \left( K_{yy}(h_f - s) \frac{\partial h_f}{\partial y} \right) + Q$$

$$n_s \frac{\partial s}{\partial t} = \frac{\partial}{\partial x} \left( K_{xx}(s-p) \frac{\partial (s+Gh_f)}{\partial x} \right) + \frac{\partial}{\partial x} \left( K_{xy}(s-p) \frac{\partial (s+Gh_f)}{\partial y} \right) + \frac{\partial}{\partial y} \left( K_{yx}(s-p) \frac{\partial (s+Gh_f)}{\partial x} \right) + \frac{\partial}{\partial y} \left( K_{yy}(s-p) \frac{\partial (s+Gh_f)}{\partial y} \right) + Q$$

Flujo superficial (*Muskingum*)

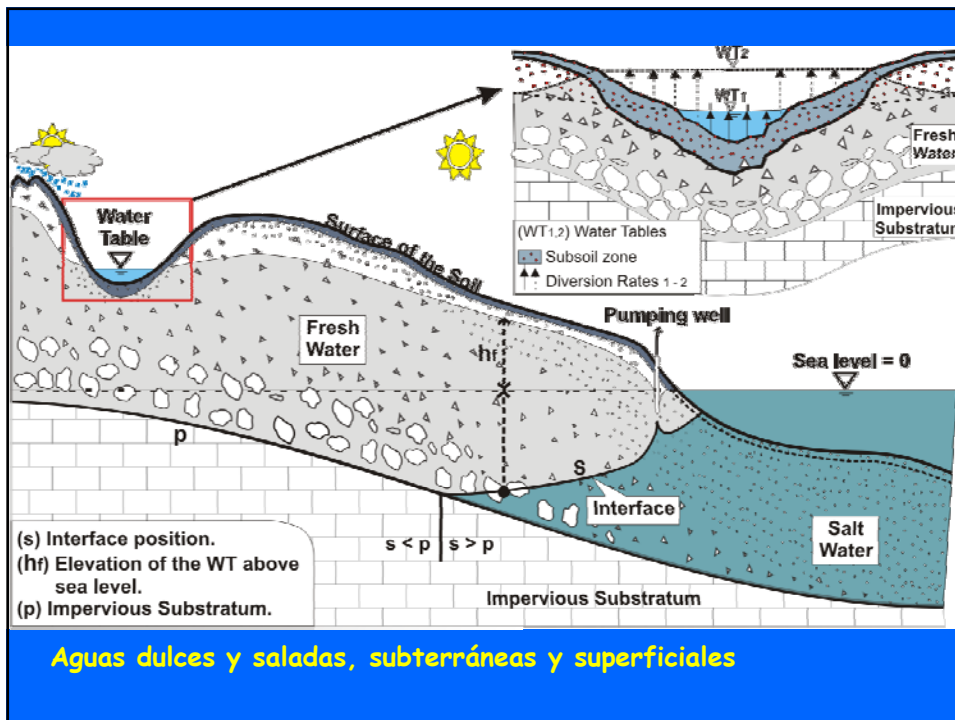
$$\frac{\Delta S}{K} = dQ + d(I-Q)X$$

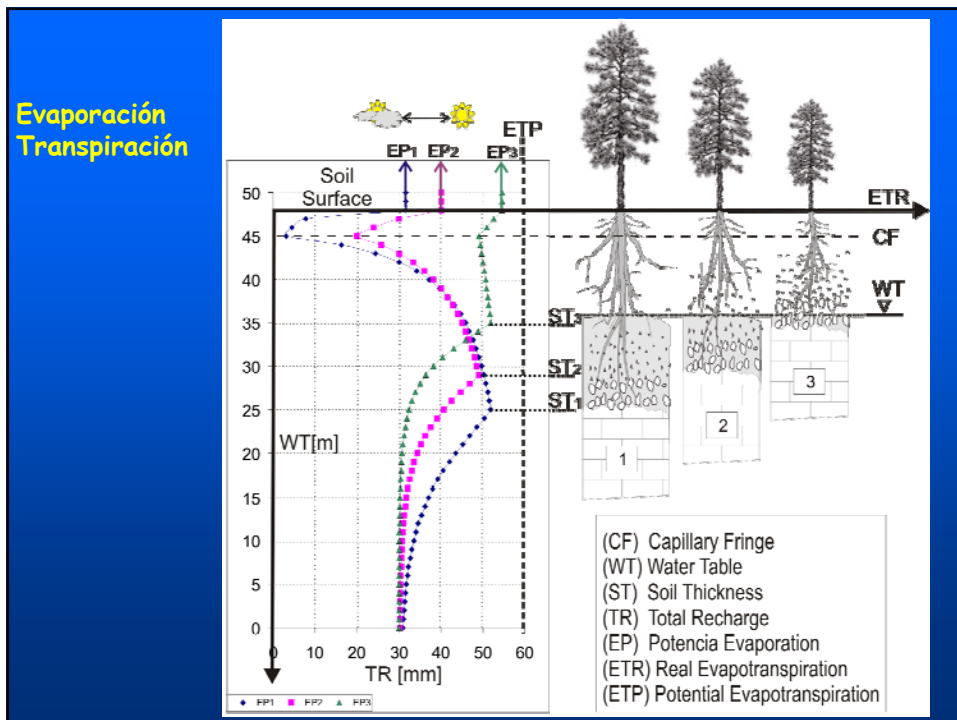
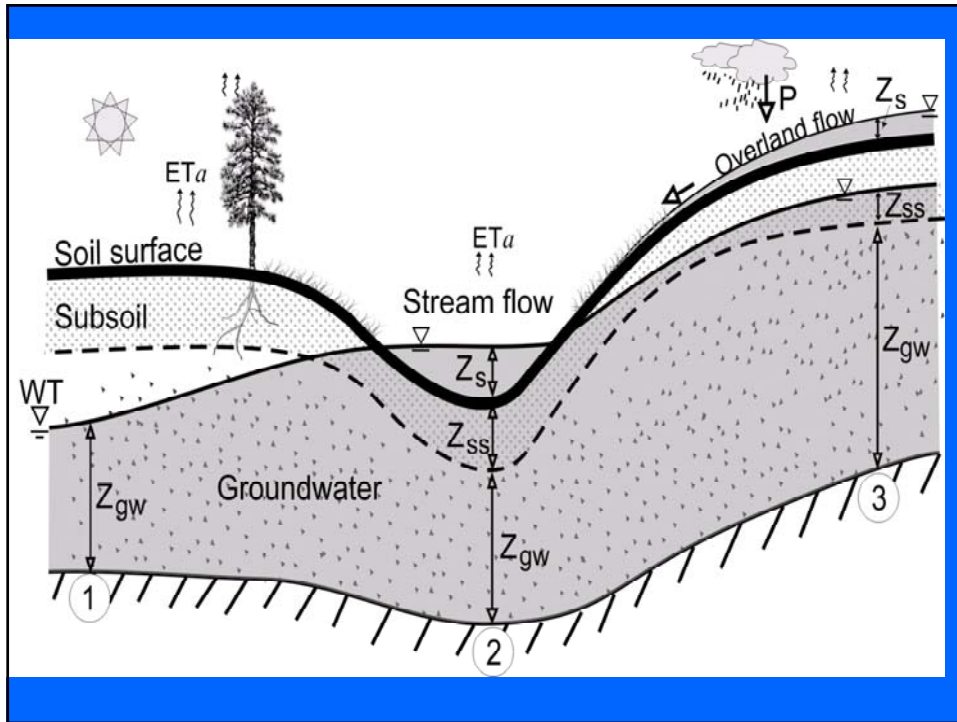
$$\frac{d(I-Q)}{dz_s} = \frac{(I-Q)}{z_s^X}$$

$$(1-X)(I-Q) = dQ$$

$$q = v_s \cdot (1-X) \left( e^{\frac{z+X}{z_s}} - 1 \right) = v_s \cdot f(z_s, X)$$

