Transformar Problemas Geofísicos em Problemas sosɹəʌuI

Estrutura

- Exemplos
  - Exemplo em Sísmica
  - Exemplo em Gravimetria
  - Exemplo em SEV
  - Exemplo em GPR

Exemplo em Sísmica

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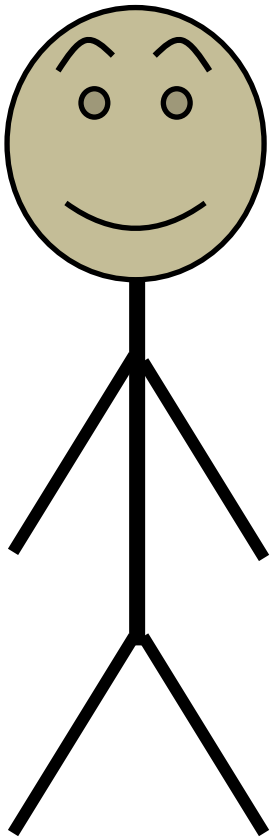

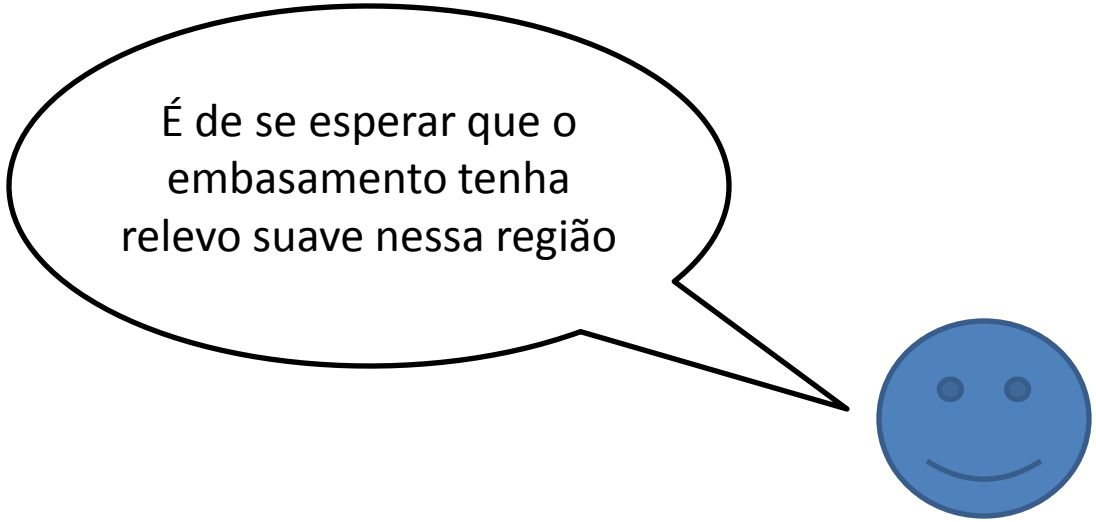

Exemplo em Sísmica

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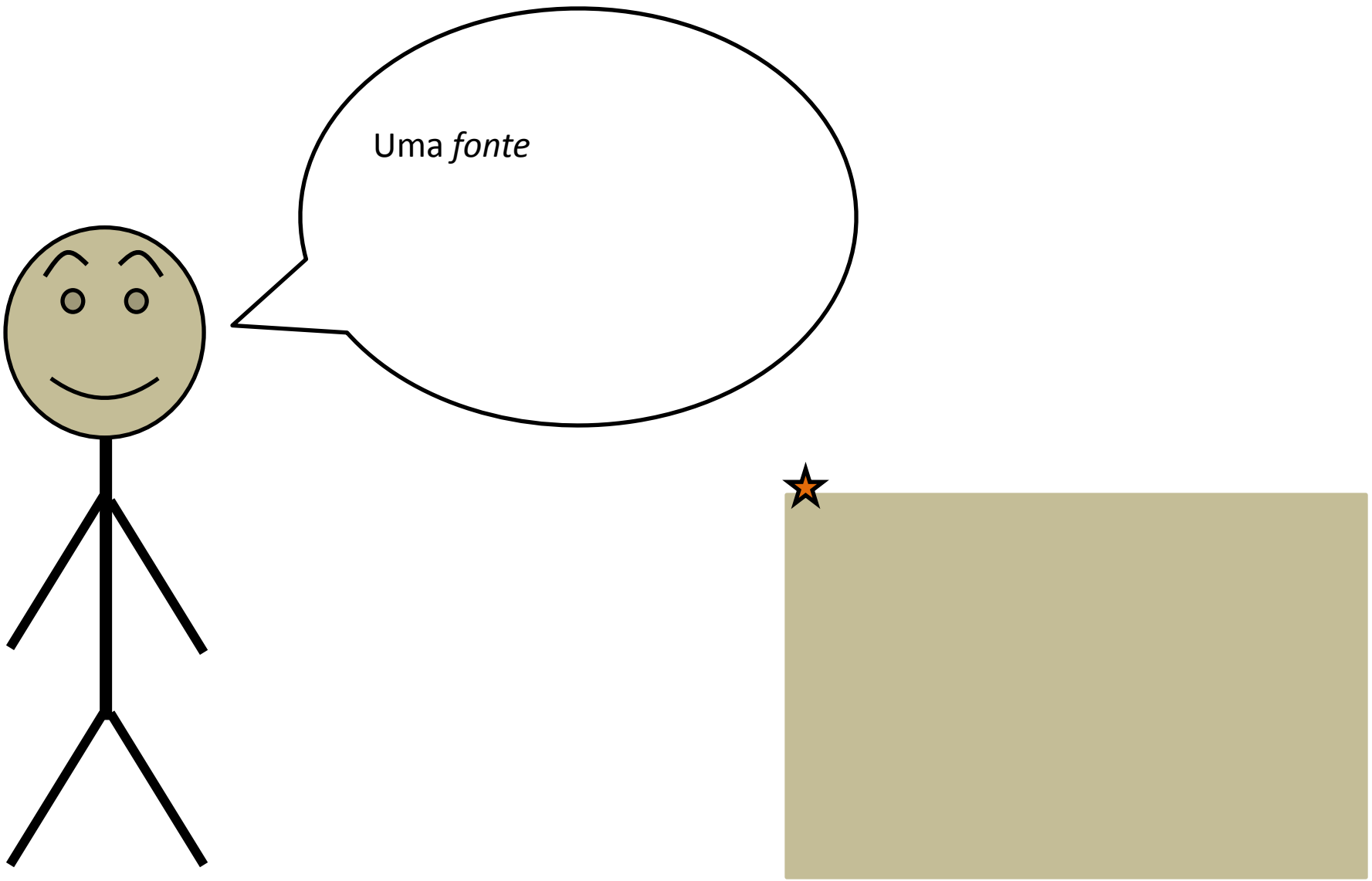
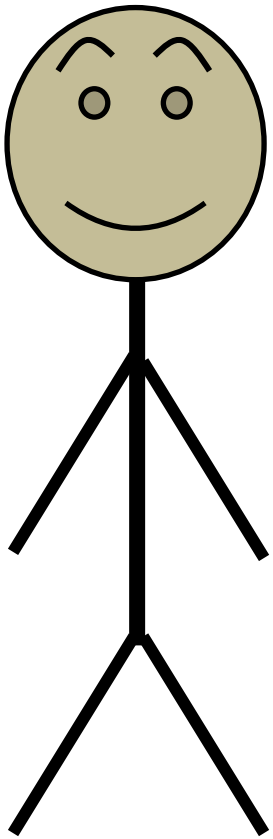
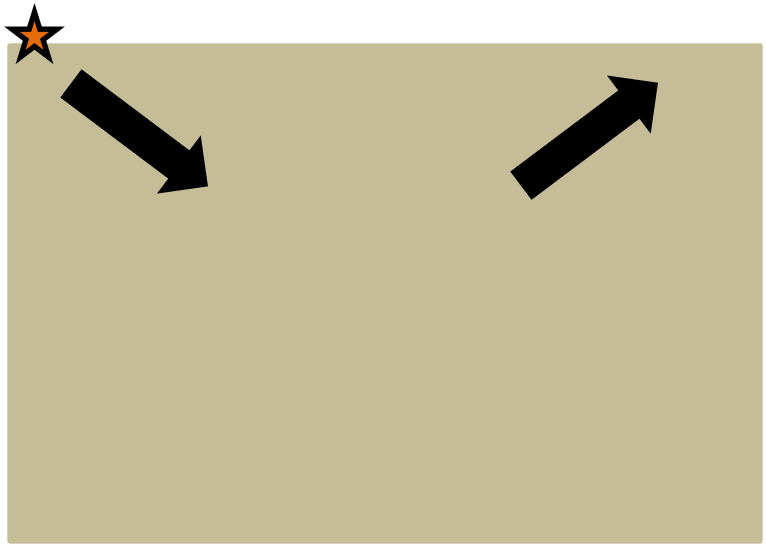


Exemplo em Sísmica

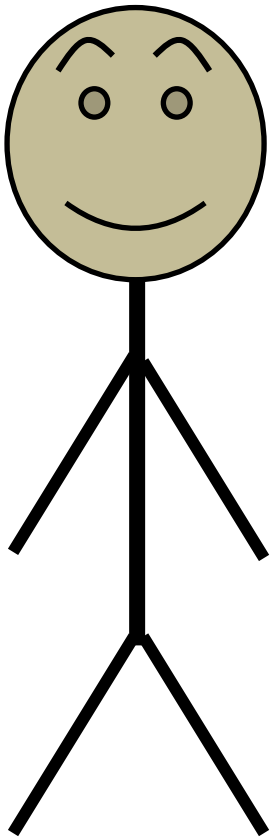
Uma *fonte* produz as *ondas elásticas*, que se propagam em subsuperfície

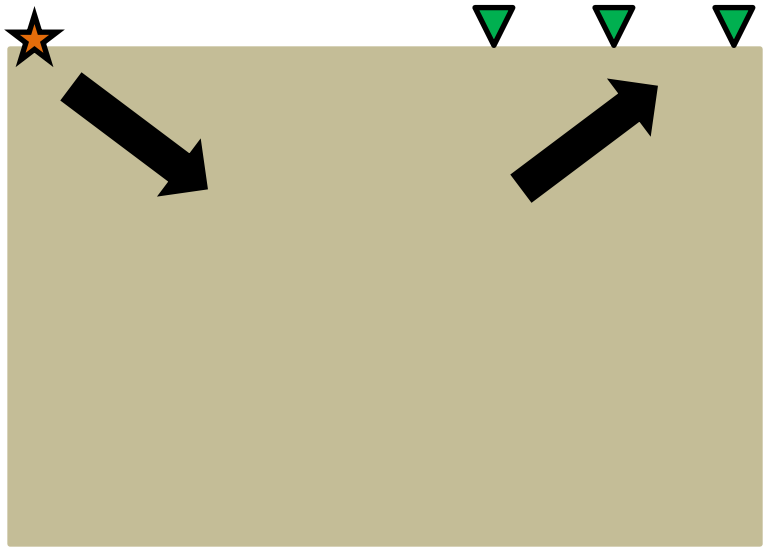




Exemplo em Sísmica

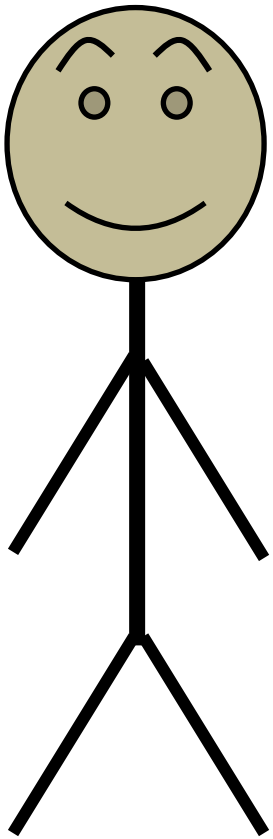
Uma *fonte* produz as *ondas elásticas*, que se propagam em subsuperfície e são medidas em *receptores*

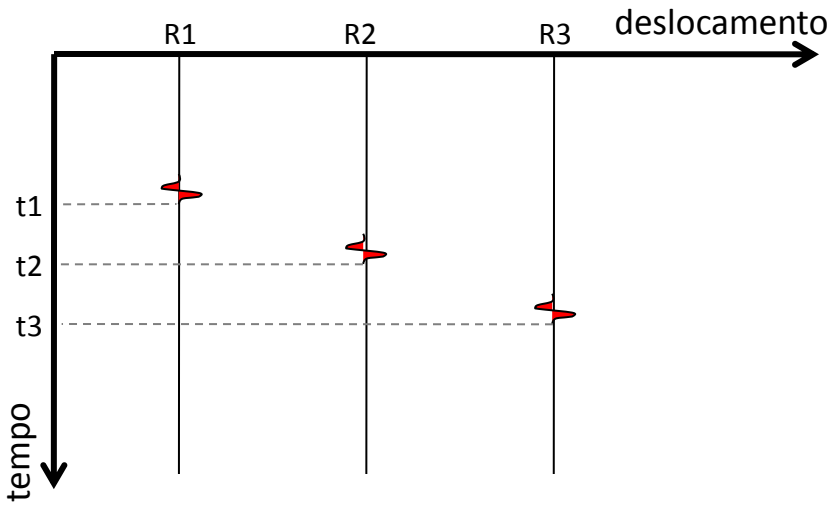


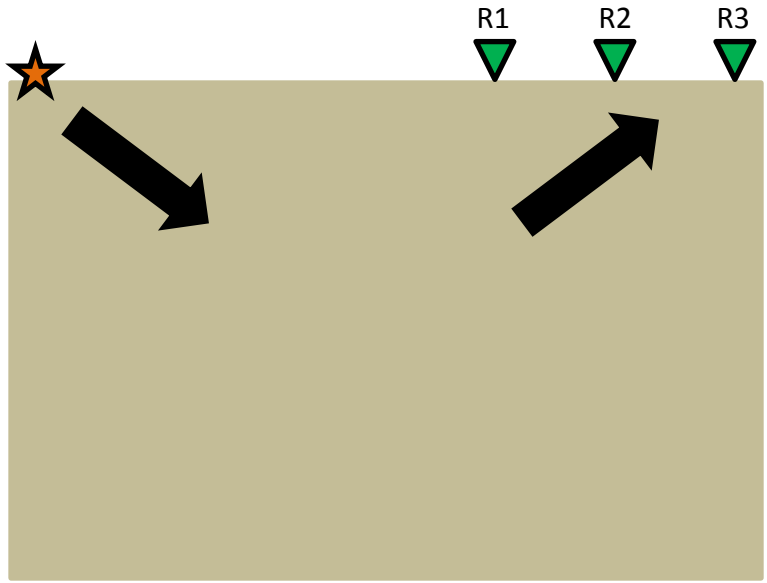


Exemplo em Sísmica

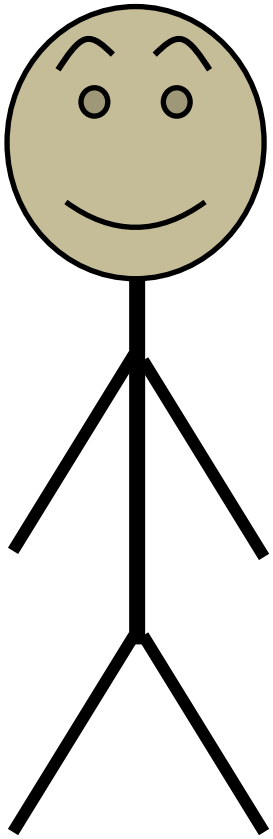
As *observações* são o deslocamento dos receptores causado pela chegada das ondas e o tempo que estas demoram durante a propagação



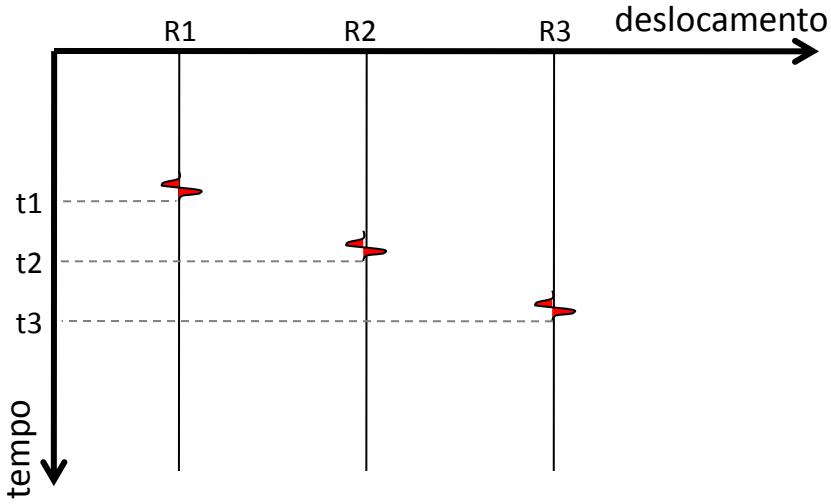


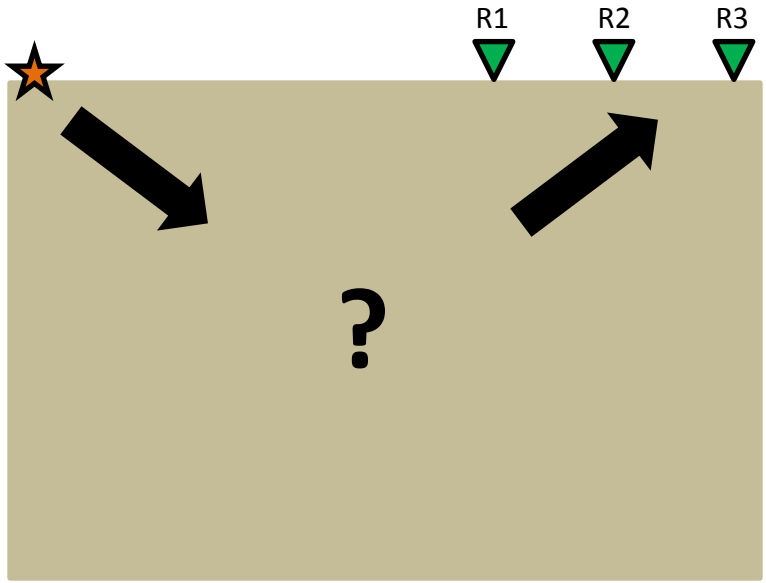


Exemplo em Sísmica



A forma com que as ondas se propagam e, consequentemente, a maneira como estas chegam aos receptores depende, por exemplo, da velocidade de propagação das ondas em subsuperfície





