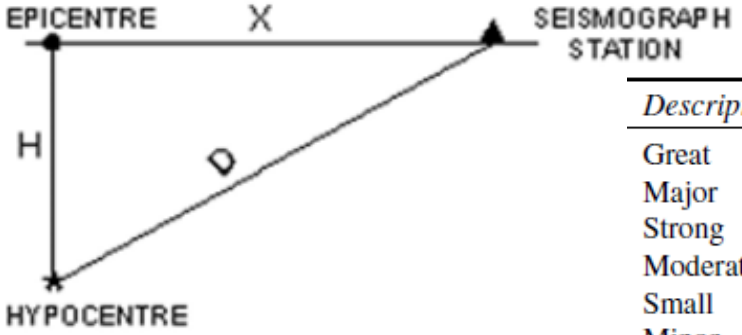
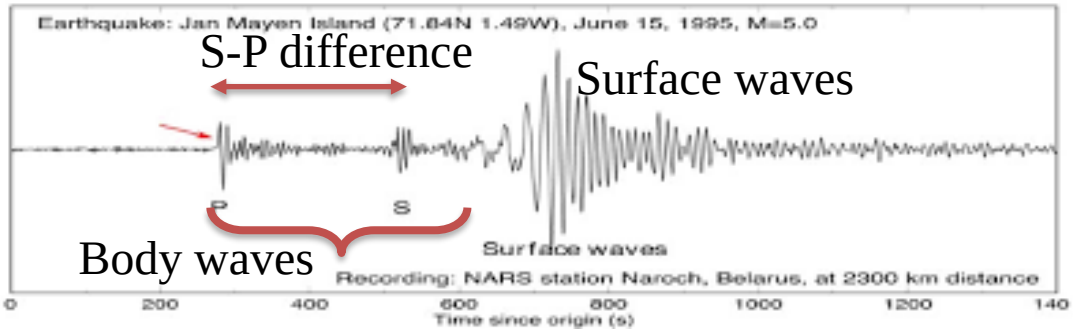
ES2105
Earth Science Lab 1

23/08/2024

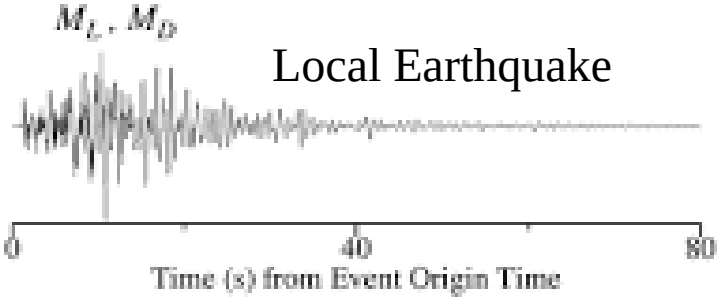
Earthquakes



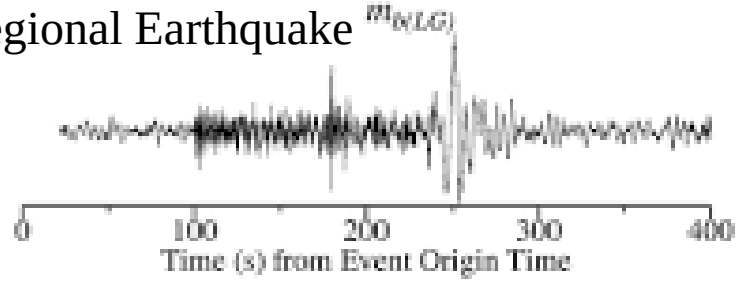
Description	*Magnitude*
Great	8 and higher
Major	7 - 7.9
Strong	6 - 6.9
Moderate	5 - 5.9
Small	4 - 4.9
Minor	3 - 3.9
Microearthquakes	<3.0