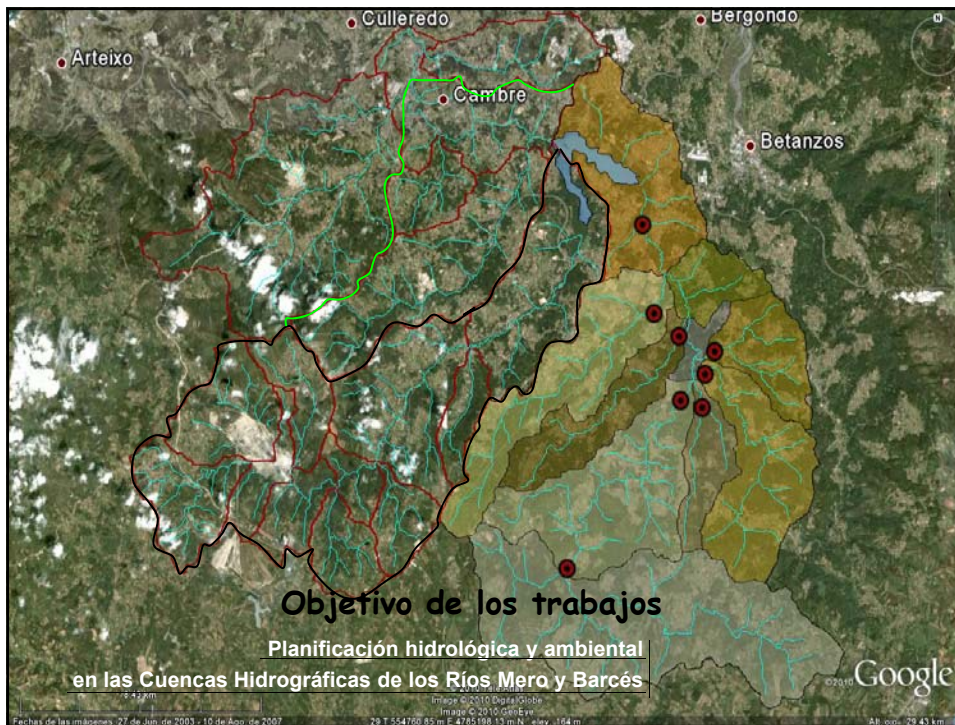
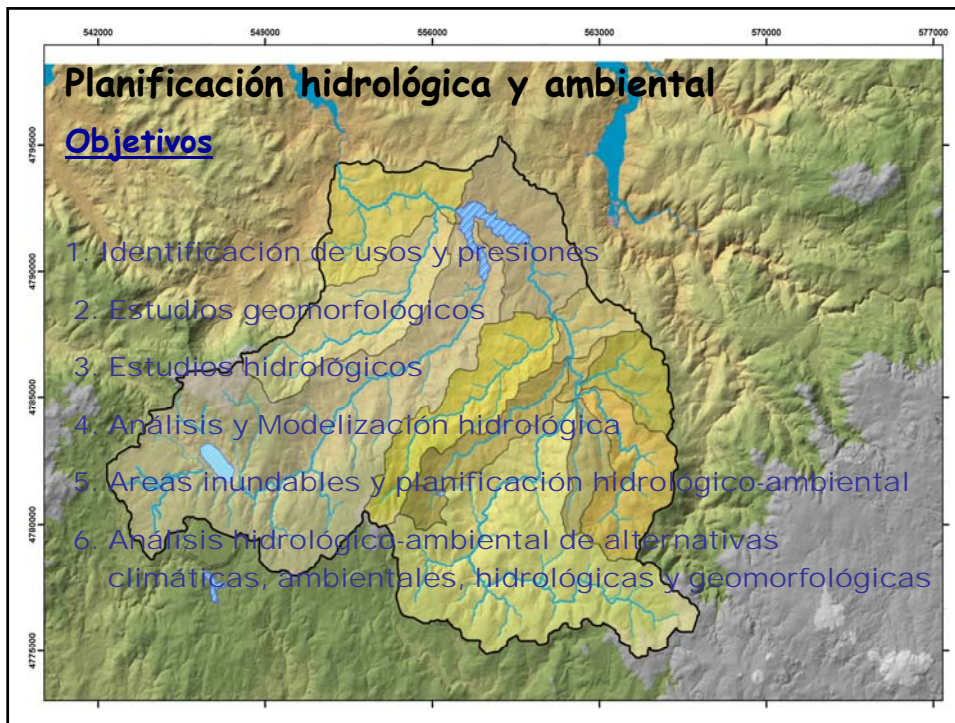
$$q = -K_s \frac{\partial h}{\partial x} \cdot