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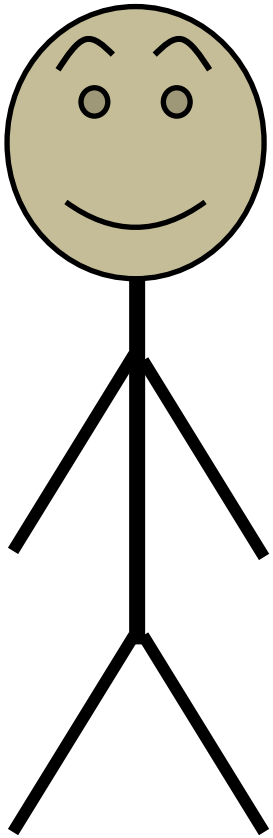
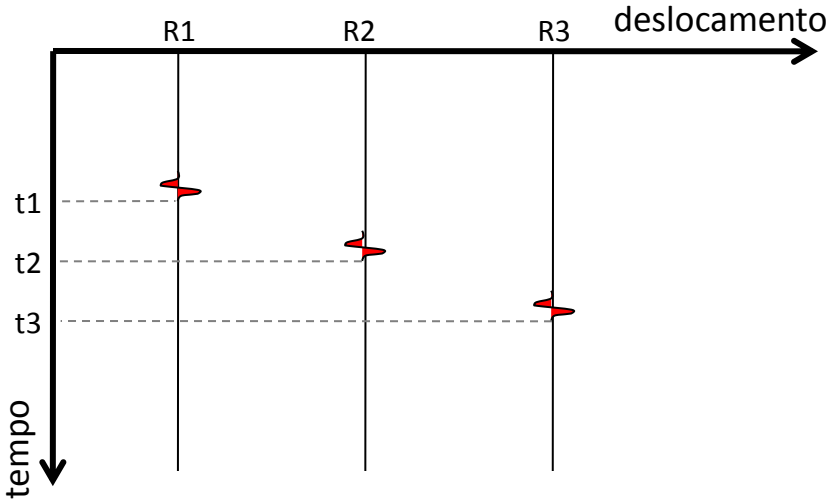
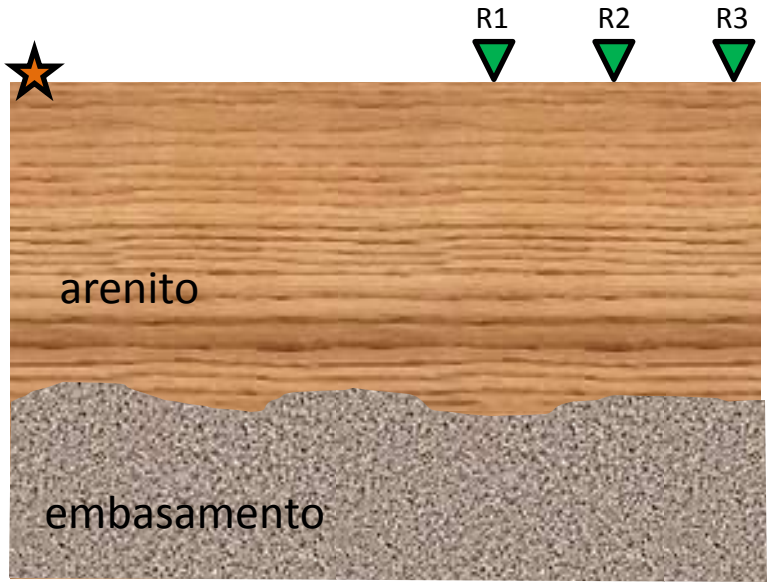
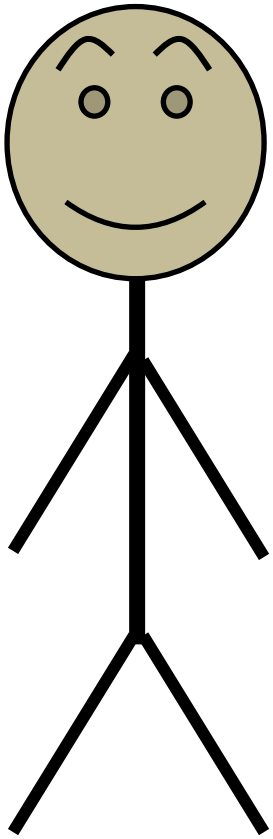


Sabe-se que há uma camada de arenito sobre o embasamento

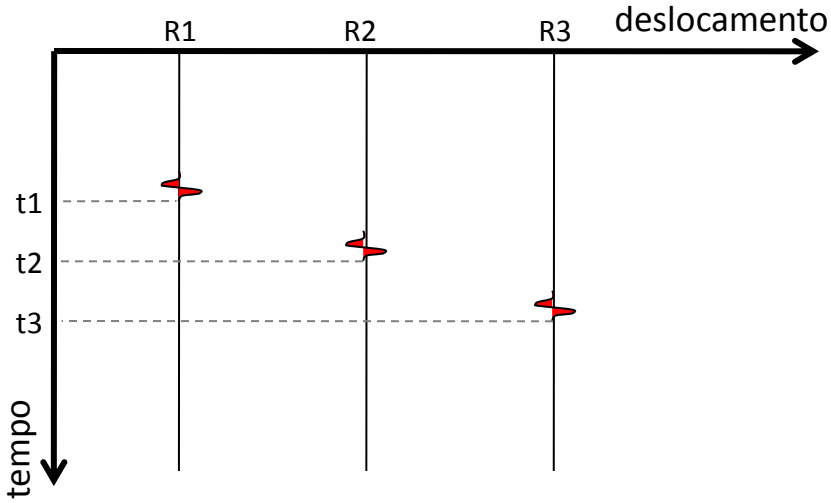


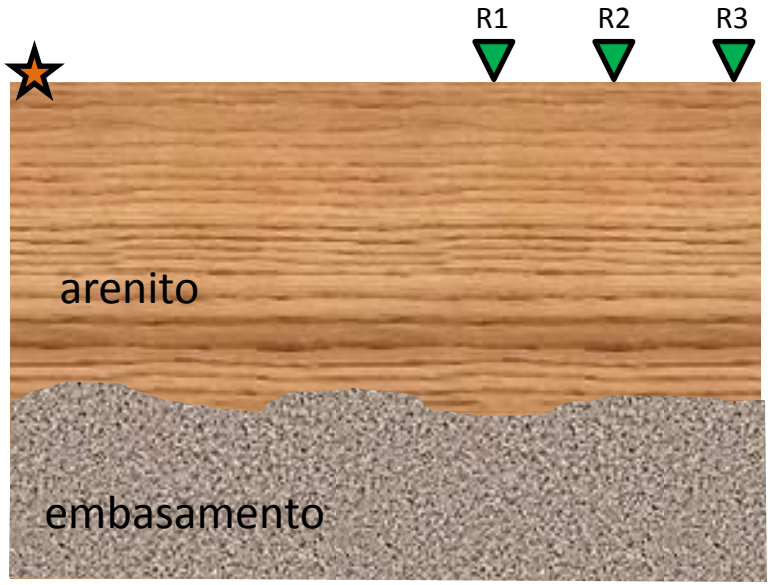


Exemplo em Sísmica

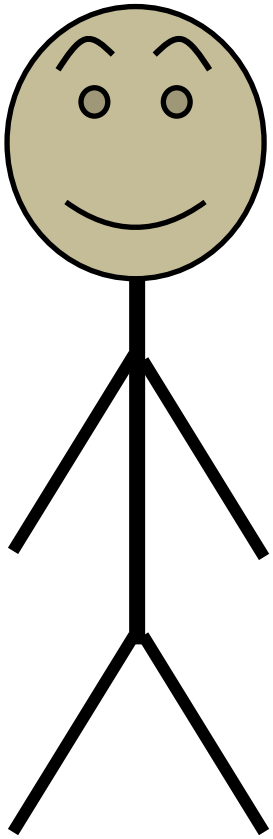


Sabe-se que arenitos tem velocidade de propagação menor que as do embasamento

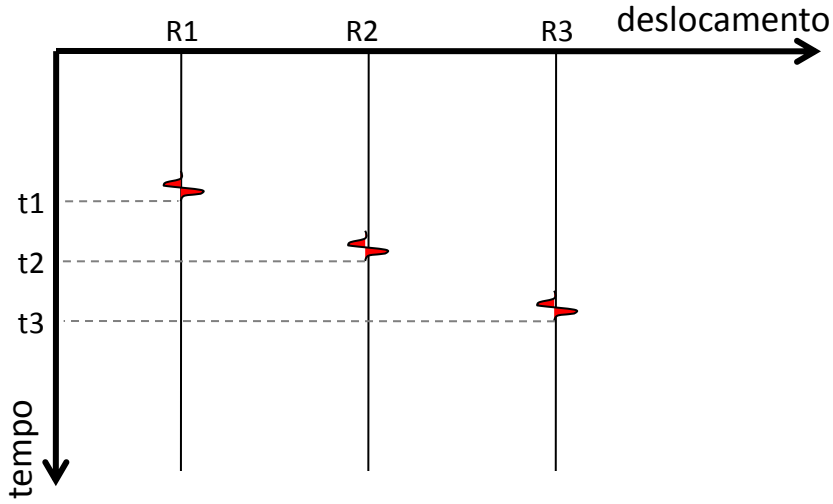


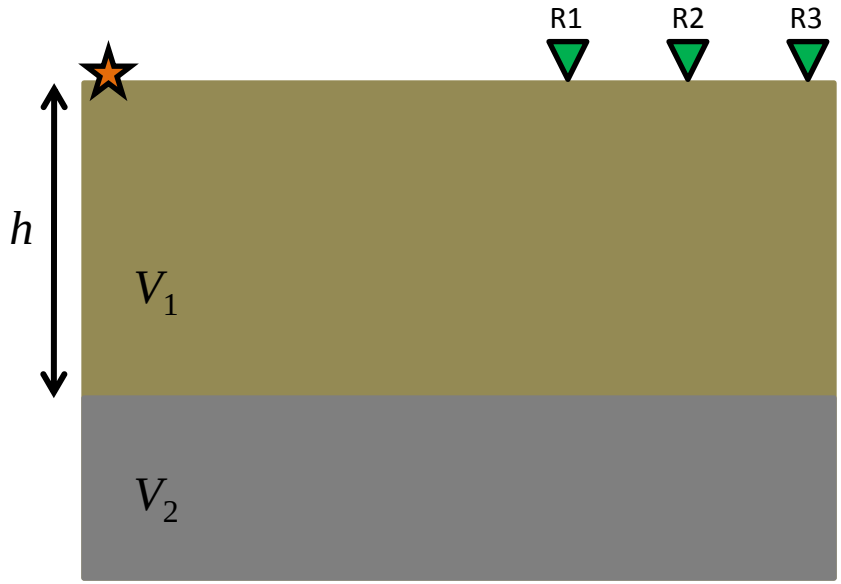


Exemplo em Sísmica



Vamos *parametrizar* da seguinte forma: os meios são homogêneos e isotrópicos, as camadas são plano-paralelas, o arenito tem velocidade V_1 e espessura h e o embasamento tem velocidade $V_2 > V_1$





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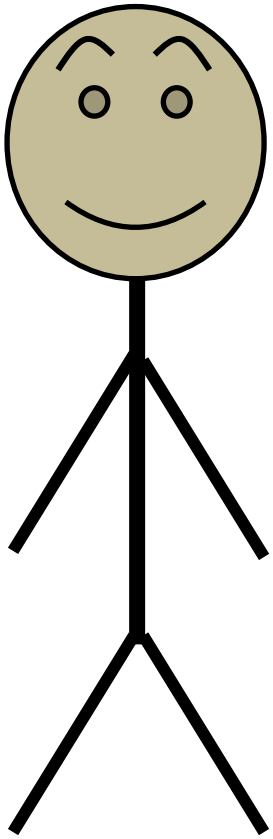
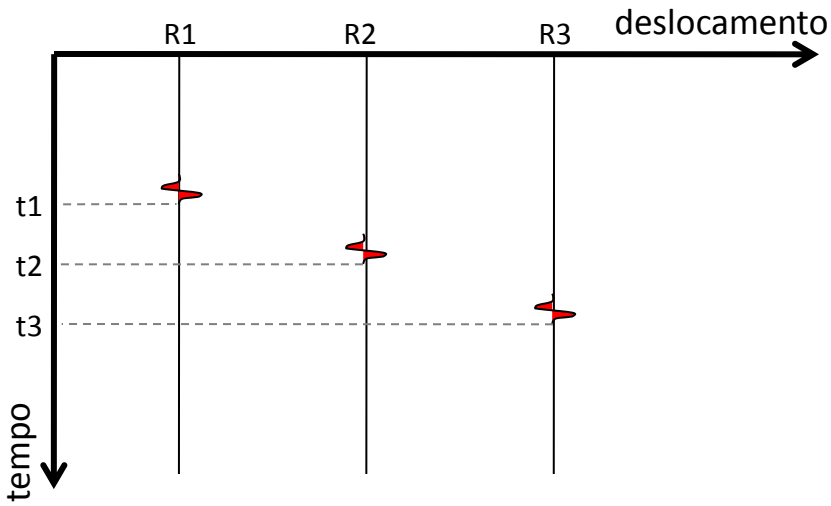
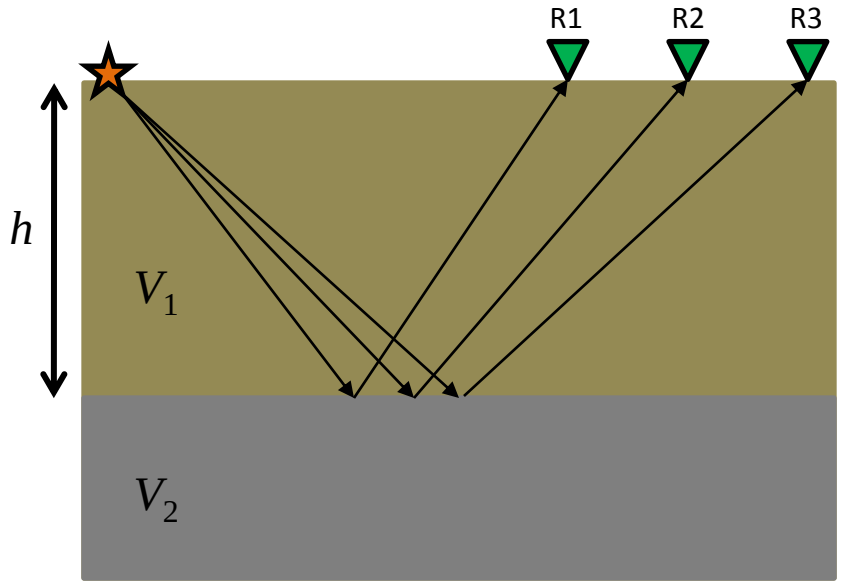
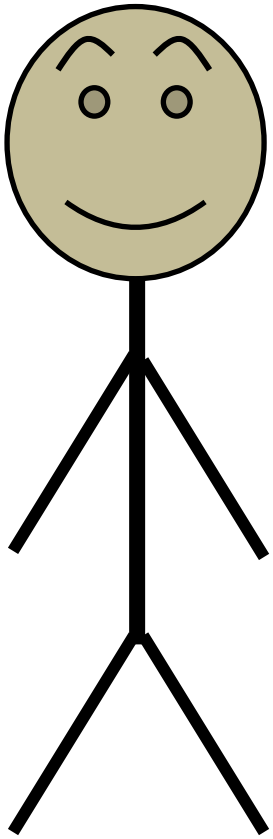


Nesse caso,
sabemos que haverão
ondas que serão
refletidas na interface
arenito-embasamento



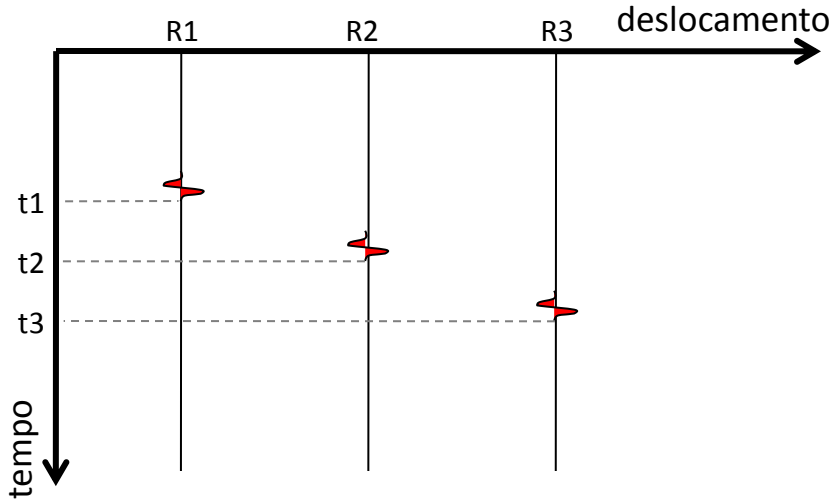


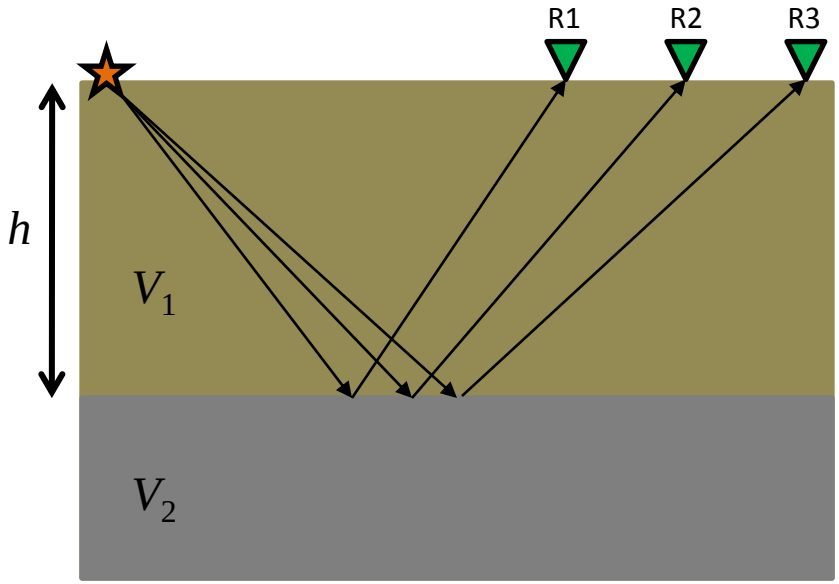
Exemplo em Sísmica



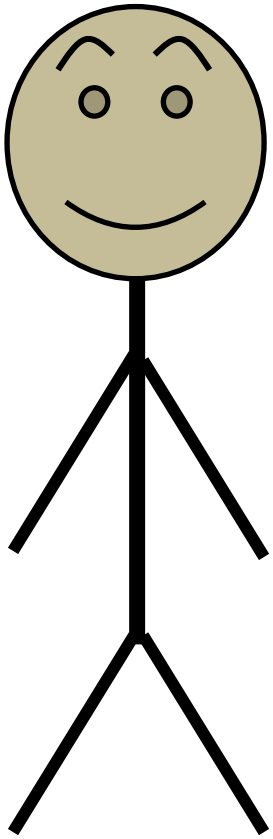
E que a *função f* do *problema direto* calcula, dadas a velocidade V_1 e a espessura h, os tempos de chegada preditos