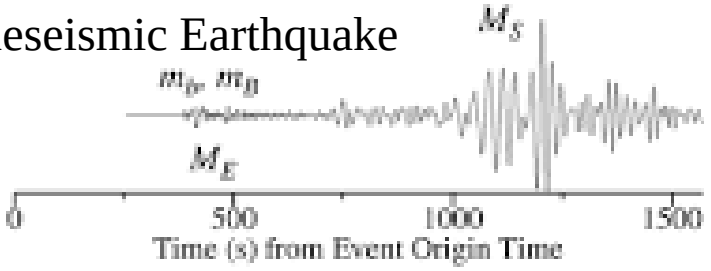
Local Earthquake



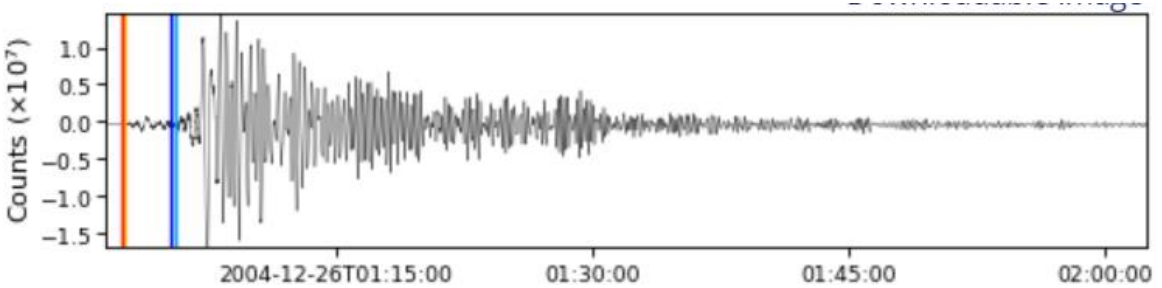
Regional Earthquake

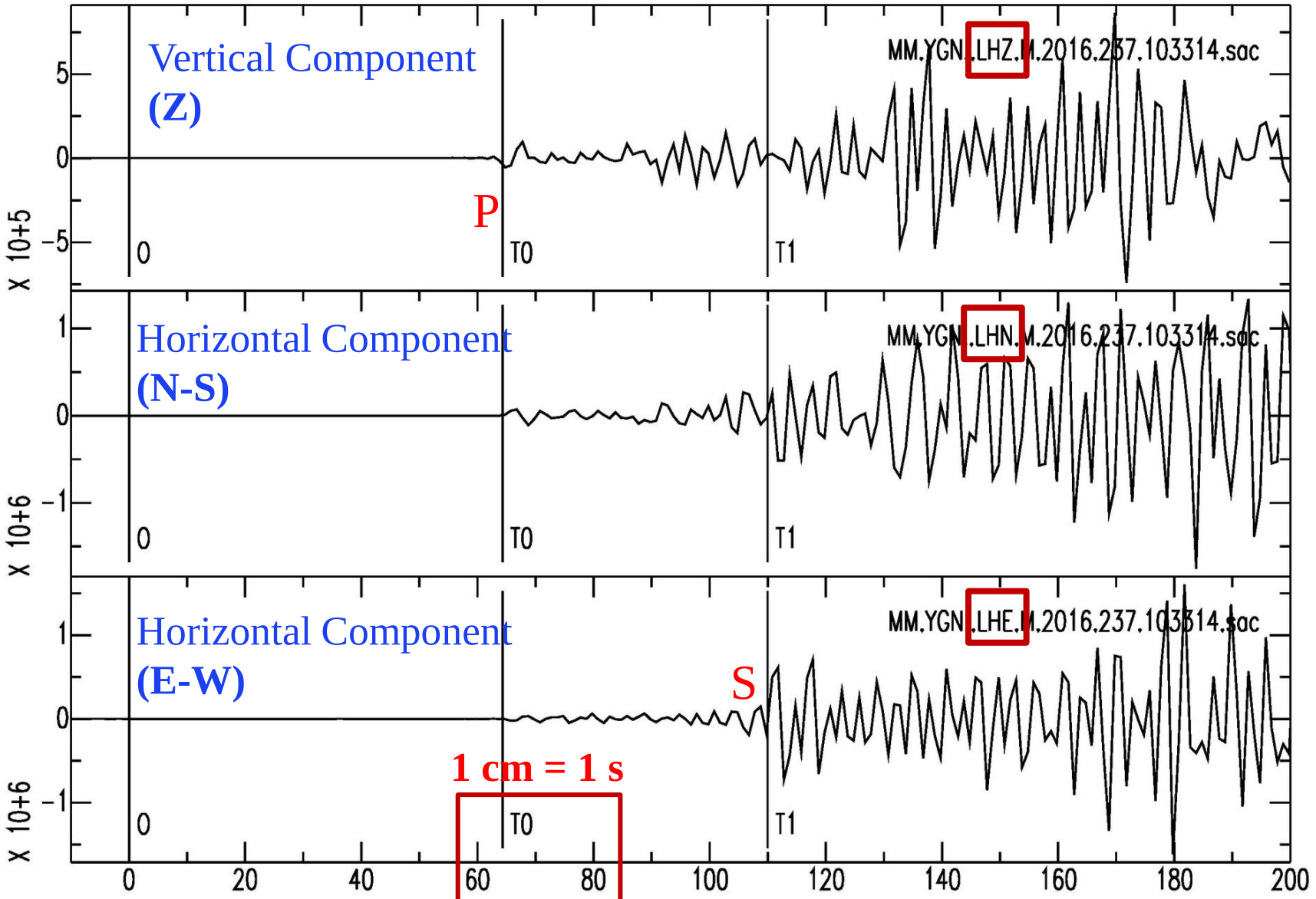


Teleseismic Earthquake



Great Andaman Earthquake, December 26, 2004, M=9.1