f(z_s, X) = -T^* \frac{\partial h}{\partial x}$$



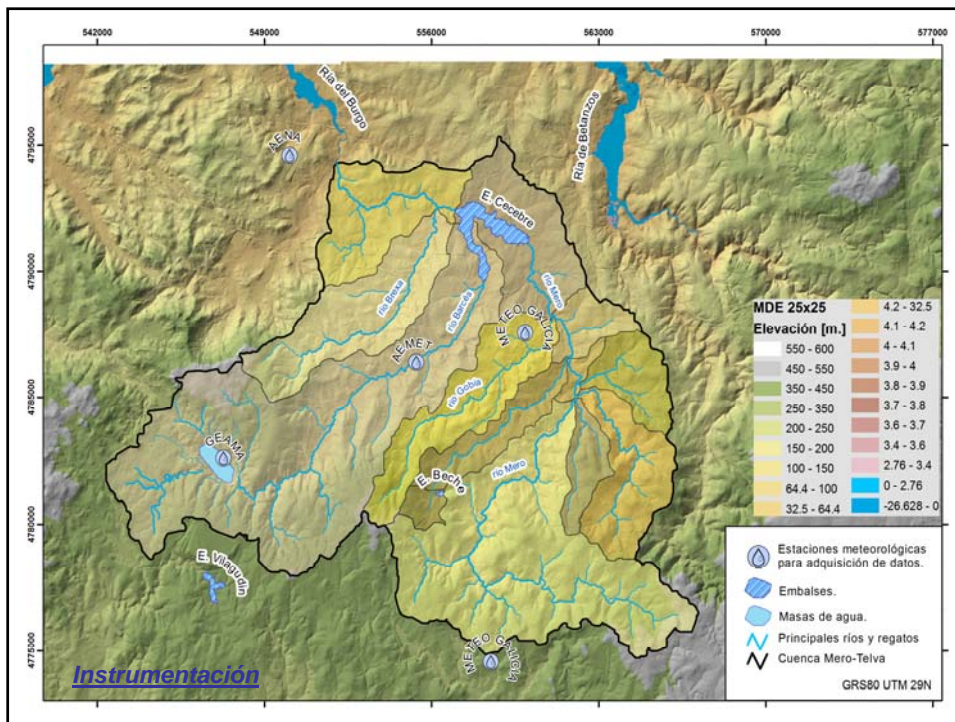
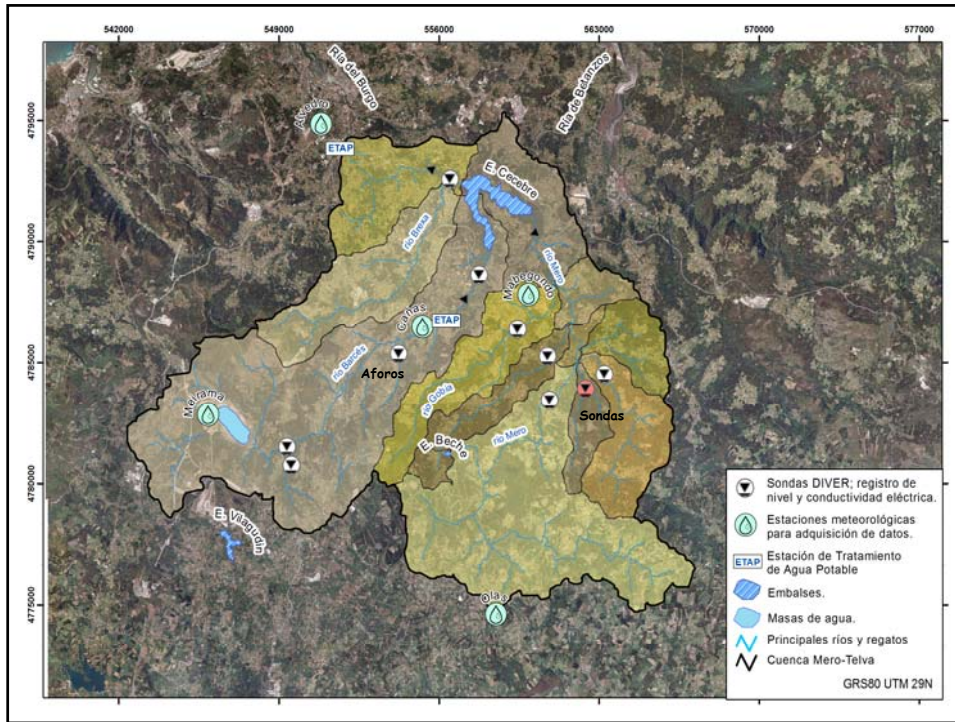


