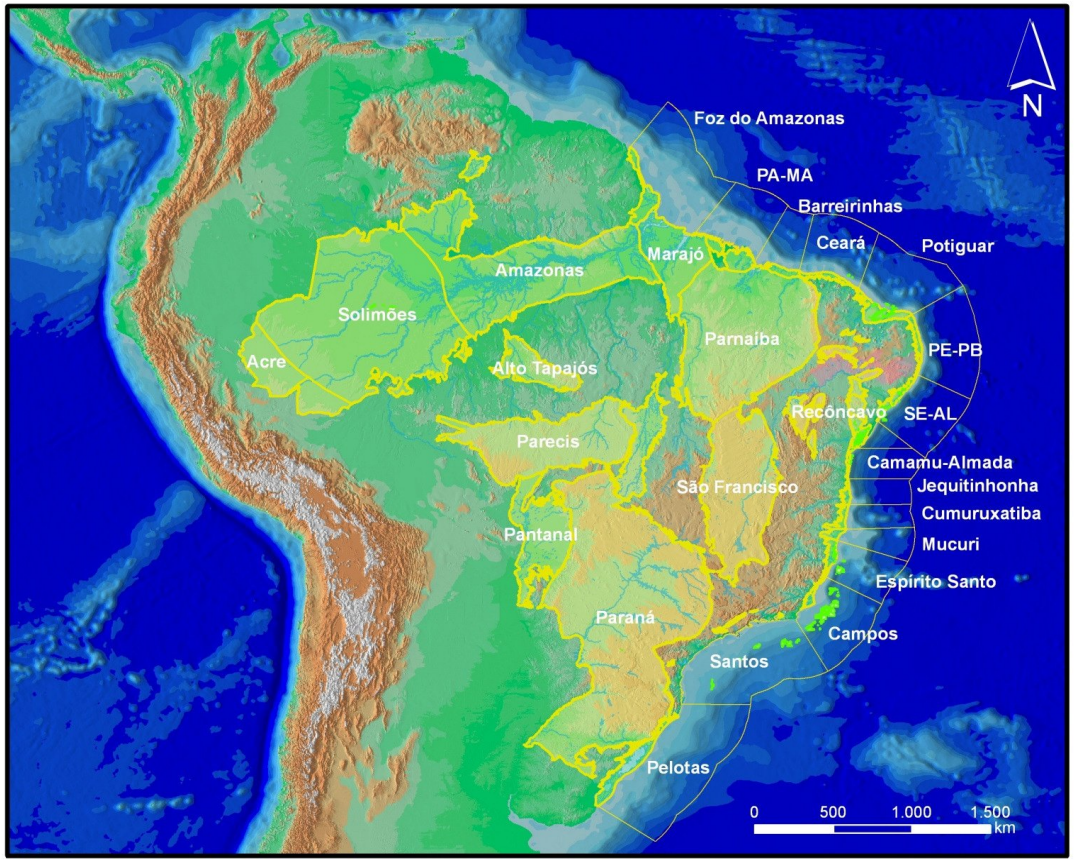
GEOFÍSICA COMPUTACIONAL

LÚCIO SANTOS

IMECC – UNICAMP

SISMOLOGIA SÍSMICA

BACIAS SEDIMENTARES



POÇOS PERFURADOS

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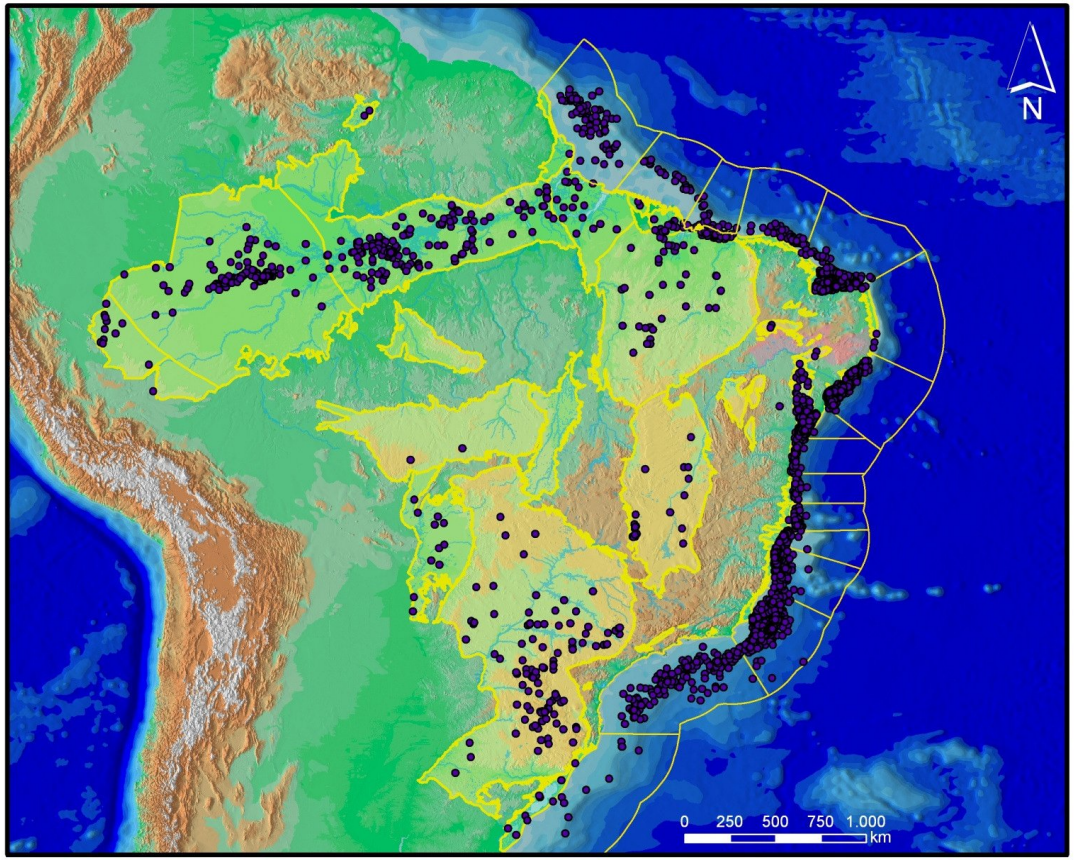
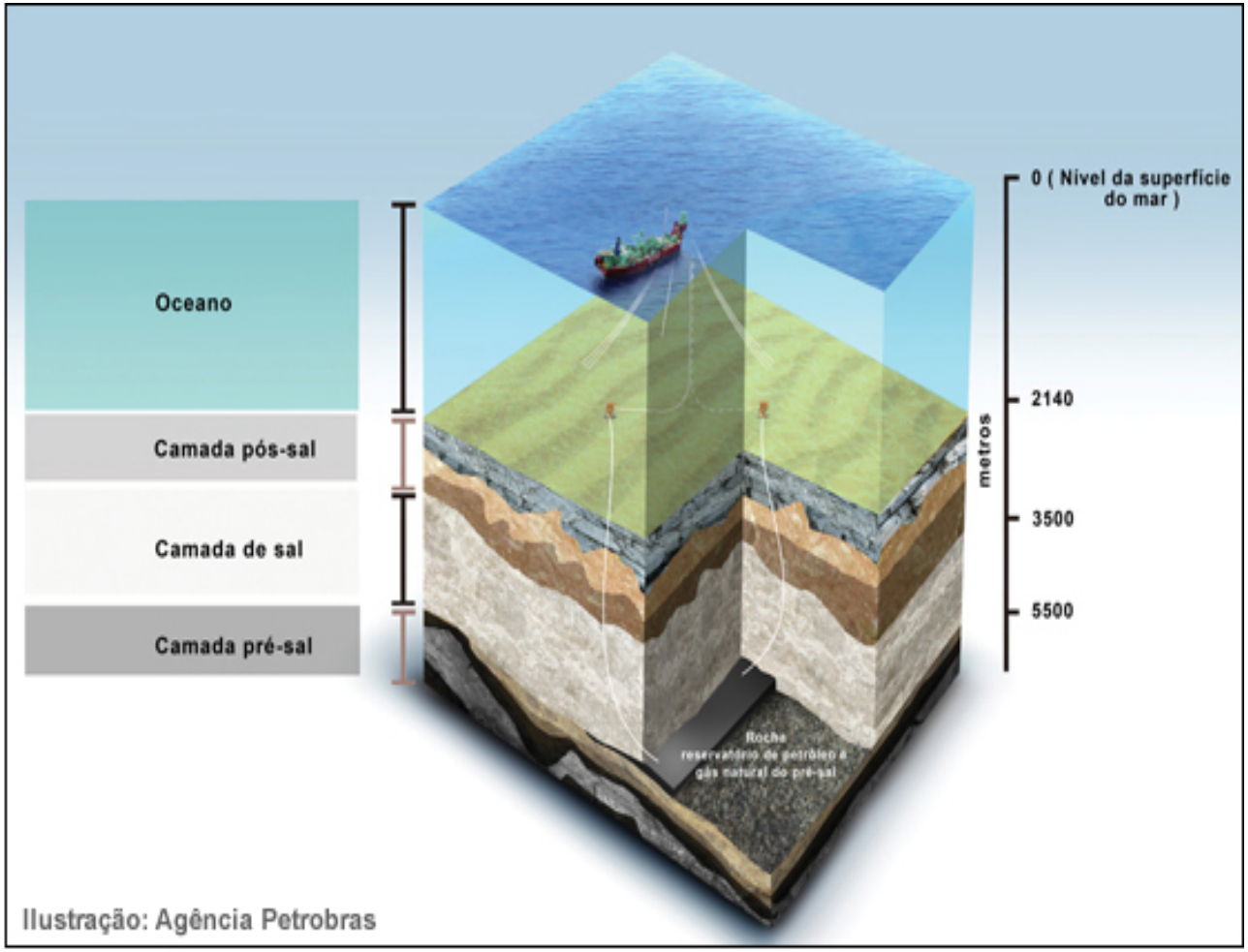
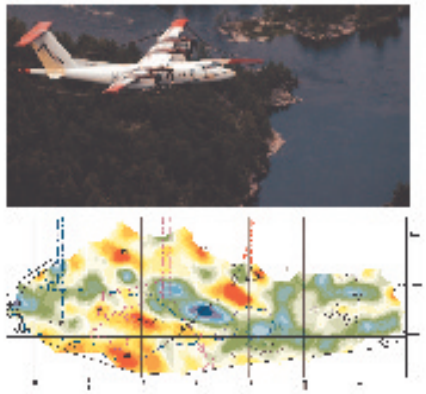


PROFUNDIDADES



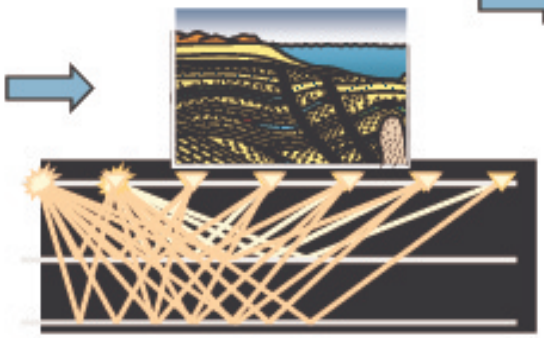
EXPLORAÇÃO PETROLÍFERA

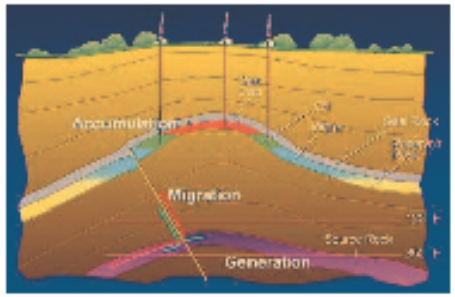
Levantamentos Aéreos



Levantamentos Geoquímicos

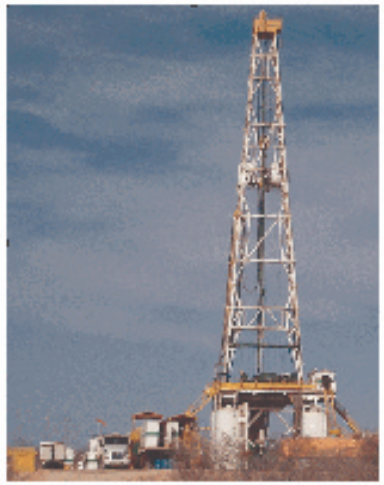
Levantamentos Sísmicos



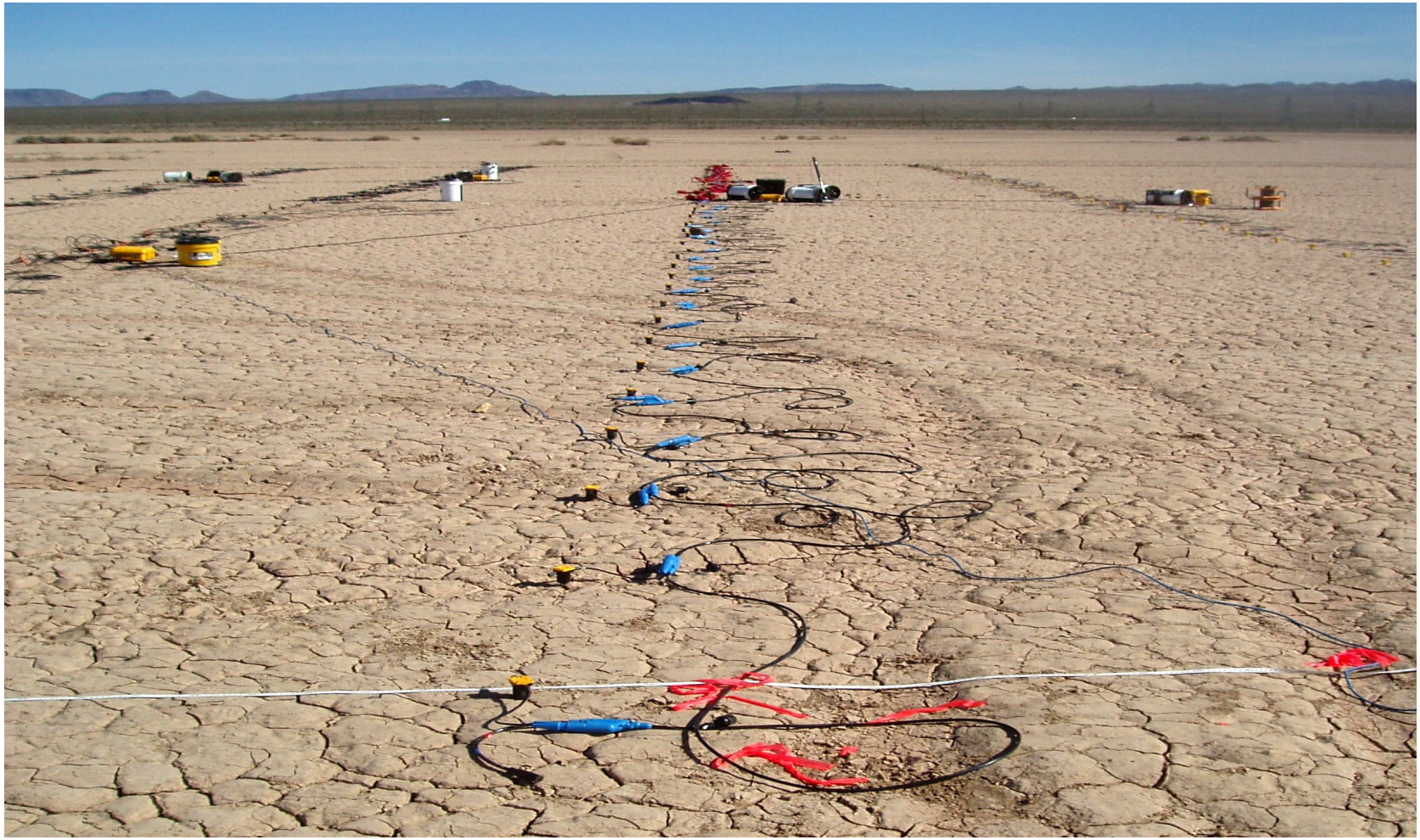


Integração de Dados

Perfuração de poço



LEVANTAMENTO SÍSMICO (TERRA)



LEVANTAMENTO SÍSMICO (MAR)

