EARTHQUAKE RELOCATION OF CHINA CONTINENT AND VICINITY DURING THE PERIOD OF JANUARY TO OCTOBER 2004

Ruomei Sun [1*], Ruifeng Liu [2], Zongliang Wu [3]

1. Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing CHINA
2. China Earthquake Networks Center, Beijing CHINA
3. Institute of Geophysics, China Earthquake Administration, Beijing CHINA

In response to the call of SW004 for Modernizing the ISC Procedures, we made earthquake relocation research for about 300 earthquakes in China continent and vicinity during the period of January- October of 2004.

Method

It is a major problem we are facing in earthquake relocation that the inversion of hypocenter is strongly coupled with inversion of velocity structure model. Here we introduce an orthogonal projection operator $P_B = BB^+$ from the space R^m into the image space $\Re(B)$ of B, where B+ is the Moore-Penrose generalized inverse matrix B, to separate the two kinds of parameters; velocity structures and hypocenters. Noting that $P_B B = B$ implies $(I-P_B B)B = 0$.

For m_e events recorded in n_s stations this system of equations may be written in matrix form as $t = A\delta v + B\delta q$

$$\delta T_{ij} = \sum_{k=1}^{n} \delta v_k \int_{L_{ij}} \frac{\partial u}{\partial v_k} ds + \sum_{k=1}^{4} \frac{\partial T_{ij}}{\partial q_{ik}} \delta q_{ik}$$

The minimization can be written as:

$$\|t - A\delta v - B\delta q\| =$$
$$\|P_B(t - A\delta v) - B\delta q\| + \|(I - P_B)t - (I - P_B)A\delta v\| \min$$

The above condition is equivalent to the following two conditions;

$$\|(I - P_B) - (I - P_B)A\delta v\| = \min$$

and

$$\| P_B(t - A\delta v) - B\delta q \| = \min$$

Although we ignore δv, then $P_B t - B\delta q = 0$ throw off more or less a part of travel residue. And the equation is compatible for δq.
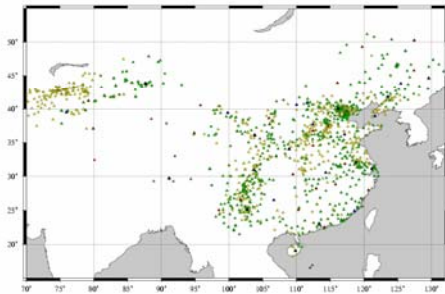
Data

Fig. 1

We assemble arrival time data from local and regional stations, including ABCE stations and stations of local seismological bureaus as well as. The distribution of total stations is as Fig 1. For those events (Mb$\geq$5) there are more than 100 arrivals utilizable. During the period from January to October of 2004, there are about 400 events (Mb>3.4) in ISC catalogue in China continent and vicinity. Most of these events are distributed in the western part of China. For the events (Mb<4) in Tibet no enough data available, they are not in our catalogue. We relocate 303 events.

Velocity model

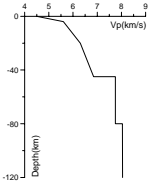| Depth(km)	0	4	20	45	45	80	120
Vp(km/s)	4.5	5.6	6.3	6.85	7.75	8.045	8.05

Fig. 2

About the velocity of S wave Vp/Vs is taken as 1.68 in the crust, 1.75 from Moho down to 80 km, 1.81 bellow 80km.

Result

Here we give our location result and try to give the deference among them to let others to compare. The total average RMS of ISC_JB is 1.13, 1.09 for ISC_AK, 0.775 for OPT.
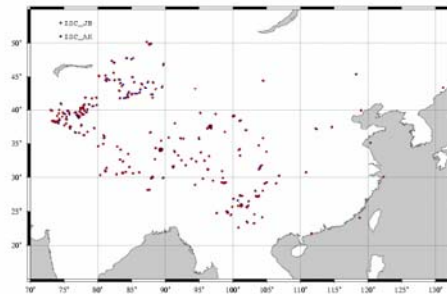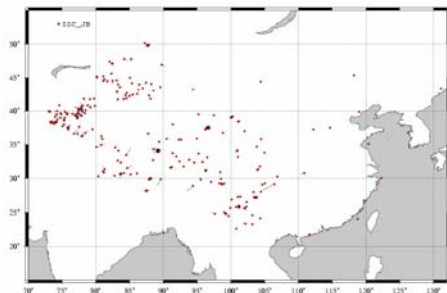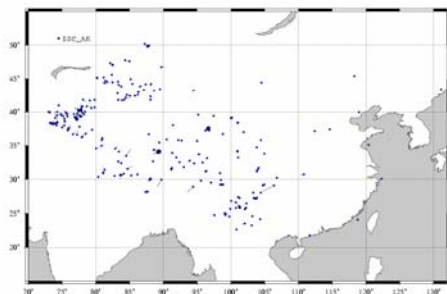

Fig. 3

Fig. 4

Fig. 5