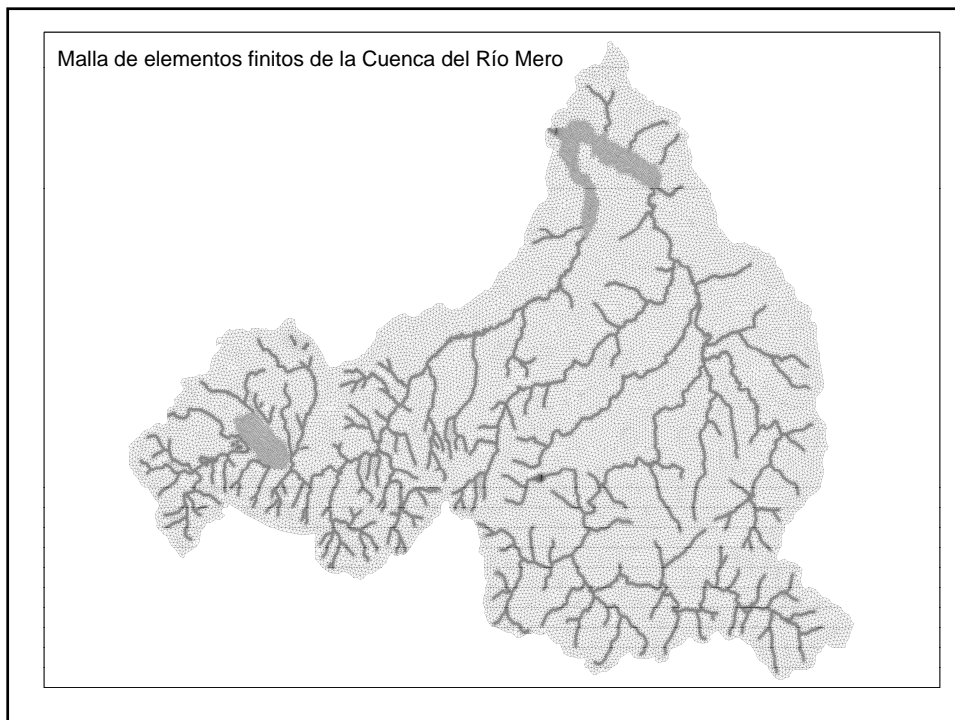
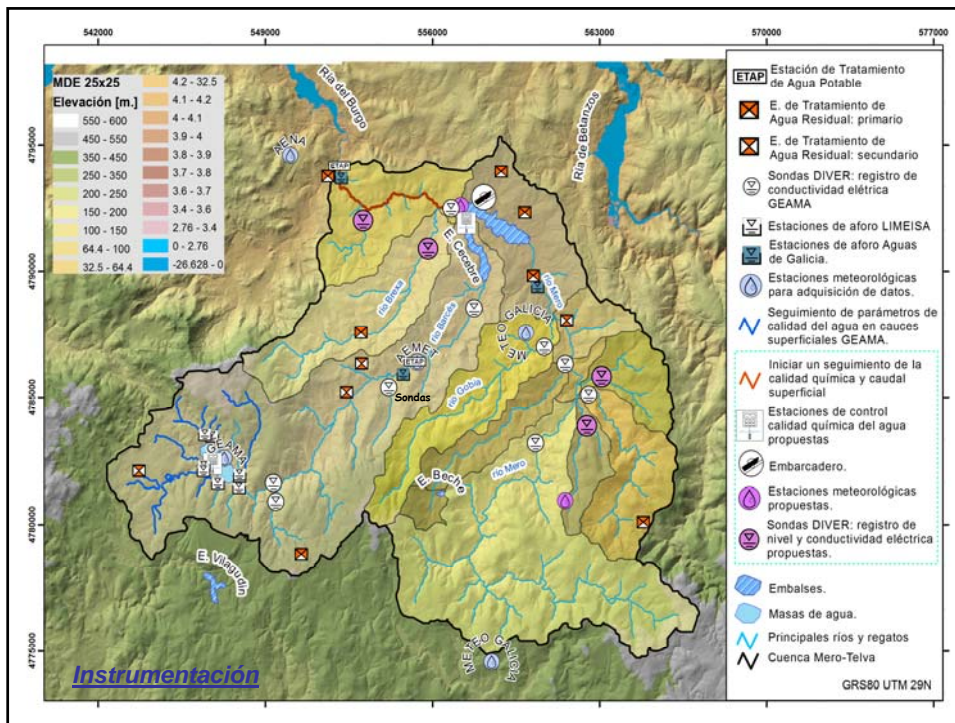