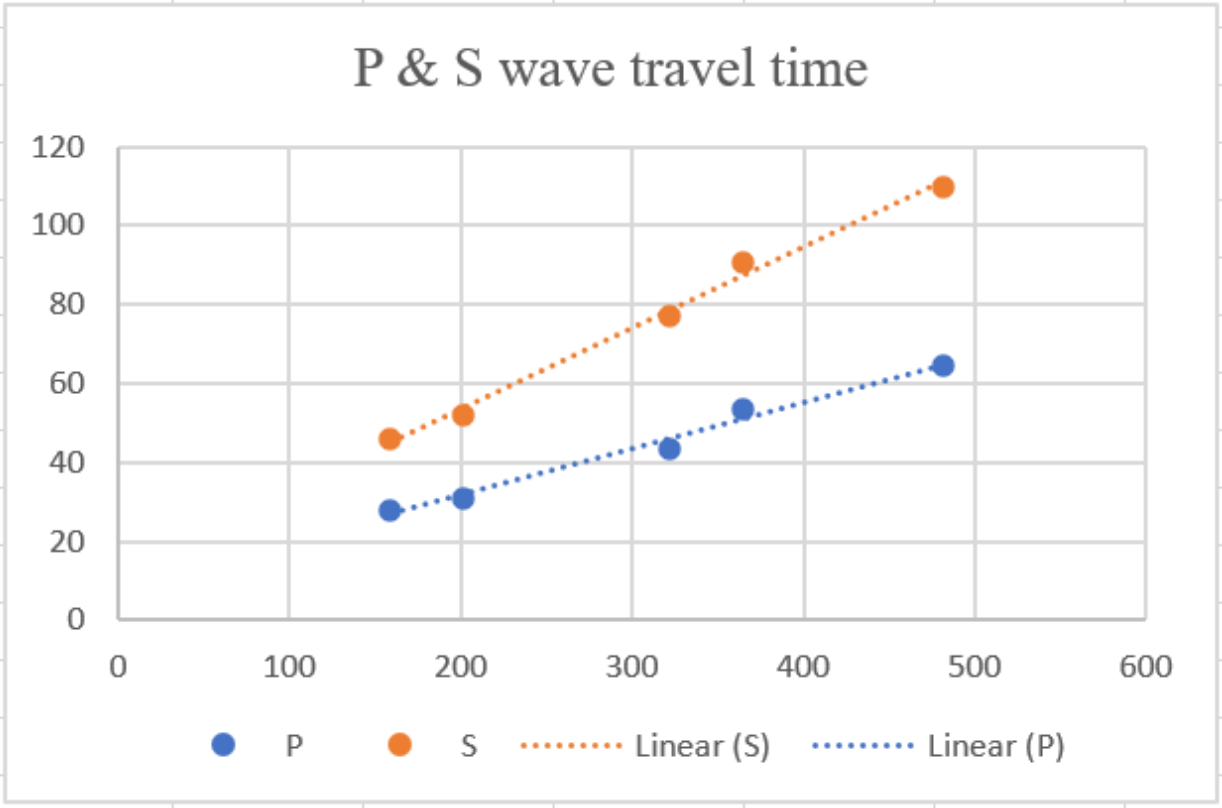
DIST – 482.08

T0 – 64.33

T1 – 109.97

P & S wave Travel-time Graph

Distance	P	S
159.116	27.6898	46.168
200.821	31.057	52.1838
321.223	43.57	77.08
364.767	53.65	90.9
482.08	64.33	109.97