$$t = f(V_1, h)$$



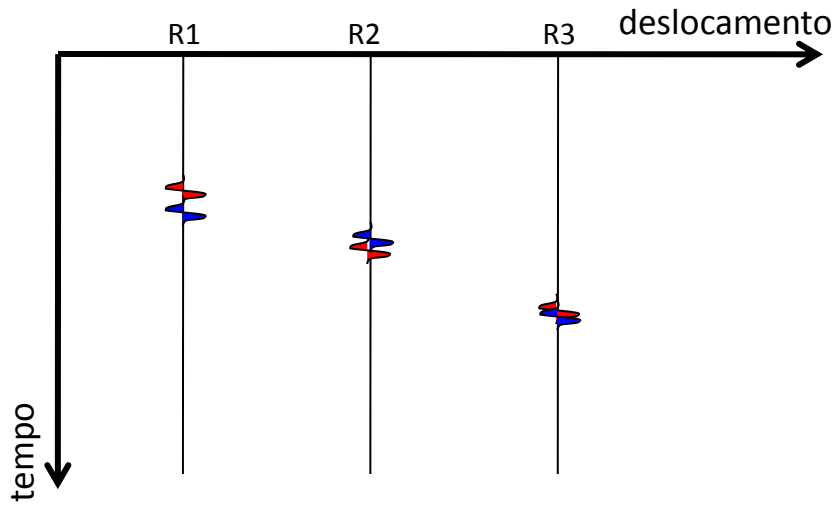


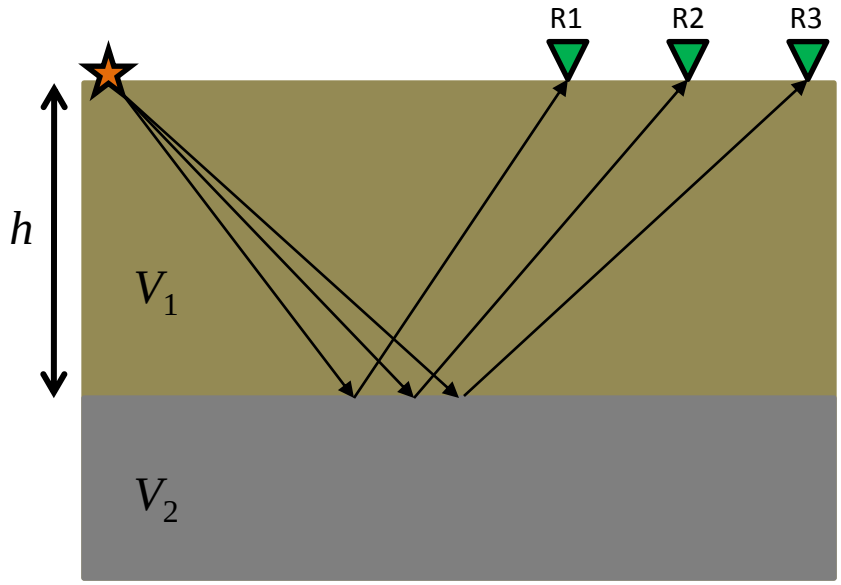
Exemplo em Sísmica



Sendo assim, o *problema inverso* consiste em encontrar V_1 e h que produzem os tempos de chegada preditos mais próximos aos tempos de chegada observados de acordo com uma *norma* preestabelecida

$$t = f(V_1, h)$$





Exemplo em Gravimetria

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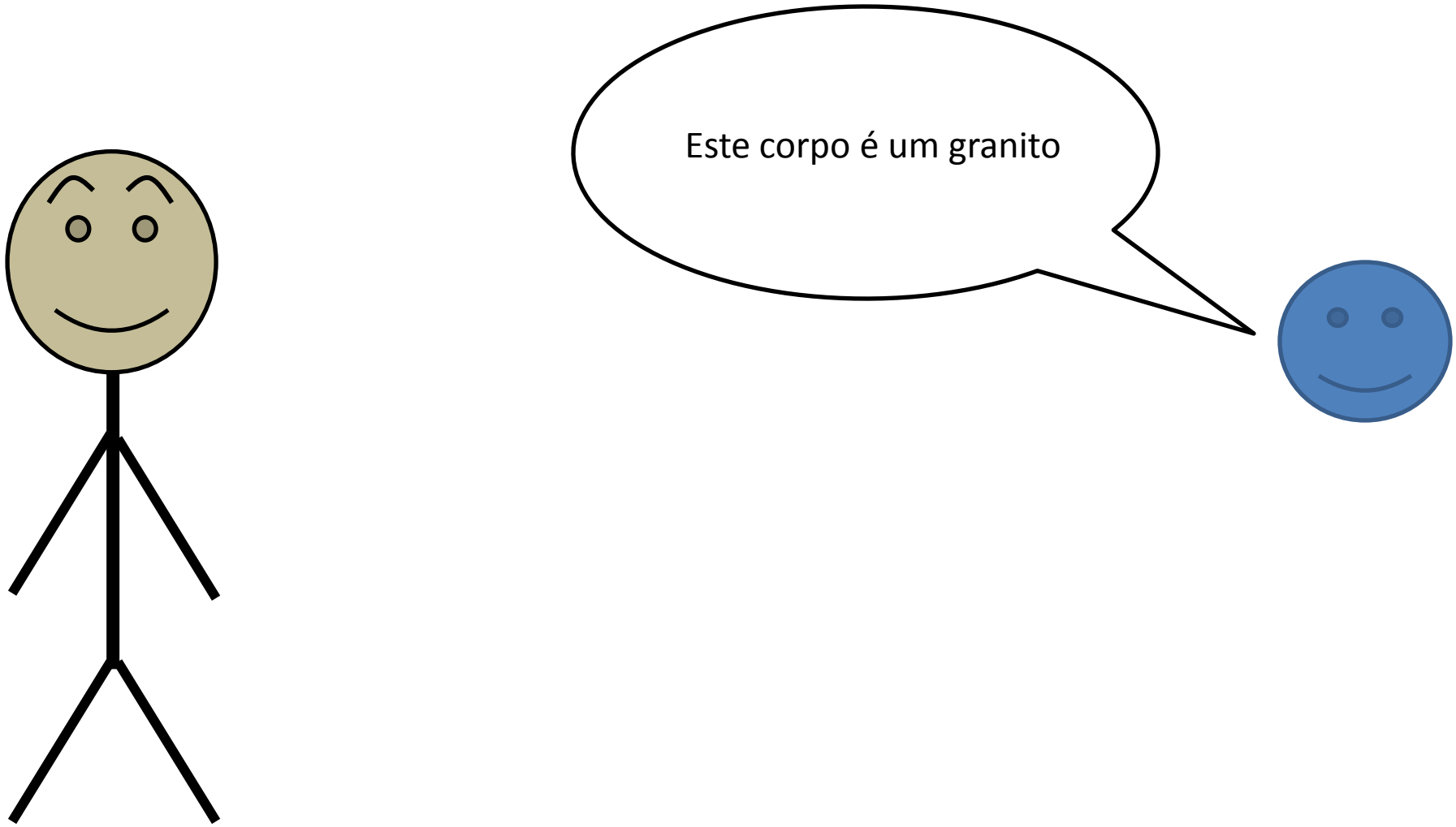
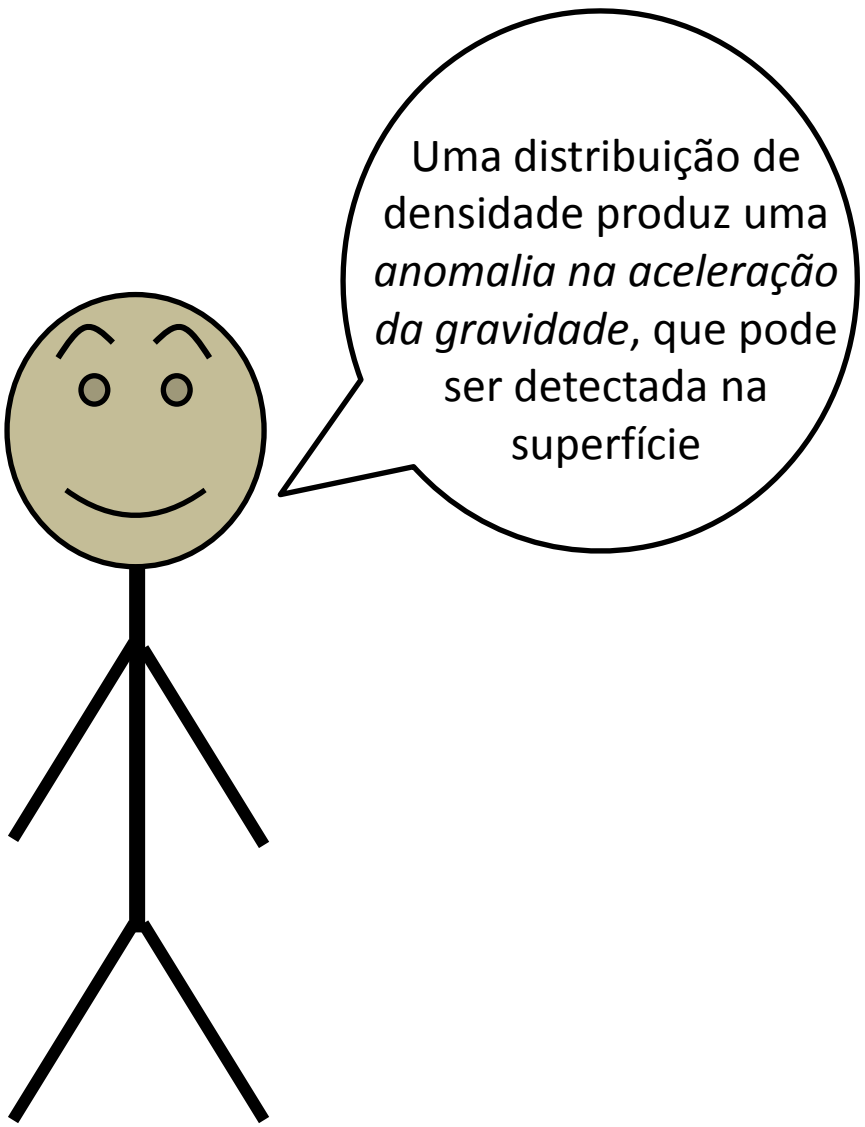


Exemplo em Gravimetria

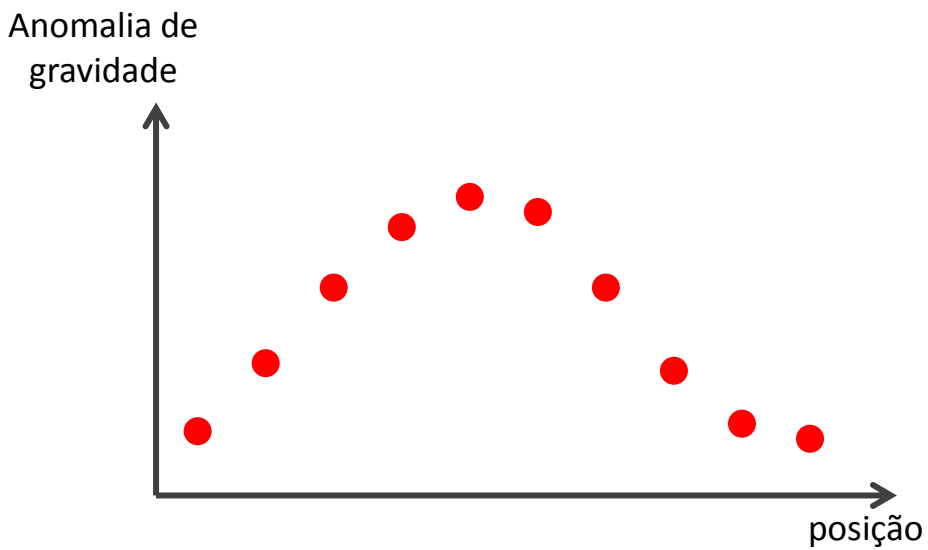
subsuperfície

Exemplo em Gravimetria

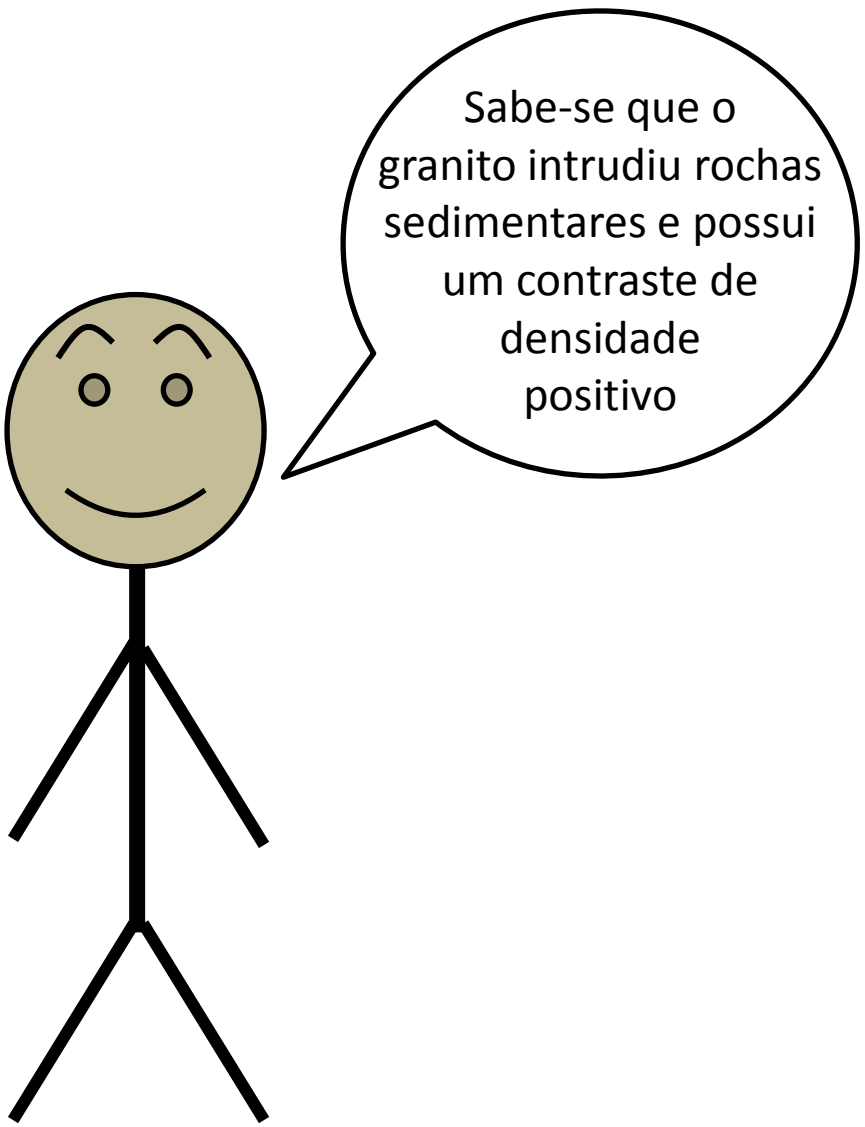
Exemplo em Gravimetria

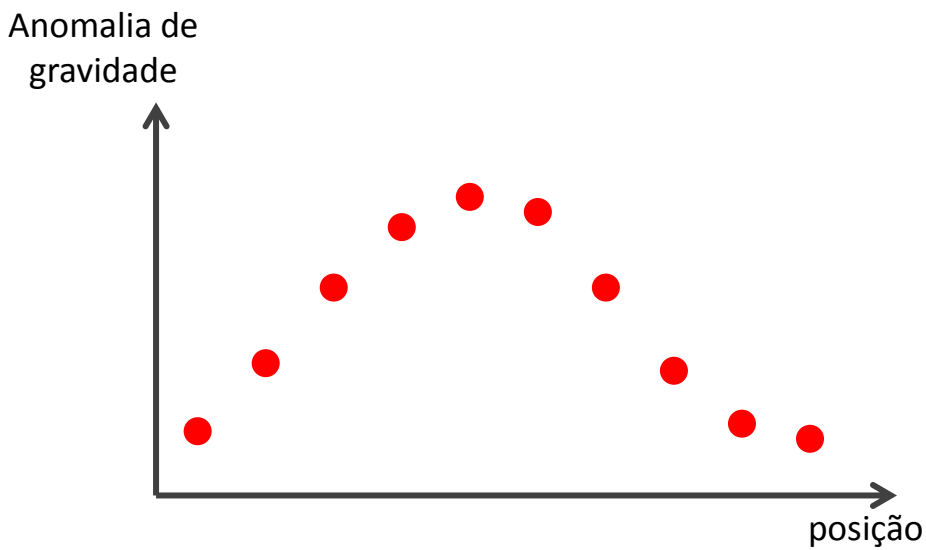


Exemplo em Gravimetria

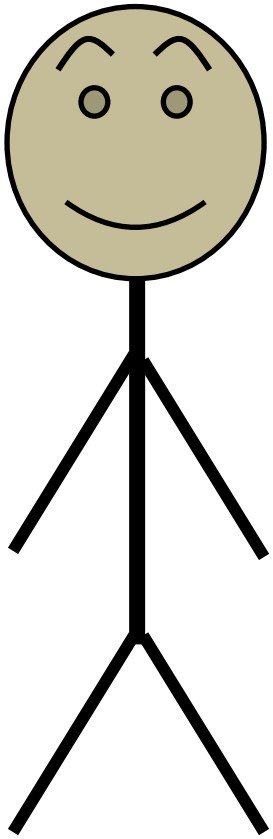


Exemplo em Gravimetria

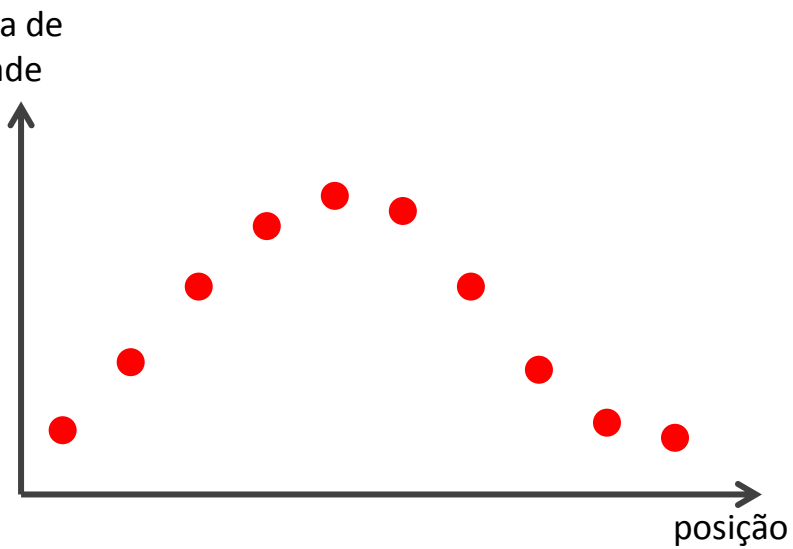




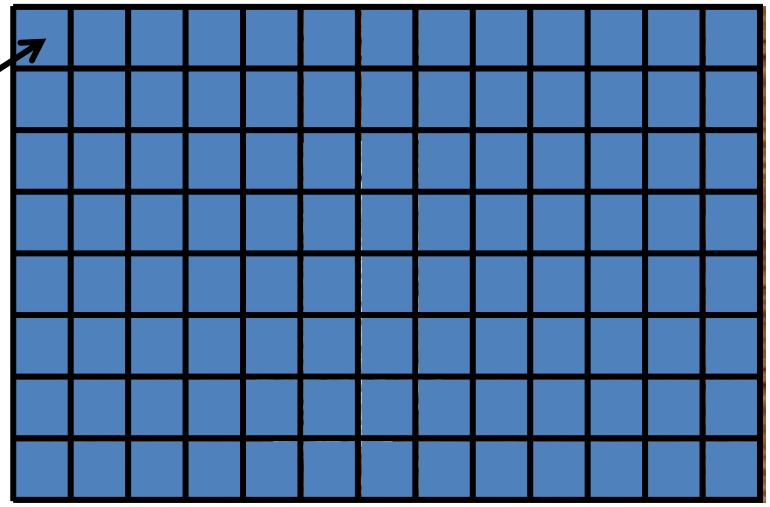
Exemplo em Gravimetria



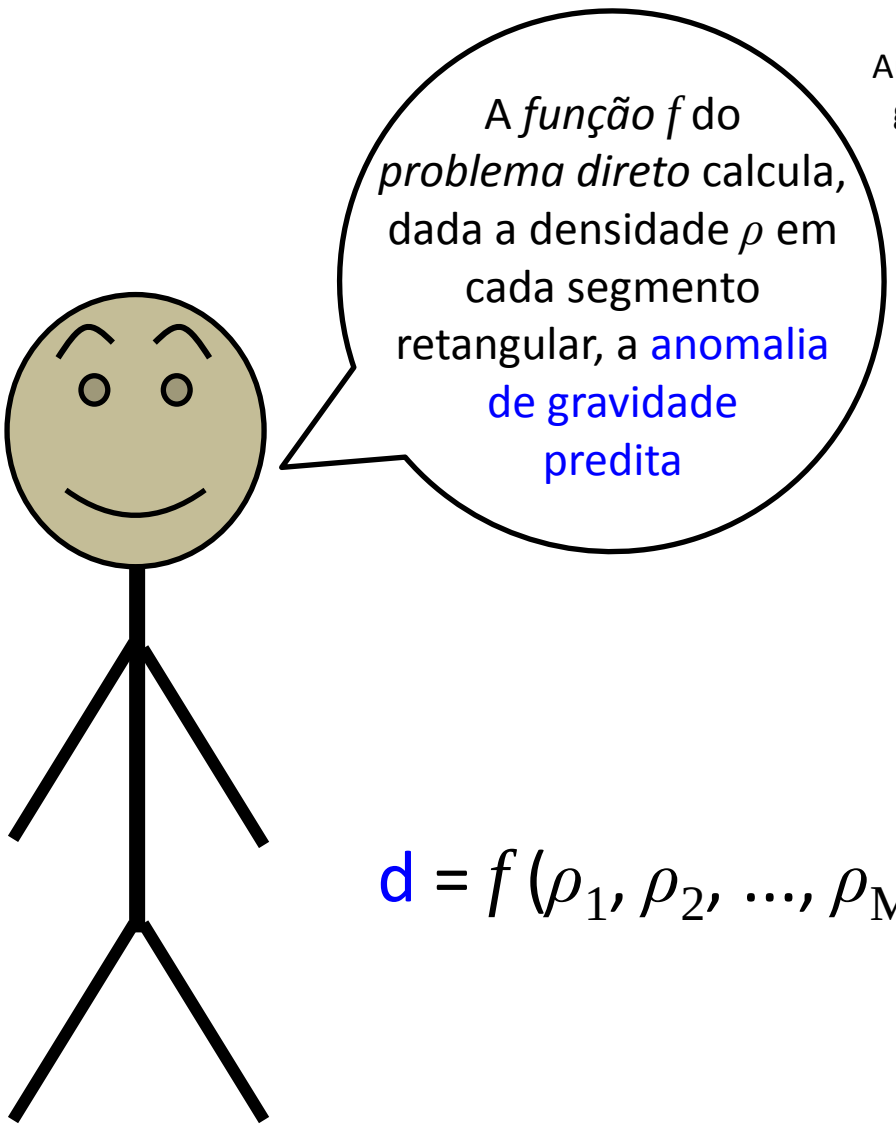
Vamos *parametrizar* da seguinte forma: a distribuição de densidades é continua por partes, representada por M segmentos retangulares com densidade ρ constante