IMAGEAMENTO

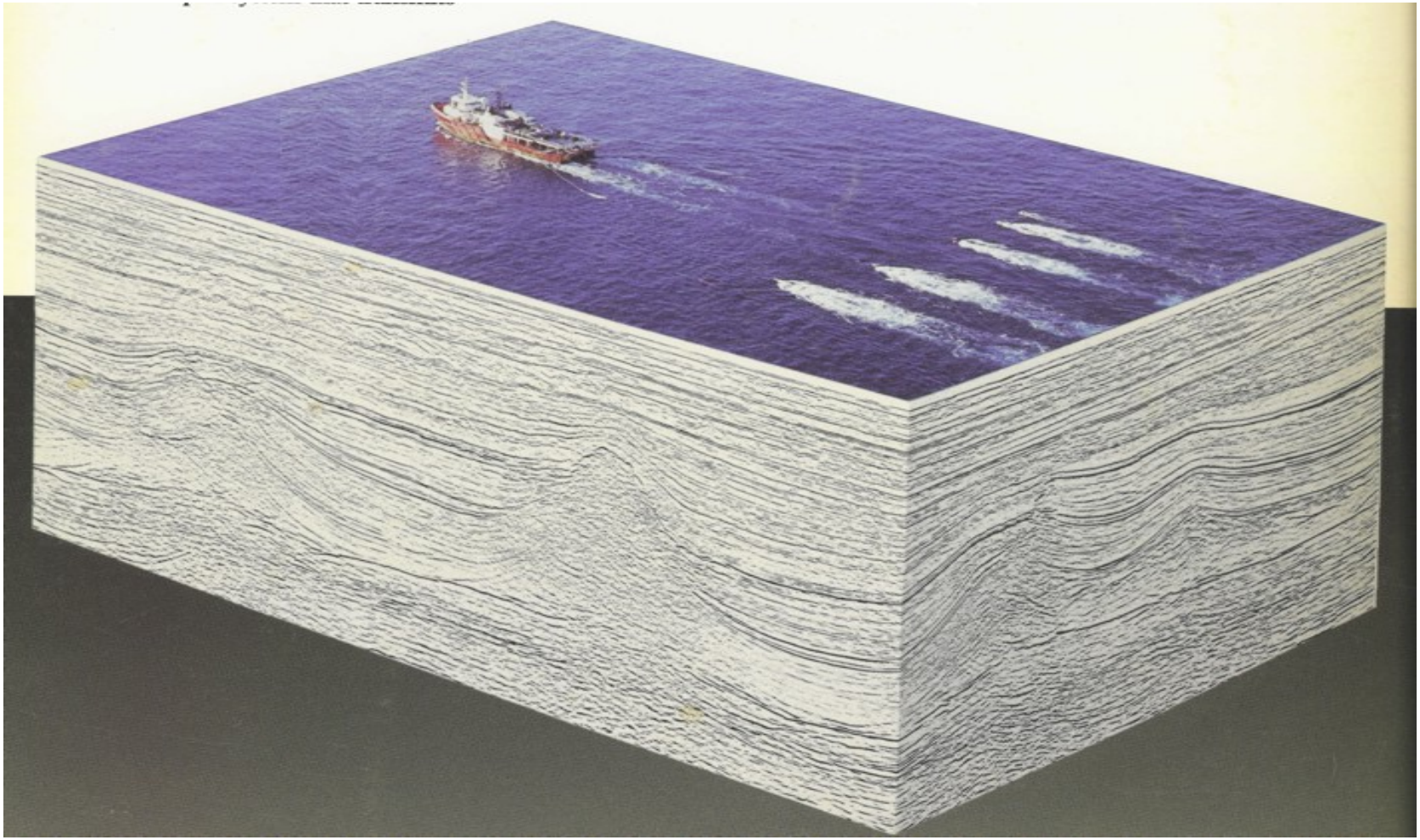


IMAGEM 2D

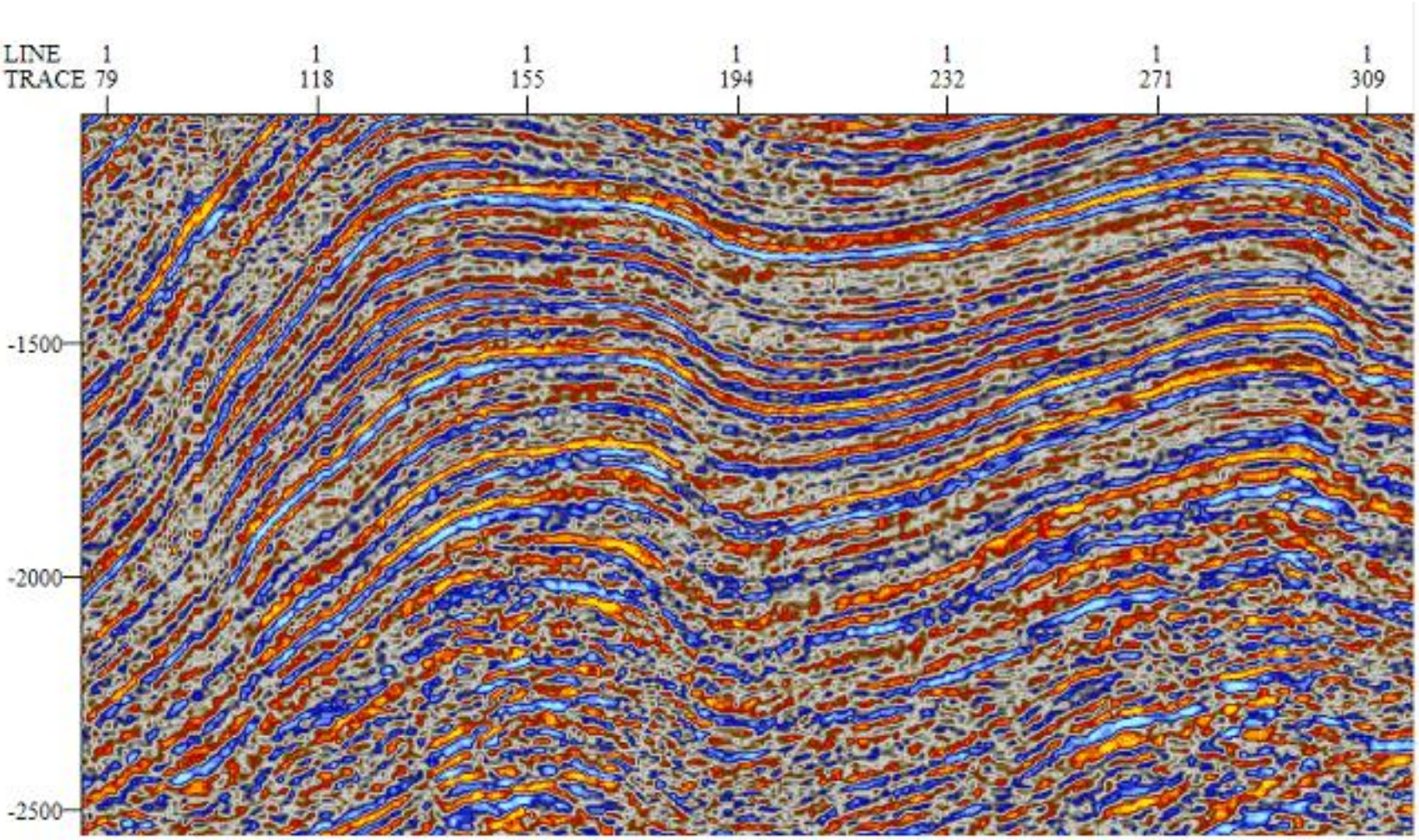
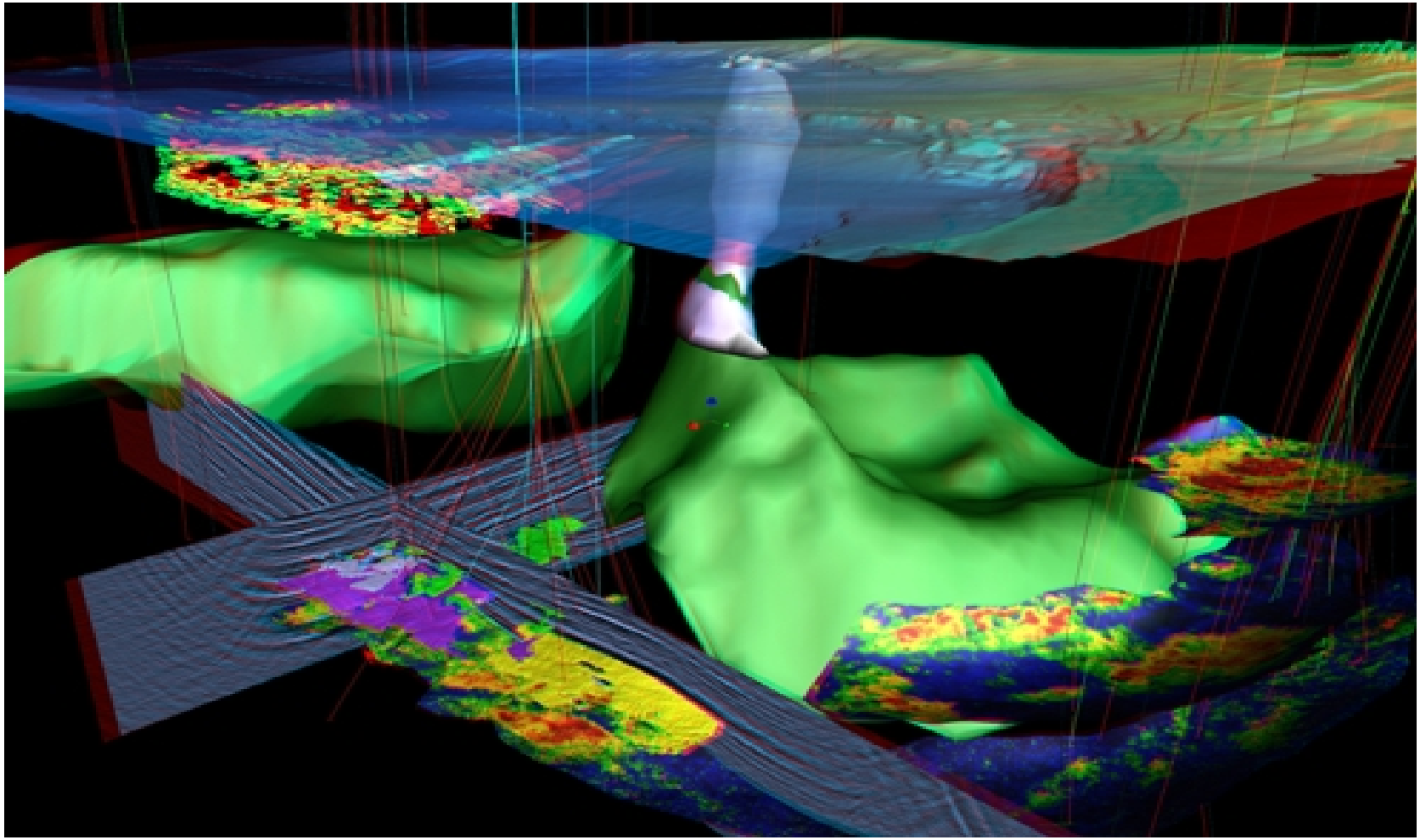
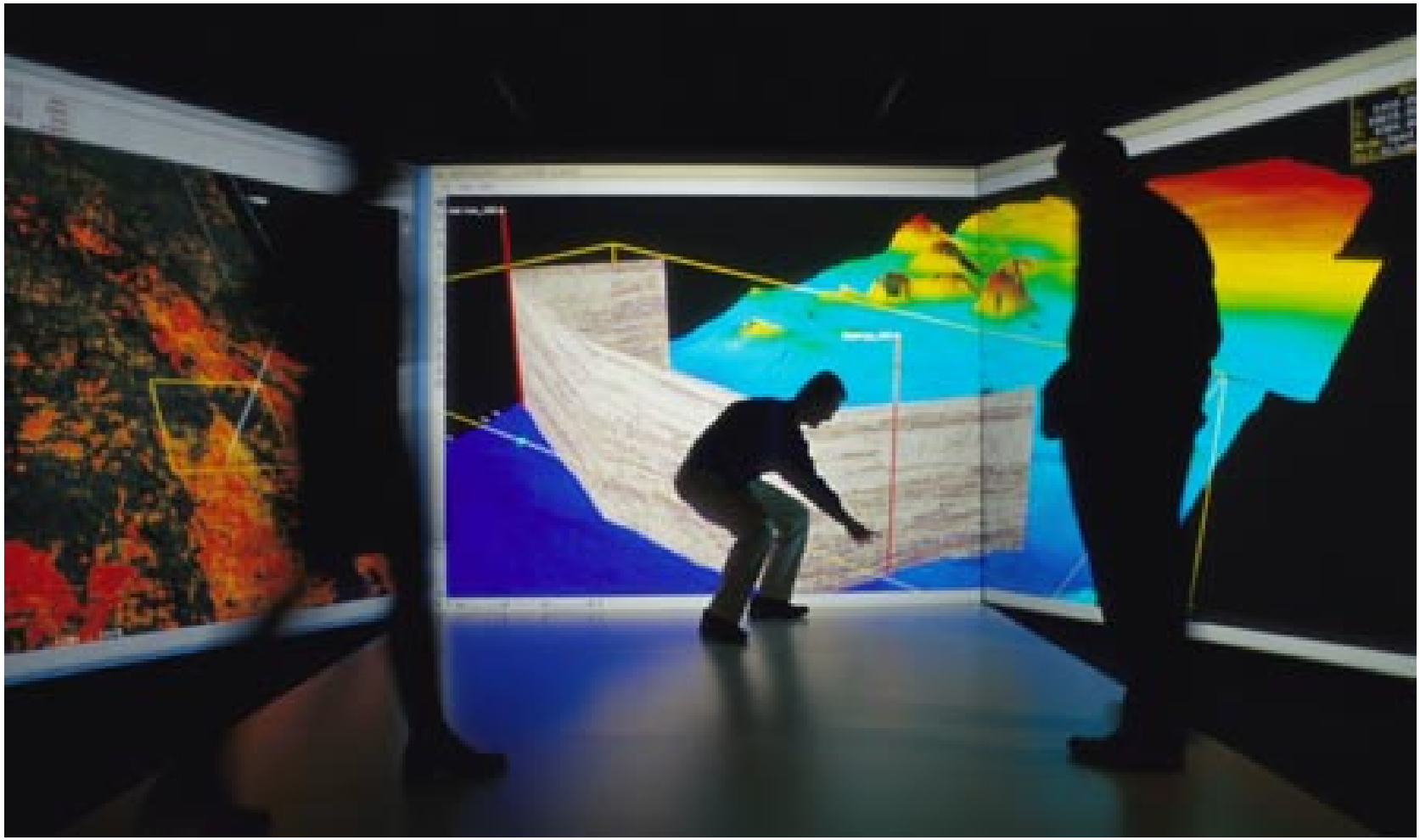