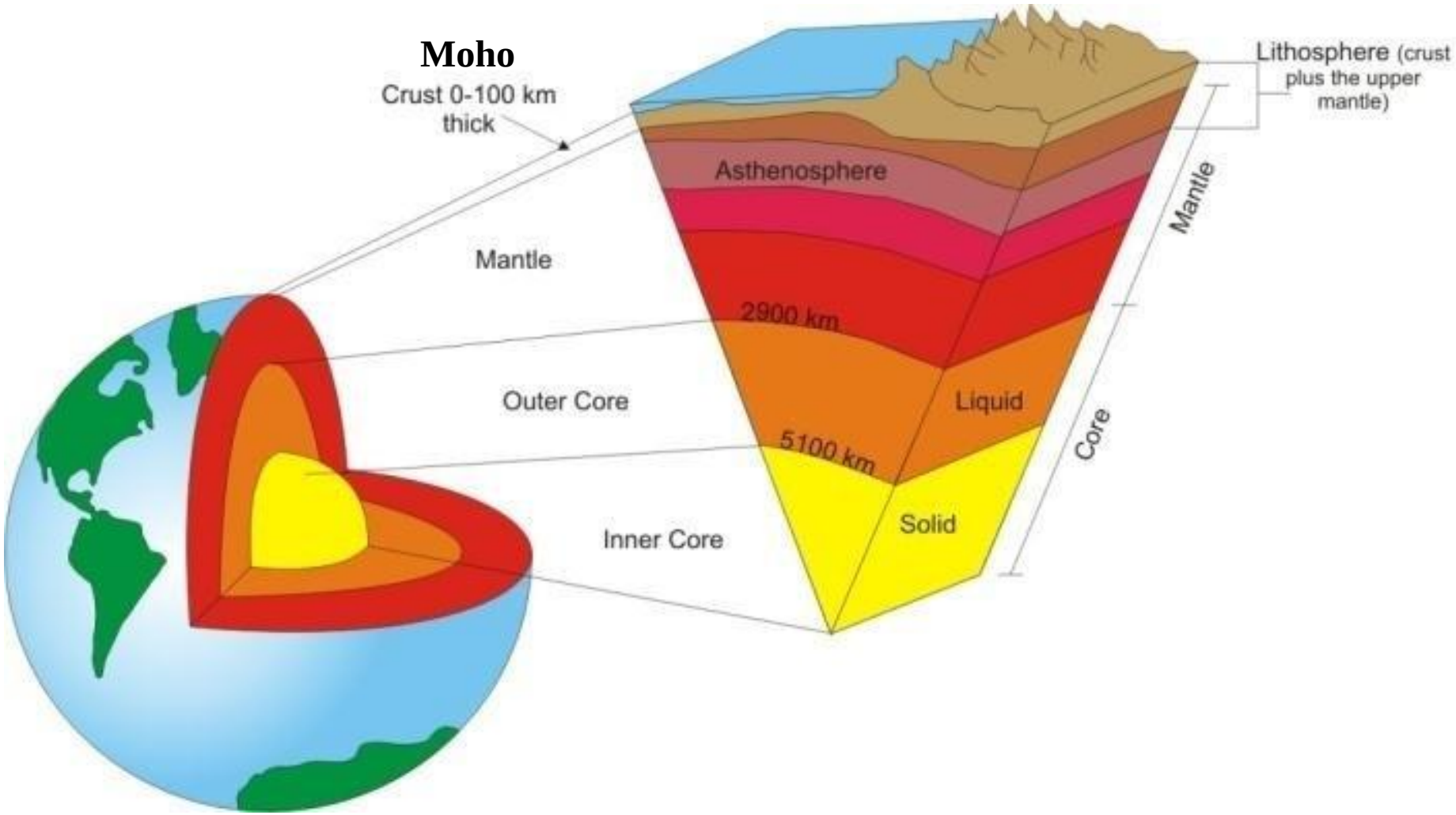
Seismometer

3T-ESP series

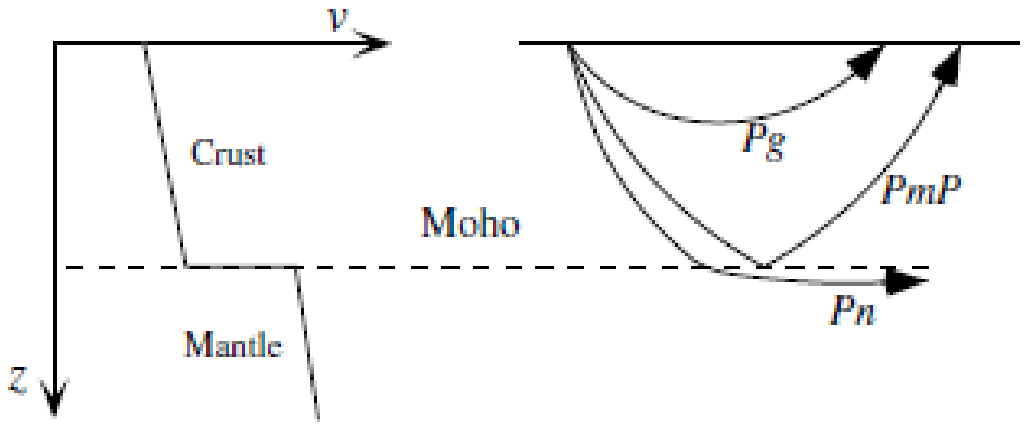
6 series

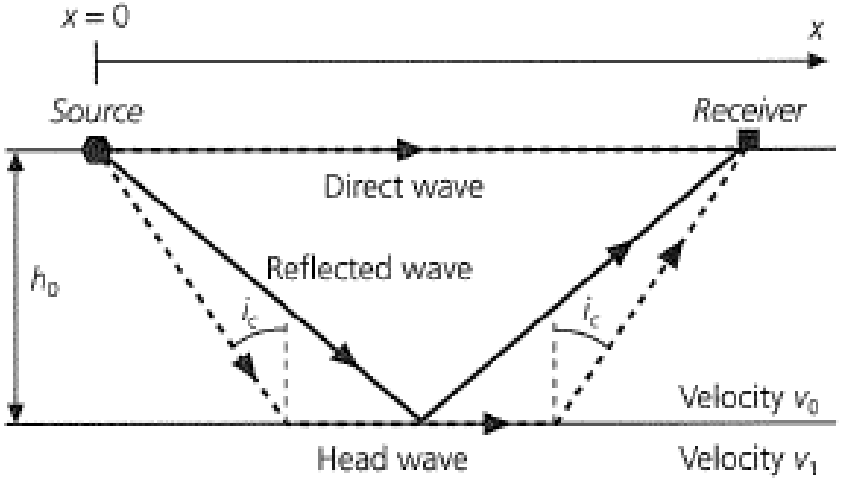
Certimus