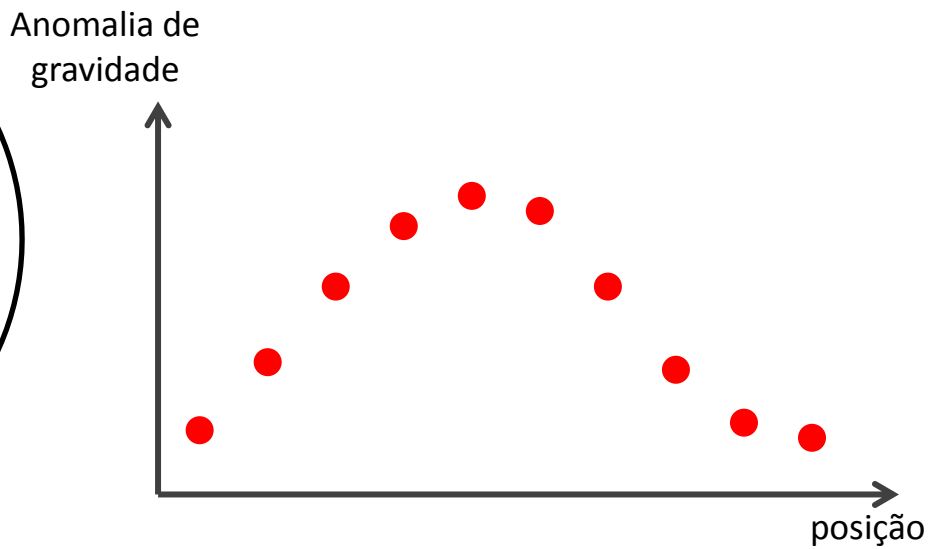


Segmento retangular com densidade ρ constante

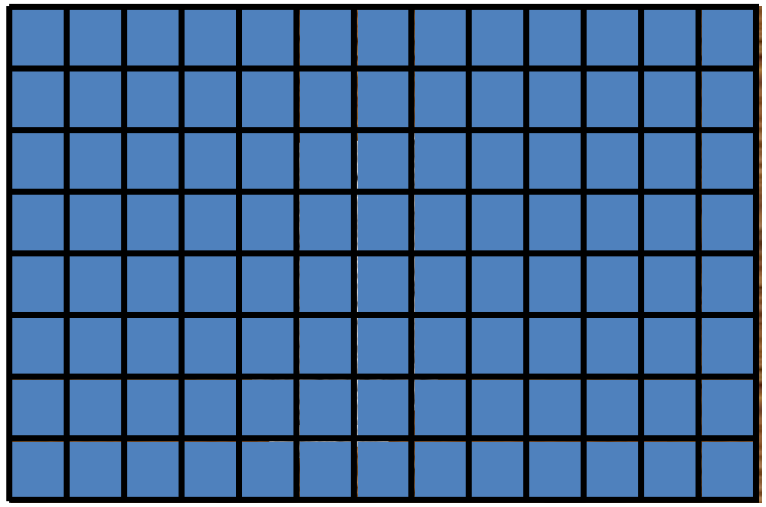


Exemplo em Gravimetria





$$\mathbf{d} = f(\rho_1, \rho_2, \ldots, \rho_M)$$



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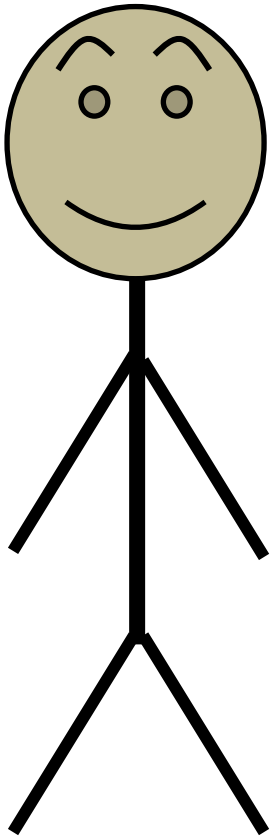
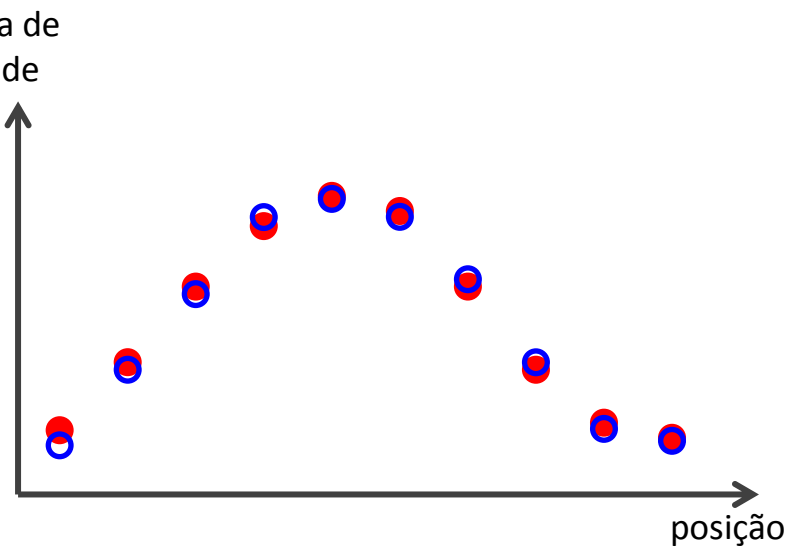
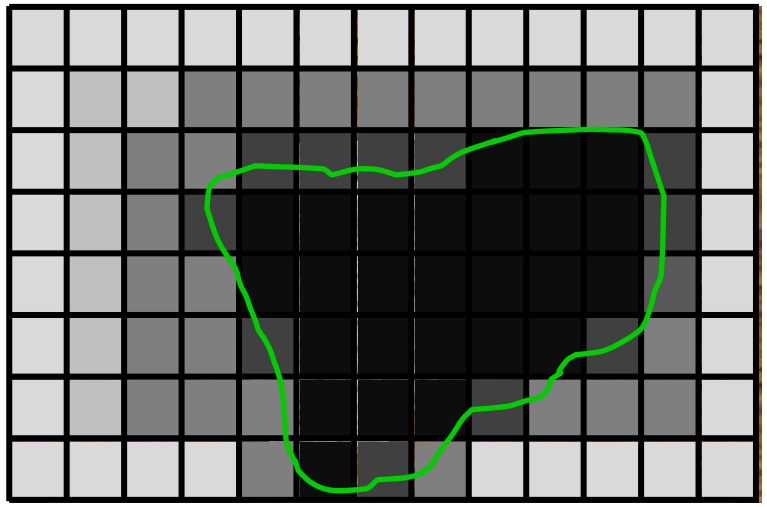


Sendo assim, o *problema inverso* consiste em encontrar a densidade ρ em cada segmento retangular, de forma que os dados preditos sejam os mais próximos possíveis aos dados observados de acordo com uma *norma* preestabelecida