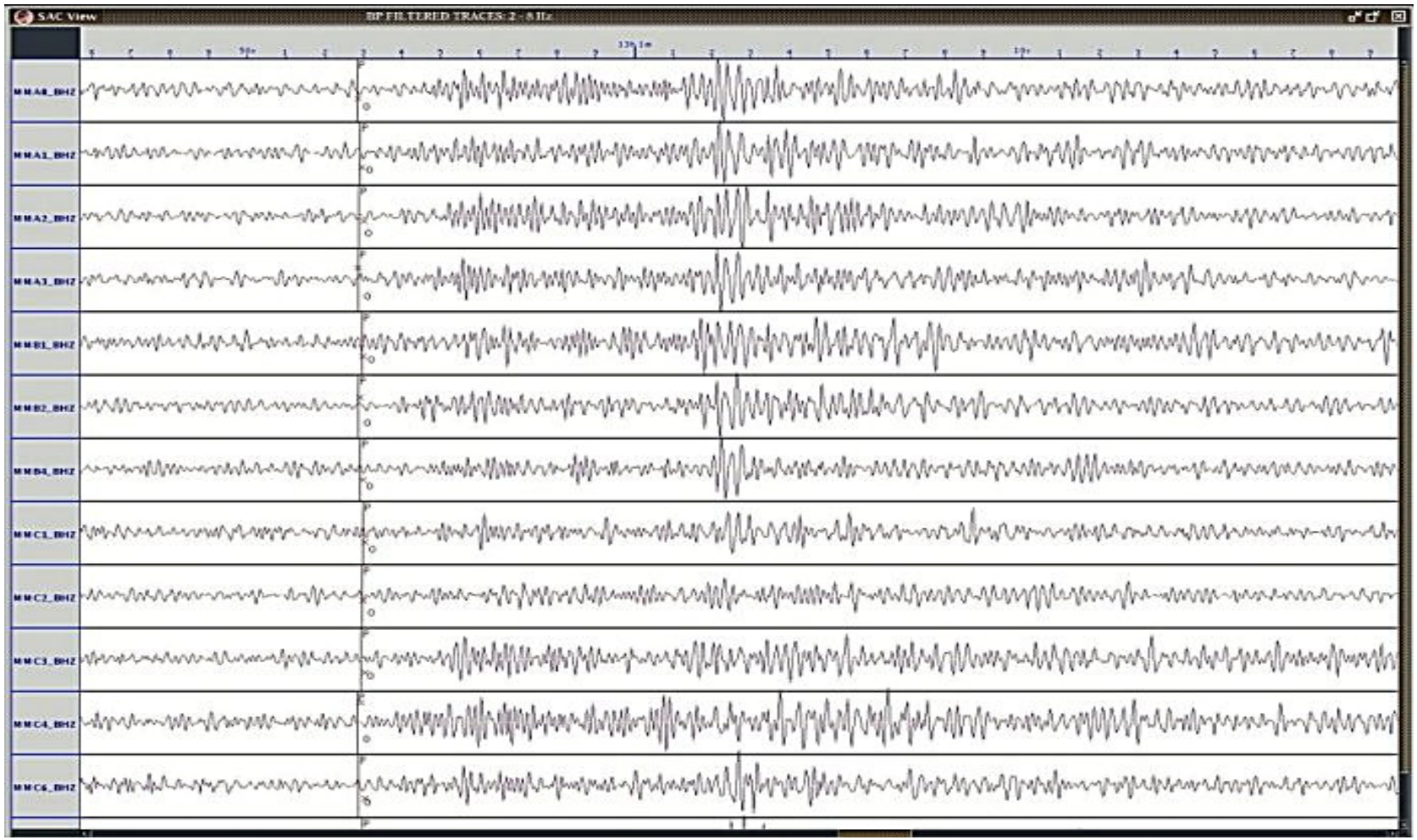
IMAGEM 3D



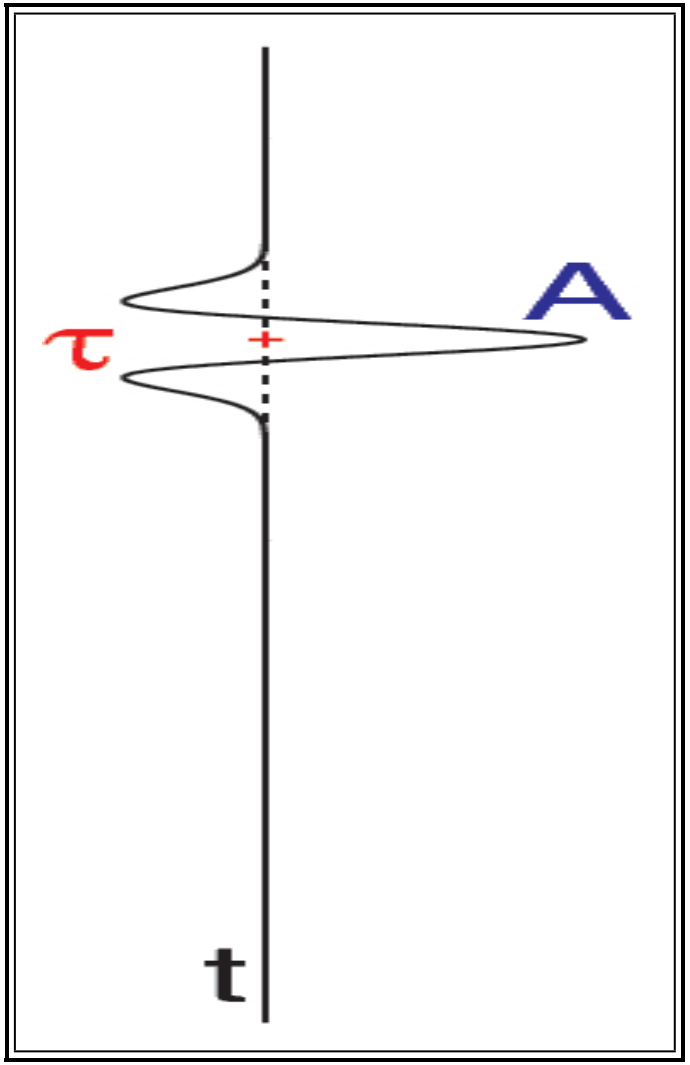
SALA DE VISUALIZAÇÃO



DADOS SÍSMICOS



TRAÇO SÍSMICO



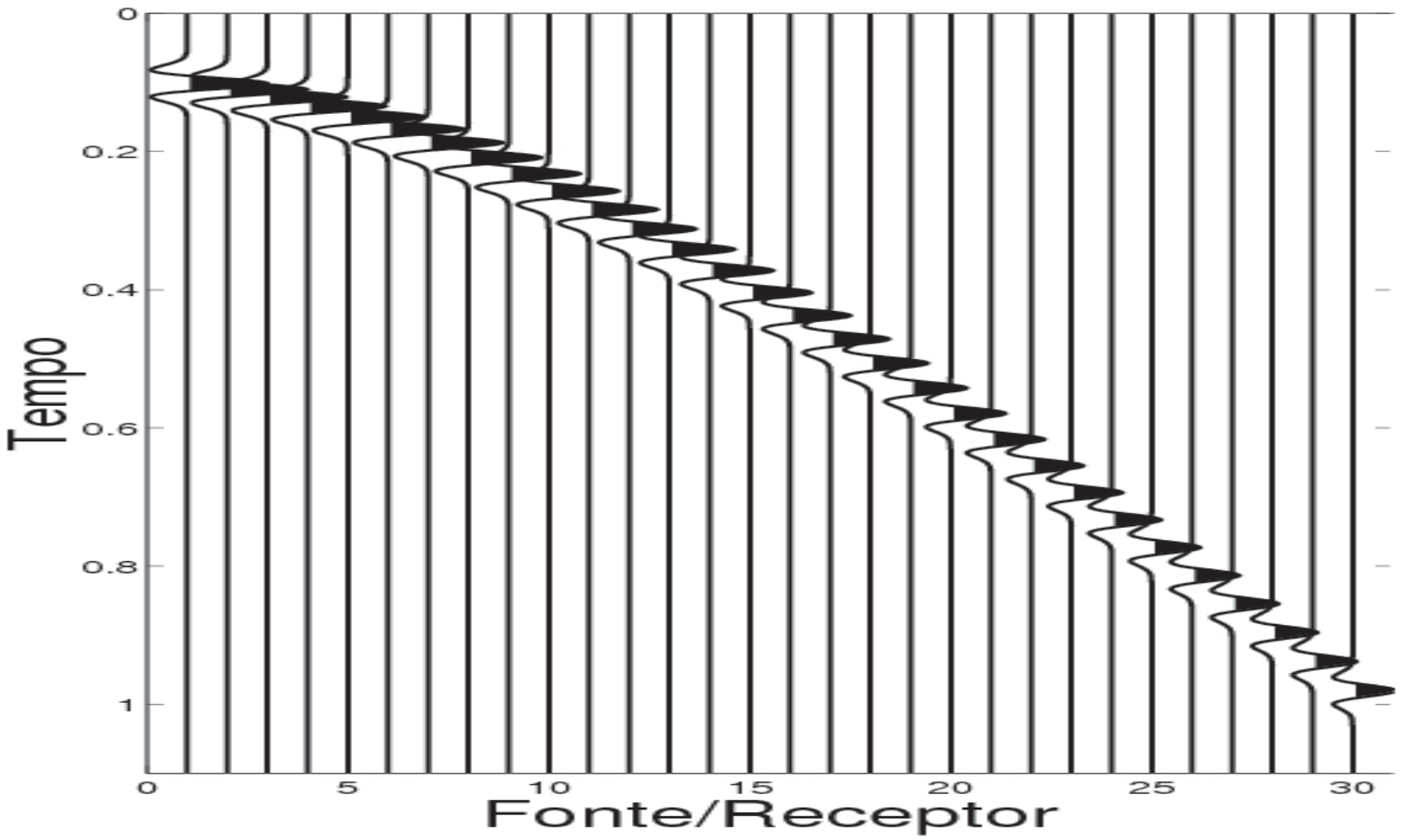
$$F(t) = A \cdot W(t - \tau)$$

A = Amplitude

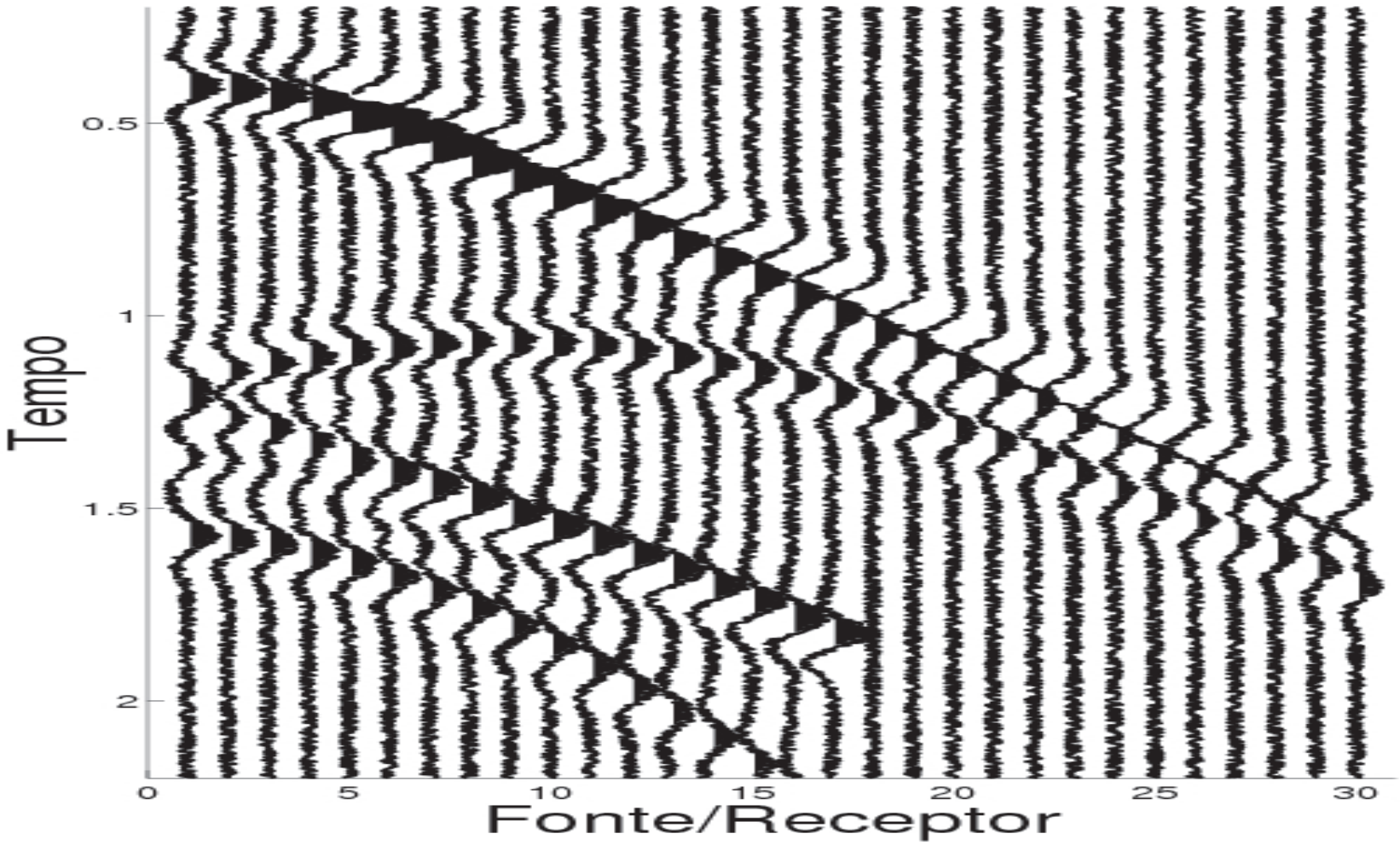
W = Wavelet

τ = Tempo de Reflexão

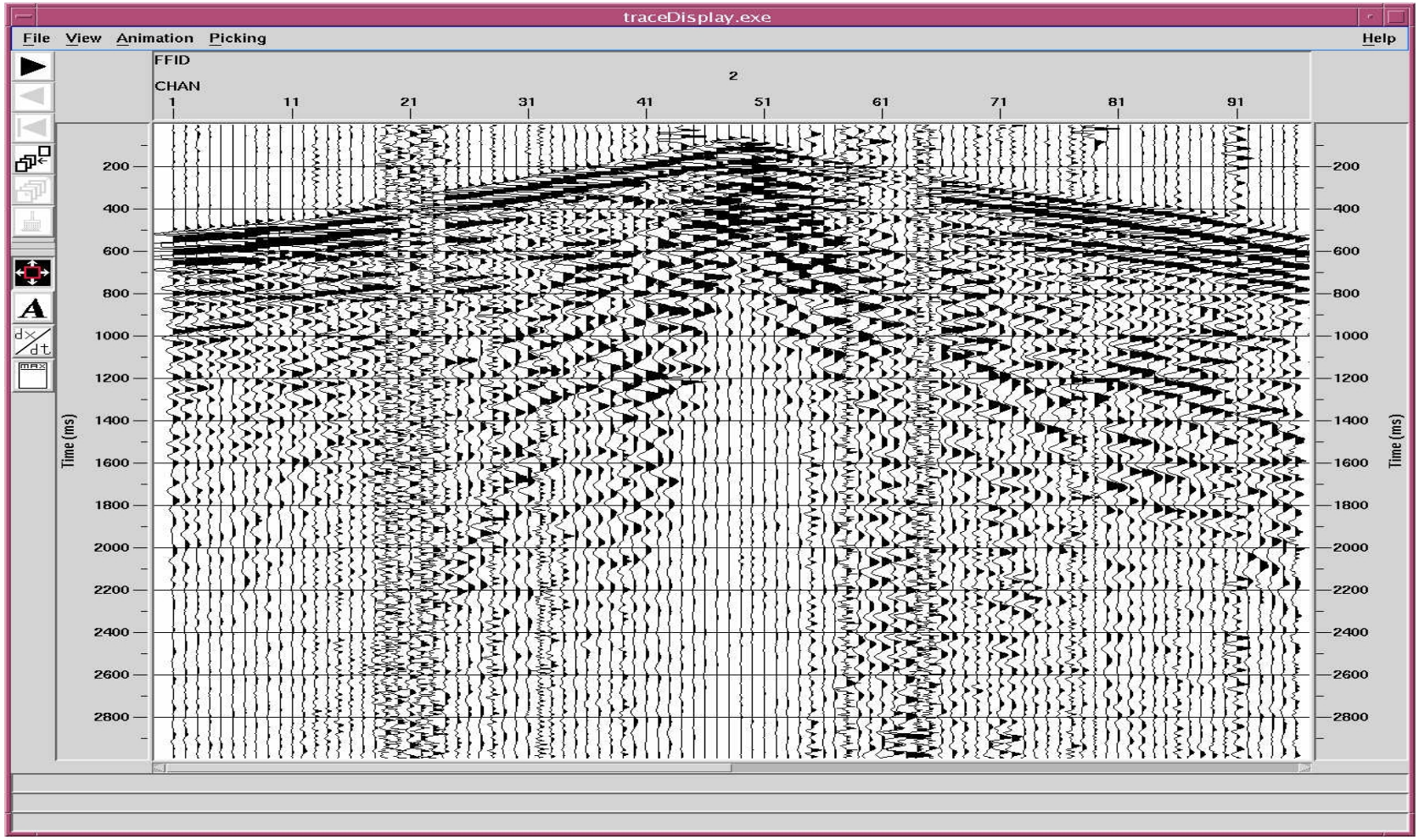
SISMOGRAMA



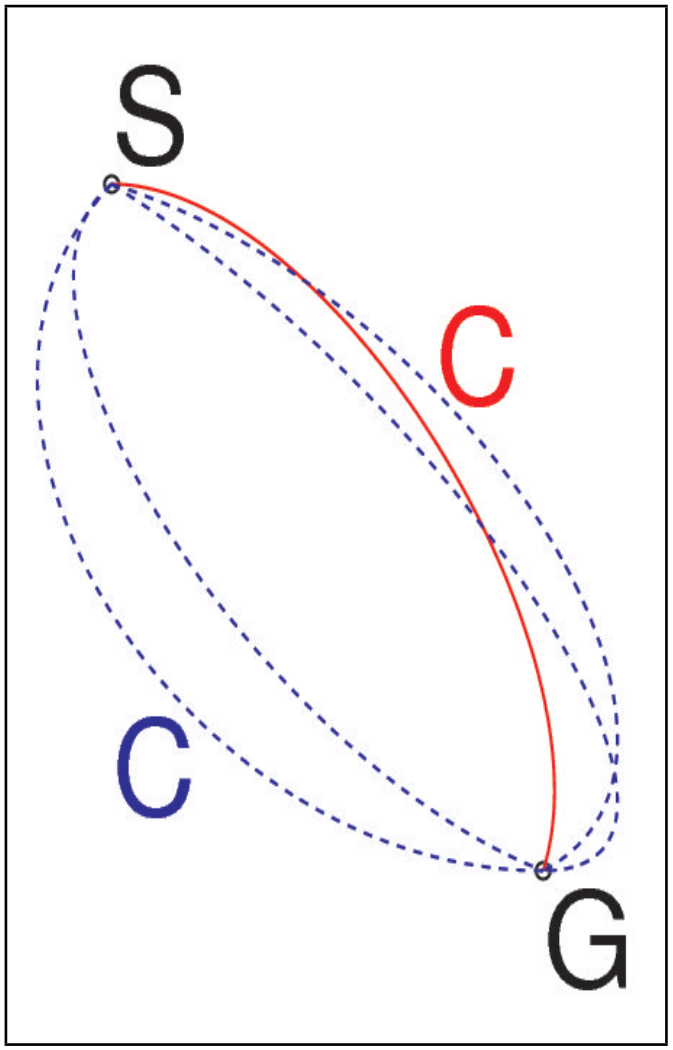
DADOS SINTÉTICOS



DADOS REAIS


traceDisplay.exe
File View Animation Picking
Help
FFID
2
CHAN
1 11 21 31 41 51 61 71 81 91
Time (ms)
200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400 2600 2800
dx/dt
max

PRINCÍPIO DE FERMAT: RAIO

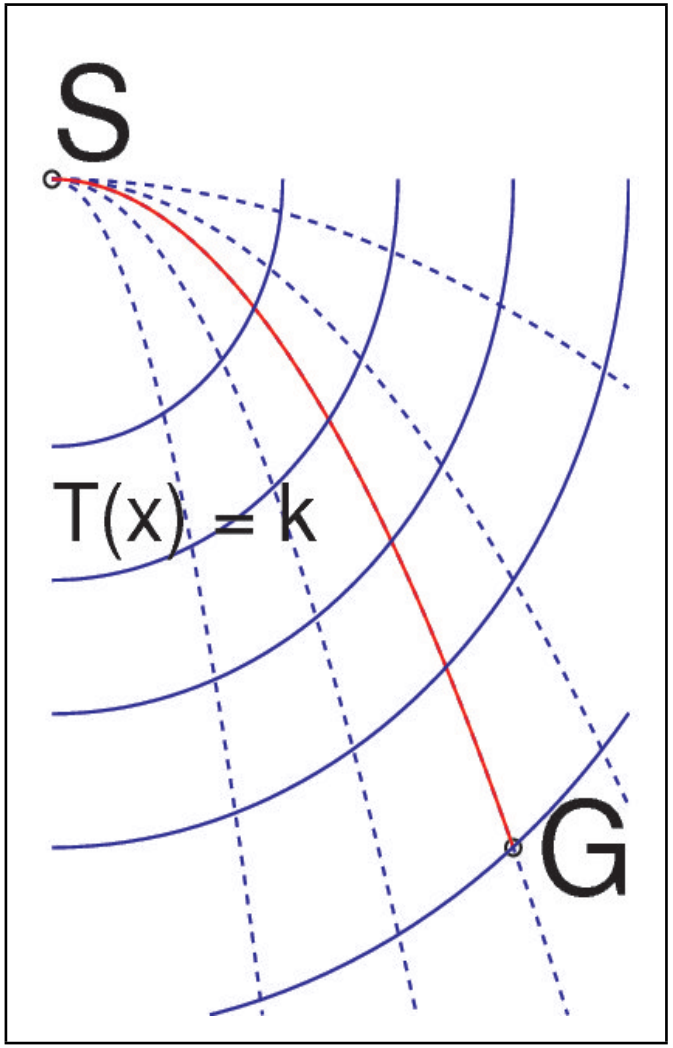


$$T_{\mathsf{C}}(S,G) = \int_{\mathsf{C}} \frac{ds}{v}$$

O tempo de trânsito é estacionário:

$$\left.\frac{d}{d\mathsf{C}} T_{\mathsf{C}}\right|_{\mathsf{C}=\mathsf{C}} = 0$$