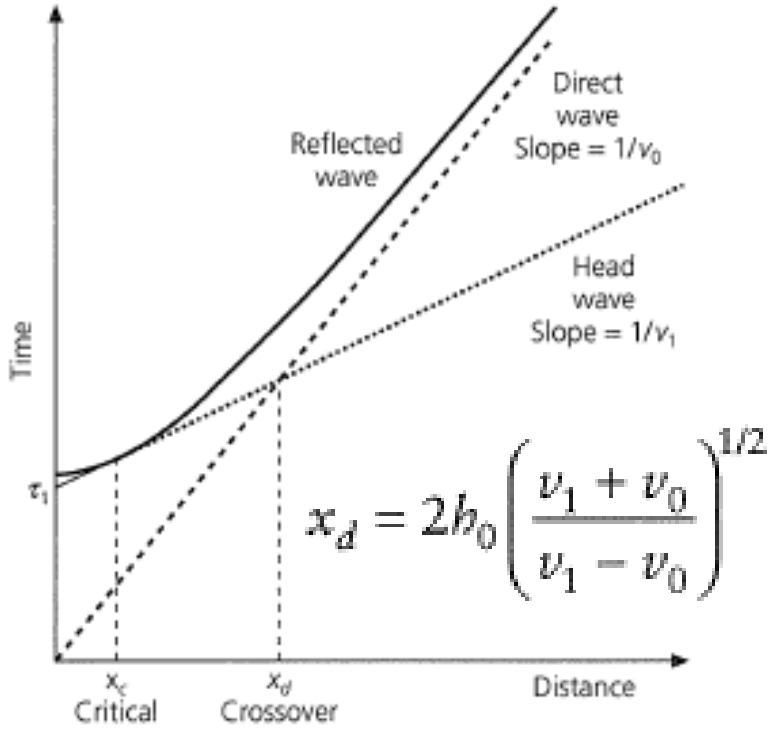
Internal Structure of the Earth



Moho Calculation







$$T_D(x) = x/v_0.$$

$$T_R^2(x) = x^2/v_0^2 + 4h_0^2/v_0^2.$$