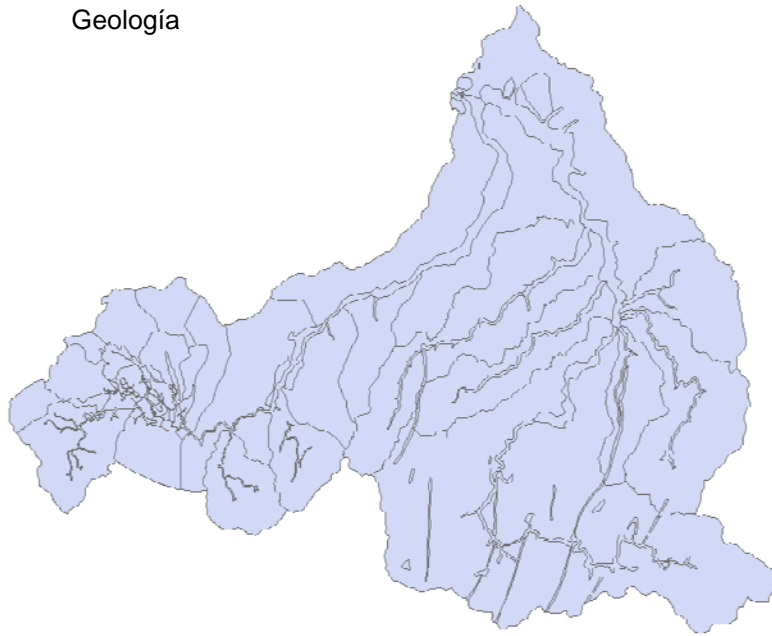




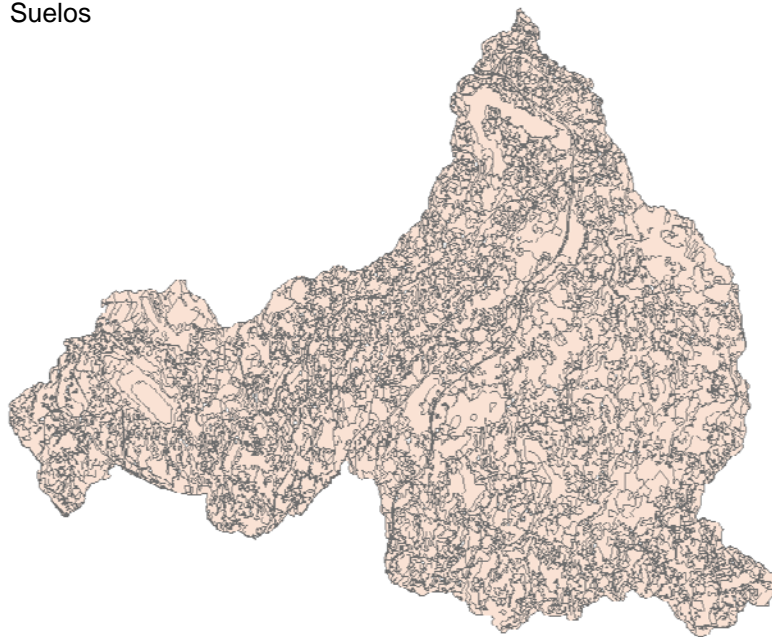




Geología

