

# effect of picking wrong seismic velocity on epicentre location

consider 1<sup>d</sup> earth of  $\Delta$  \* group A  
AAA  $\rightarrow$  x

note biased distribution of stations.

suppose we measure arrivals,  $t_i$  and station locations  $x_i$  exactly  
if  $v$  known exactly then residuals

$$r_i = 0 = t_{obs} - t_{calculated} = t_i - t_0 - \frac{x_i - x_0}{v}$$

but if  $v + \delta v$  is used and  $\delta v > 0$  then all the measured residuals are positive for stations in group A  
in earthquake location we seek to minimize the

error =  $\sum r_i^2$ . Since we have a biased station distribution we can artificially reduce the error by moving the epicenter away from its actual position. The residual from group A look like

$$r_{i \text{ group A}} = \underbrace{t_i - t_0}_{\text{positive}} - \frac{\overbrace{(x_i - x_0)}^{\text{Positive}}}{\underbrace{(v + \delta v)}_{\text{Positive}}} = \text{positive}$$

we make  $r_i$  smaller by :  
: decreasing first term  
: increasing second term

decreasing first term : make  $t_0$  larger earthquake appears later than actually was  
increasing second term : make  $x_0$  smaller, earthquake seems farther away from group A than it actually is.