$$T_H(x) = x/v_1 + 2h_0(1/v_0^2 - 1/v_1^2)^{1/2};$$

$$x_c = 2h_0 \tan i_c$$

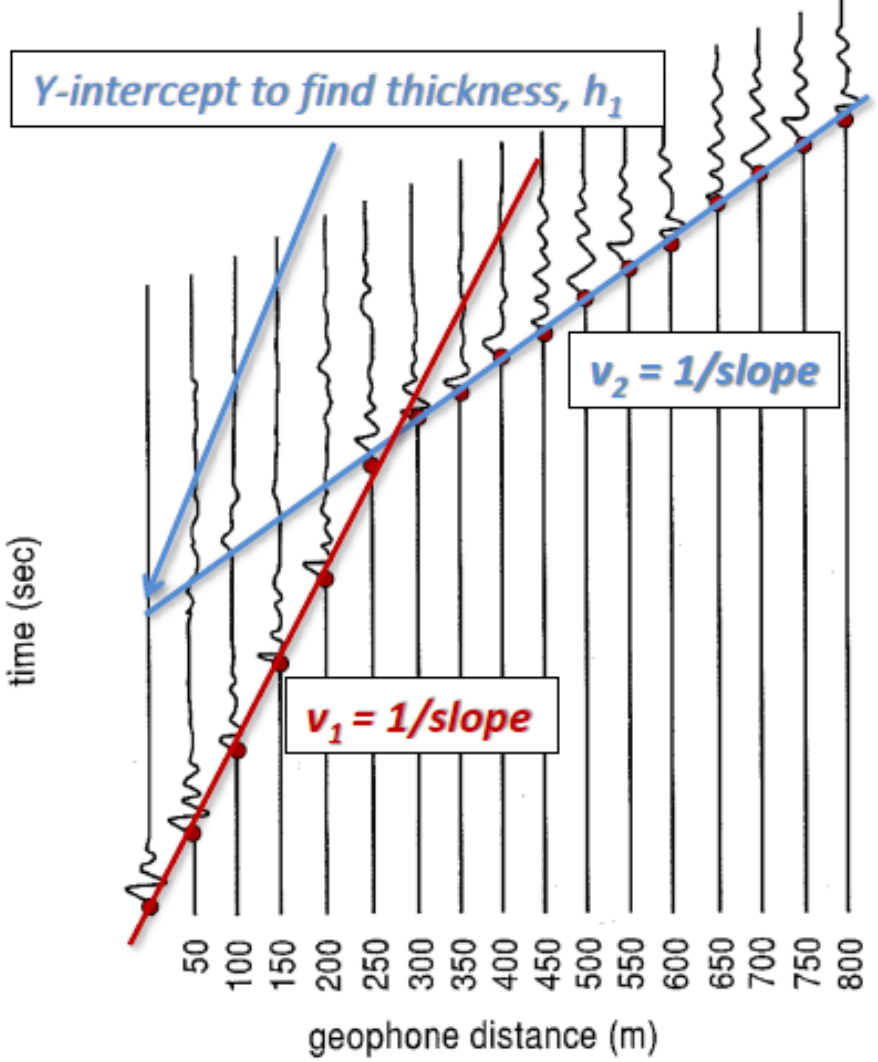
Moho Calculation

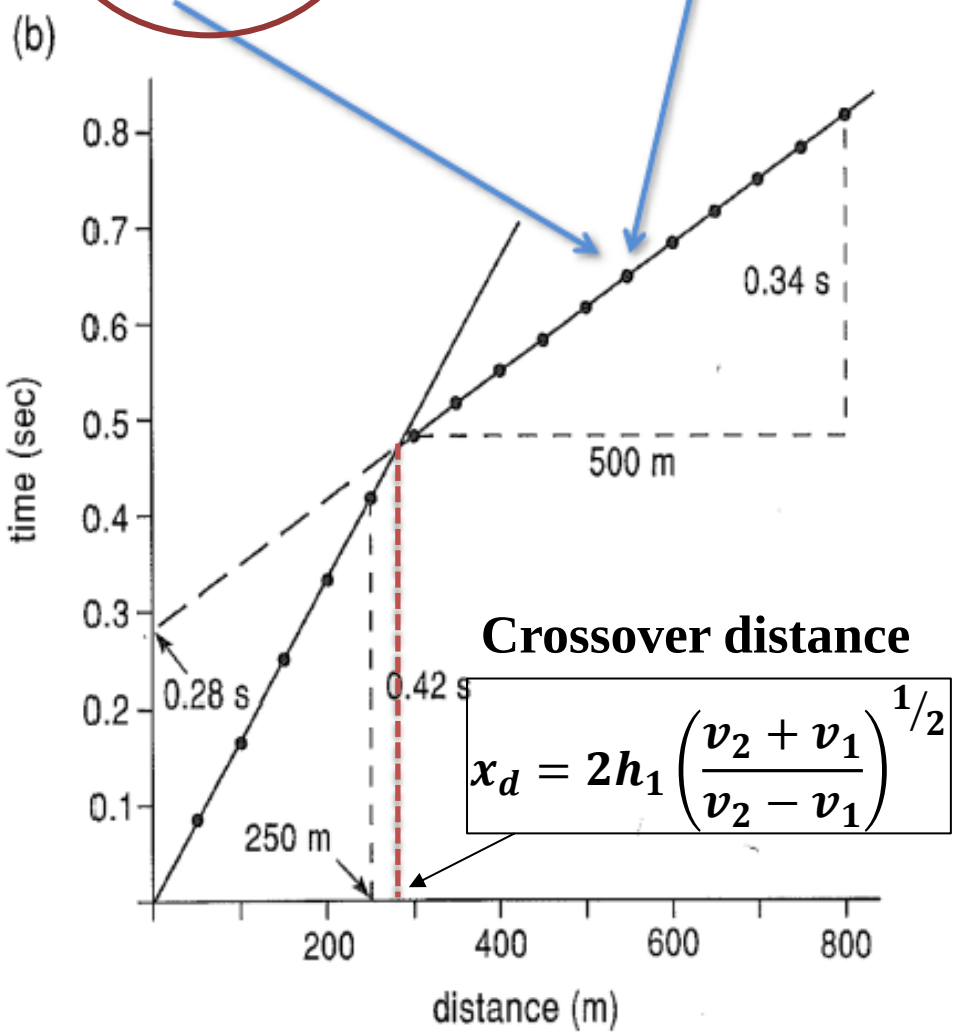
= 0.28

Refracted Ray Arrival Time, t

$$t = \frac{x}{v_2} + 2h_1\sqrt{\frac{1}{v_1^2} - \frac{1}{v_2^2}} \quad \text{or} \quad t = \frac{x \sin i_c}{v_1} + \frac{2h_1 \cos i_c}{v_1}$$