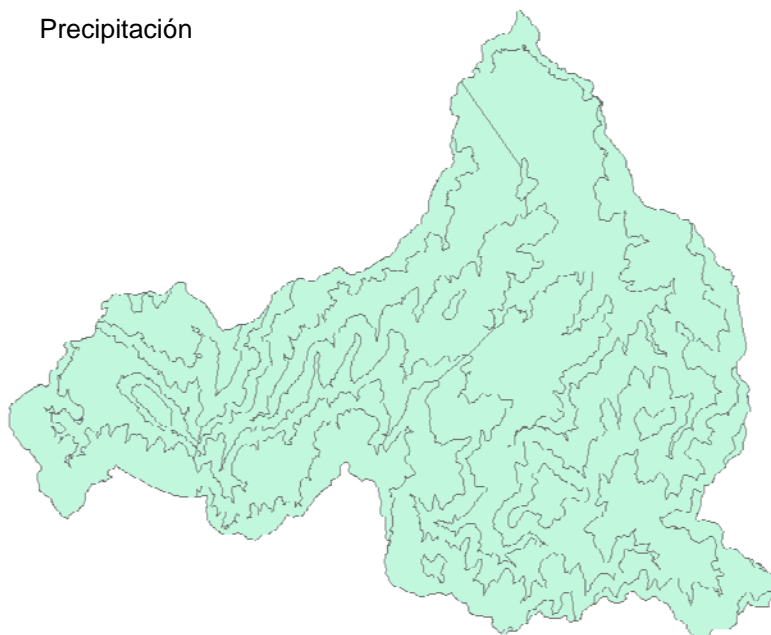


Suelos



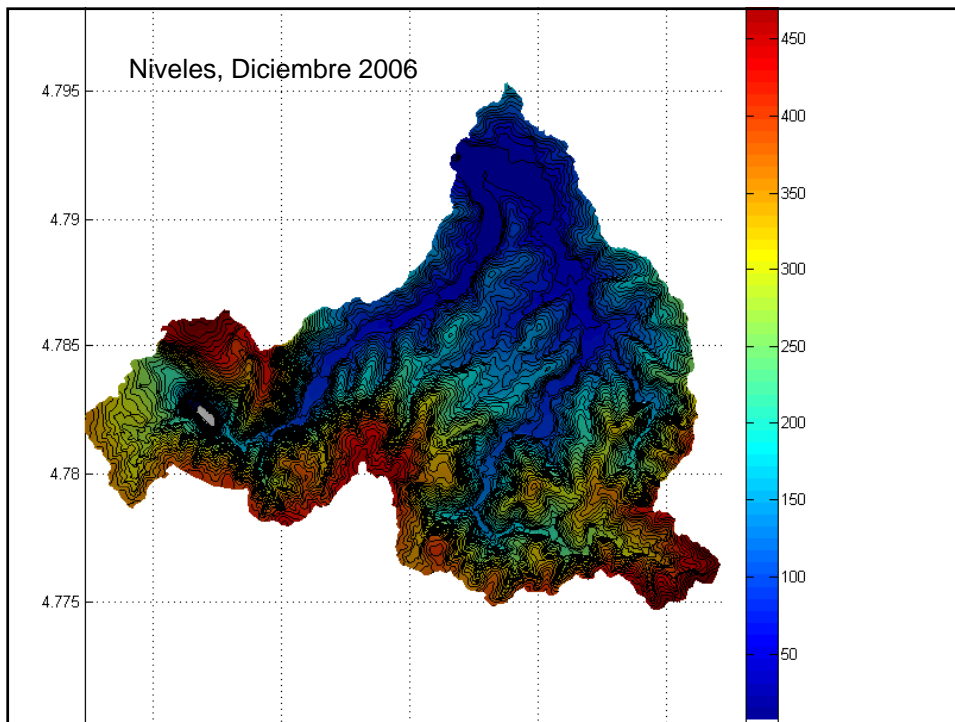
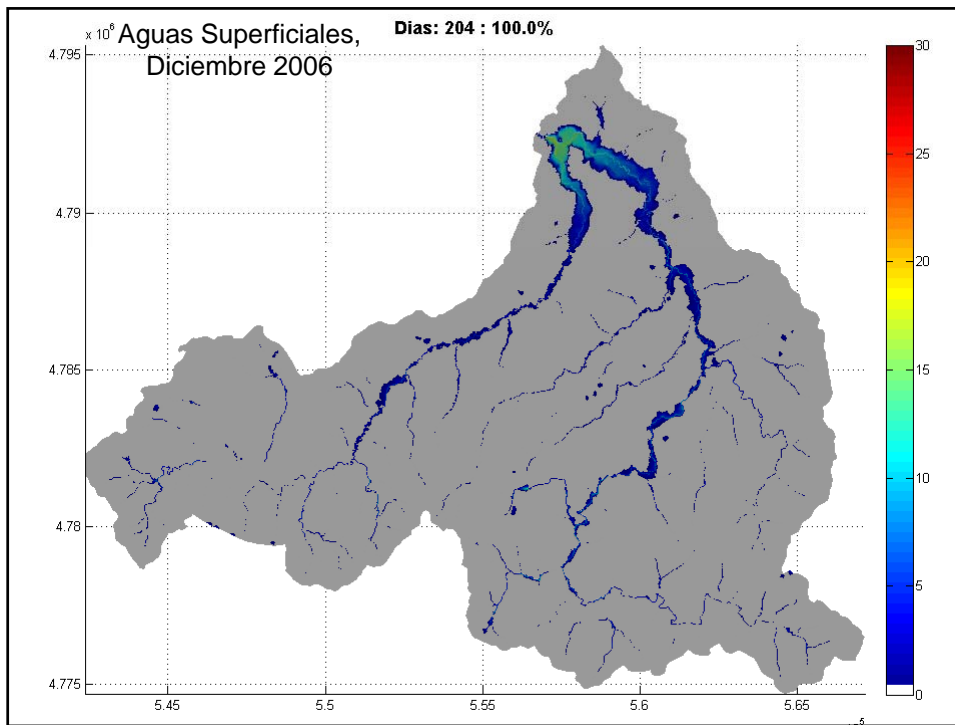