EQUAÇÃO ICONAL

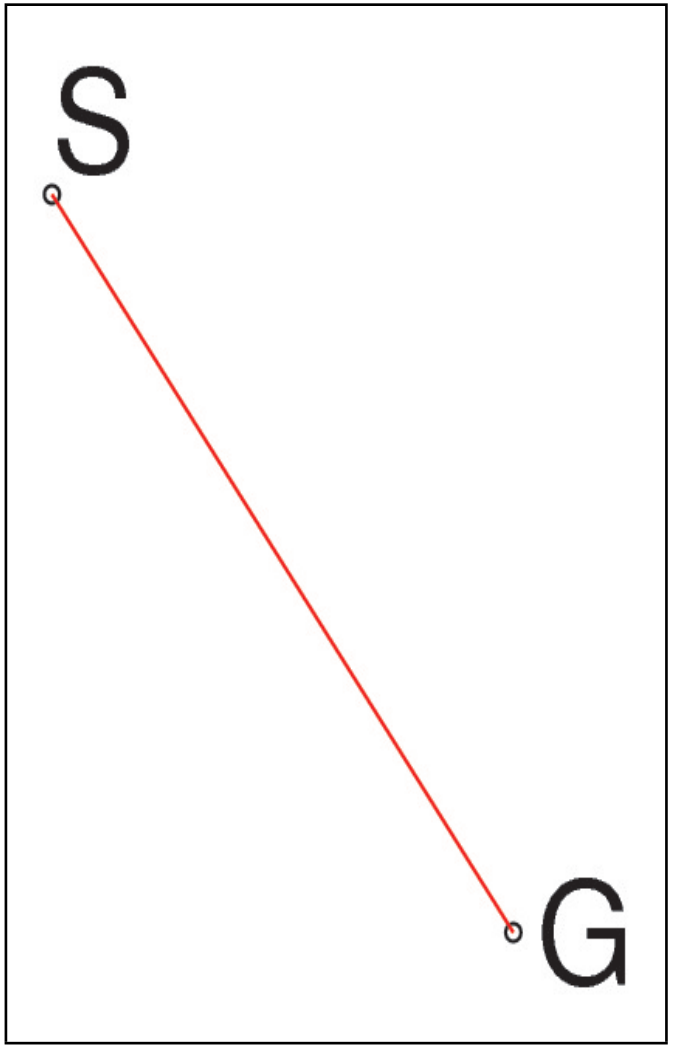


EDP Não Linear de Primeira Ordem:

$$\| \nabla T(x) \|^2 = \frac{1}{v(x)^2}$$

$$T(S) = 0$$
$$T(G) = \mathcal{T}(S, G)$$

MEIO HOMOGÊNEO

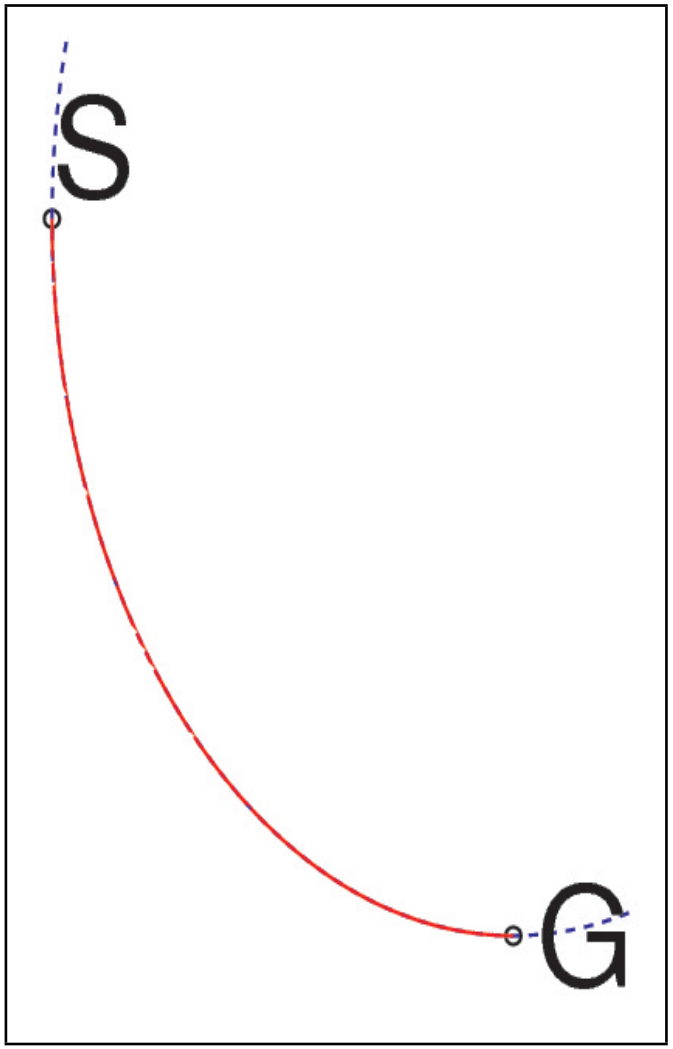


$$v(x) = v_0$$

$$\mathcal{T}(S, G) = \frac{\|G - S\|}{v_0}$$

Raio = Segmento de reta que une S e G

VELOCIDADE AFIM NA PROFUNDIDADE

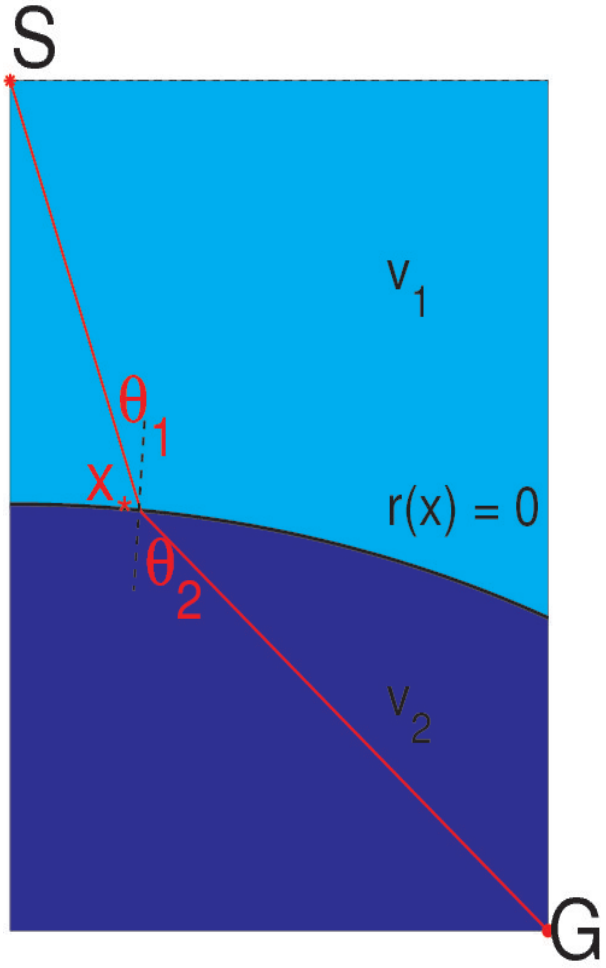


$$v(x) = a\, x_3 + v_0$$

$$\mathcal{T}(S,G) = -\frac{1}{2a} \ln \mathcal{H}$$

Raio $=$ Arco de círculo unindo S e G

LEI DE SNELL

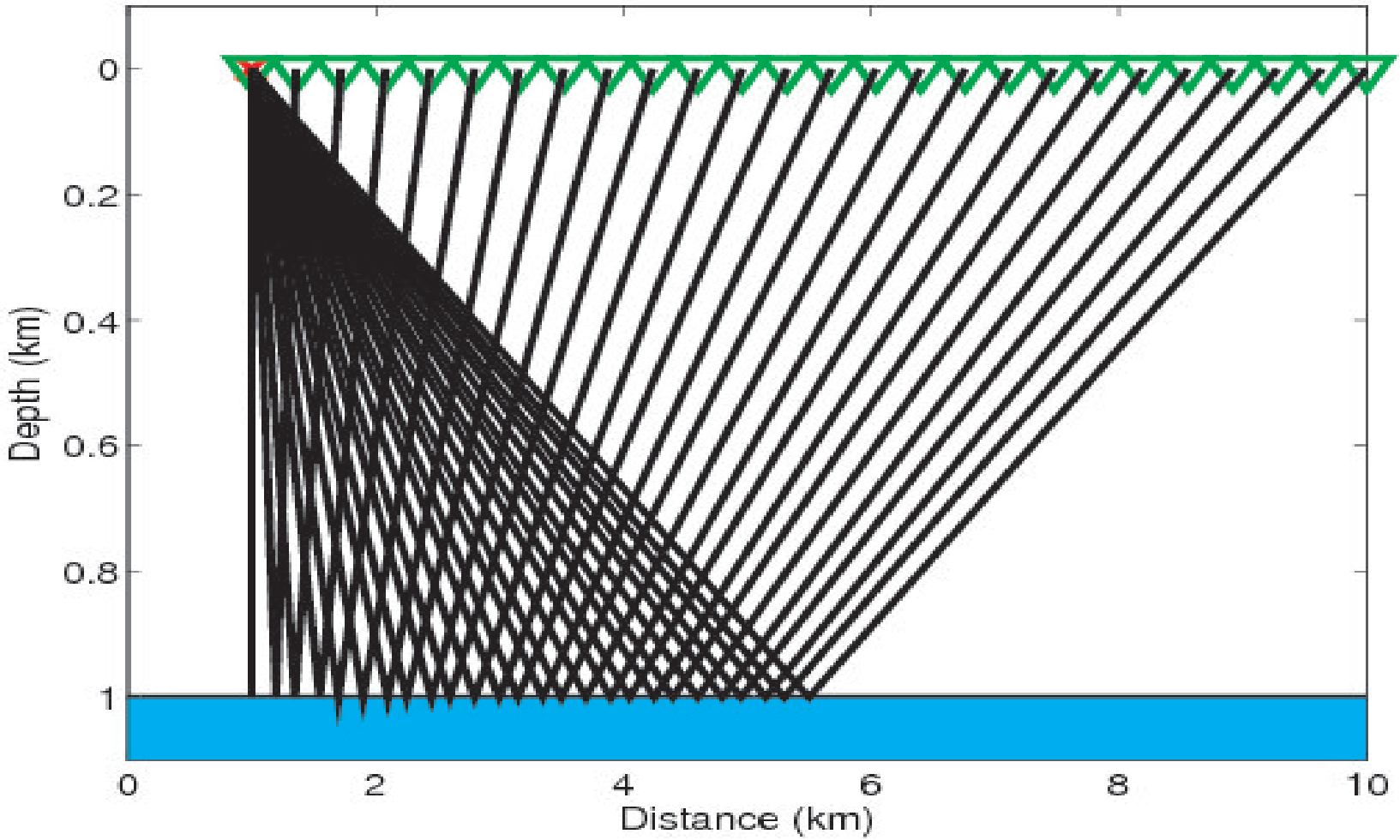


$$\begin{aligned} \text{Min} \quad & T(S,x) + T(G,x) \\ \text{s.a} \quad & r(x) = 0 \end{aligned}$$

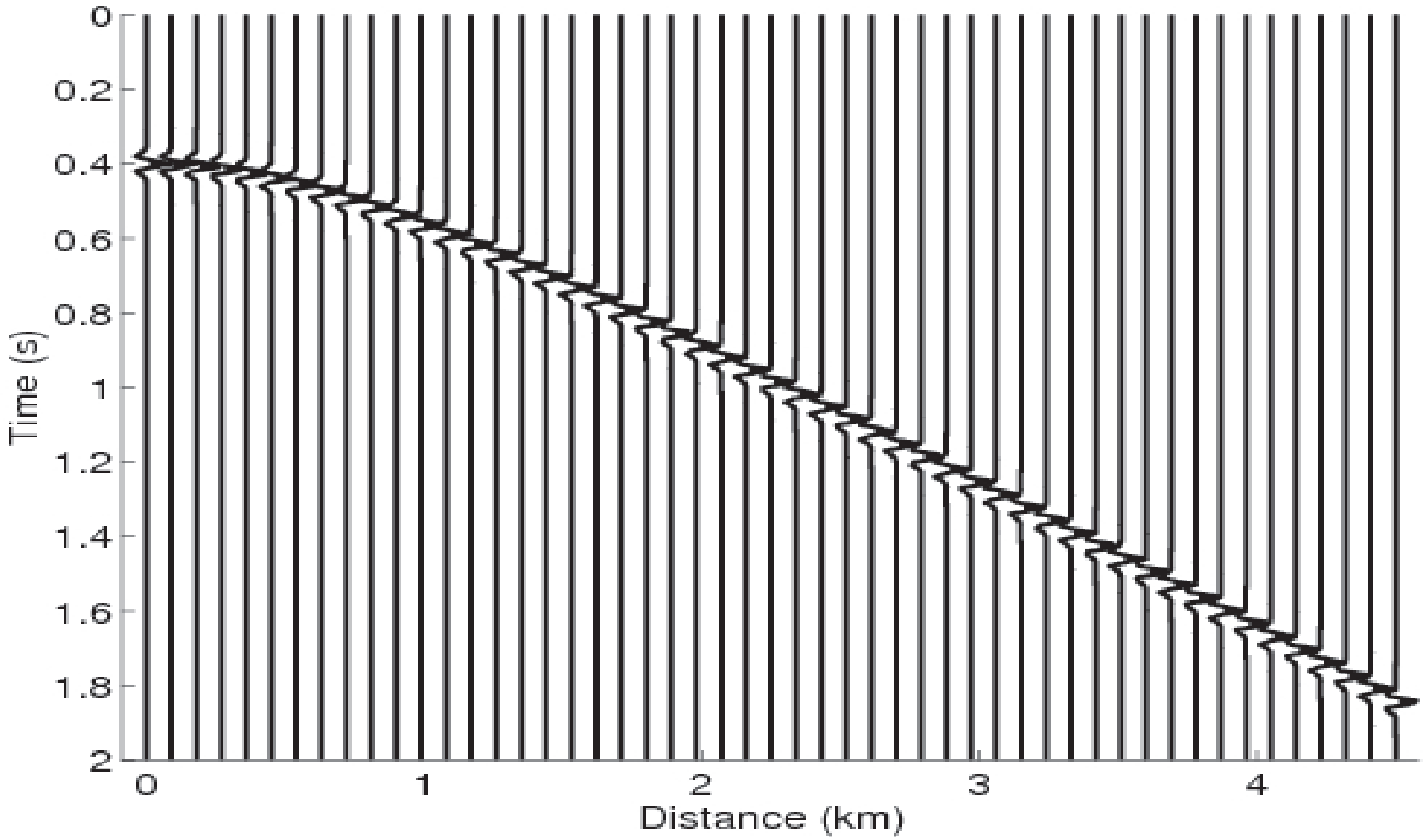
$$\nabla T(S, x_*) + \nabla T(G, x_*) = \lambda \, \nabla r(x_*)$$