$$\mathbf{d} = f(\rho_1, \rho_2, \ldots, \rho_M)$$

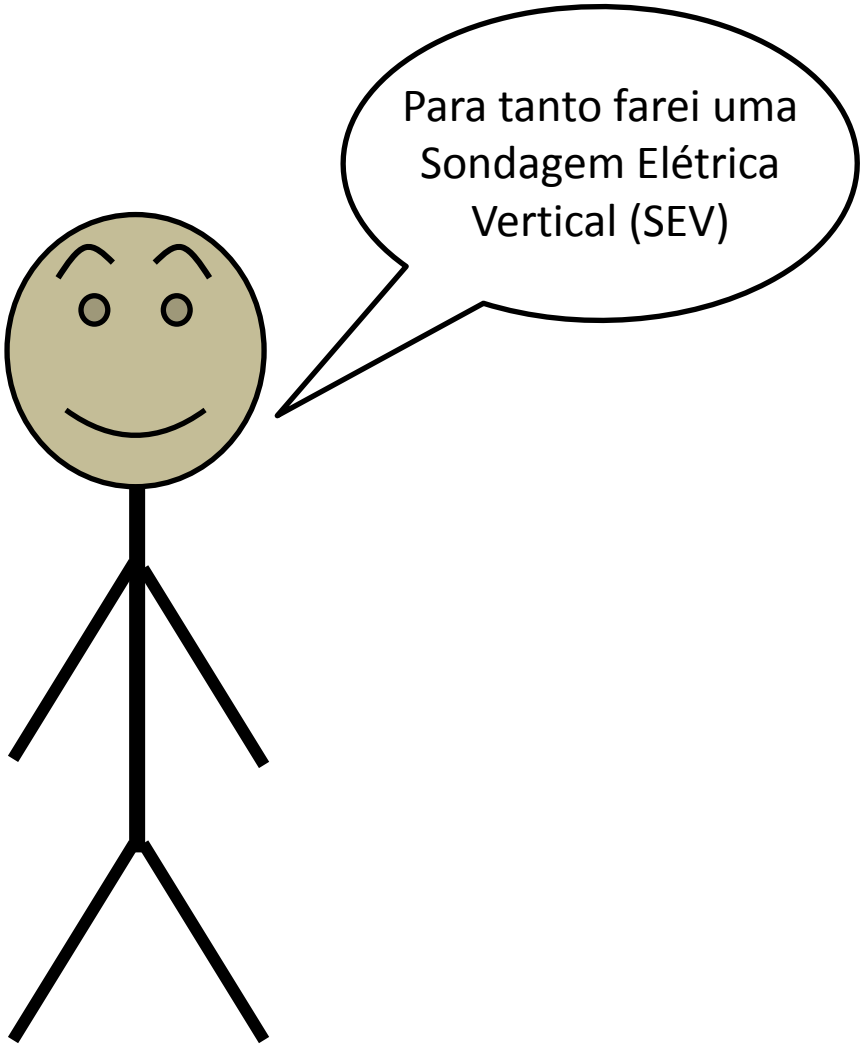
Contorno do corpo verdadeiro



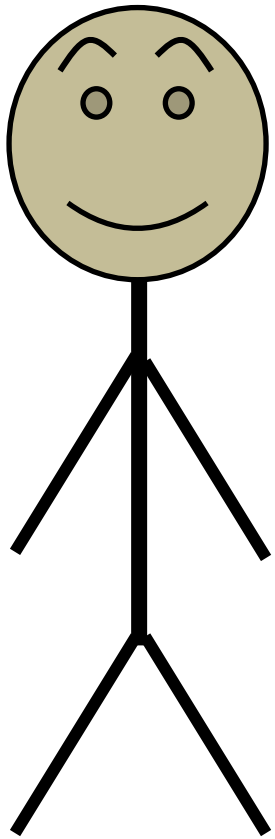


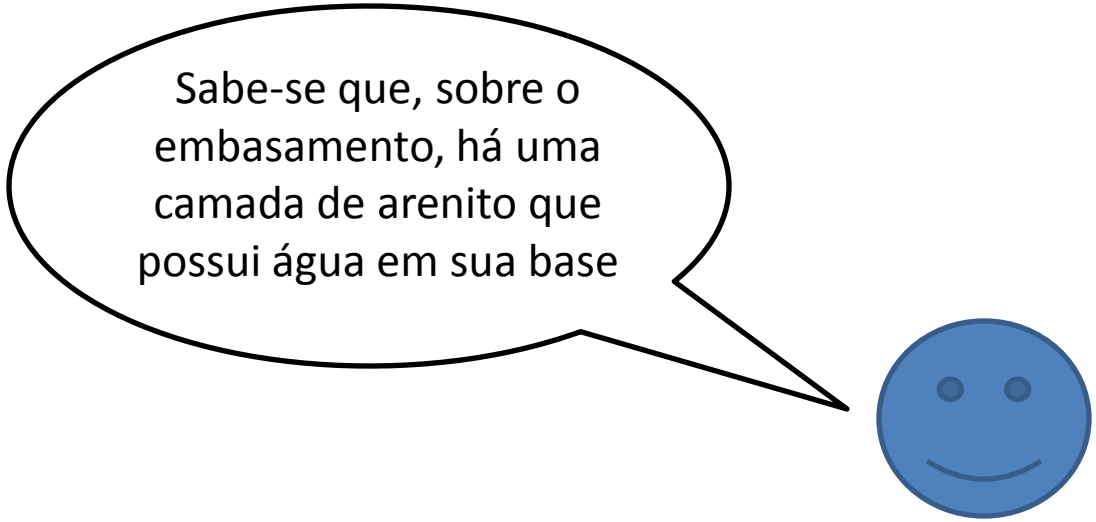
Exemplo em SEV

Exemplo em SEV



Exemplo em SEV

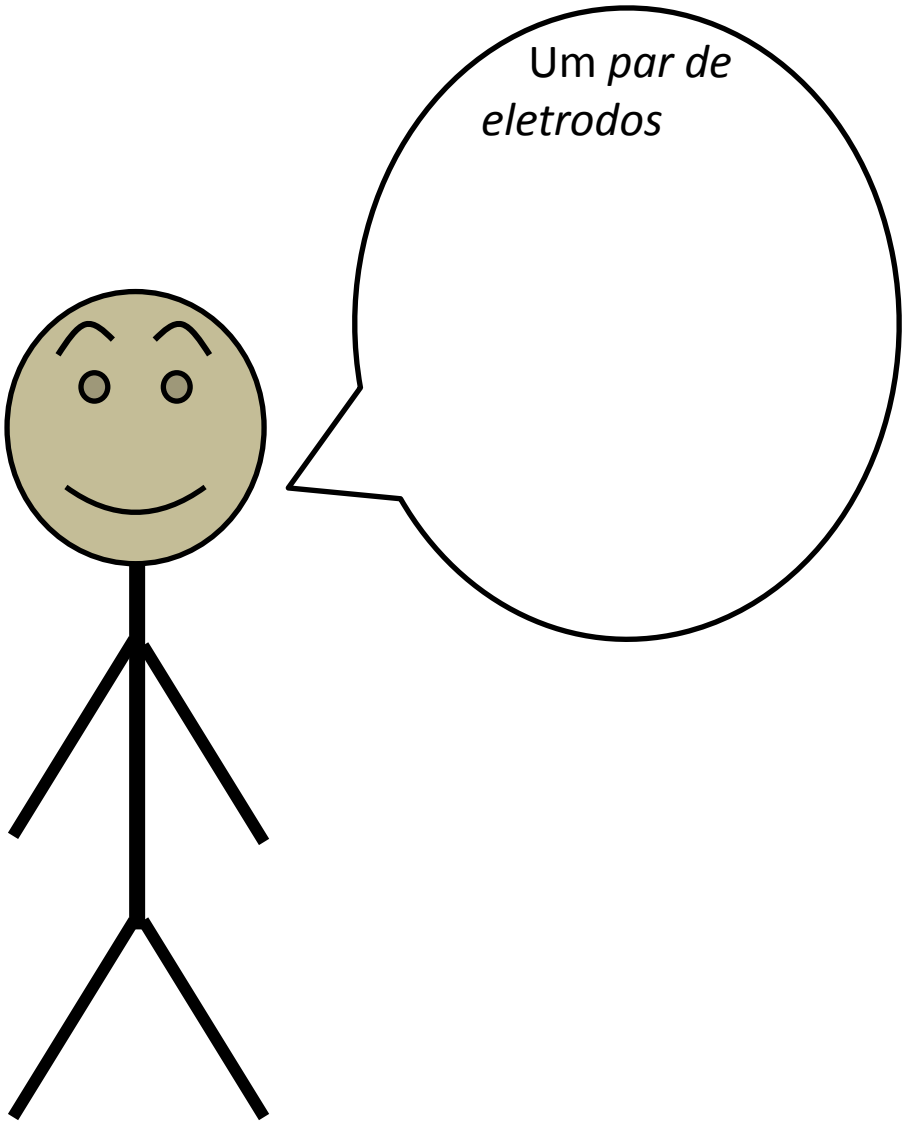




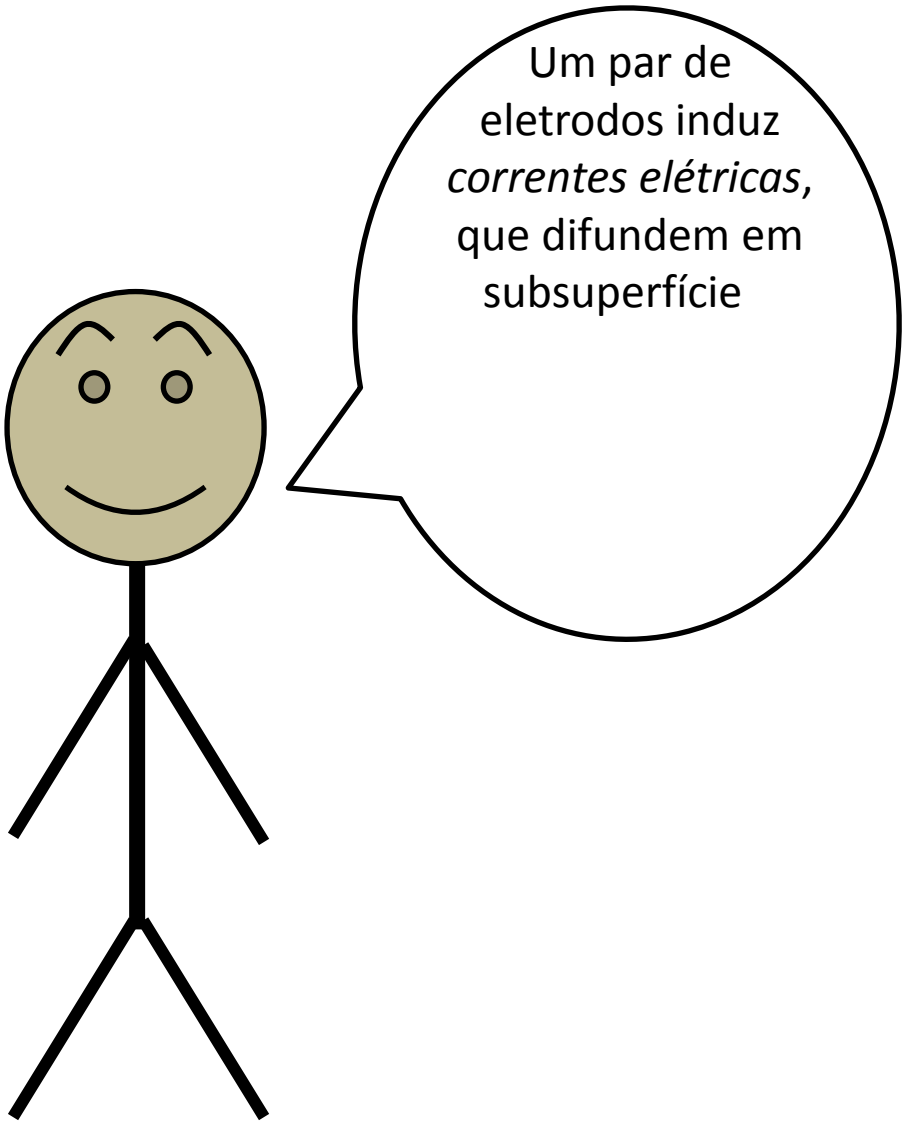
Exemplo em SEV

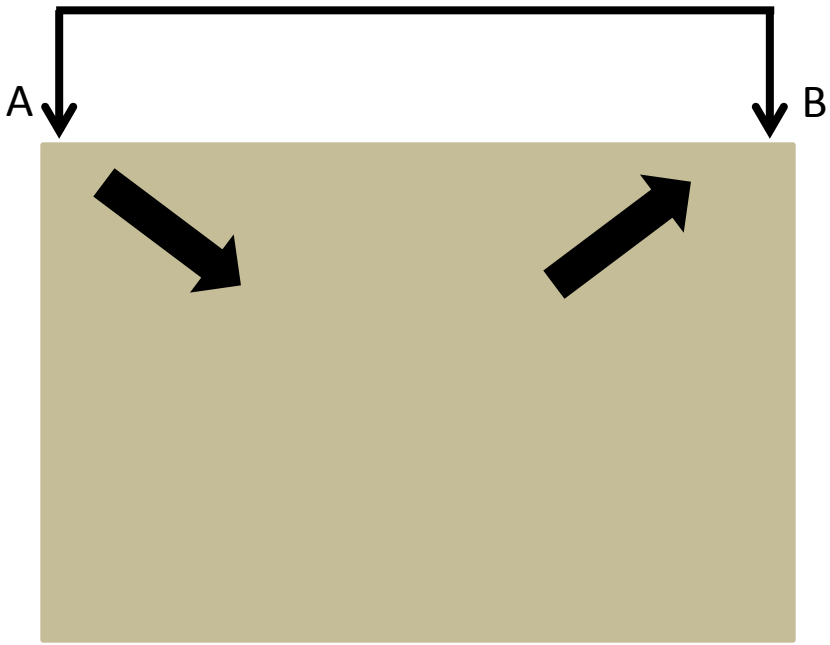
subsuperfície

Exemplo em SEV

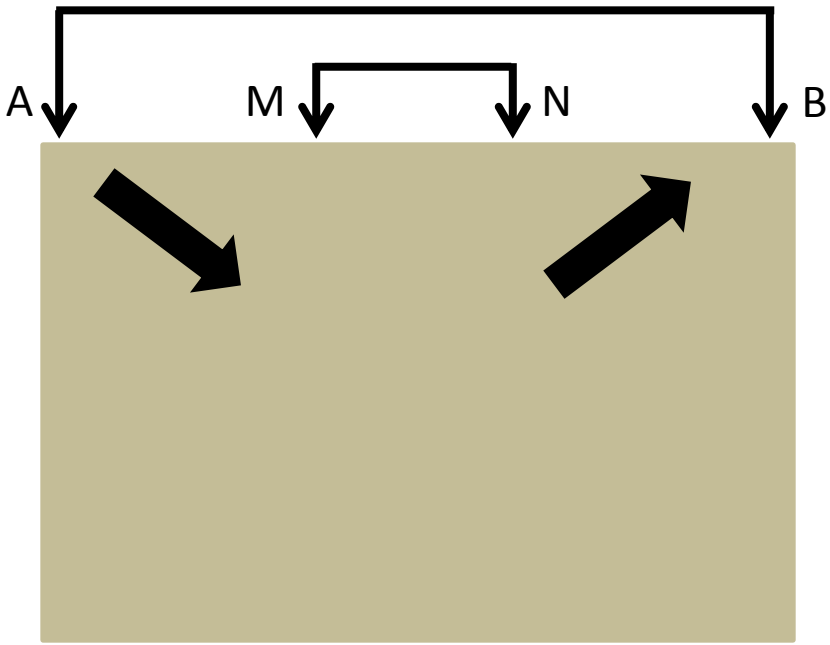


Exemplo em SEV

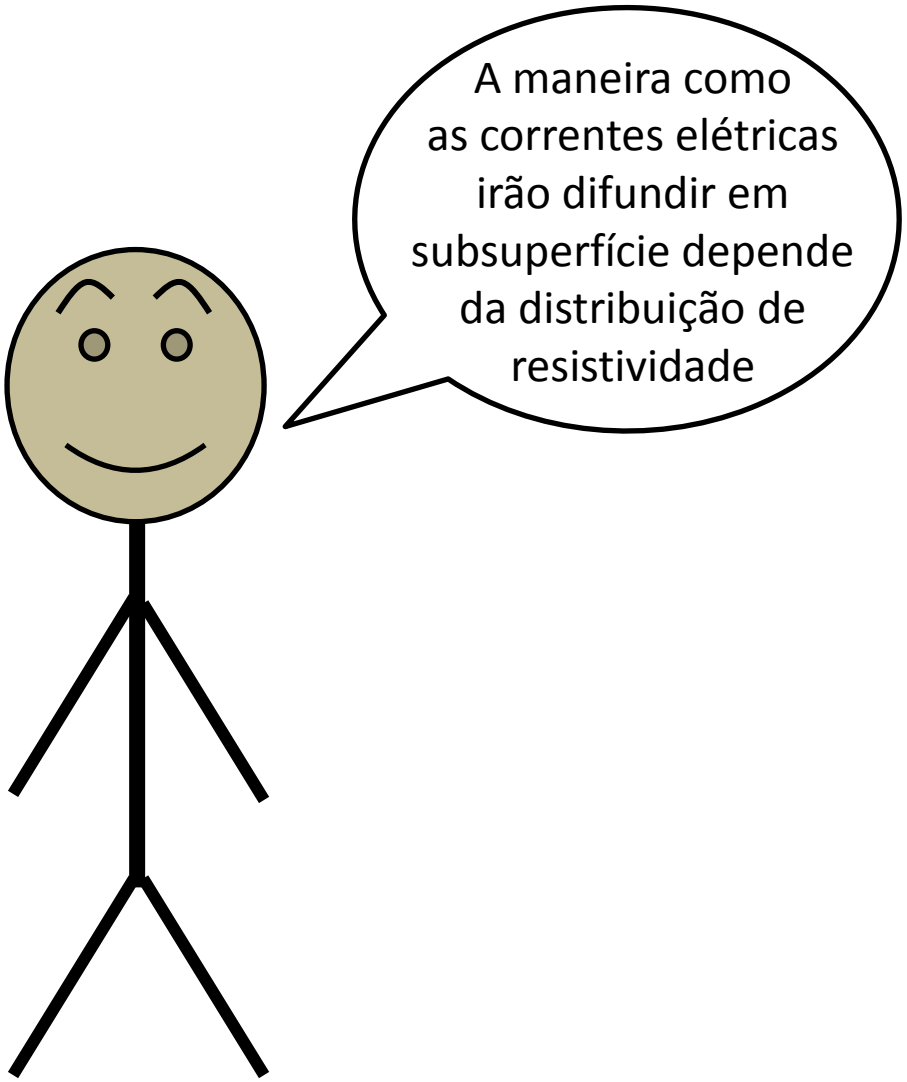


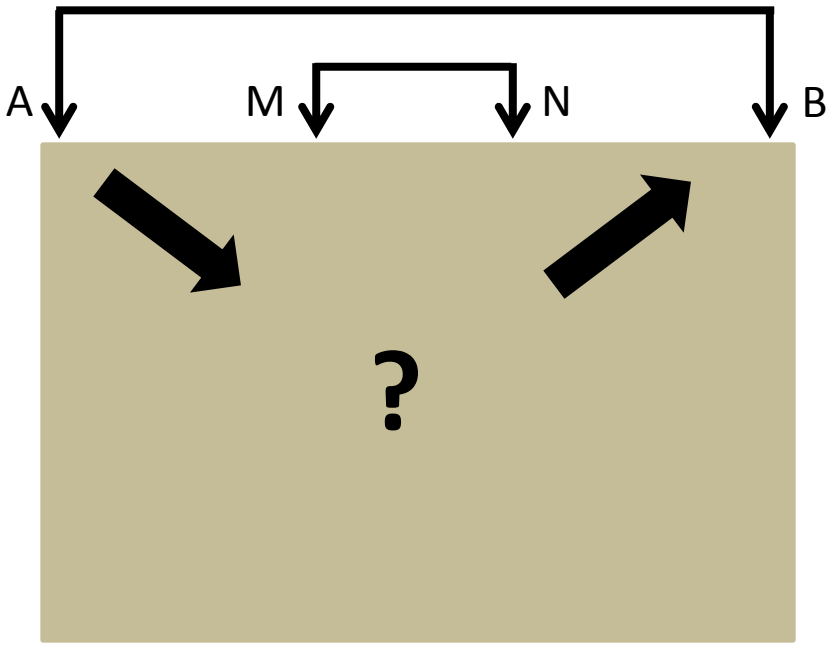


Exemplo em SEV

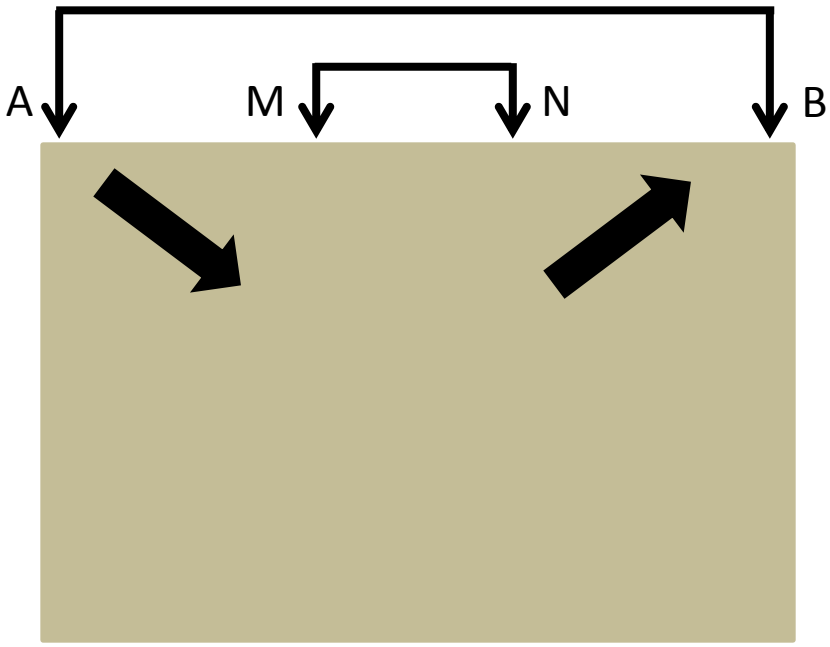


Exemplo em SEV

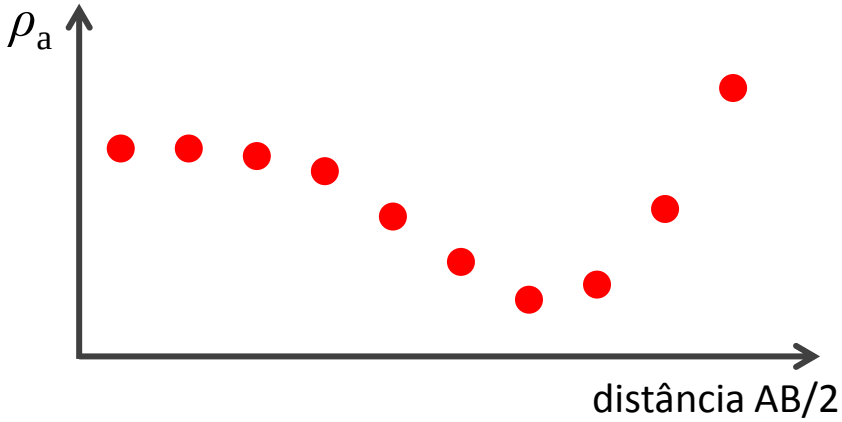


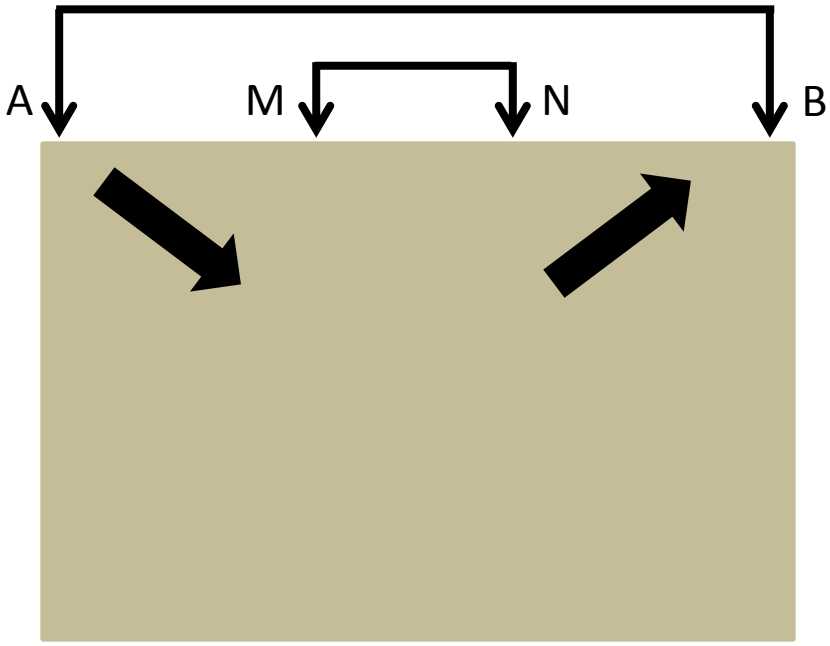


Exemplo em SEV

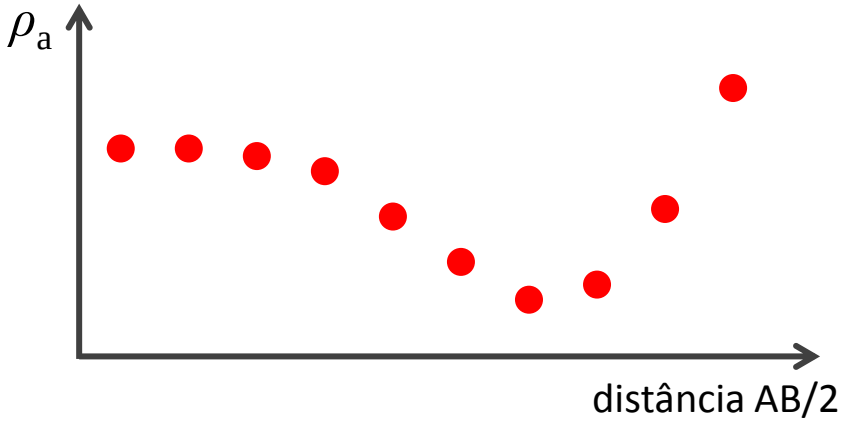


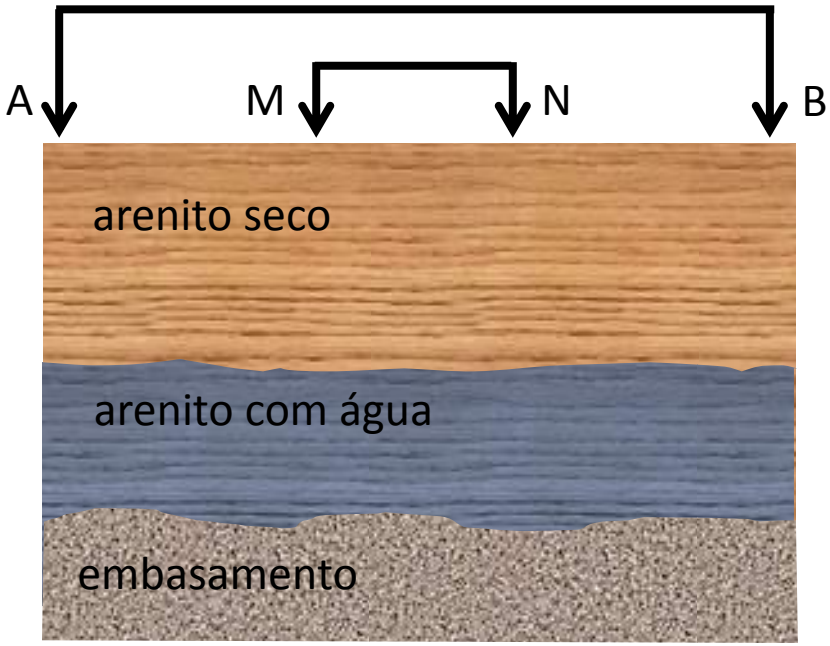
Exemplo em SEV



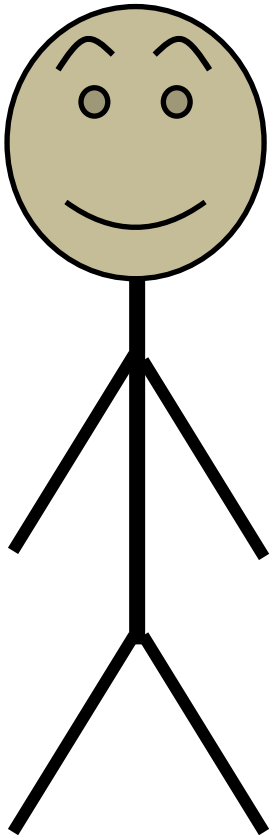


Exemplo em SEV

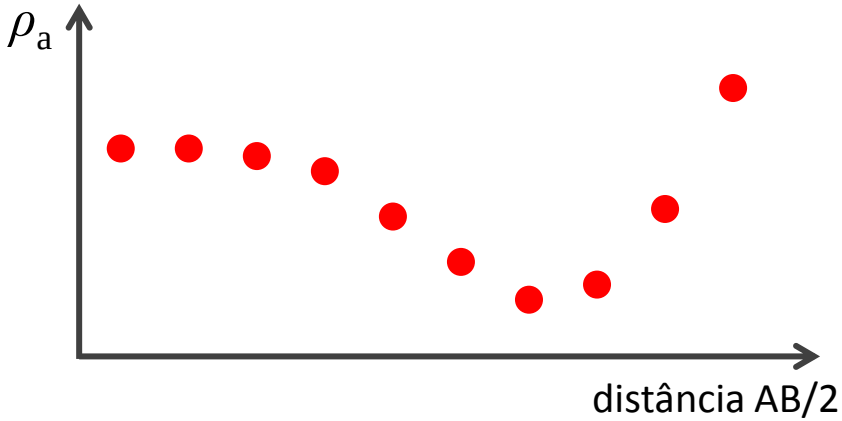


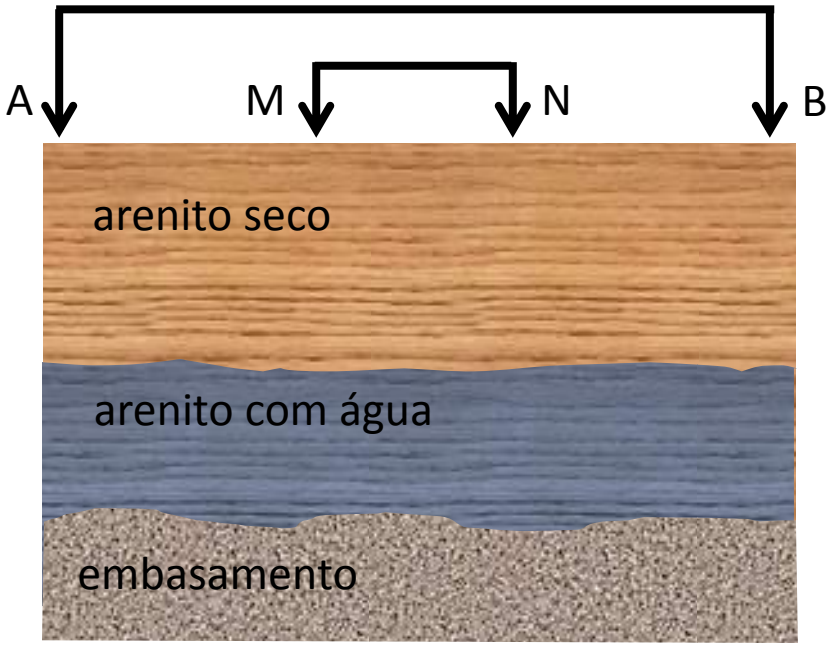


Exemplo em SEV

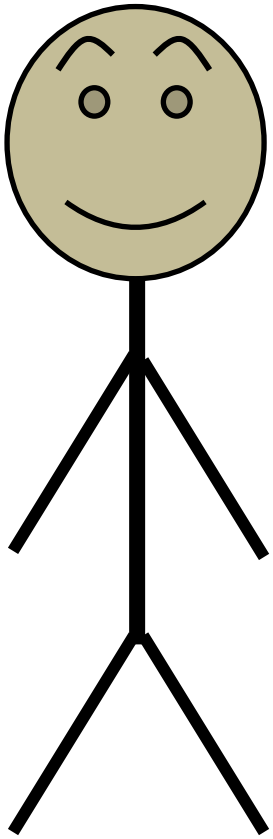


