Geophysical Research Abstracts
Vol. 13, EGU2011-1581, 2011
EGU General Assembly 2011

P-phase Arrival Time Local Earthquake Tomography in BAM Region

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The catastrophic December 26, 2003 Mw 6.6 Bam earthquake is one of the most disastrous earthquakes in Iran. This earthquake attracted much attention, and has been far more studied that which would be expected from a moderate magnitude earthquake. Nevertheless, there are doubtful results related to geometry and location of the causative fault that produced the Bam earthquake.
The only known fault which can be related to the earthquake, the Bam fault zone, is not clearly expressed at the surface along its large extent as a result of rapid sedimentation. The Bam-Baravat escarpment, located east of the city of Bam, is made of three major segments, probably active during the Pleistocene time, trending approximately N-S and ranging from 10 to 30 km long. The historical and instrumental seismic activity associated with the Bam-Bravat escarpment itself is rather low and most earthquake are related to Nayband, Gowk and Shahdad faults located north of Bam or to the Jiroft fault located in the south. As very little is known about the 3D structure of the region and in order to define the 3D velocity structure and the geometry of the active fault in the Bam area travel time data from the aftershock series of the Bam earthquake are inverted simultaneously for both hypocenter locations and 3D Vp structure. The data used for this purpose are 6201 P-wave arrival times from 544 selected local earthquakes recorded by temporary 23 short-period seismic stations. Thurber's simultaneous inversion method (1983) was applied to the arrival time data to obtain a 3D velocity structure, and hypocentral locations by using Simulps14. 3D P-wave velocity variations down to 20 km depth were obtained. The acquired tomographic images show that the 3D velocity structure beneath the region is heterogeneous in that low velocity appears throughout the region down to $\sim$10 km depth, and high velocities occur in western part from $\sim$14 km depth. The inverse problem of 3-D local earthquake tomography is formulated as a linear approximation to a non linear function. This process helps in determination of geometry of the Bam-Baravat escarpment and its role as causative fault during the Bam earthquake. Special efforts were made to access the solution quality including resolution estimates and synthetic tests. Velocity structure of seismogenic region are well resolved to a depth of 20 km. Difference in observed velocities in two sides of the Bam fault in depth of 10-20 km is clear in tomographic images and on cross sections. We relate this difference in velocity to the effect of the reverse Bam-Baravat fault which seems influenced the deeper layer down to 20 km depth. This implies that the pre-existing reverse Bam-Baravat fault is a major active structure in the region that could be caused the December 2003 Bam earthquake.