Source fault geometry of the 2015 Gorkha earthquake (Mw 7.9), Nepal, derived from a dense aftershock observation

*Eiji Kurashimo[1], Hiroshi Sato[1], Shin'ichi Sakai[1], Naoshi Hirata[1], Ananta Prasad Gajurel [2], Danda Pani Adhikari[2], Bishal Nath Upreti [3], Krishna Subedi[3], Hiroshi Yagi[4], Tara Nidhi Bhattarai [2], Tatsuya Ishiyama[1]

1. Earthquake Research Institute, the University of Tokyo, 2. Tribhuvan University, 3. Nepal Academy of Science and Technology, 4. Yamagata University

The megathrust of the Himalayan foothills produced the Mw 7.9 Gorkha earthquake, on 25 April 2015, in Nepal. This earthquake occurred in the India-Eurasia Plate Collision Zone. Several geological cross sections through the central Himalaya have been proposed. However, the megathrust geometry beneath the Himalayan foothills is still debated (e.g., Lave and Avouac, 2000; Bollinger et al., 2004; Hubbard et al., 2016). The geometry of the source fault provides basic information for understanding the active tectonics of the area and for forecasting seismic hazards. To obtain the seismic image of source fault, we conducted a dense seismic array observation across the central focal area of the 2015 Gorkha earthquake. Thirty-five portable seismographs were deployed along a 90-km-long line between Shabru Besi and Hetauda in the north-south direction with 3-10 km spacing. Each seismograph consisted of a 4.5 Hz 3-component seismometer and a digital data recorder (GSX-3). Waveforms were continuously recorded at a sampling rate of 250 Hz for a total of two months in two separate deployments between August 15 and November 28, 2015. The continuously recorded data obtained by the GSX recorders were processed in the laboratory subsequent to the observations. STA/LTA trigger algorithm was applied to detect the seismic event. A total 716 of earthquake events were detected and their hypocenters were determined using a 1-D velocity structure (Pandey et al., 1995). In order to obtain a high-resolution velocity model, a well-controlled hypocenter is essential. Due to this, we selected 609 events, whose hypocentral errors were less than 0.5 km. To investigate the aftershock distribution and the velocity structure, the double-difference tomography method (Zhang and Thurber, 2003) was applied to the 9,551 P- and 5,769 S-wave arrival time data obtained from 609 local earthquakes. The initial 1-D velocity model used in the tomographic study was obtained by the joint hypocenter determination technique (Kissling et al., 1994). The final velocity structure is resolved down to about 15 km depth. The aftershock distribution portrays a gently northward-dipping zone at 5-15 km depth. In several earthquake record sections, later arrival phases, probably reflected waves from the deeper part of the crust, can be recognized. We estimated the geometry of the reflectors which can well explain the observed reflection travel-times, using a 3D finite difference travel-time algorithm (Hole and Zelt, 1995). We identified two reflectors between 60 to 80 km north from the Main Frontal Thrust (MFT). Shallower reflector corresponds to the plate boundary and lower reflector is in the Indian slab. The aftershock distribution is located above reflector. Estimated source fault geometry from earthquake reflection is divided into two parts by 80 km from the MFT; southern part is dipping north by 5 degrees and northern part dips 13 degrees. Our estimated source fault is shallower in depth and lower in dip angle than previous geological estimates (e.g., Bollinger et al., 2004). In the immediate vicinity of the estimated source fault, we find a high-Vp zone in the area 80-90 km north of MFT, which coincides with the large co-seismic slip zone (>6m) as deduced from InSAR and GPS data (e.g., Elliott et al., 2016). A low-Vp zone corresponds to the southern edge of the large co-seismic slip zone. These results suggest that heterogeneous structure around the plate boundary control frictional properties of the fault.

©2017. Japan Geoscience Union. All Right Reserved.

Keywords: The 2015 Gorkha earthquake, Earthquake source fault, Dense seismic array observation, Aftershock distribution, Velocity structure

©2017. Japan Geoscience Union. All Right Reserved.