Precipitación

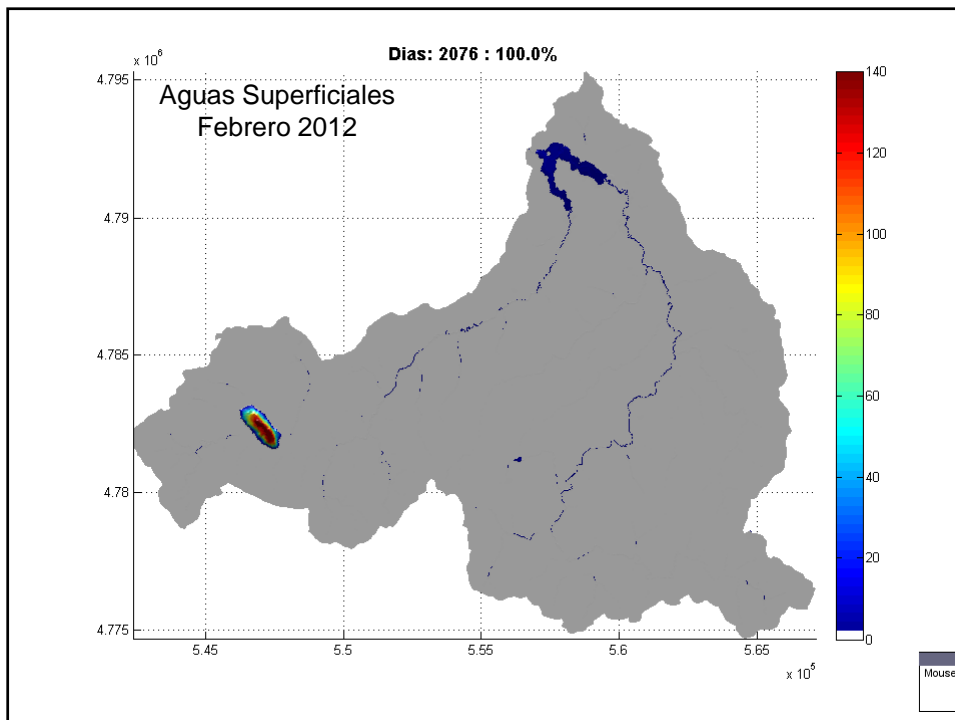
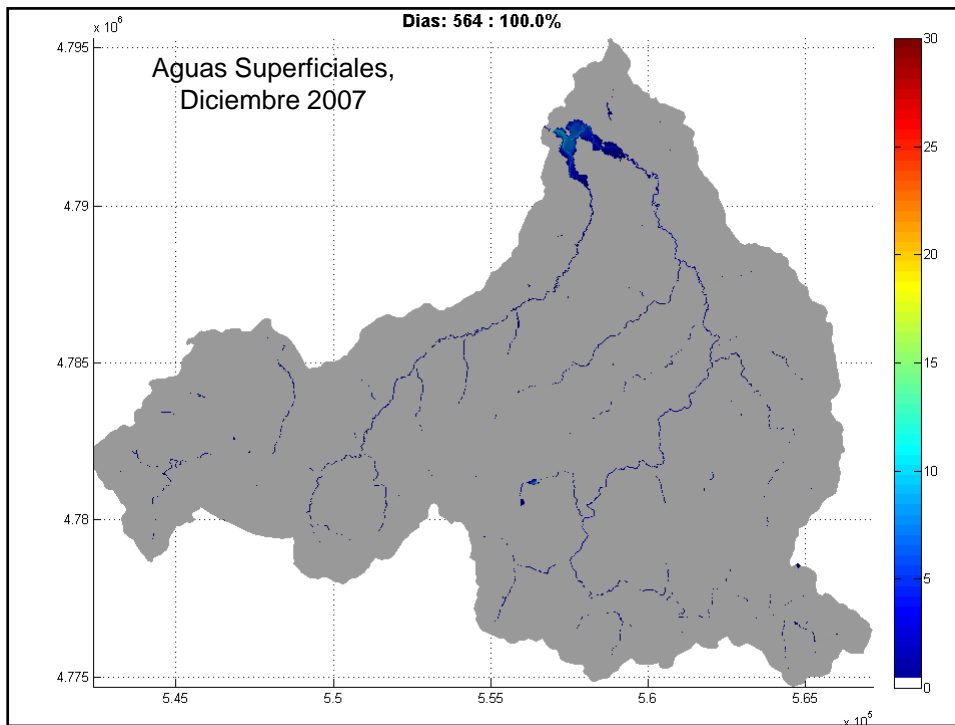