$$\frac{\sin \theta_1}{v_1} = \frac{\sin \theta_2}{v_2}$$

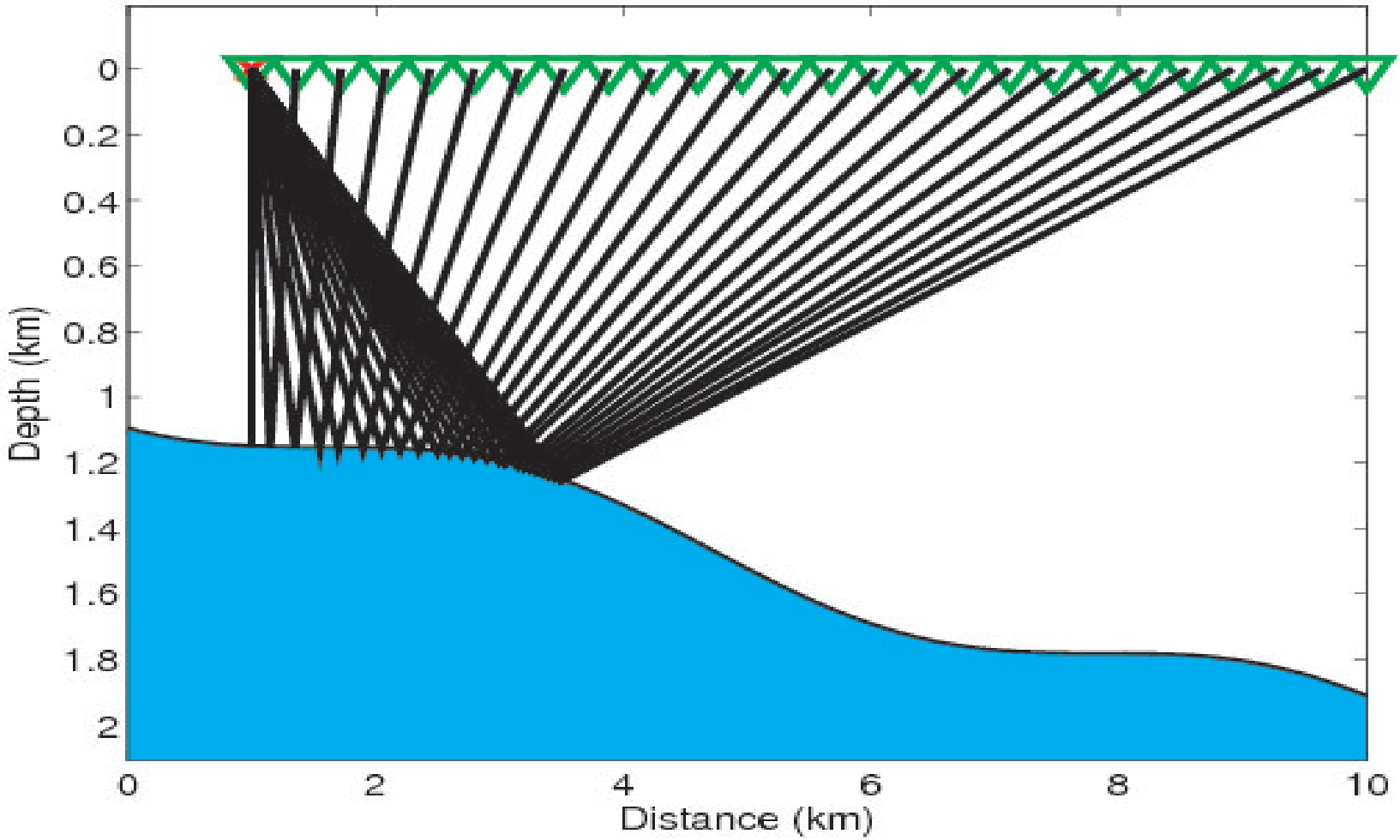
MODELO PLANO



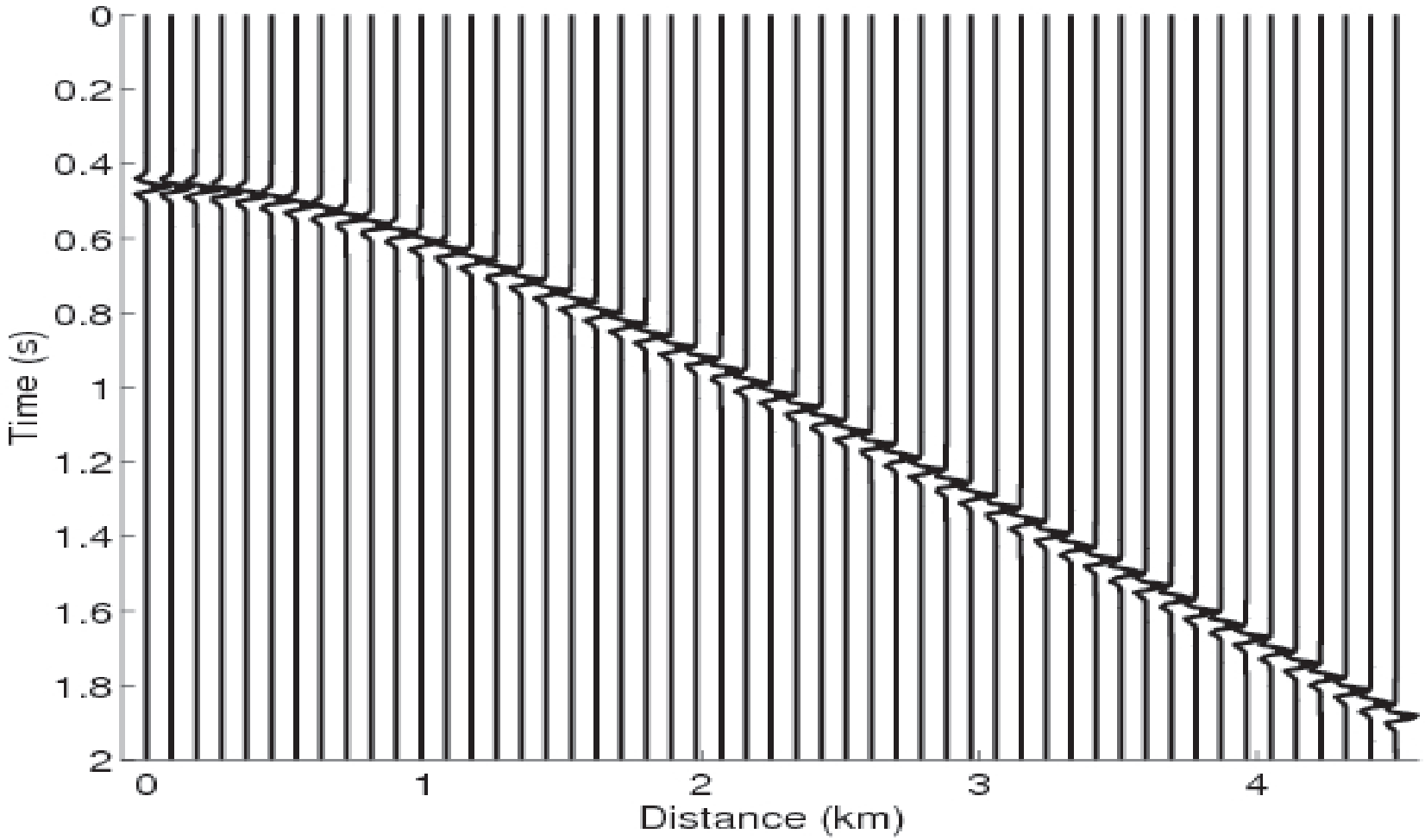
SISMOGRAMA I



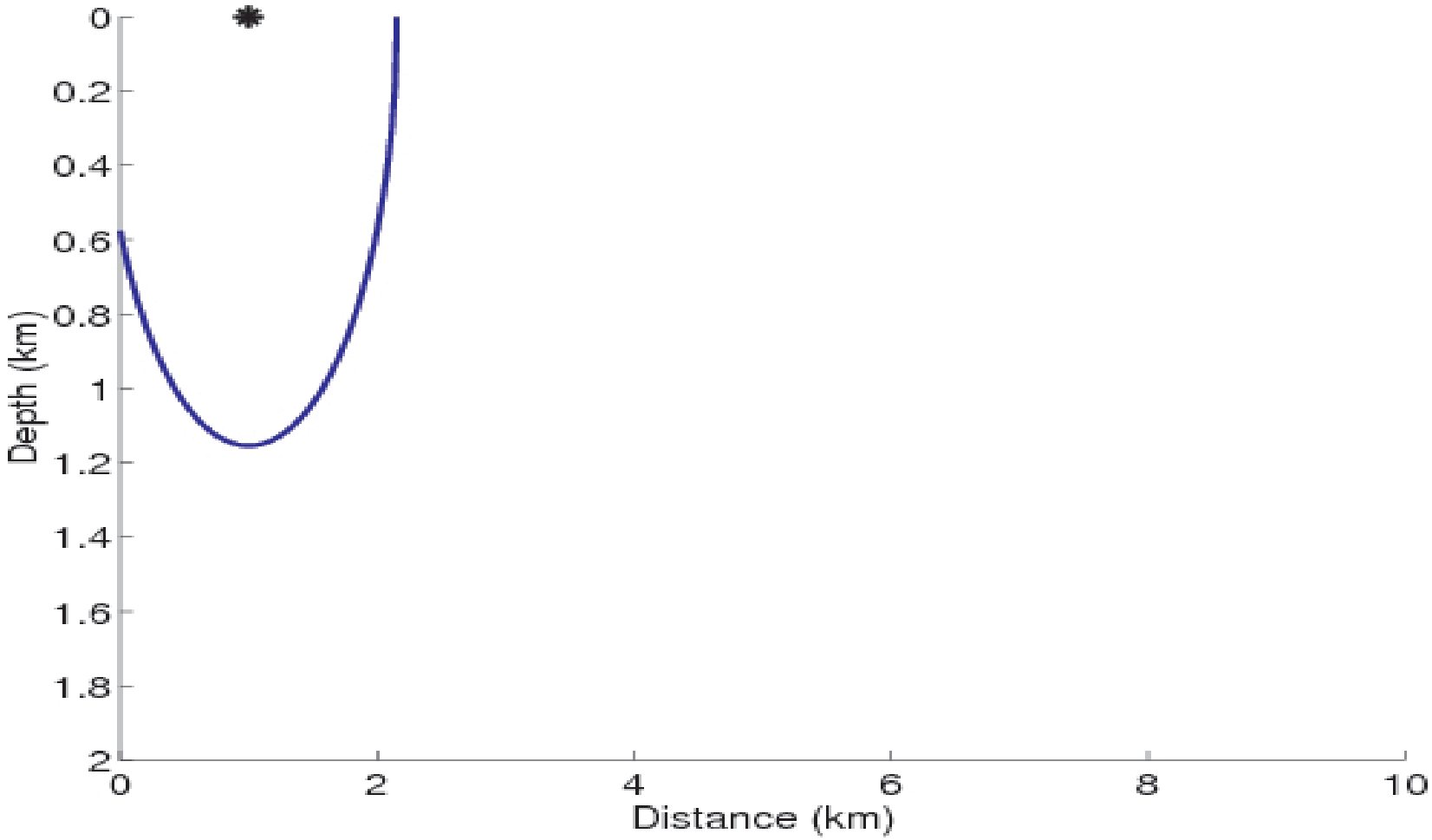
MODELO CURVO



SISMOGRAMA II



ISÓCRONAS



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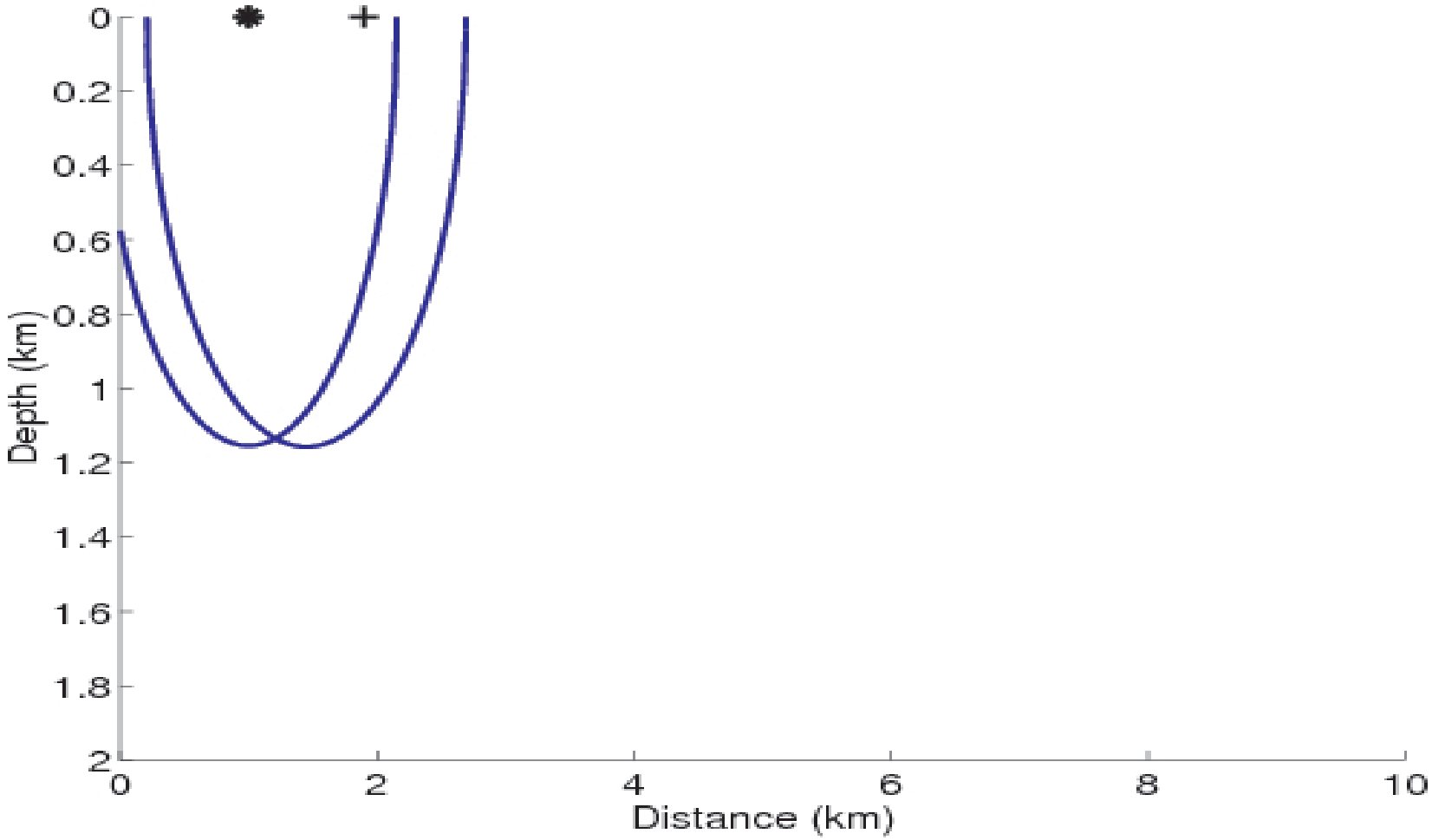