Structural Properties of the 2015 Mw7.8 Nepal Earthquake

*Ling Bai[1], Simon Klemperer[2], Hiroshi Sato[3], James Mori[4], Sanjev Dhakal[1,5]

1. ITP Institute of Tibetan Plateau Research, Chinese Academy of Sciences, 2. Geophysics Department, Stanford University, 3. Earthquake Research Institute, Tokyo University, 4. Disaster Prevention Research Institute, Kyoto University, 5. Tribhuvan University

The Himalaya orogenic belt is the largest continental collision zone on Earth and presents extreme seismic hazards to growing population centers in Nepal, India and China. Seismologists believe that earthquake rupture zones start and end at locations where there are changes in material properties and/or fault plane changes geometry. The 2015 Nepal earthquake is the most significant sequence along the Himalaya since modern digital earthquake recordings have become available and provides important new data.
In this study, we relocate aftershock hypocenters and conduct 3D P- and S-wave tomography of the source region. This study will benefit from the waveforms recorded by near-field temporary arrays of nearly 100 broadband and short-period seismic stations deployed by the Chinese Academy of Sciences, Stanford University, and Tokyo University. This study extends our previous work (Bai et al., 2016; Pei et al., 2016) which relocated aftershocks within one month and conducted two-dimensional P-wave tomography of the source area. It is our goal to deepen the understanding of the velocity heterogeneity of the earthquake source zones and the geometry of the MHT, along with the Moho and other crustal discontinuities.

References:

Bai, L., Liu, H., Ritsema, J., Mori, J., Zhang, T., Ishikawa, Y., Li, G., 2016. Faulting structure above the Main Himalayan Thrust as shown by relocated aftershocks of the 2015 Mw 7.8 Gorkha, Nepal earthquake, *Geophys. Res. Lett.*, 43, 637-642,doi:10.1002/2015GL066473.
Pei, S., Liu, H., Bai, L., Liu, Y., Sun, Q., 2016. High-resolution seismic tomography of the 2015 Mw7.8 Gorkha earthquake, Nepal: Evidence for the crustal tearing of the Himalayan Rift, *Geophys. Res. Lett.*, 43: 9045-9052. doi:10.1002/2016GL069808.

Keywords: the 2015 Mw7.8 Nepal earthquake , Earthquake relocation, Velocity structure

©2017. Japan Geoscience Union. All Right Reserved.

The ISC products and services related to Tibetan Plateau region

*Dmitry Storchak[1], Domenico Di Giacomo[1], James Harris[1]

1. International Seismological Centre

Several seismological agencies are tasked with the rapid determination of parameters of recent earthquakes such as the 2015 Gorkha Mw 7.8 earthquake in Nepal. The main mission of the International Seismological Centre (ISC) is to provide the definitive information on past earthquakes with the reviewed ISC Bulletin usually becoming available approximately two years after event occurrence. Nevertheless, the historical information relevant to recent earthquakes such as Gorkha is immediately available through a variety of products and services made available to researchers by the ISC.

The ISC Bulletin is the most long-term source of earthquake information that, among other applications, can be used for retrospective seismicity analysis in the area of a recent large earthquake. The data from the EHB bulletin –a groomed subset of the ISC Bulletin –also provides a high-precision view of seismicity in the region. The ISC also updates and maintains the IASPEI Reference Event List (GT) useful for a variety of calibration tasks. The ISC-GEM Catalogue is a highly homogeneous ISC dataset primarily designed for global and regional studies of seismic hazard and risk. The ISC Event Bibliography is an interactive facility that enables searches for references to scientific articles devoted to specific natural and anthropogenic seismic events that occurred within a region and time period of interest.

In this presentation we show examples of how various ISC datasets can be useful to studies of recent earthquakes and structure beneath the Tibetan Plateau region.