Sabe-se que a resistividade do arenito com água é menor que a do arenito seco, que por sua vez é menor que a do embasamento



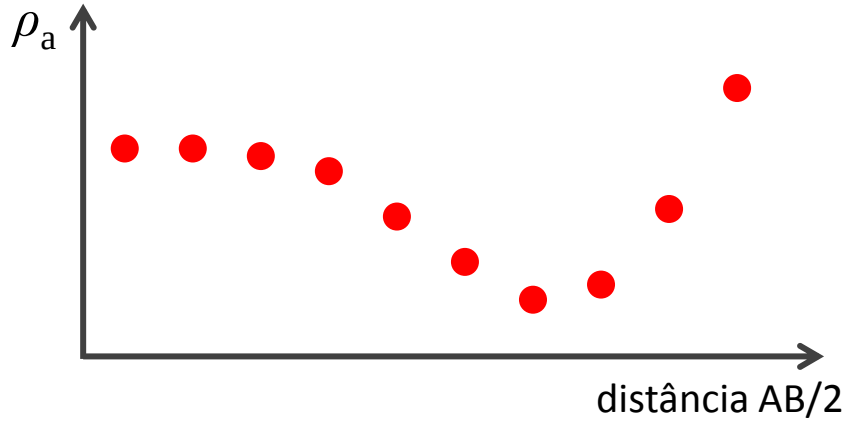


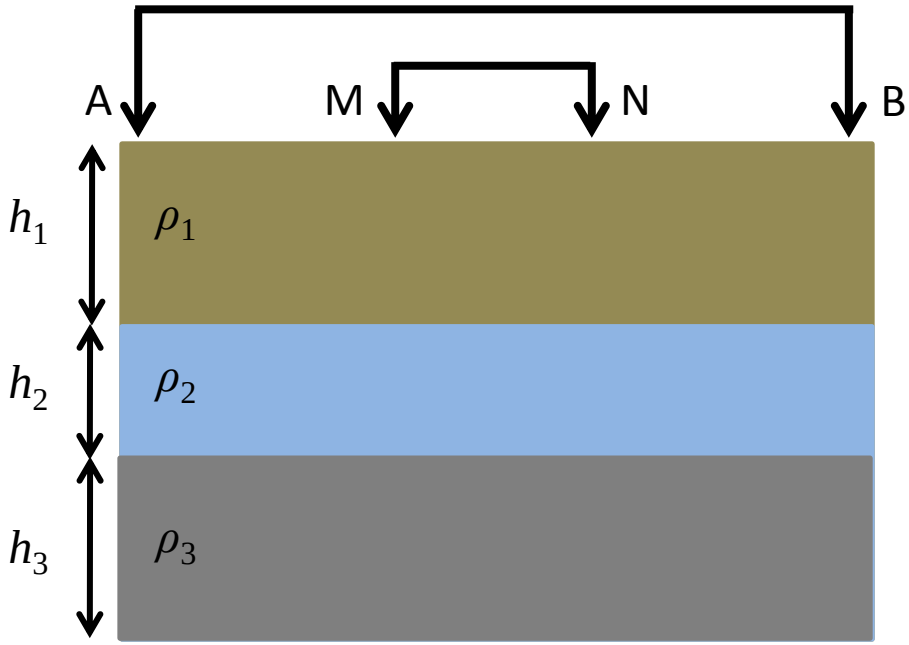
Exemplo em SEV



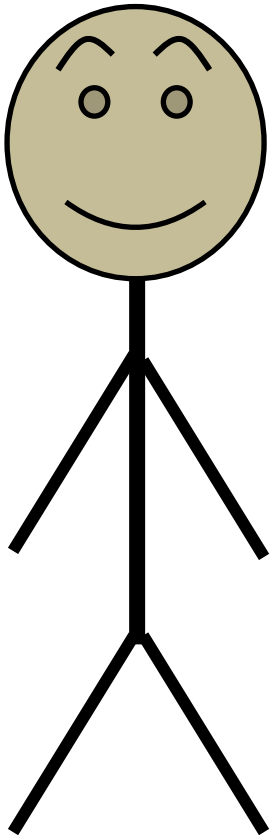
Vamos *parametrizar* da seguinte forma: há três camadas homogêneas, isotrópicos e plano-paralelas, cada uma com uma espessura h e uma resistividade ρ

$\rho_2 < \rho_1 < \rho_3$

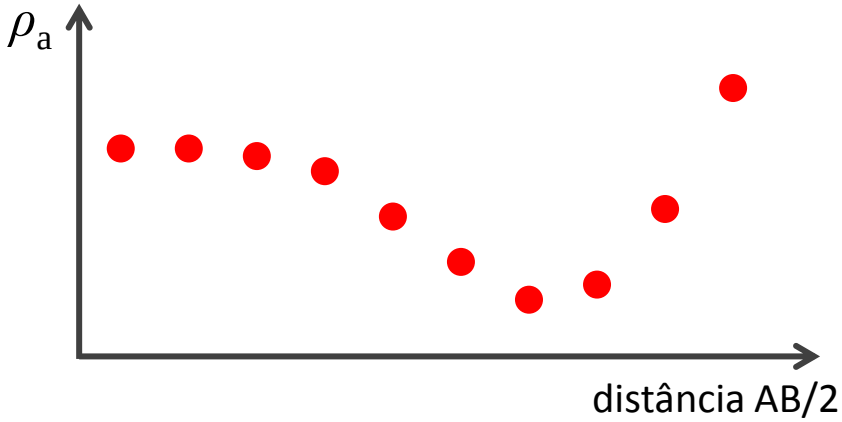




Exemplo em SEV

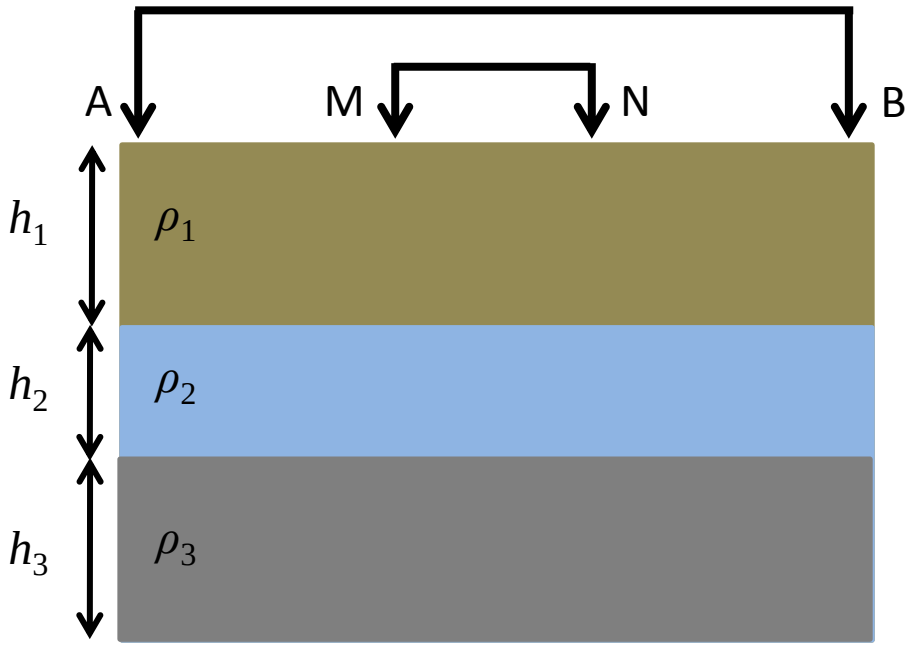


A *função f* do *problema direto* calcula, dadas as espessuras h_1, h_2 e h_3, a curva de resistividade aparente predita

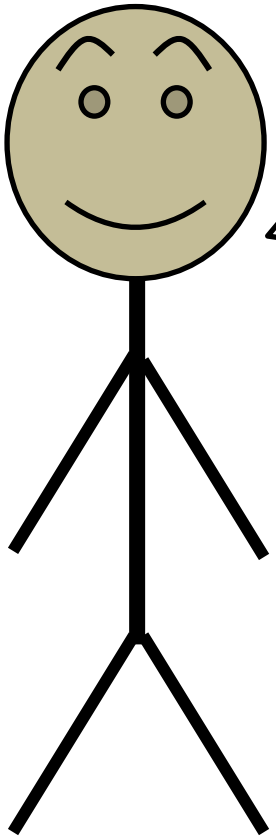


$\rho_2 < \rho_1 < \rho_3$

$\rho_a = f(h_1, h_2, h_3)$



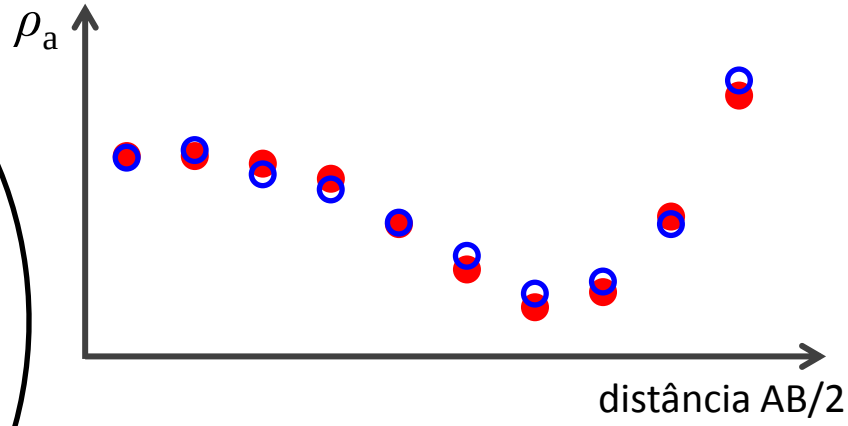
Exemplo em SEV

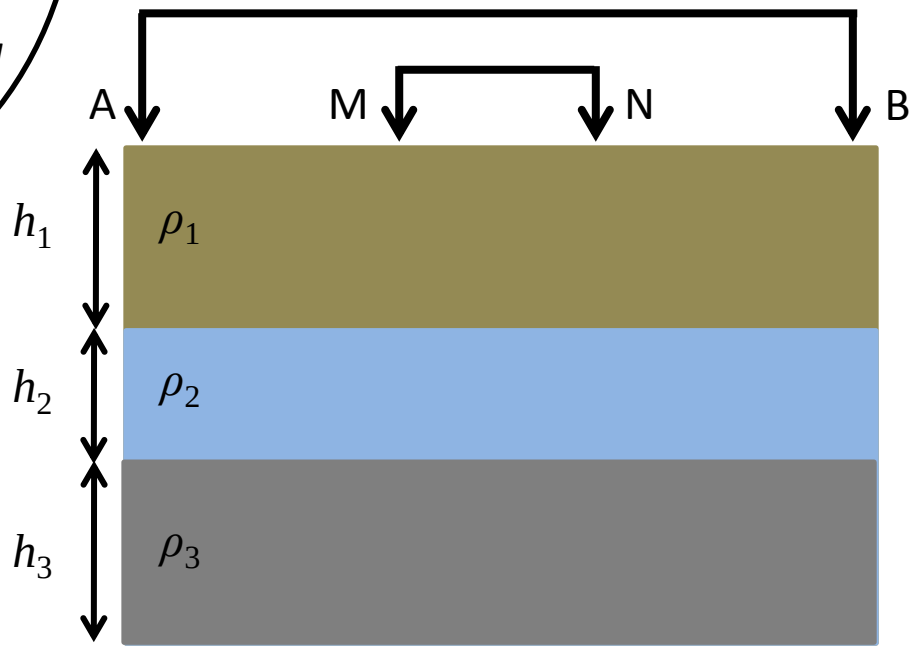


Sendo assim, o *problema inverso* consiste em encontrar as espessuras h_1, h_2 e h_3, tal que os dados preditos sejam os mais próximos possíveis aos dados observados de acordo com uma *norma* preestabelecida