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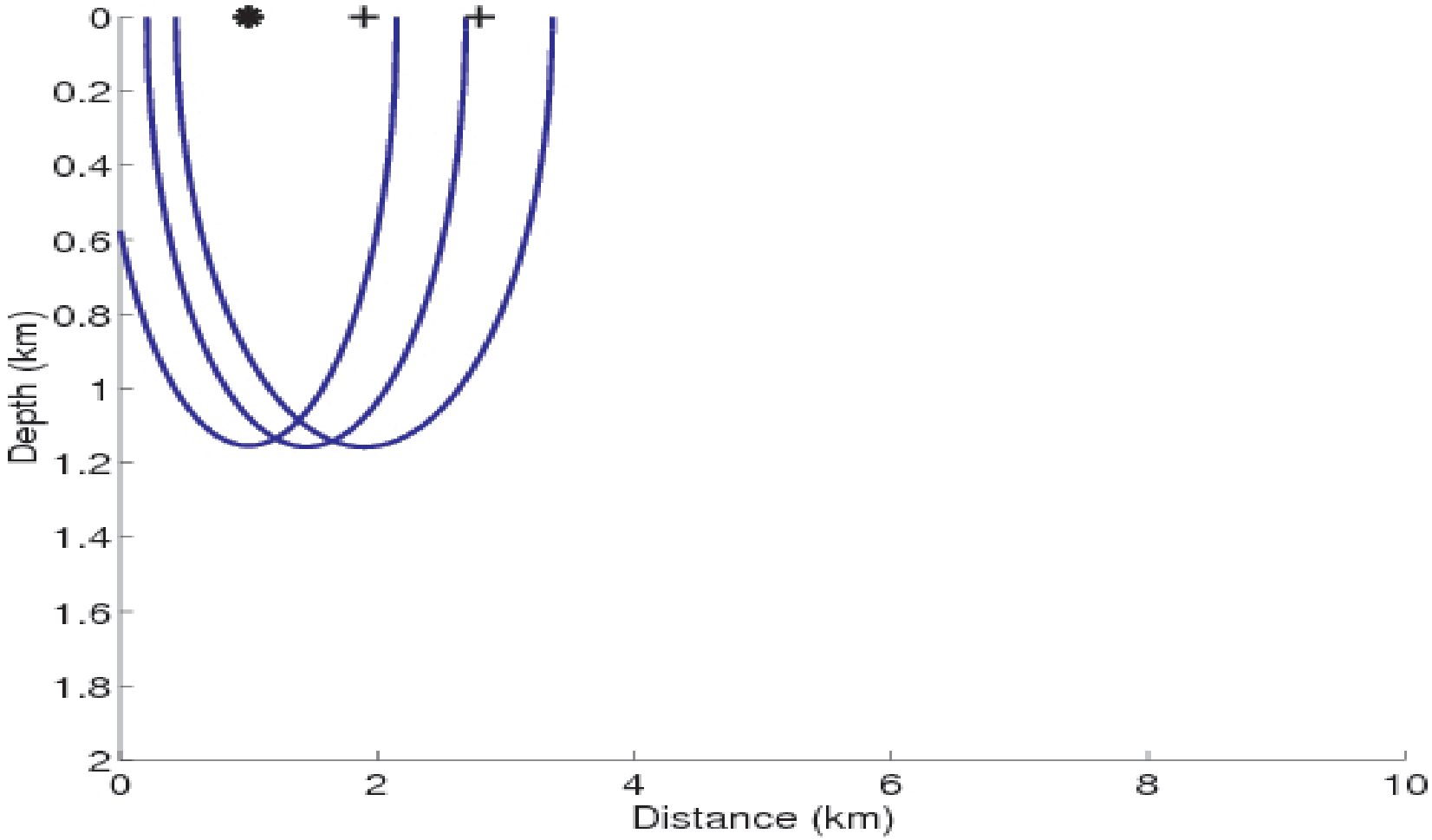
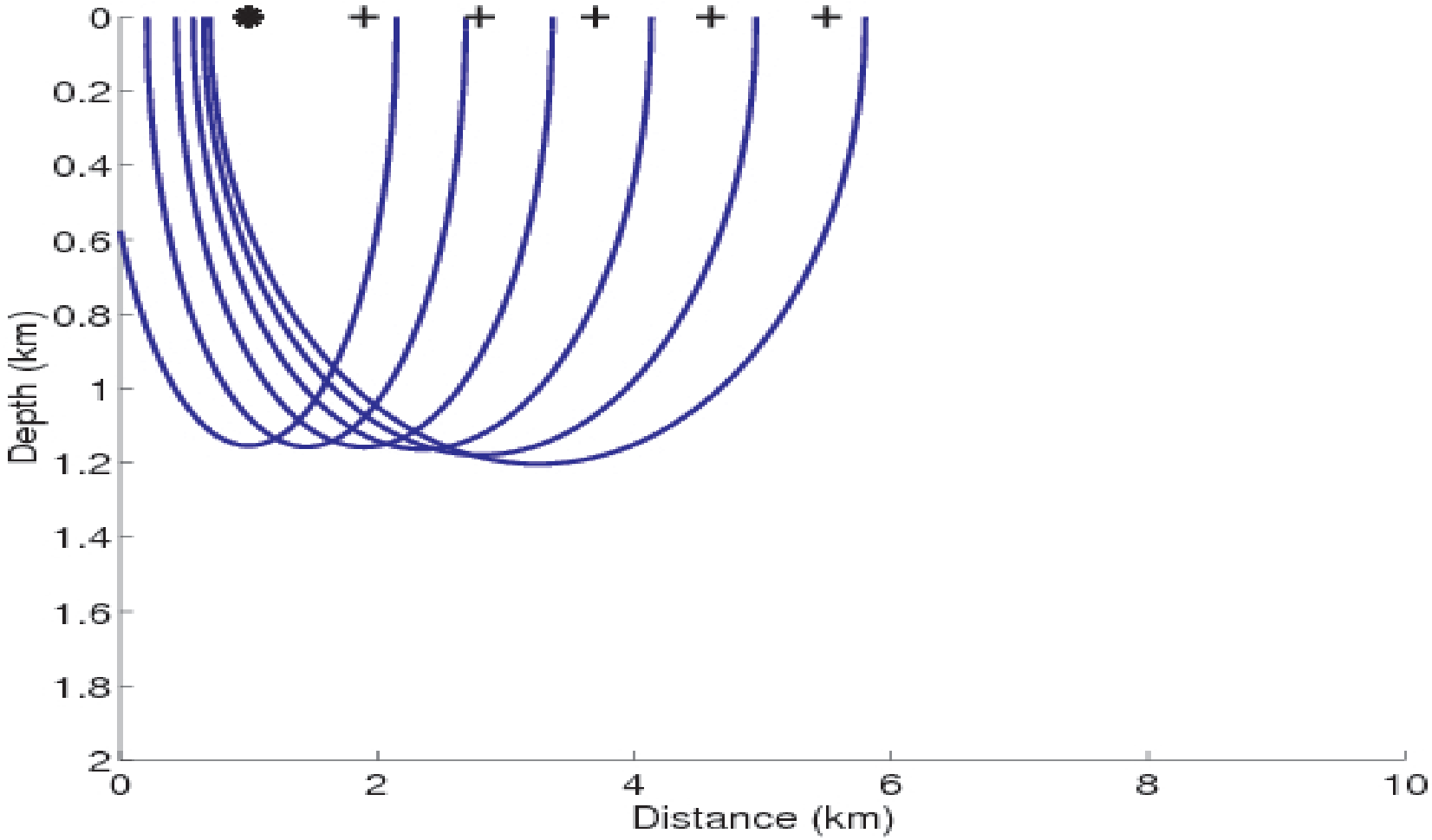
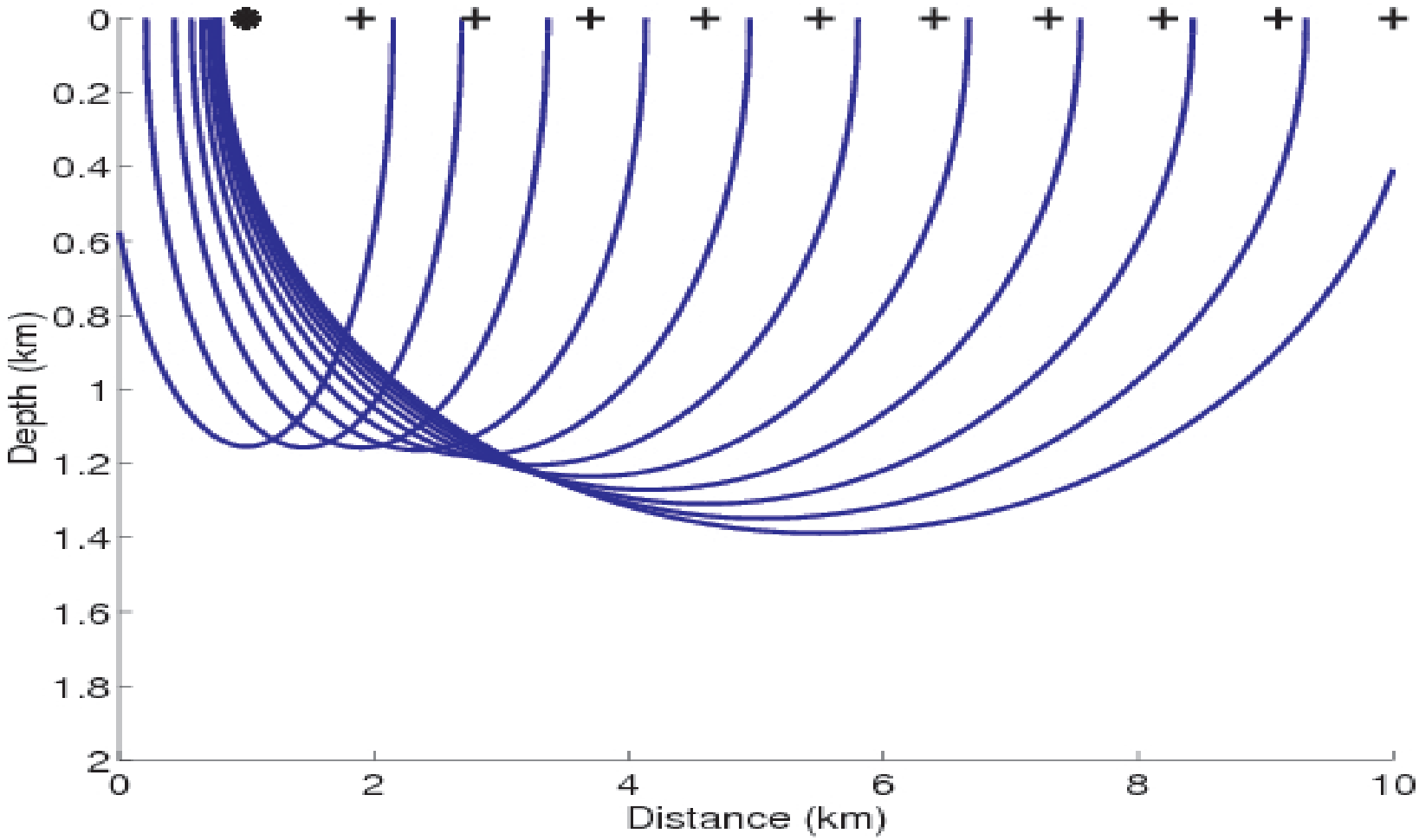