Keywords: Tibet, earthquake, catalogue

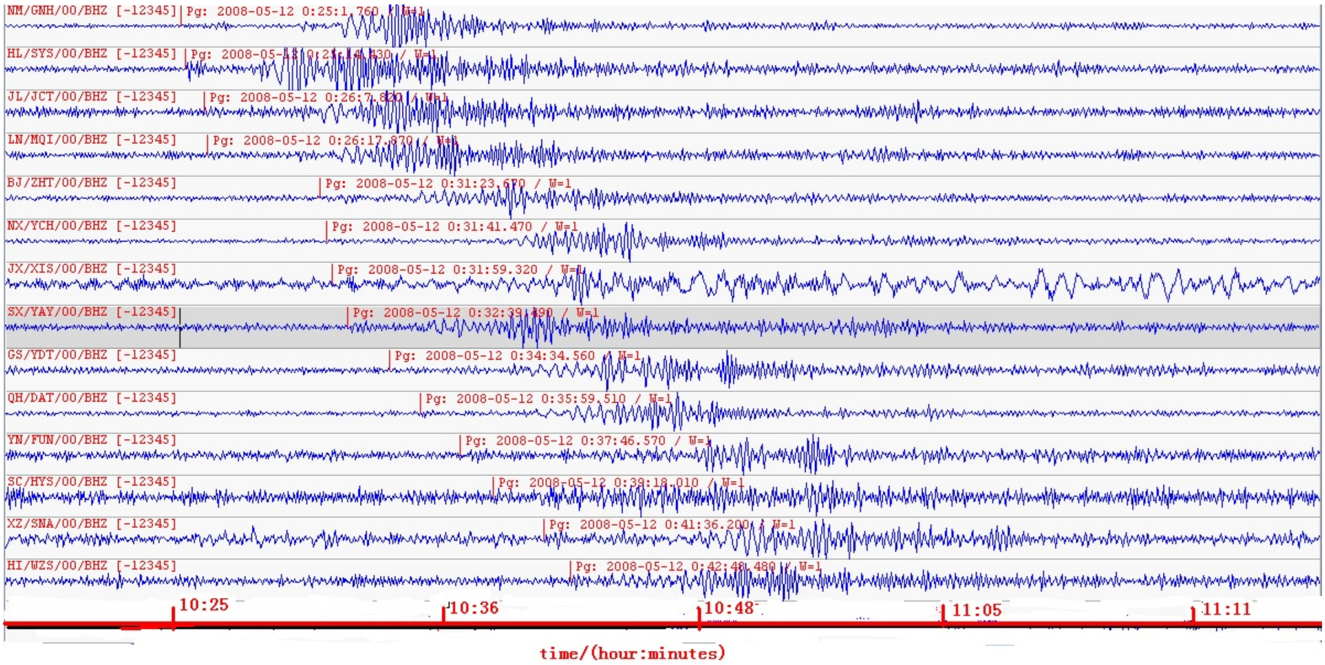
©2017. Japan Geoscience Union. All Right Reserved.

The very low frequency earthquakes (VLFEs) relation with the 2008’s great Wenchuan earthquake

*jin deng

This study reports discovery of very low frequency earthquakes (VLFEs) that occurred 4 h before the 2008 Ml=8.0 Wenchuan earthquake. The VLF events swarm is of 35 events, recorded by China seismic monitoring network between 10:00 to 12:00 on 12 May 2008. The VLFEs are characterized by waveform durations of 1000-2000 s, magnitudes of Mw2-4 and focal depths 25-40 km deeper than those of natural earthquakes in the same regions. The VLFs last arrived phase is reflected wave and clearly to be identified in VLFs waveform, as fig.1. The VLF waveforms is from more than one events with its Pg arrival times.
The VLFEs swarm can be one of important precursor evidence before the large earthquake.