Y-intercept to find thickness, h_1





Crossover distance

$$x_d = 2h_1\left(\frac{v_2 + v_1}{v_2 - v_1}\right)^{1/2}$$

Vp/Vs Calculation

Arrival Time =
Origin Time + Travel Time

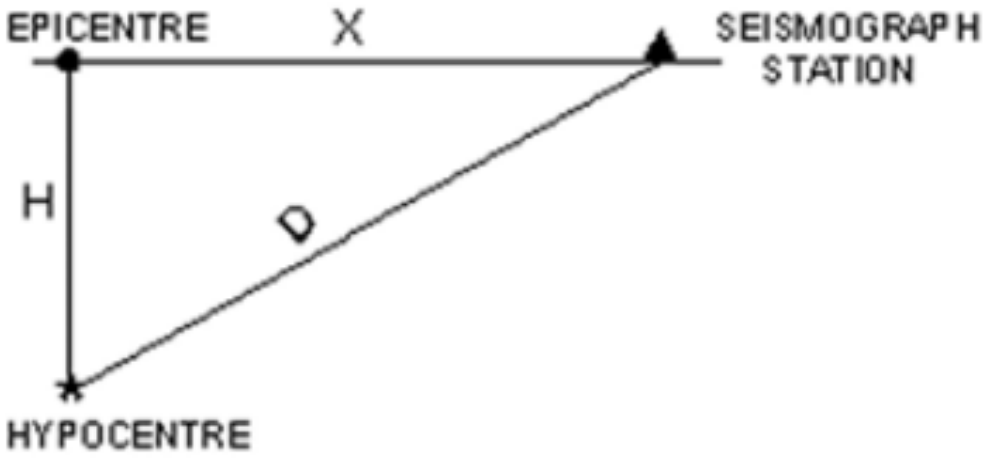
$$T_P = T_0 + \frac{D}{V_P}$$

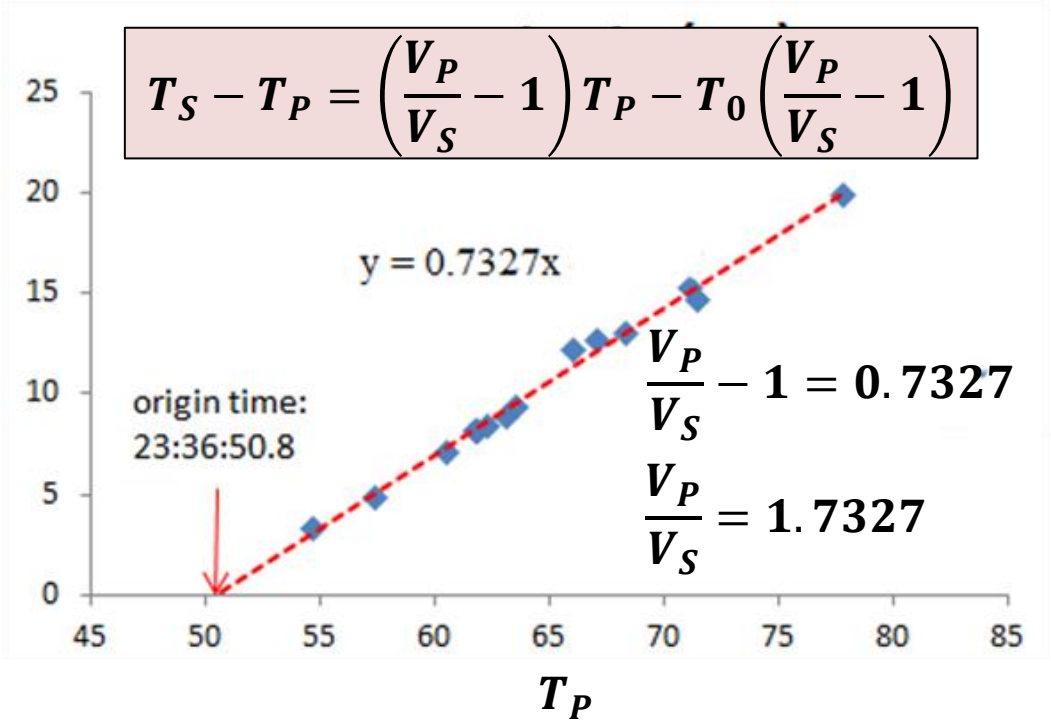
$$T_S = T_0 + \frac{D}{V_S}$$

$$T_S - T_P = D\left(\frac{1}{V_S} - \frac{1}{V_P}\right)$$

$$T_S - T_P = \frac{D}{V_P}\left(\frac{V_P}{V_S} - 1\right)$$

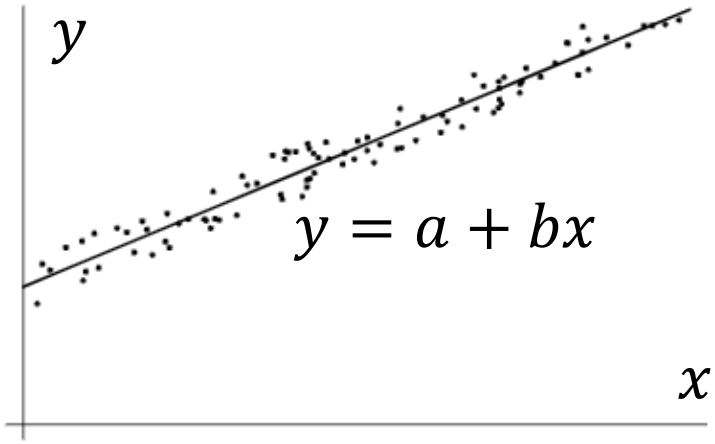
$$T_S - T_P = \left(\frac{V_P}{V_S} - 1\right)(T_P - T_0)$$





Wadati Diagram

Least Squares Fitting



$$a = \frac{\sum_{i=1}^{n} y_i \sum_{i=1}^{n} x_i^2 - \sum_{i=1}^{n} x_i \sum_{i=1}^{n} x_i y_i}{n \sum_{i=1}^{n} x_i^2 - (\sum_{i=1}^{n} x_i)^2}$$

$$b = \frac{n \sum_{i=1}^{n} x_i y_i - \sum_{i=1}^{n} x_i \sum_{i=1}^{n} y_i}{n \sum_{i=1}^{n} x_i^2 - (\sum_{i=1}^{n} x_i)^2}$$