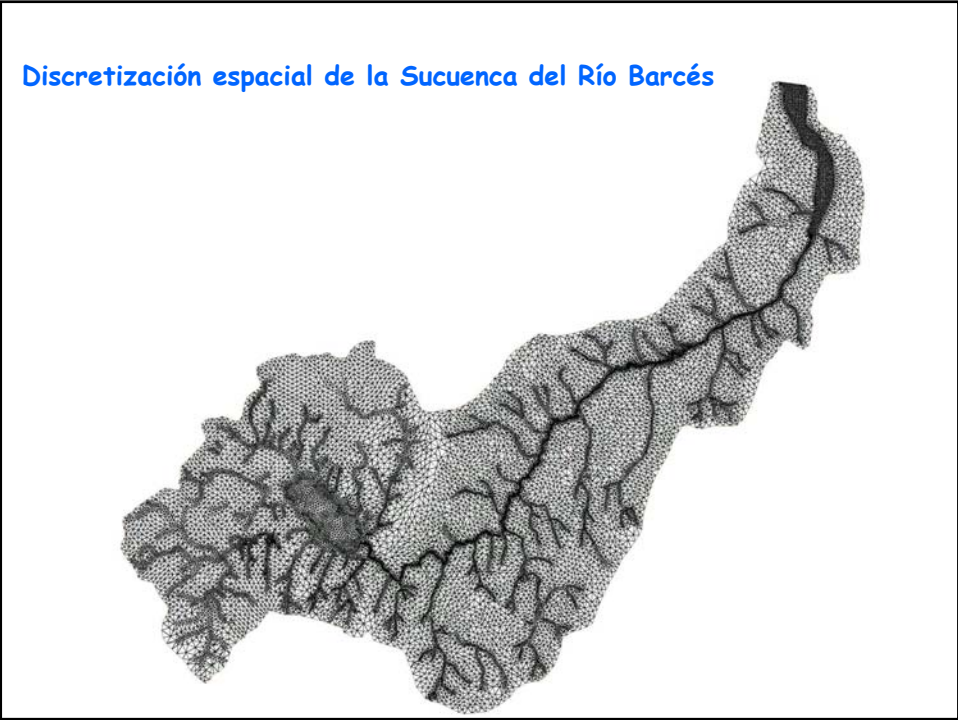
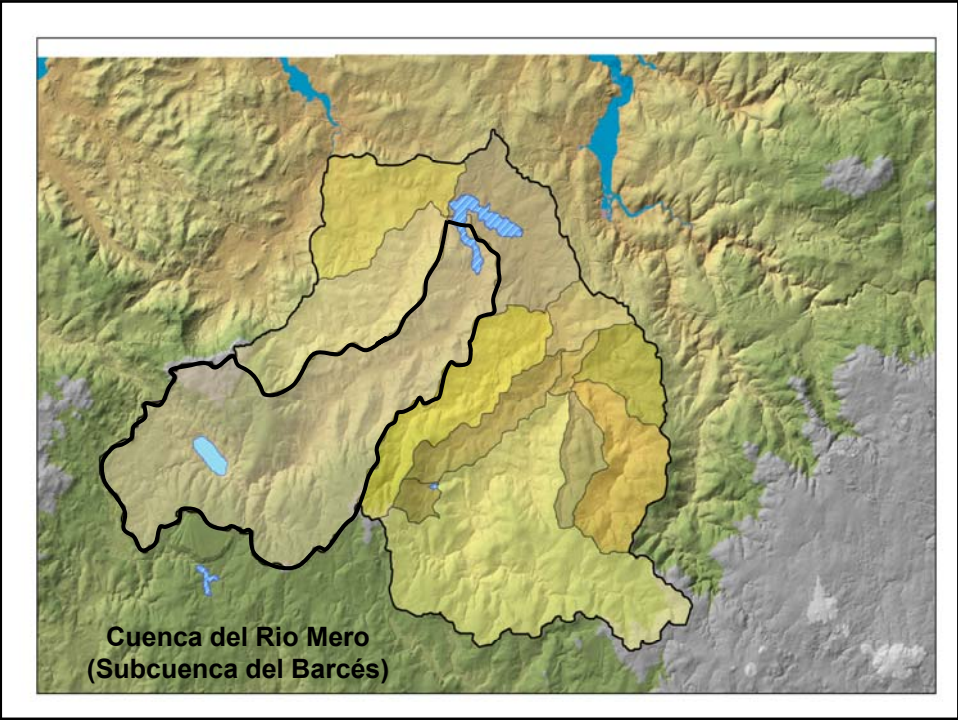
Usos del Agua















Analisis del flujo de las aguas durante el llenado y la evolución del régimen hídrico de la excavación minera de Meirama



**Cuenca hidrográfica de la Mina de Meirama**  
**Régimen de Llenado del hueco de la mina**

Condiciones de llenado de la mina

