

Example Problem (Lect. - 8, 07/2/2013)

- . The arrival times of P and S waves in different seismographs located at different sites for an earthquake are listed below.

Seismograph		P-wave arrival time	S-wave arrival time
Latitude	Longitude		
$37^{\circ}22'30''$	$121^{\circ}52'30''$	05:35:19.84	05:35:27.81
$37^{\circ}45'00''$	$122^{\circ}20'00''$	05:35:15.78	05:35:19.80
$37^{\circ}52'33''$	$121^{\circ}43'38''$	05:35:18.35	05:35:25.00

It is given that one degree change of latitude and longitude corresponds to 111.00 km and 88.20 km respectively at latitude $37^{\circ}45'00''$. Using 3-circle method, estimate the epicentral location (latitude and longitude) of the above earthquake.

Soln :-

$$D = \frac{\Delta t_{s-p}}{\frac{1}{v_s} - \frac{1}{v_p}}$$

$$\text{Let, } \left. \begin{array}{l} v_p = 6 \text{ km/s} \\ v_s = 3 \text{ km/s} \end{array} \right\} \text{ for crust.}$$

$$D = 6 [\Delta t_{s-p}] \text{ km}$$

where Δt_{s-p} in sec.

$$\begin{aligned} \text{Station-1} \div D_1 &= 6 [27.81 - 19.84] \text{ km} \\ &= 47.82 \text{ km} \end{aligned}$$

$$\text{Station - 2 :- } D_2 = 6 [19.80 - 15.78] \text{ km} \\ = 24.12 \text{ km}$$

$$\text{Station - 3 :- } D_3 = 6 [25 - 18.35] \text{ km} \\ = 39.9 \text{ km}$$

Reference Station — 2

Station - 1 :- In N-S dir.

$$\text{Change in Latitude} = [45 - 22.5]'$$

$$= 22.5' = 0.375^\circ \\ = 41.625 \text{ km}$$

$$\boxed{1^\circ \equiv 111 \text{ km}}$$

In E-W dir.

$$\text{Change of Longitude} = (80' - 52'30'')$$

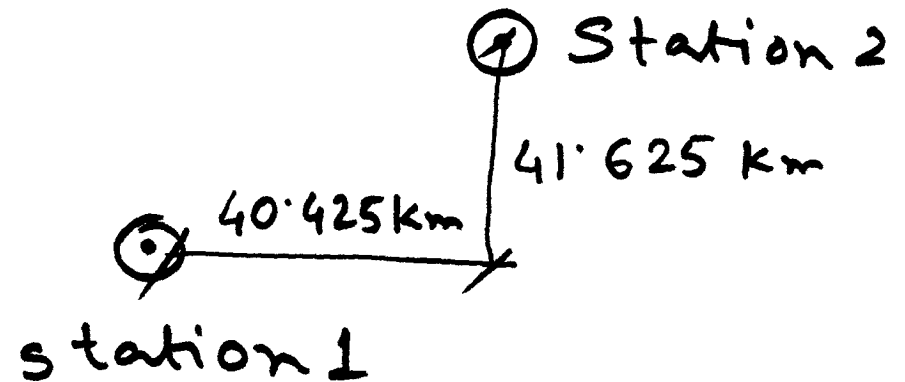
$$= 27.5'$$

$$= 0.4583^\circ$$

$$= 40.425 \text{ km.}$$

↑ N

$$1^\circ \equiv 88.2 \text{ km}$$



Station-3 :- In N-S dir,

$$\text{Change in Latitude} = (52'33'' - 45'00'')$$

$$= 7.55'$$

$$= 0.125833^\circ$$

$$= 13.9675 \text{ km}$$

$$[1^\circ \equiv 111 \text{ km}]$$

In E-W dir.

$$\text{Change in Longitude} = (80' - 43'38'')$$

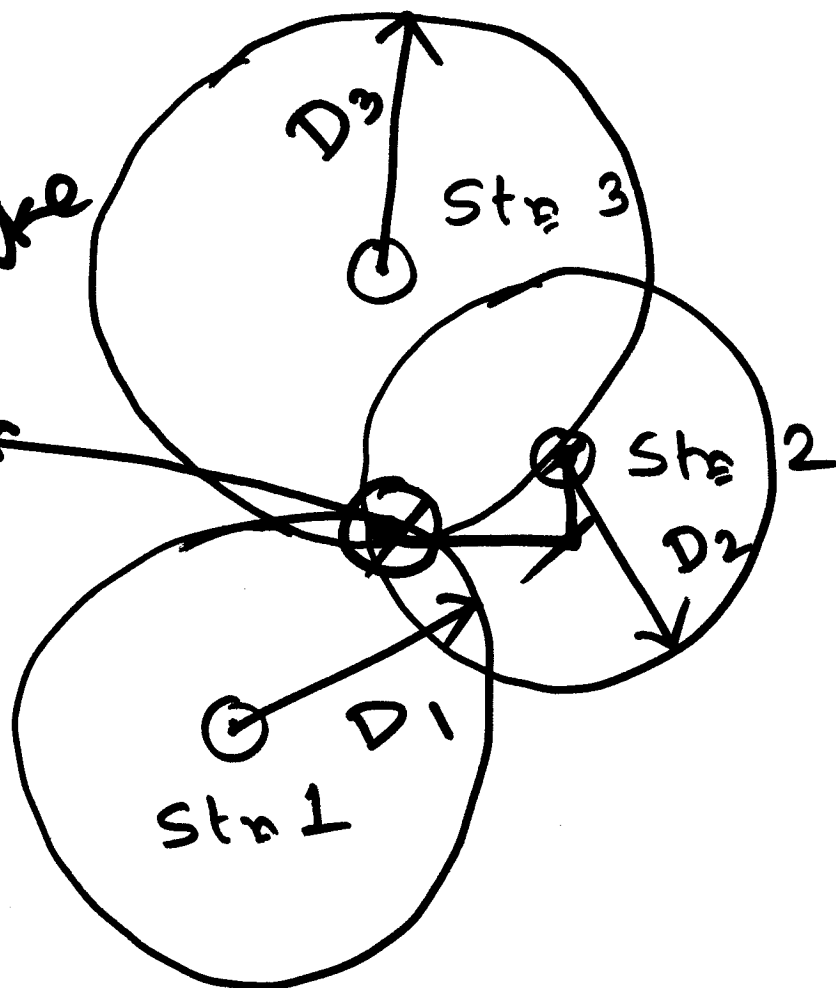
$$= 36.366'$$

$$= 0.60611^\circ$$

$$= 53.459 \text{ km.}$$

$$[1^\circ \equiv 88.2 \text{ km}]$$

Earthquake
Epicenter



↑ N

DC/6