Keywords: very low-frequency earthquakes(VLF), Low-frequency events, the 2008’ Wenchuan 8.0 earthquake



Density and magnetic intensity of the crust and uppermost mantle across the northern margin of the Tibetan Plateau

*Junmeng Zhao[1], Shah Syed Tallataf Hussain[1], Heng Zhang[1], Xiankang Zhang[2], Changli Yao[3], Yishi Li[4], Hongbing Liu[1], Qiang Xu[1], Gong Deng[1], Zhaoguo Hu[5], Zahid Imran Bhattib[1]

1. Key Laboratory of Continental Collision and Plateau Uplift, Institute of Tibetan Plateau Research, Chinese Academy of Sciences, Beijing 100101, China, 2. Center for Geophysical Exploration, China Earthquake Administration, Zhengzhou 450002, China, 3. China University of Geosciences, Beijing100083, China, 4. China Earthquake Administration, Beijing100036, China, 5. Shandong Zhengyuan Institute of Geological Exploration, China Central Bureau of Metallurgy and Geology, Jinan 250000, China

Recently, we have processed the gravitational and geomagnetic data from a geophysical survey along a profile (Baicheng to Da Qaidam) which crosses the northern and eastern Tarim Basin, the Altyn Tagh Mountains, and the Qaidam Basin, respectively. Based on the P- and S-wave velocities (Zhao et al., 2006), both the density and magnetic intensity of the crust and uppermost mantle were determined by using a joint inversion of gravity versus geomagnetism. Our new results at the northern margin of the Tibetan Plateau reflect different crustal structures beneath Tarim basin and Qaidam basin, and these two basins may be produced by different terranes. In addition, strong deformation has occurred in the basement and interior of the Qaidam Basin during the tectonic evolution.

Keywords: Density, Geomagnetic intensity, Tibetan Plateau, Tarim Basin, Altyn Mountains, Qaidam Basin

©2017. Japan Geoscience Union. All Right Reserved.

Crustal deformation of the northeastern margin of Tibetan Plateau: a combination of the ductile flow and fault-controlled strain

*Qingju Wu[1], Zhengyang Qiang[1], Ruiqing Zhang[1]

1. Institute of Geophysics, China Earthquake Administration

Through the application of harmonic analysis to a new dense teleseismic data set in the northeastern margin of Tibetan Plateau, we are able to determine the orientation of anisotropy in the upper and lower crust. Upper crustal anisotropy was measured at 18 stations with the fast direction from N32°E to N169°E, which is mainly controlled by local strain. However, in the lower crust, mid/lower crustal flow is probably the main origin of anisotropy, which was measured at 11 stations trending N34°E to N158°E. The crustal deformation model of the northeastern margin of Tibetan Plateau can be interpreted as a combination of the fault-controlled strain field and mid/lower crustal flow.

Acknowledgements
We would like to thank everyone involved in instrumentation preparation and field work. This study was supported by China National Special Fund for Earthquake Scientific Research in Public Interest (Grant No. 201008001, 201308011). Waveform data for this study are provided by Data Management Centre of China National Seismic Network at Institute of Geophysics, China Earthquake Administration (SEISDMC, doi:10.11998/SeisDmc/SN).

Keywords: Tibetan Plateau, Crustal anisotropy, Crutal flow

©2017. Japan Geoscience Union. All Right Reserved.

Stress triggering of the 1927 Gulang earthquake by 1920 Haiyuan shock

*Xiuping Mei[1], Mian Liu[2]

1. Lanzhou Institute of Seismology, Lanzhou, Gansu province, China, 2. Department of Geological Sciences, University of Missouri, Columbia, Missouri, USA