$\rho_2 < \rho_1 < \rho_3$

$\rho_a = f(h_1, h_2, h_3)$

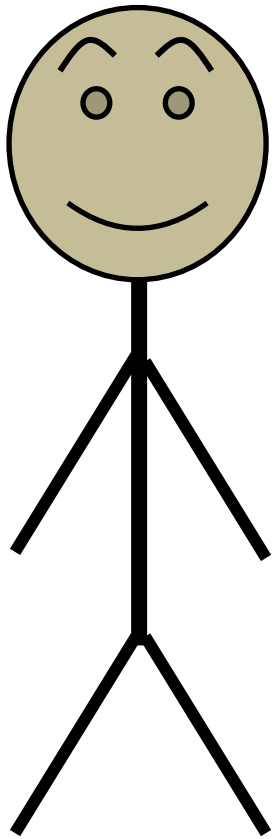


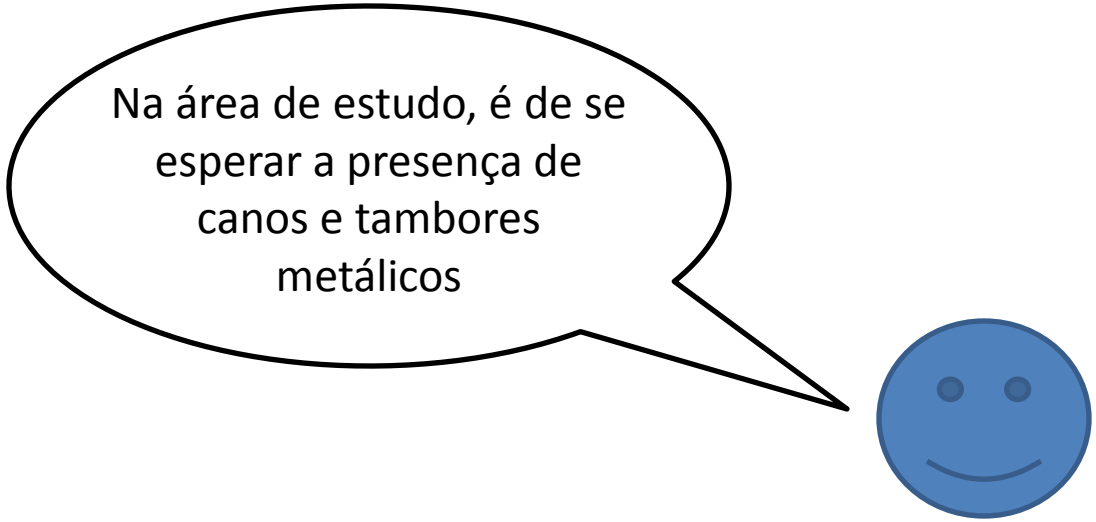


Exemplo em GPR

Exemplo em GPR

Exemplo em GPR



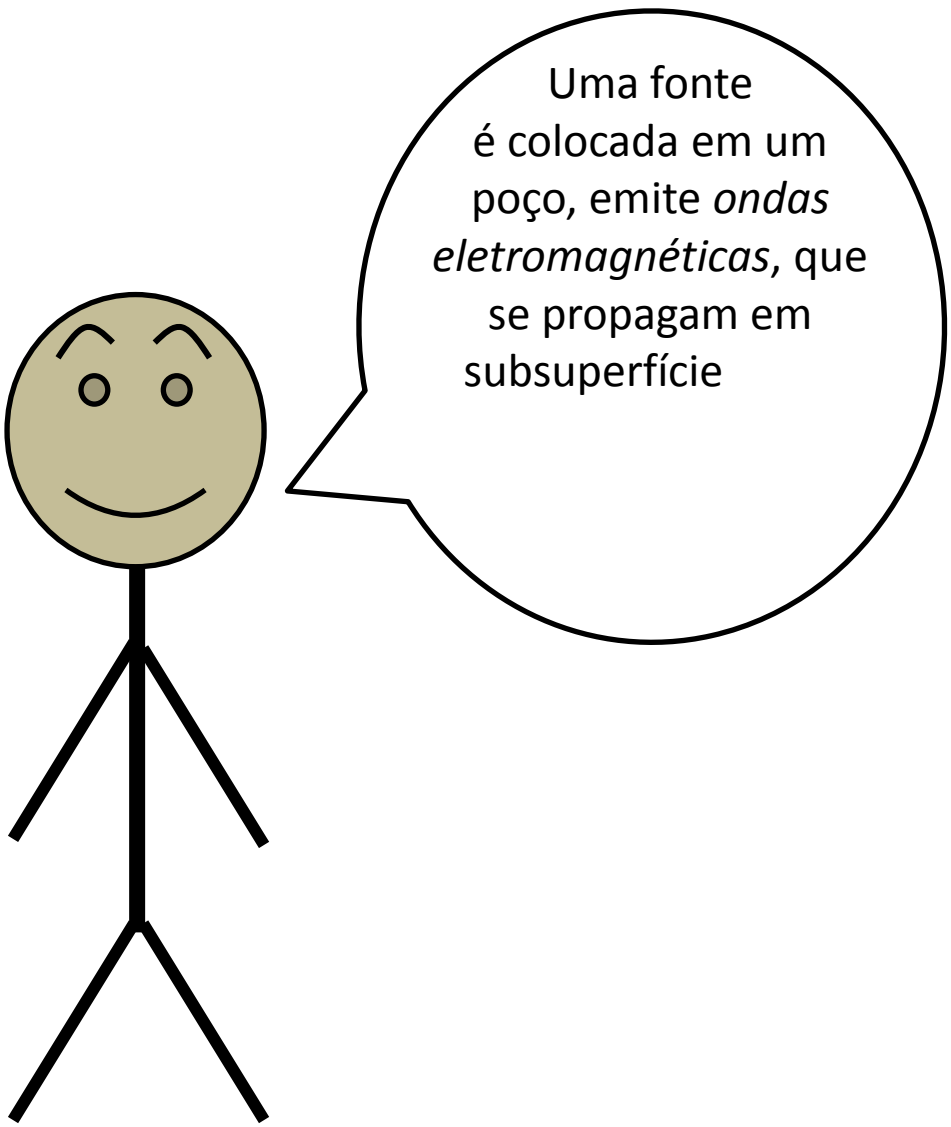


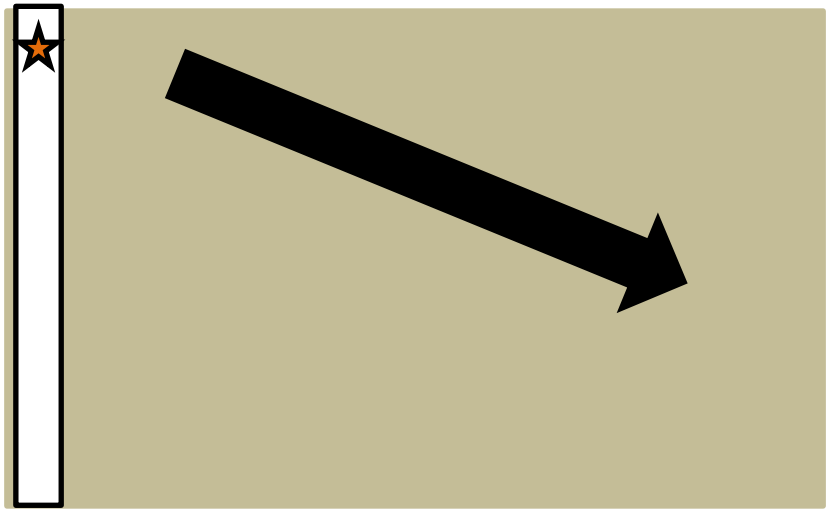
Exemplo em GPR

subsuperfície

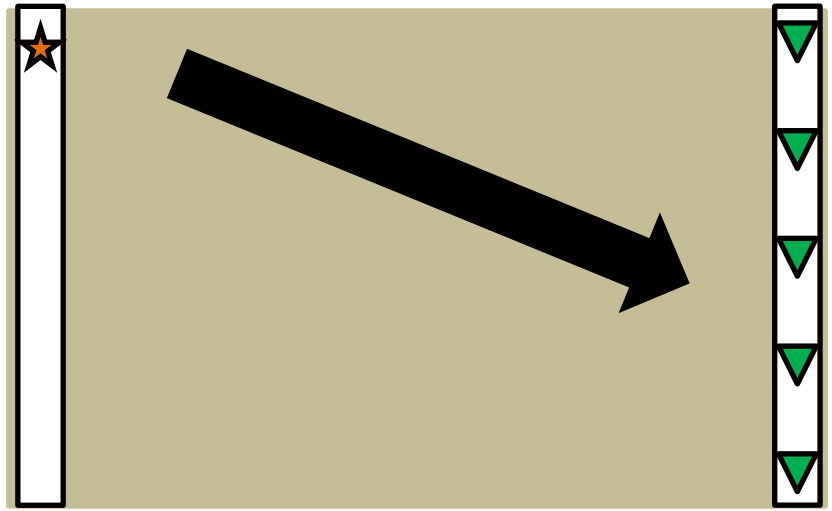
Exemplo em GPR

Exemplo em GPR

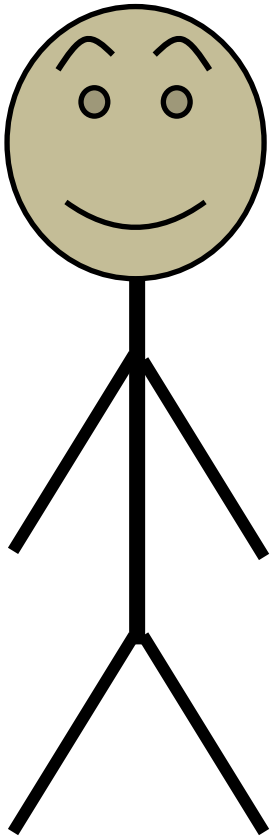




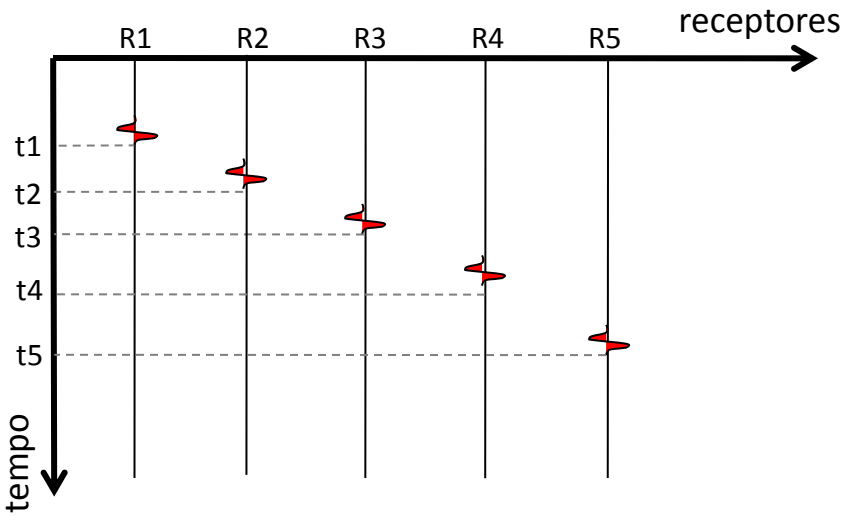
Exemplo em GPR

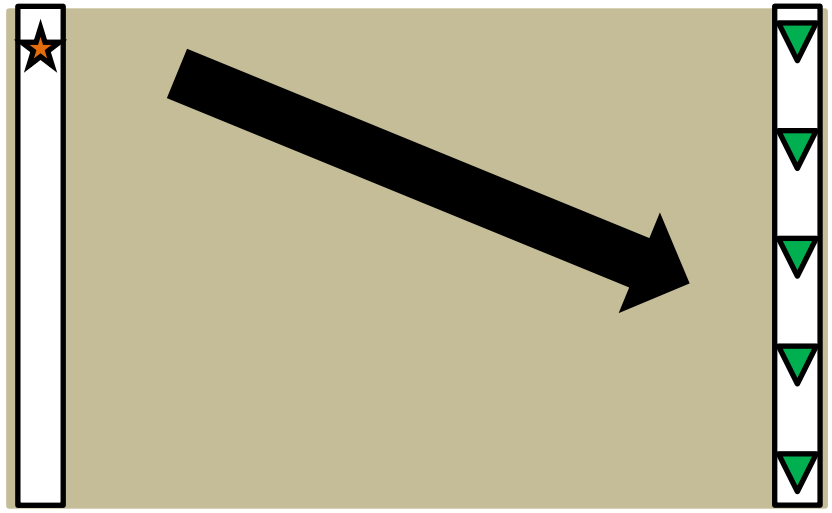


Exemplo em GPR

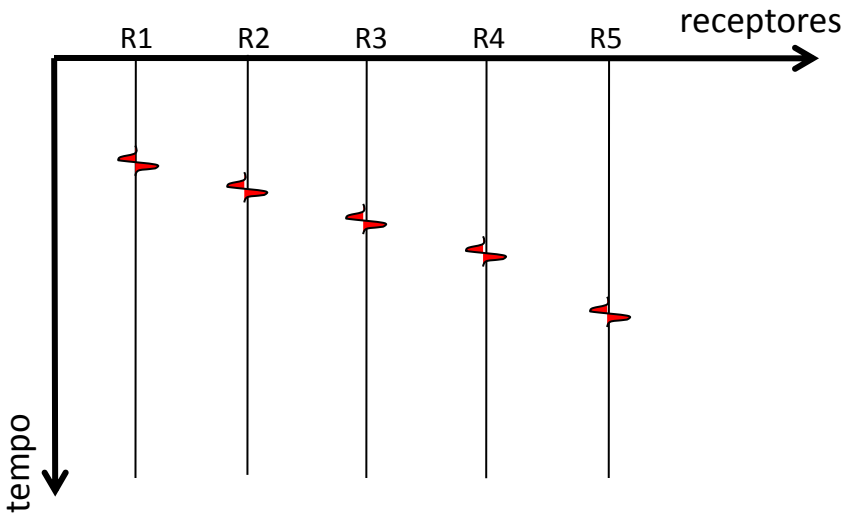


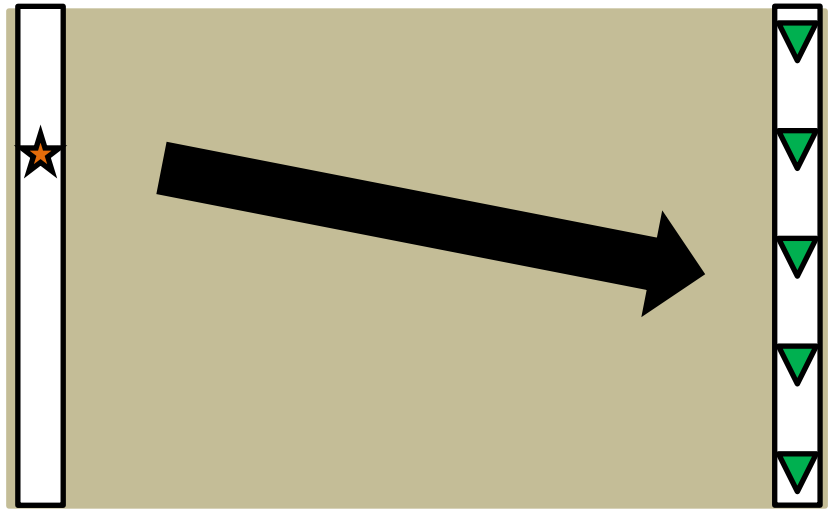
As *observações* são os tempos que as primeiras ondas demoram durante a propagação até os receptores