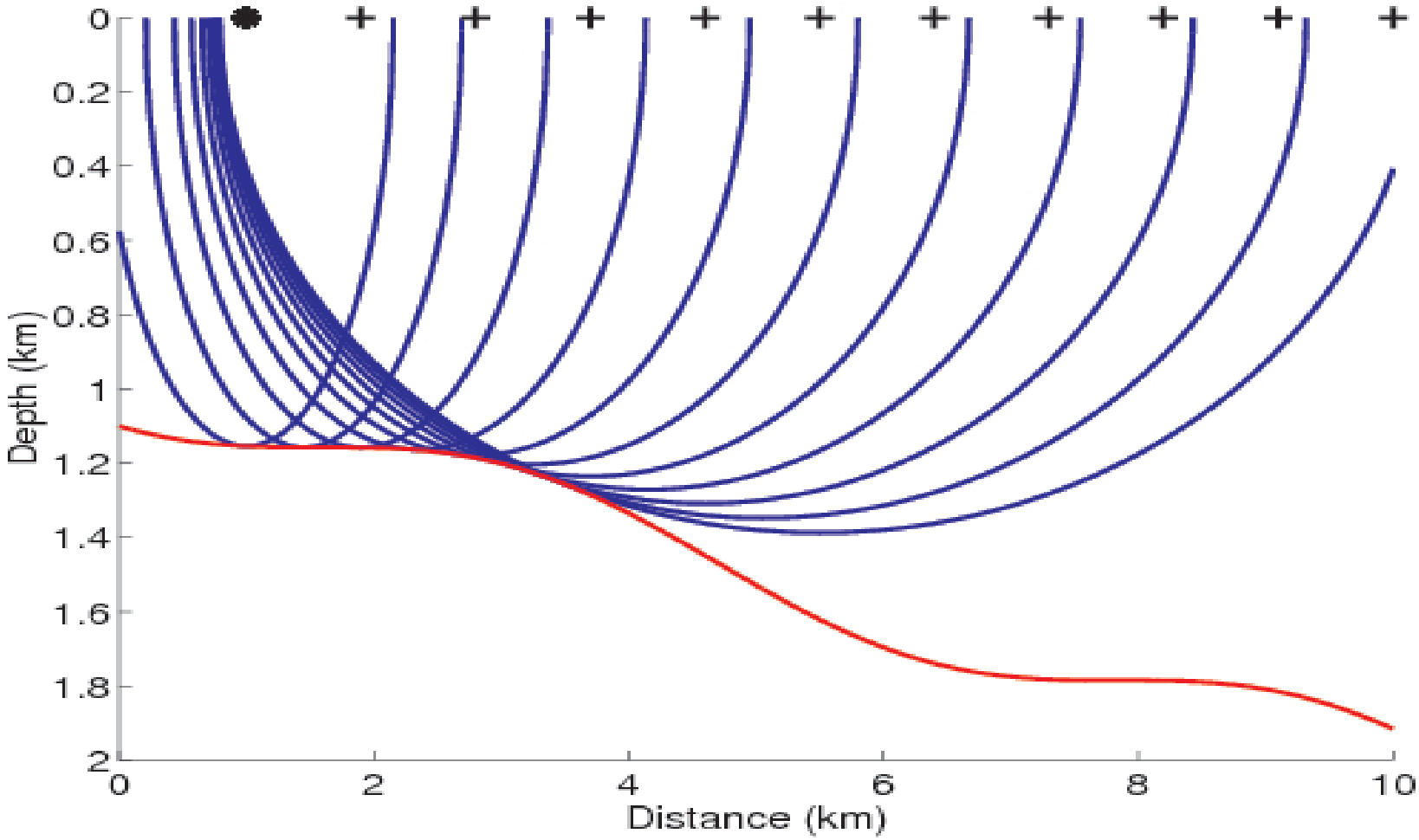
ISÓCRONAS



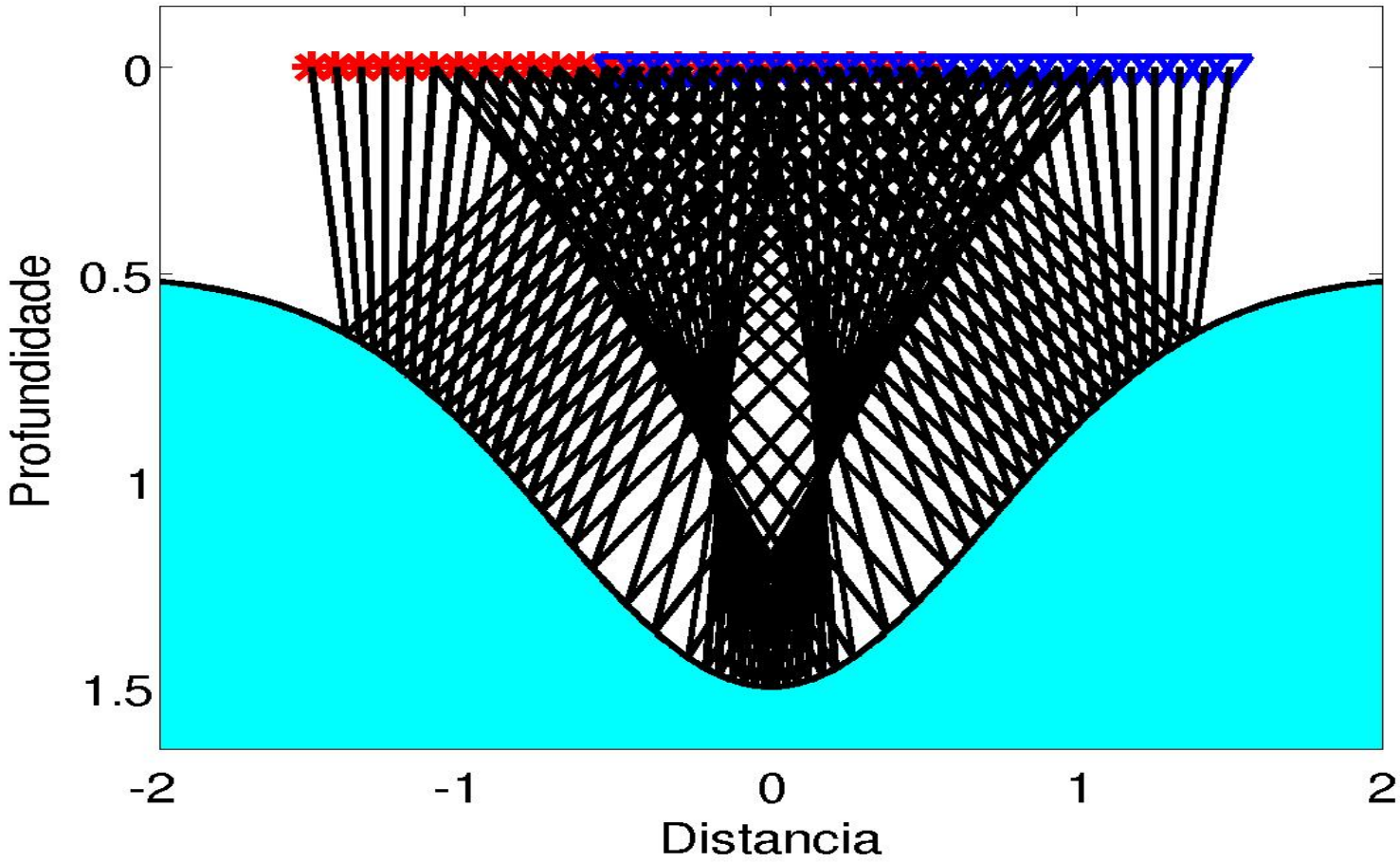
MIGRAÇÃO



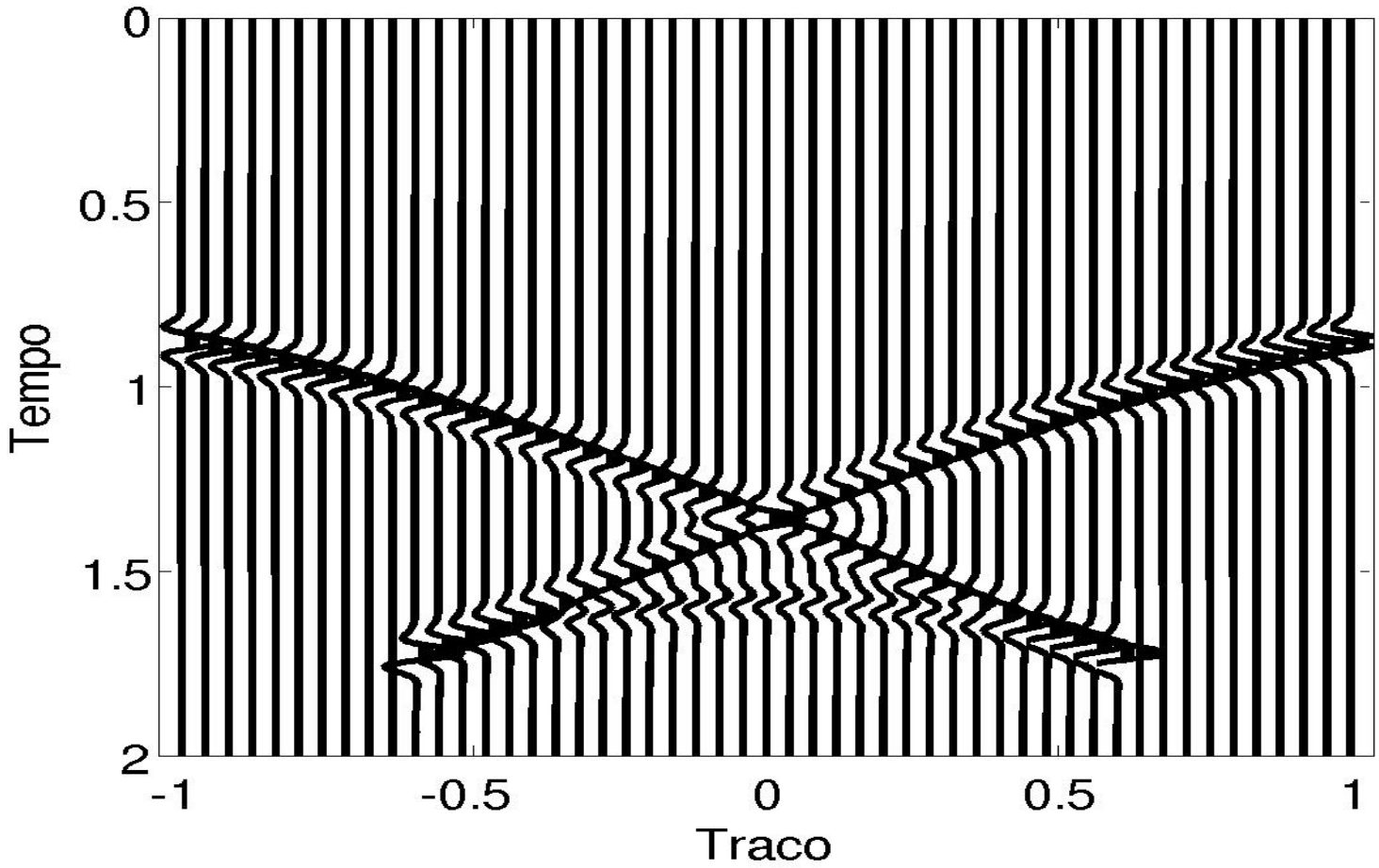
ENVOLTÓRIA = REFLETOR



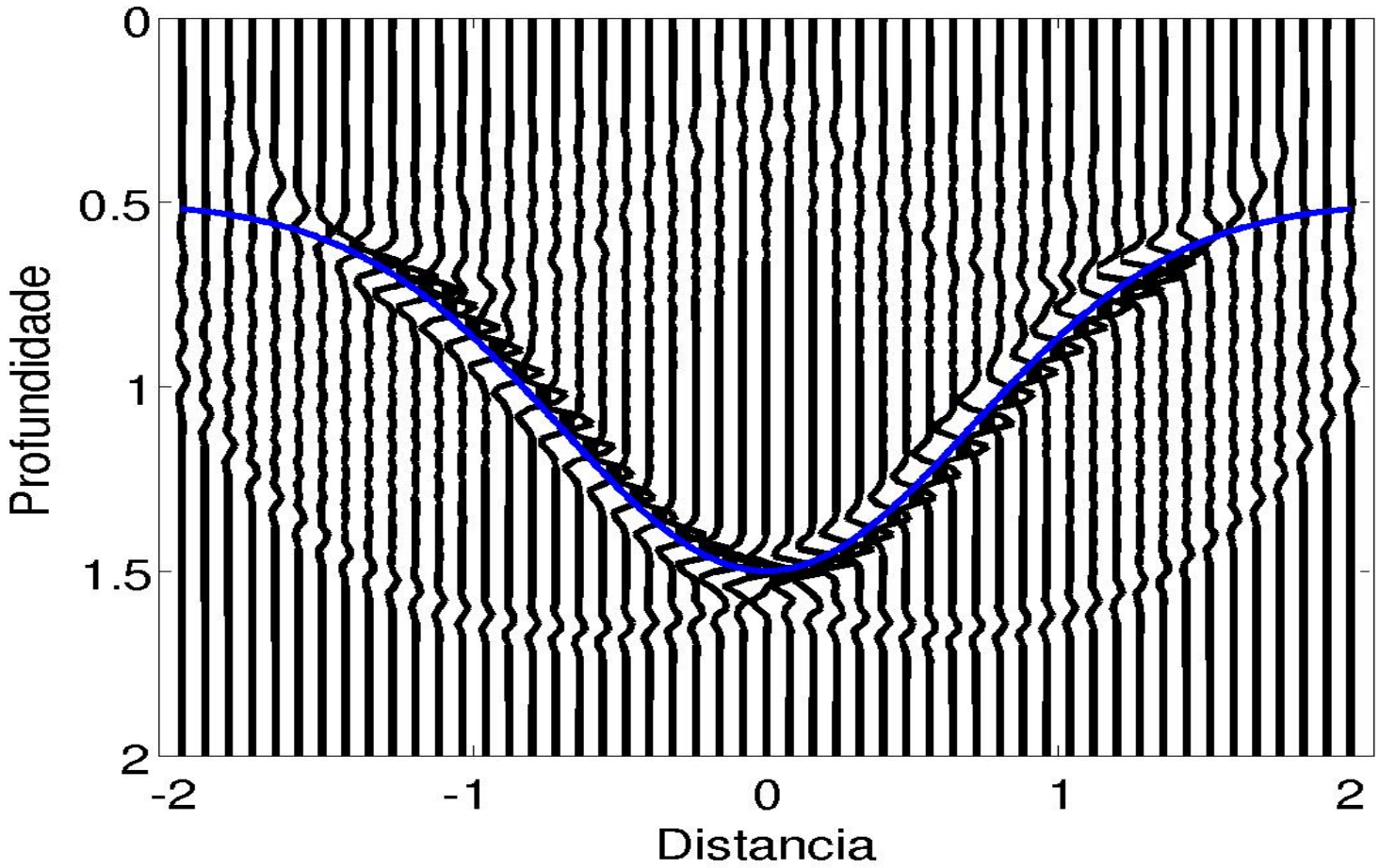
MIGRAÇÃO – MODELO & RAIOS



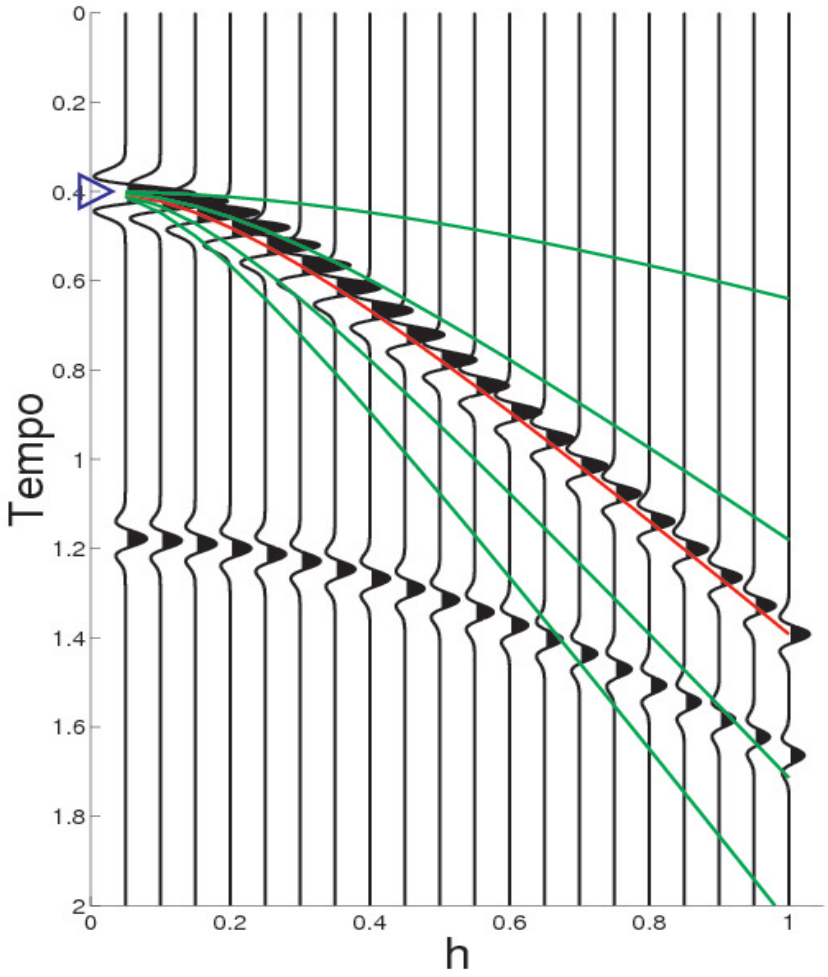
MIGRAÇÃO – SISMOGRAMA



MIGRAÇÃO



PROBLEMA DE AJUSTE

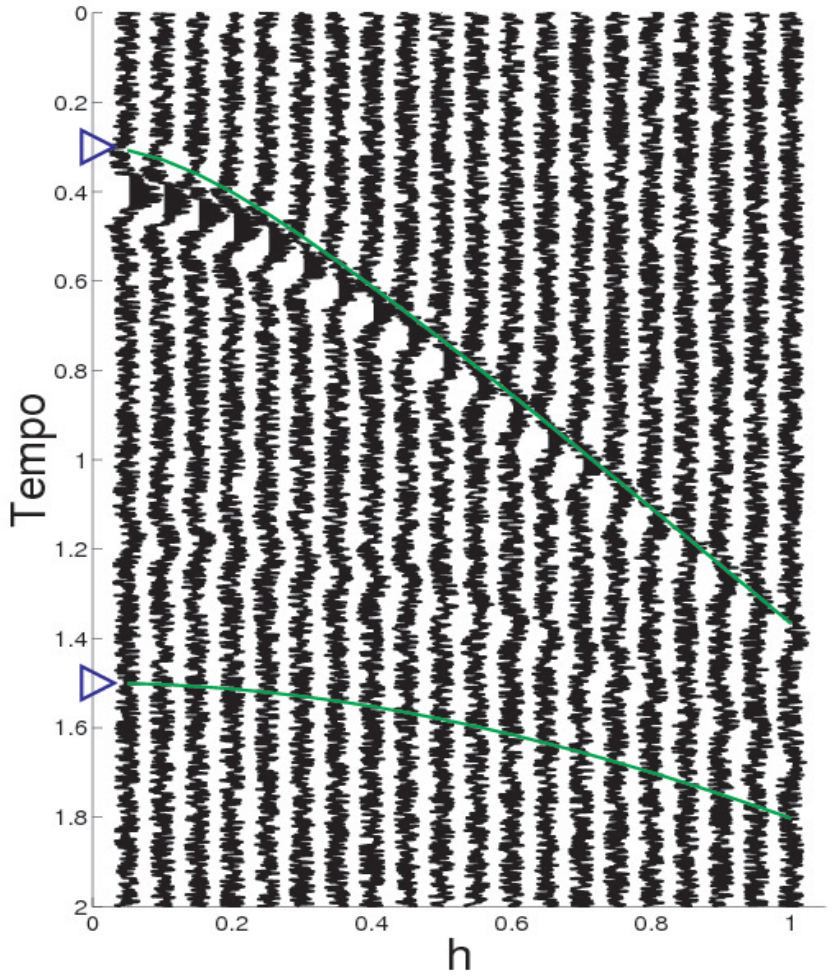


Fixado τ_0 ajustar ao tempo de reflexão a curva

$$t = \sqrt{\tau_0{}^2 + \mathcal{C}\ h^2}$$

$$\mathcal{C}_* = \mathcal{C}$$

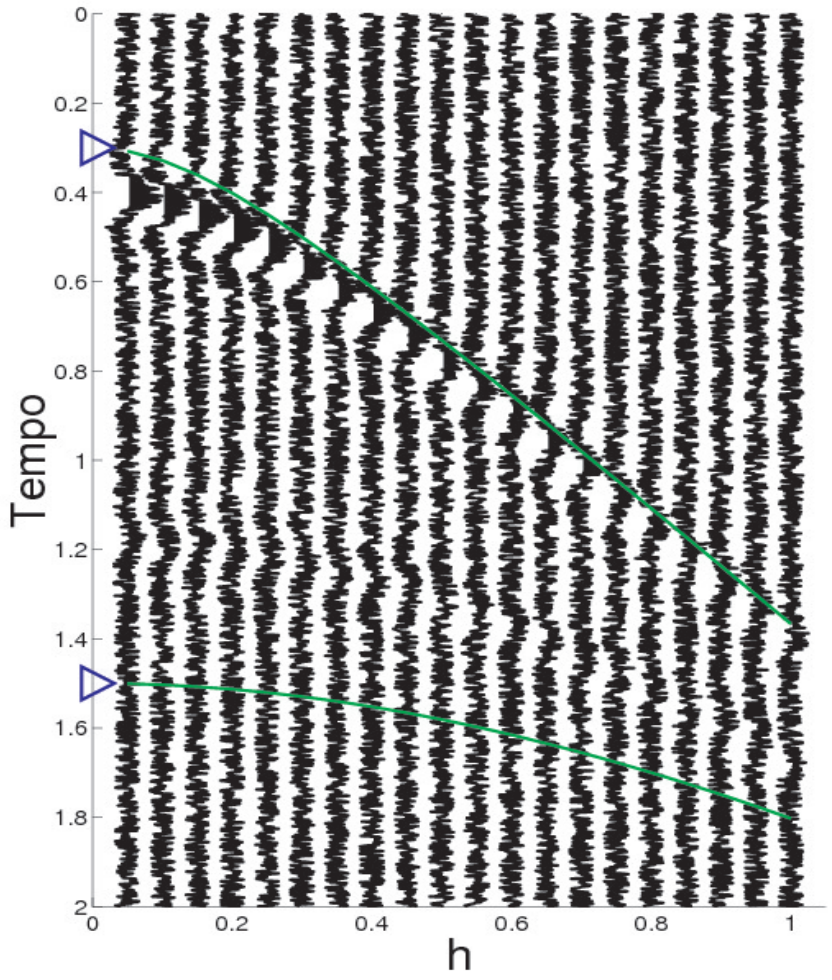
ANÁLISE DE COERÊNCIA



Para cada τ_0 seja u = vetor com as amostras ao longo da curva

u é COERENTE se $u_j \approx$ constante

FUNÇÃO SEMBLANCE



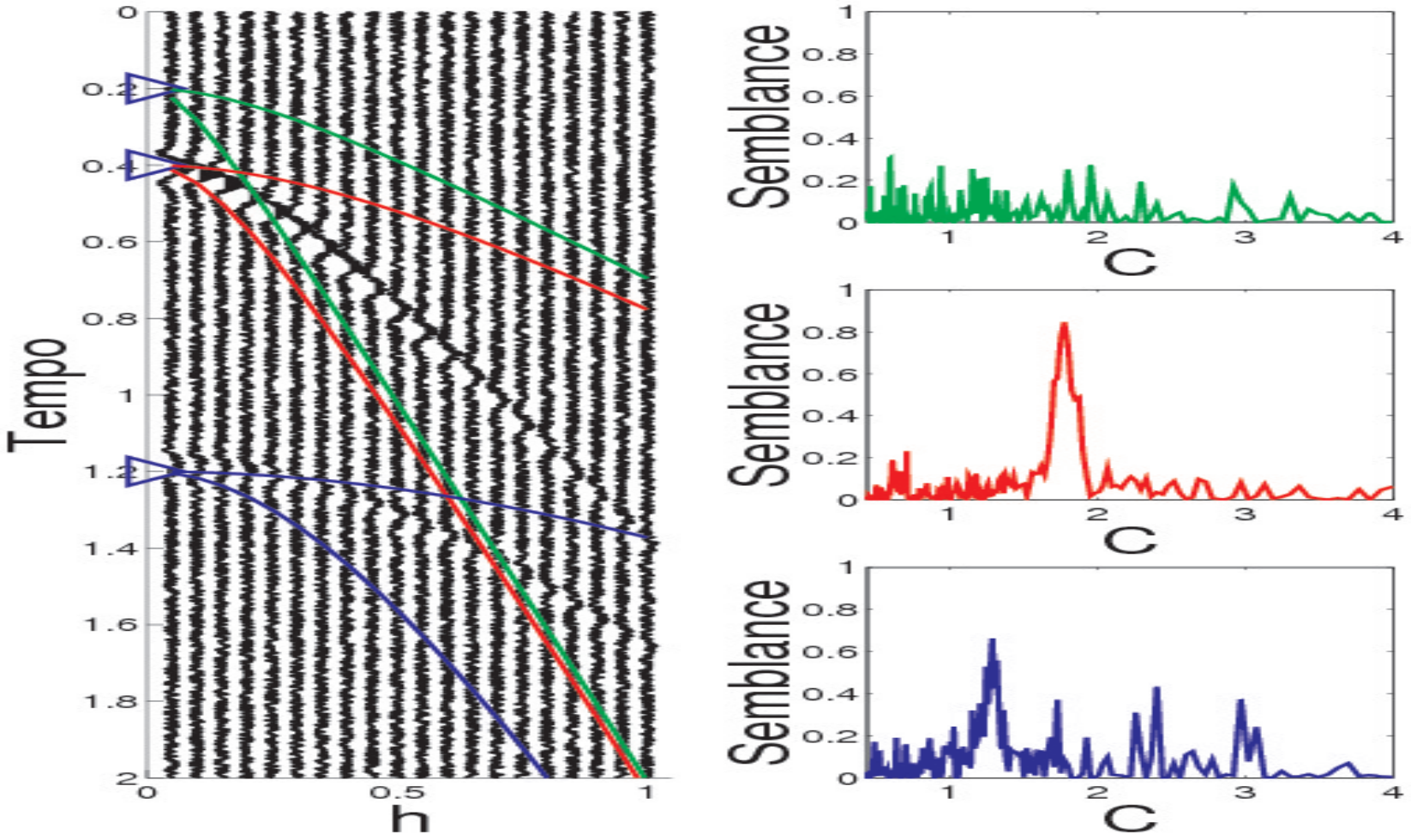
$$\mathbf{S} = \frac{1}{N}\frac{(\sum u_j)^2}{\sum {u_j}^2}$$