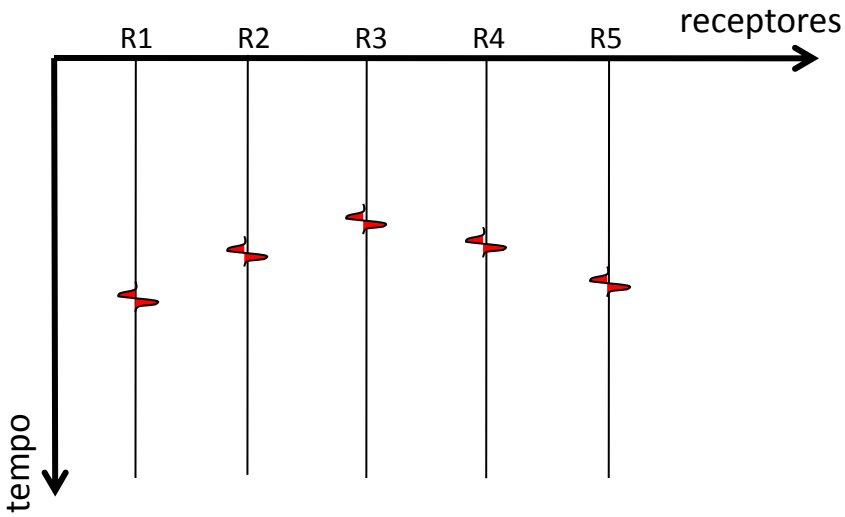


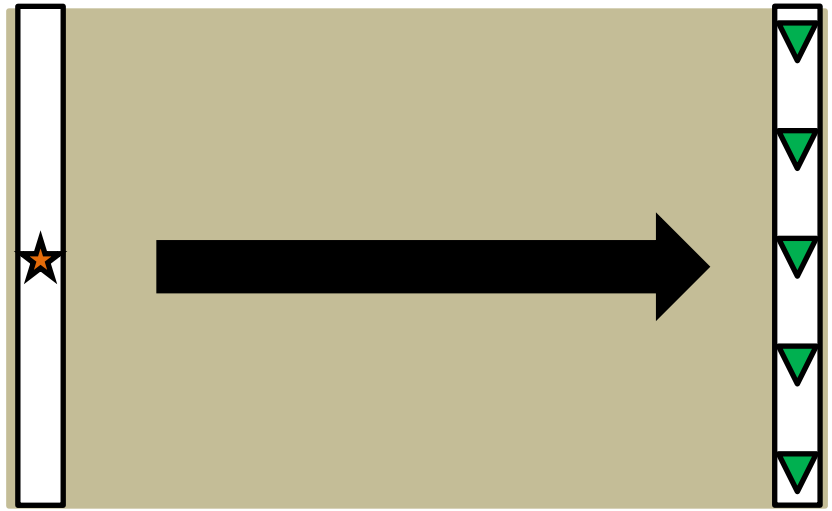
Exemplo em GPR



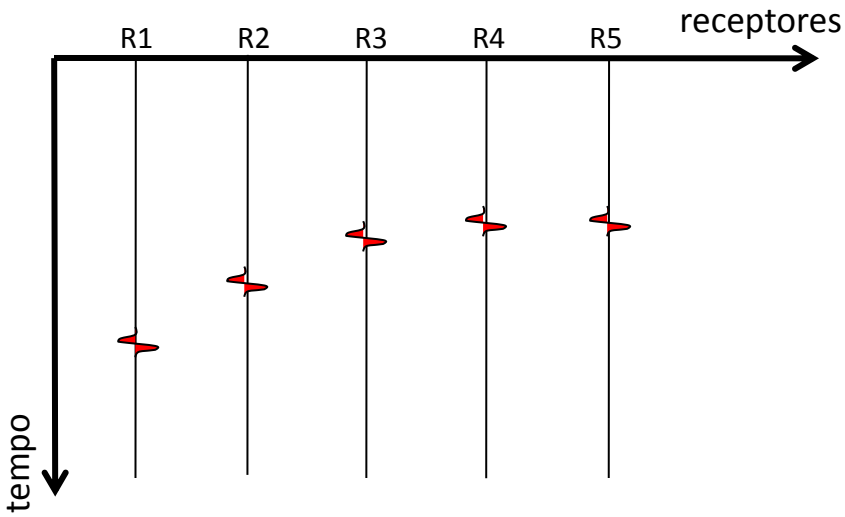


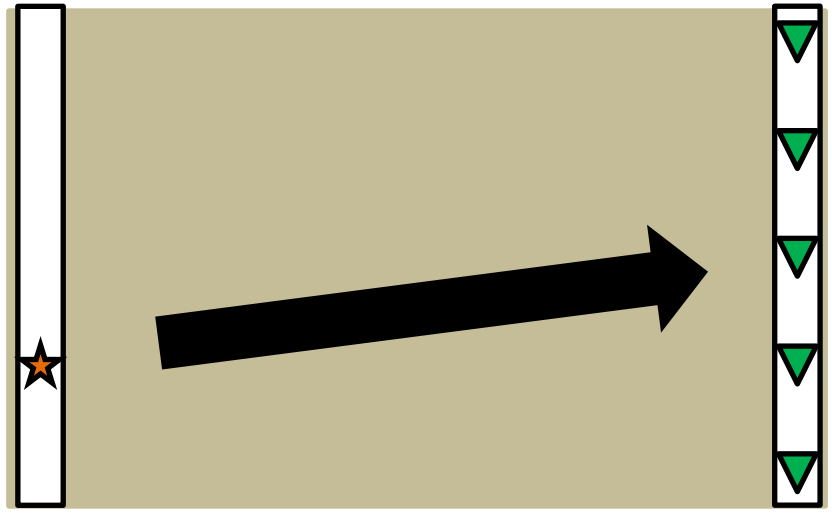
Exemplo em GPR



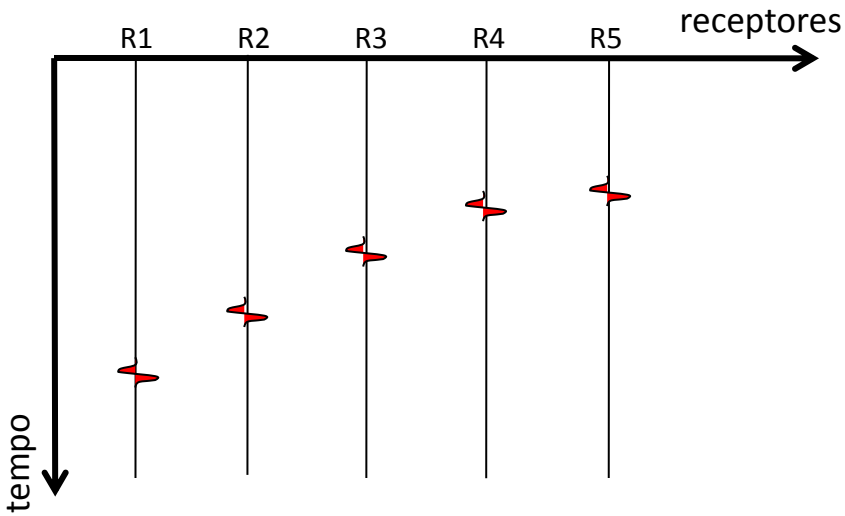


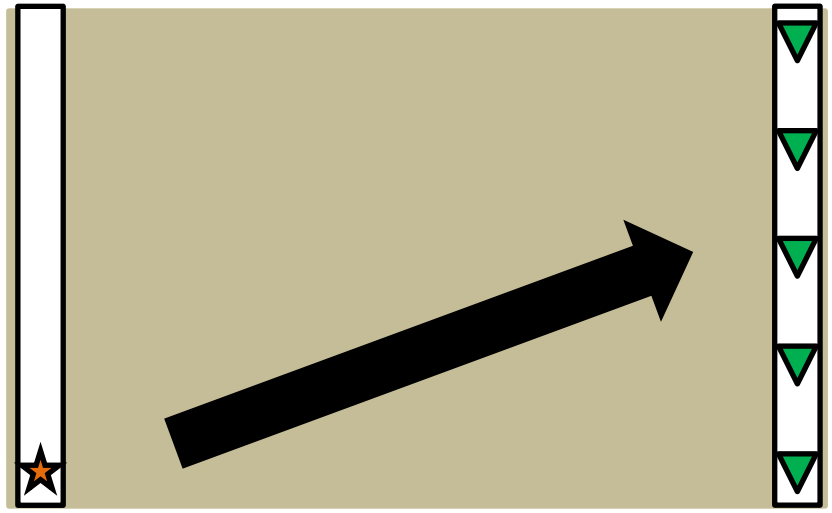
Exemplo em GPR



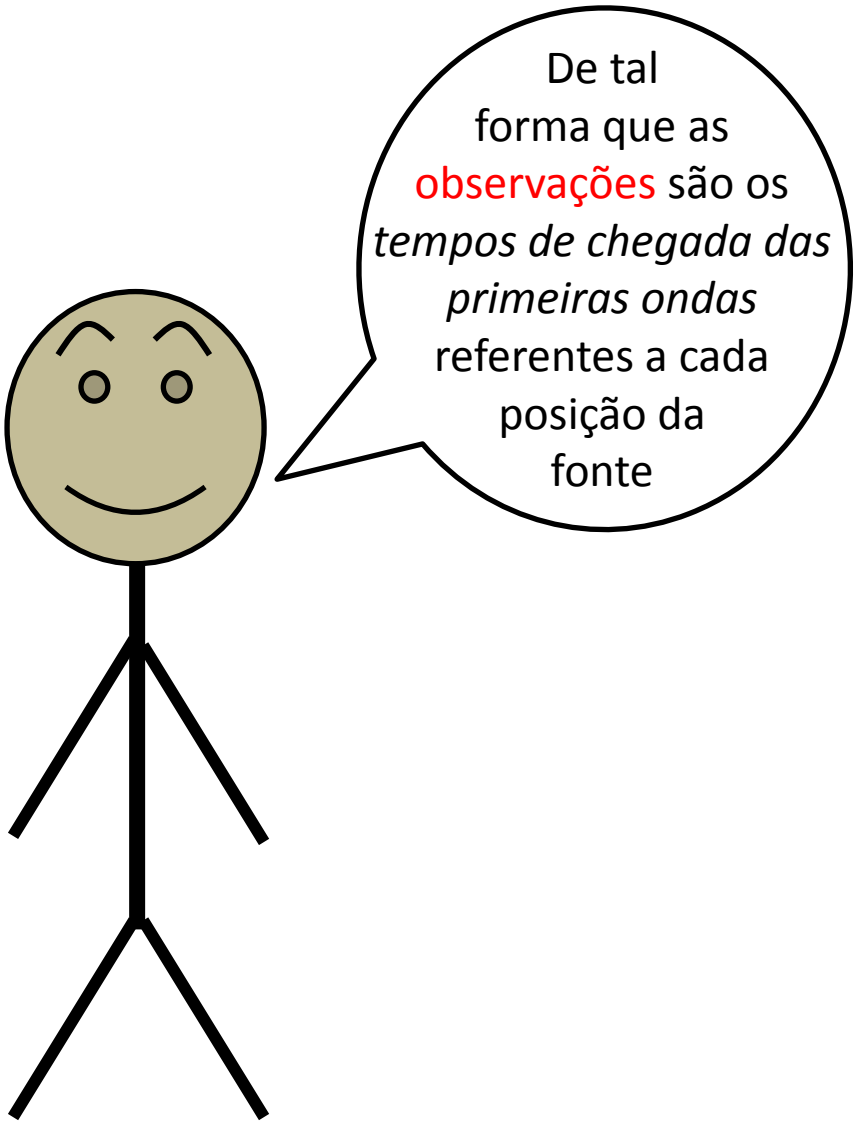


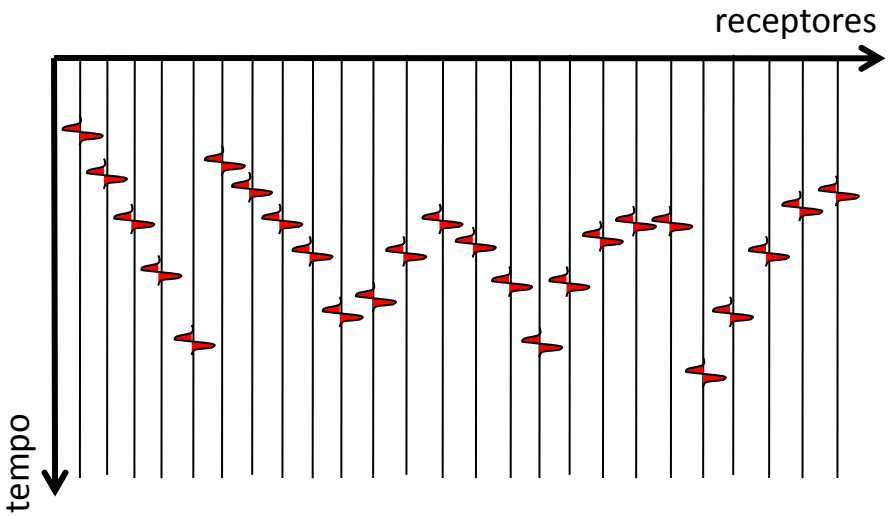
Exemplo em GPR



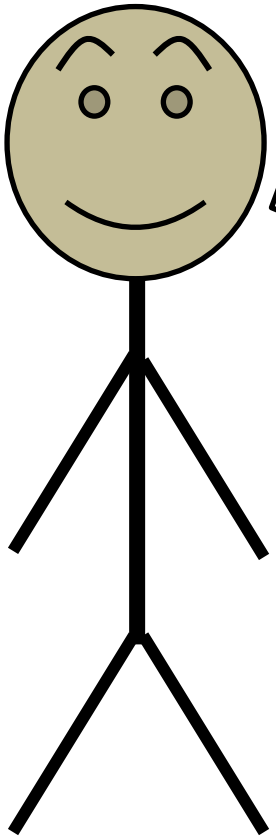


Exemplo em GPR

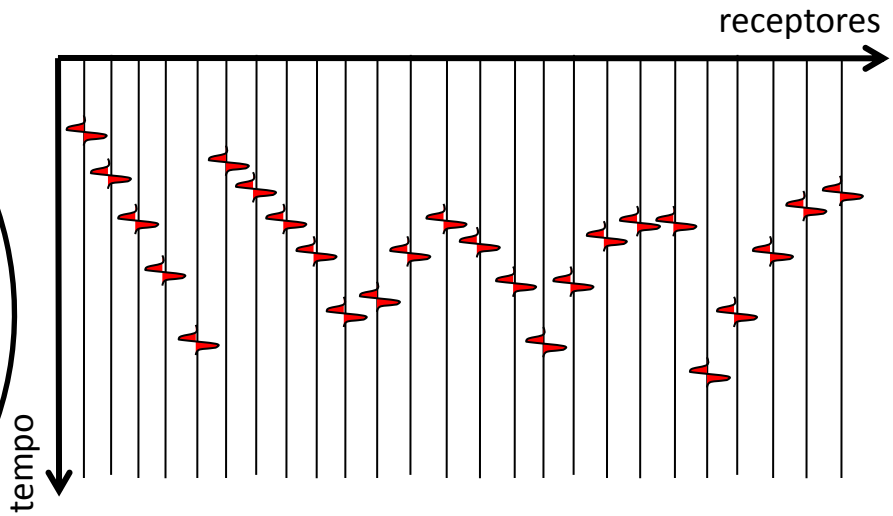


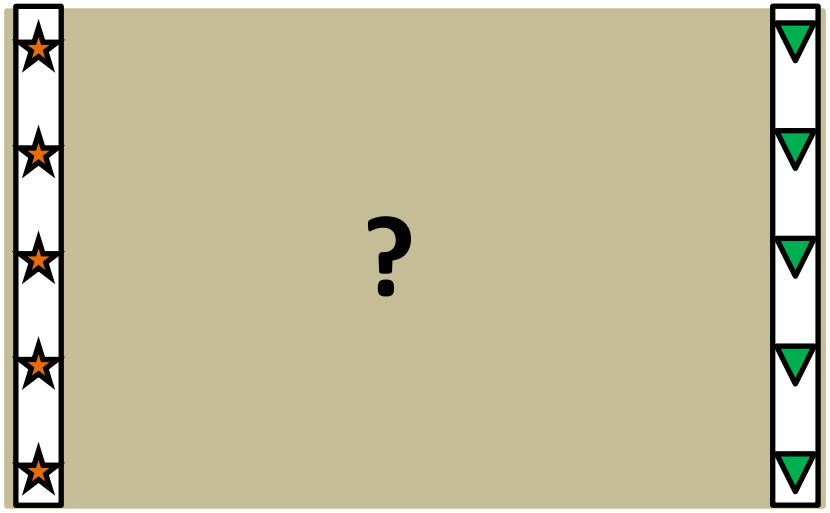


Exemplo em GPR

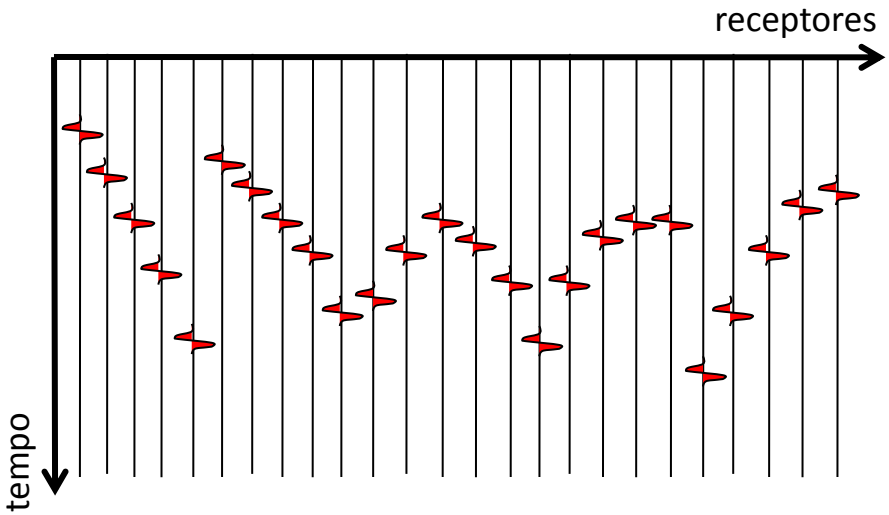


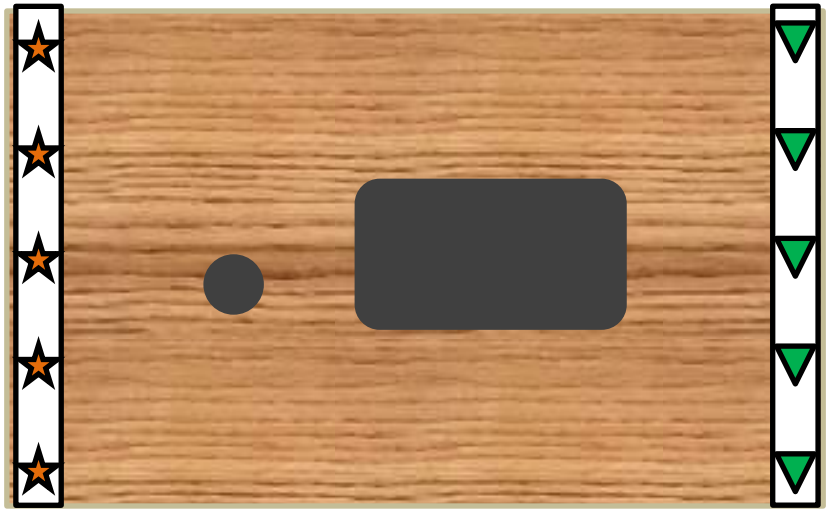
A maneira como as ondas se propagam e, consequentemente, o tempo que elas demoram para chegar aos receptores depende da *distribuição de velocidades* entre os poços



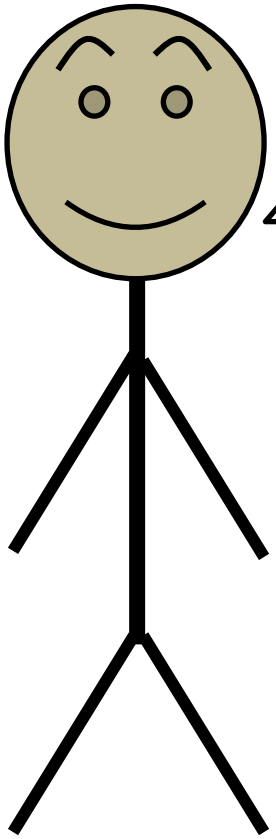


Exemplo em GPR

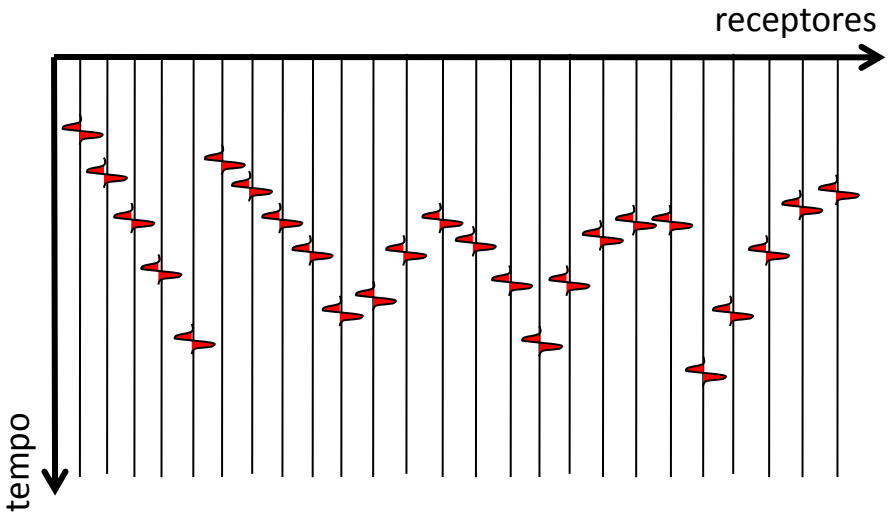




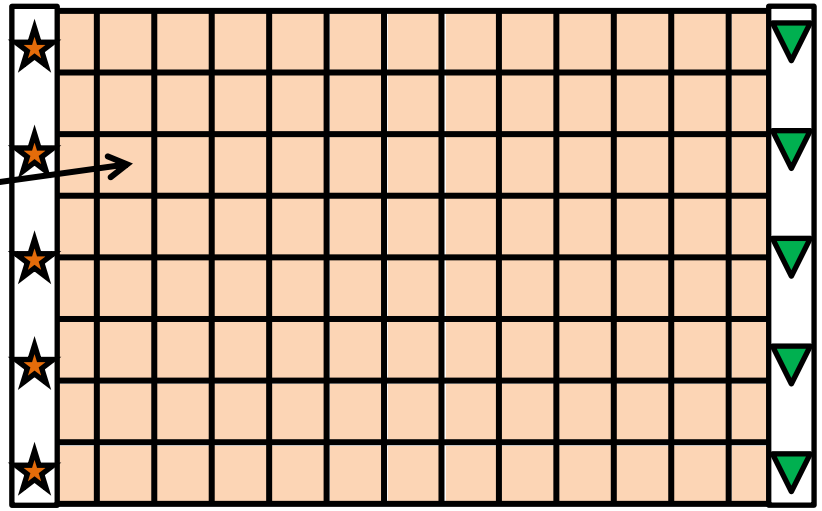
Exemplo em GPR



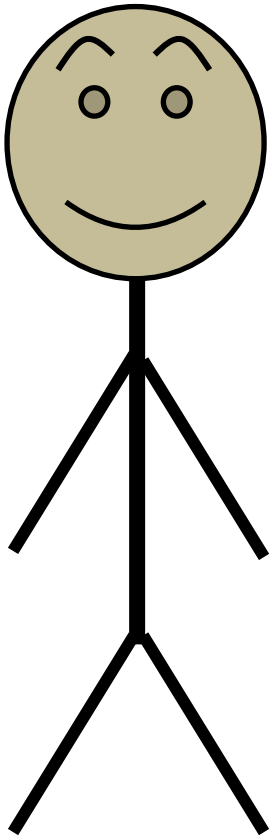
Vamos *parametrizar* da seguinte forma: a distribuição de velocidades é continua por partes, representada por M segmentos retangulares com velocidade v constante



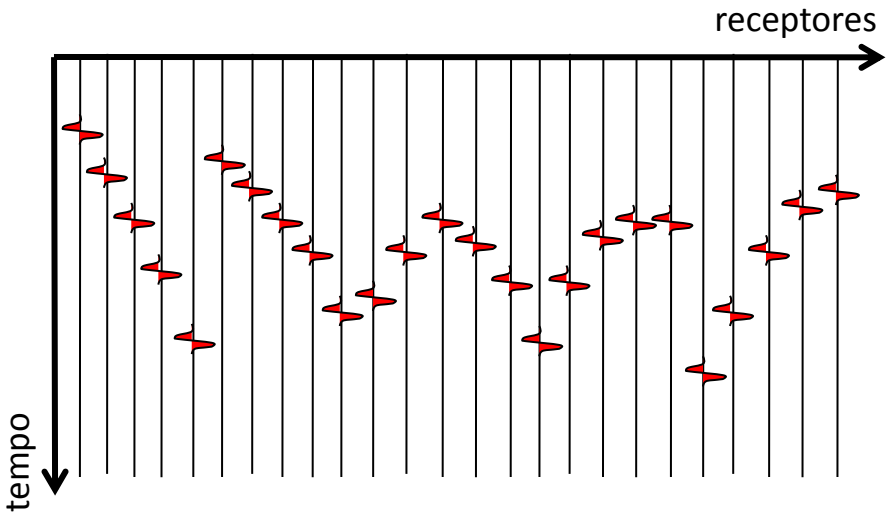
Segmento retangular com densidade v constante



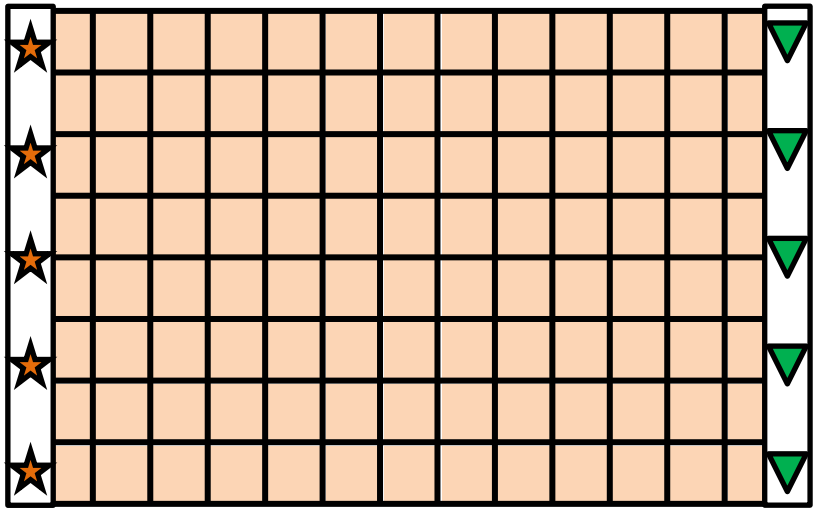
Exemplo em GPR



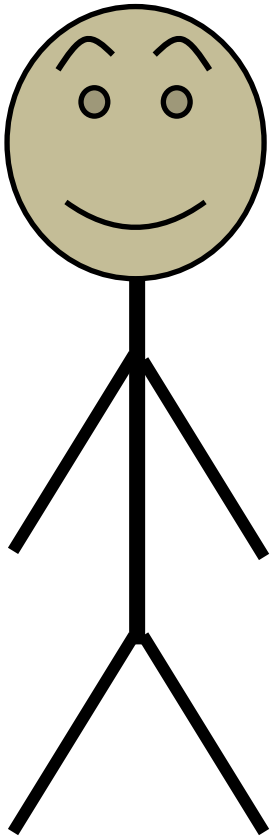
A *função f* do *problema direto* calcula, dada a velocidade *v* em cada segmento retangular, os tempos de chegada preditos para as primeiras ondas



$$t = f(v_1, v_2, \ldots, v_M)$$



Exemplo em GPR



Sendo assim, o *problema inverso* consiste em encontrar a velocidade v em cada segmento retangular, de forma que os dados preditos sejam os mais próximos possíveis aos dados observados de acordo com uma *norma* preestabelecida

$$t = f(v_1, v_2, \ldots, v_M)$$

Contorno dos corpos verdadeiros