$$\mathbf{S} = \cos^2\theta(u, \mathbf{1})$$

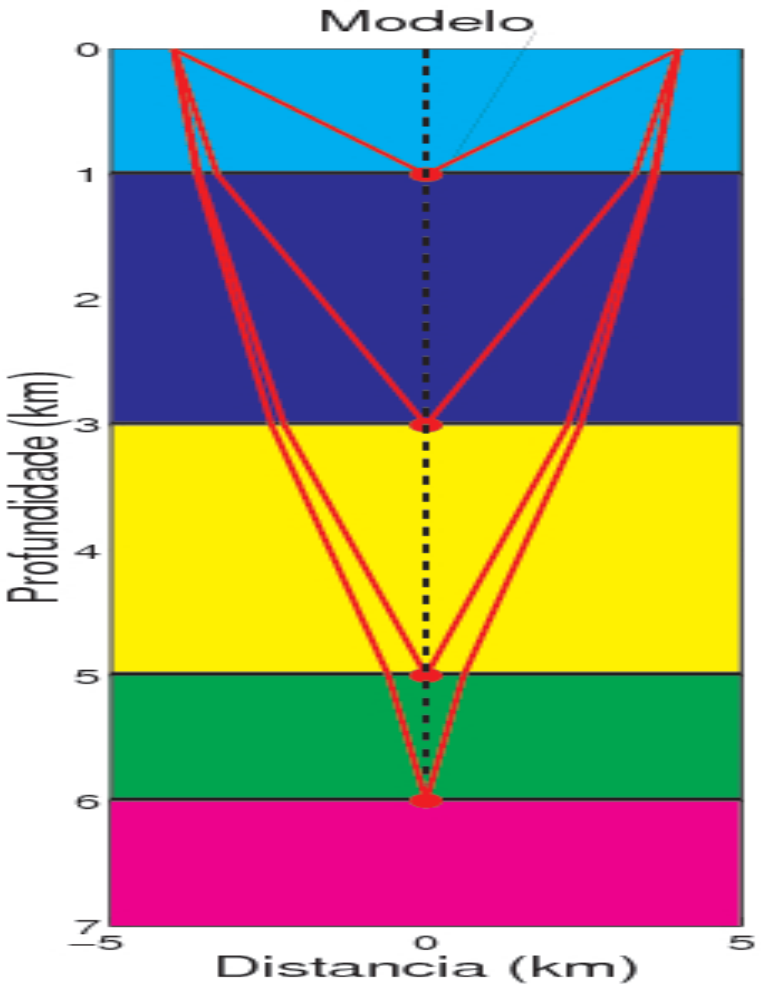
$$\mathbf{1} = (1, 1, \ldots, 1)$$

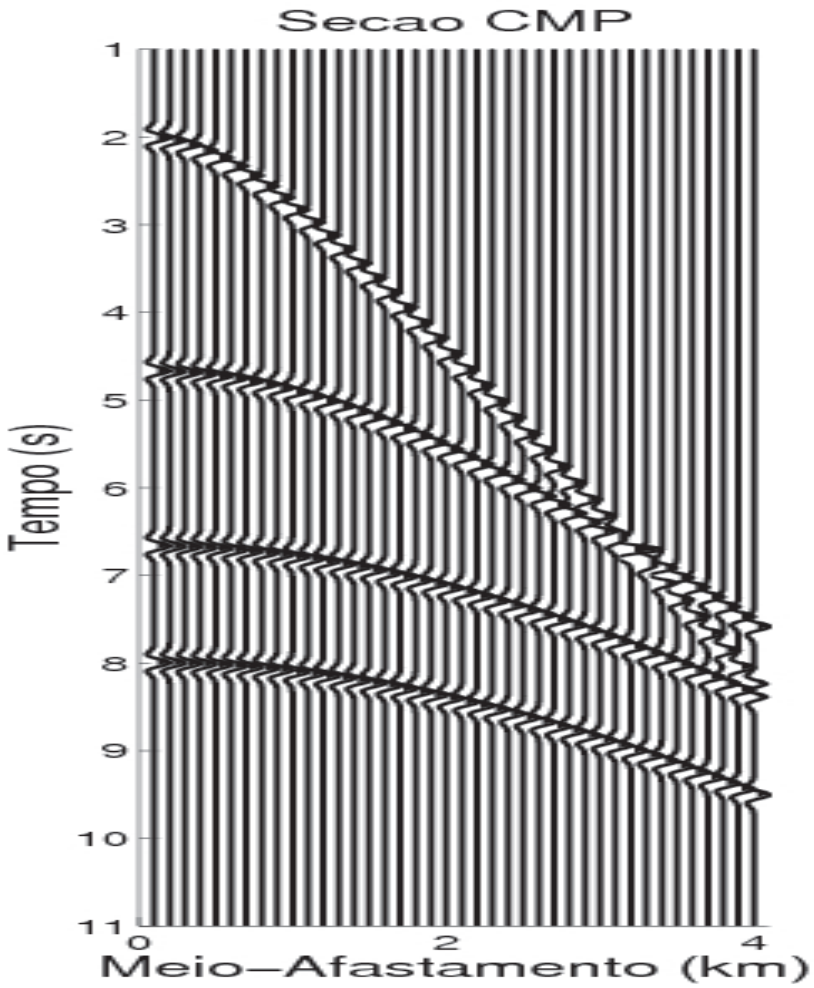
$$0 \leq \mathbf{S} \leq 1$$

COMPORTAMENTO DA SEMBLANCE

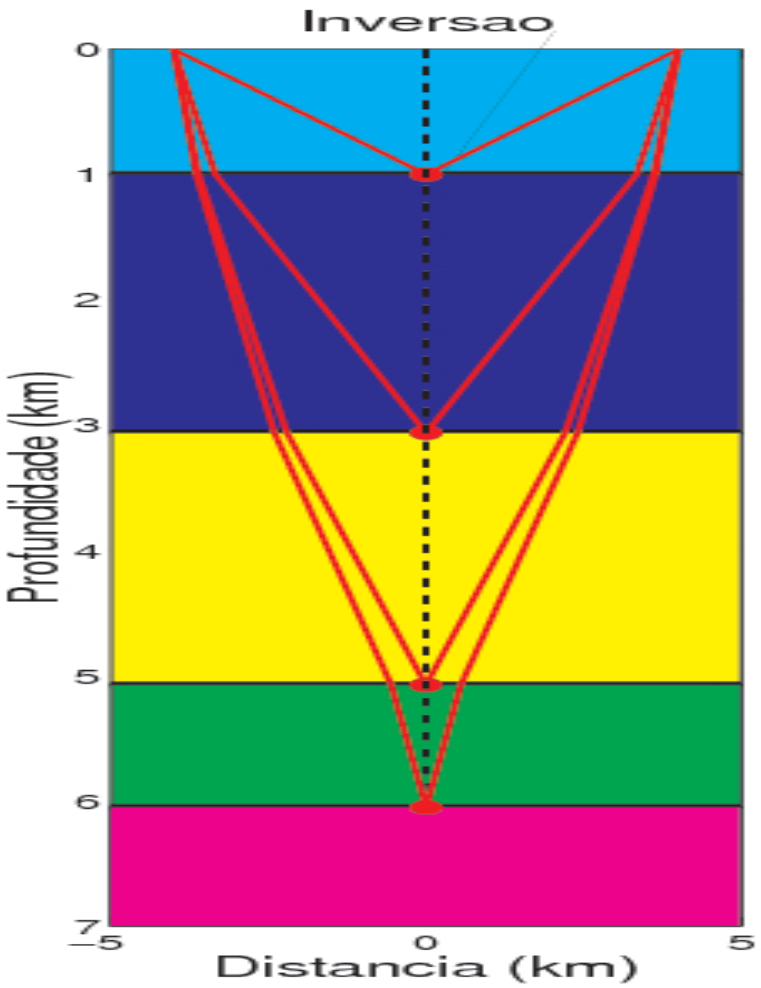


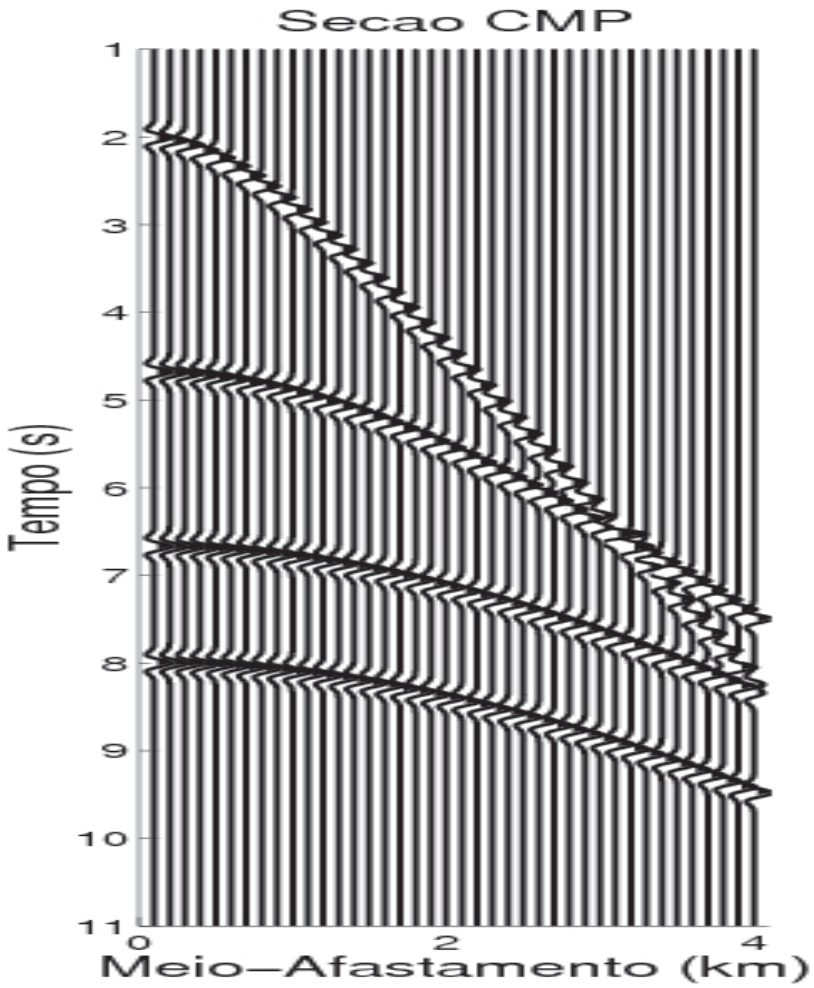
EXEMPLO DE INVERSÃO I



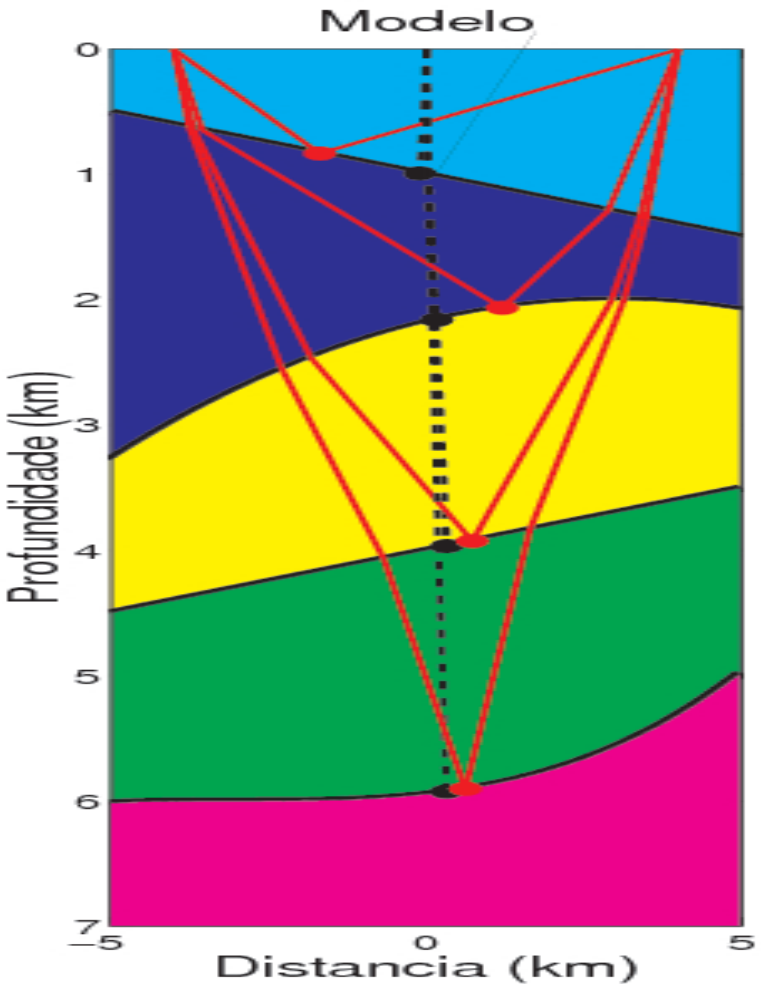


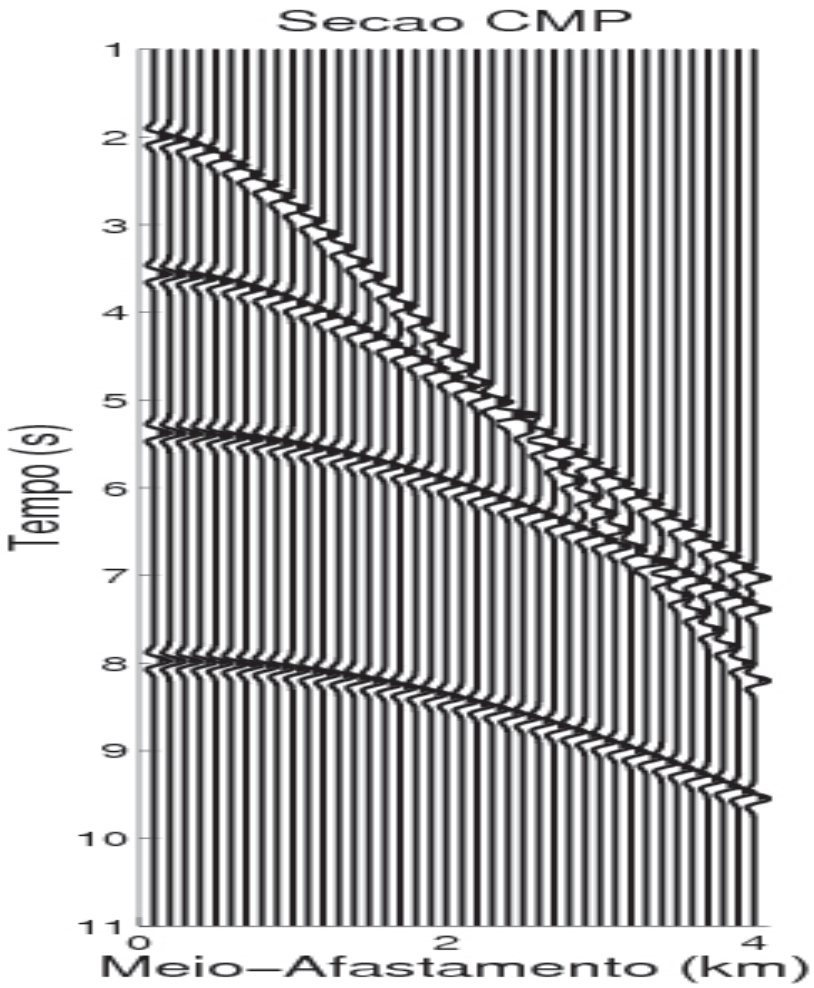
EXEMPLO DE INVERSÃO I



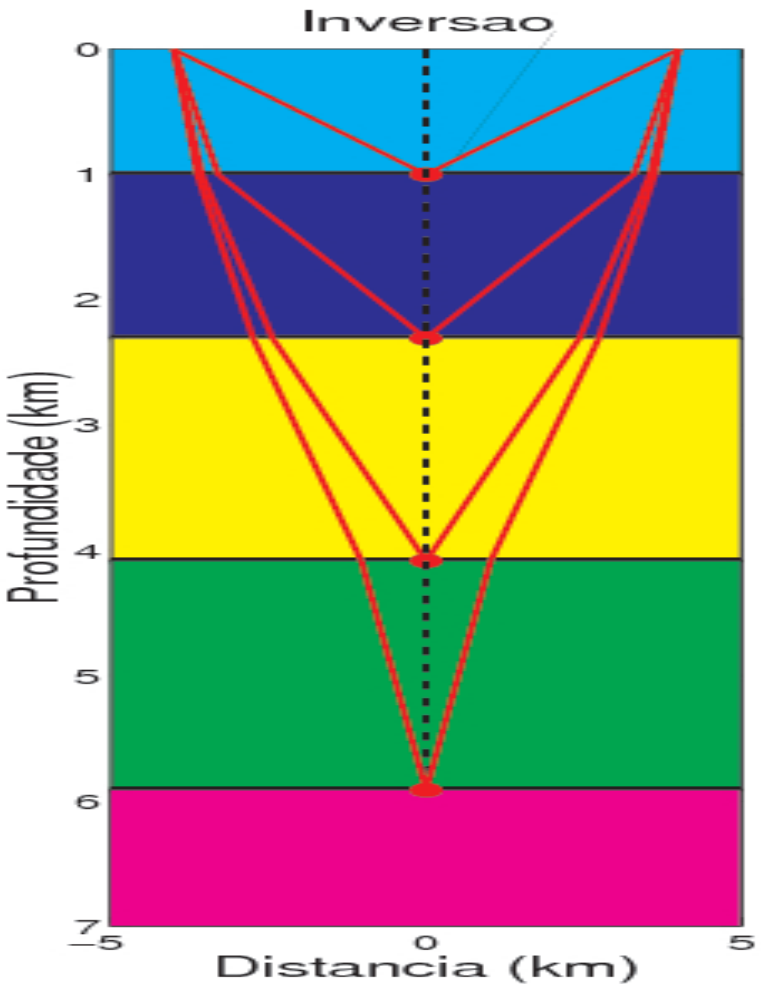


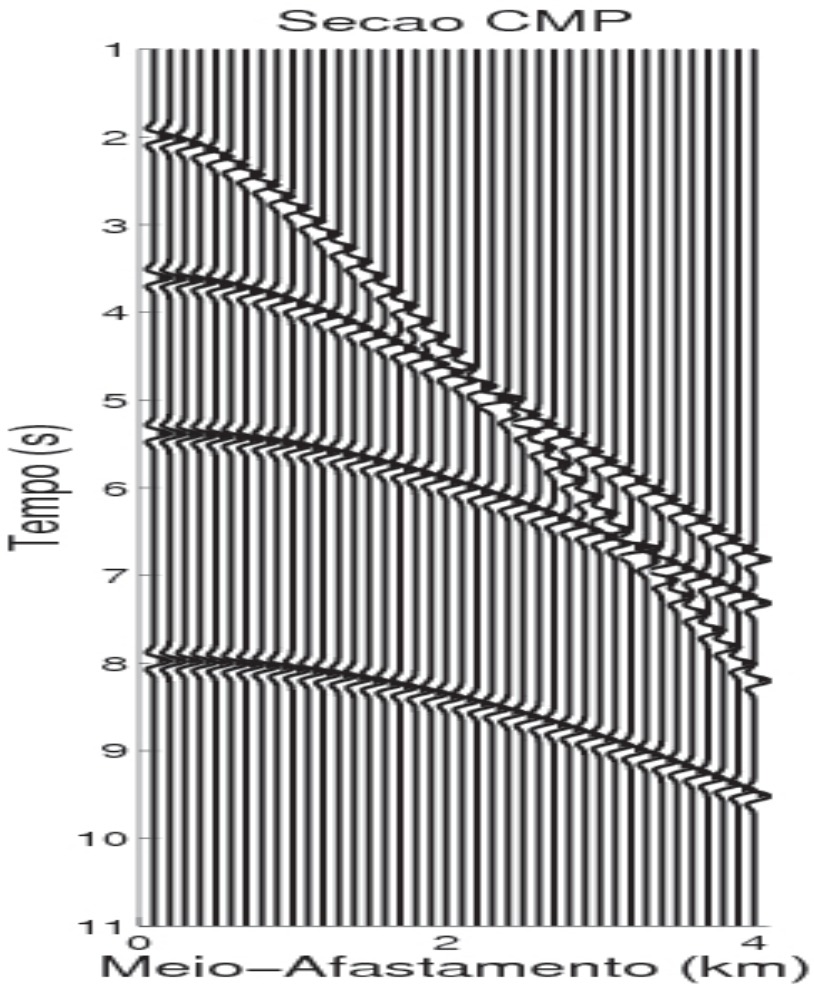
EXEMPLO DE INVERSÃO II





EXEMPLO DE INVERSÃO II





GRUPO DE GEOFÍSICA COMPUTACIONAL

RICARDO MARTIN AMÉLIA LÚCIO JÖRG