The M = 8 1927 Gulang earthquake occurred 100 km away from, 6.5 years after, the M = 8½ 1920 Haiyuan earthquake. Both of them were located on the Haiyuan fault zone which is one of the big strike slip fault system distributed on the northeastern Tibetan Plateau. The close temporal and spatial spacing between these two earthquakes suggests that the Haiyuan earthquake trigger the Gulang event. Various geological fieldworks indicate that the surface rupture of the Haiyuan earthquake is explicit and straightforward along the NW direction while that of the Gulang event is not clear. Although Gulang earthquake ruptured a complex thrust surface, aerial photographs and satellite images revealed no recent rupture. Here we investigate the Coulomb stress changes which could help us understand how the Gulang shock occurs affected by the Haiyuan event by considering broad parameter ranges.
We consider a model of viscoelastic half space which includes postseismic relaxation of the lower crust and upper mantle to investigate how the Haiyuan earthquake has advanced or delayed the Gulang earthquake. Our calculations suggest that the epicenter of the future Gulang event is totally located in the increased Coulomb stress lobe, where stresses were raised 0.107 bar by the Haiyuan rupture. This value is a little greater than the static stress change threshold. The postseismic stress change induced by Haiyuan earthquake is increased by about 0.1 bar only after 6.5 years at the hypocentral location of Gulang event.
We investigate coseismic Coulomb stress changes on some possible Gulang rupture planes by changing key source parameters including strike, dip and rake angles of receiver faults. The failure mechanism is mainly left-lateral thrusting rather than right-lateral thrusting according to the calculated results. A mechanism of strike=290°, dip=90° and rake=30° is a possible first ruptured fault plane in the process of the Gulang earthquake on which the Coulomb stress change imposed by the Haiyuan shock is the maximum by assuming broad uncertainties of the key parameters. The fault along N15°W direction could be the second failure plane. The 1920 Haiyuan mainshock might promote the rupture of those faults associated with the event of 1927 Gulang event.

Keywords: Coulomb stress changes, Haiyuan earthquake, Gualng earthquake

©2017. Japan Geoscience Union. All Right Reserved.

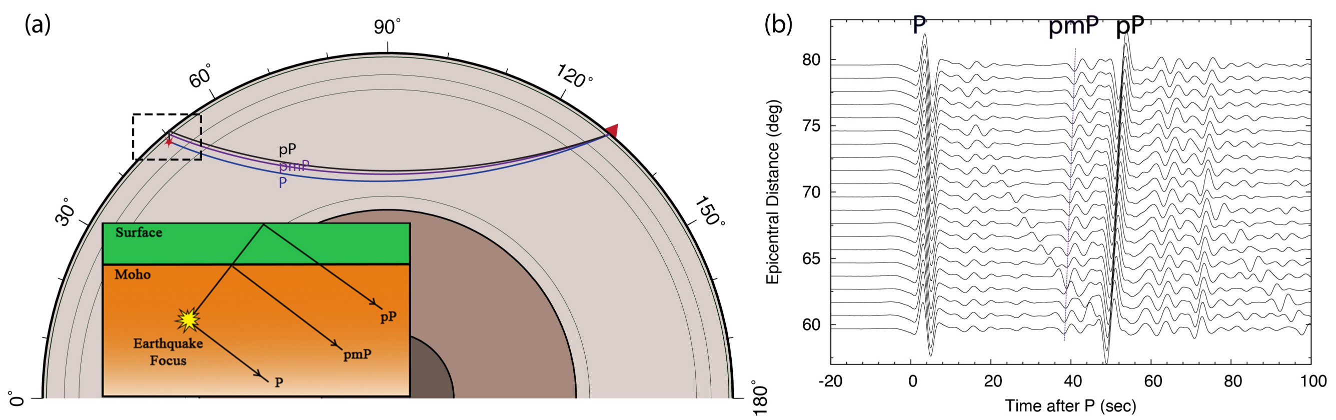
Subducting continental lower crust and crustal thickness variations in the intermediate seismic zone of Pamir-Hindu Kush from Moho underside reflection pmP

Hangqi He[1], *Xiaobo He[1]

1. Dept. of Marine Sciences, Zhejiang University

The Pamir - Hindu Kush region is an orogenic belt presenting two continental converging subduction zones where the Indian and Asian plates collide. Understanding of the regional tectonic history, however, has been hampered due to limited seismological investigations. In this study, we use the Moho underside reflection pmP phases to constrain the crustal thickness variations in the intermediate seismic zone (36-37°N, 69-72°E). The events characterized by focal depth deeper than 100 km and magnitude greater than 5.8 (Mw) are selected. The crustal thickness is determined by identifying depth phase pP along with the Moho underside reflection pmP. The measured thickness in this study varies spatially from 58.1 to 76.2 km, with some uncertainty most likely resulting from the estimation of the average velocity of P-wave (~6.21 km/s) in the crust. The strong Moho variation implies a large structural deformation of the crust, reflecting a complex collision-related mountain building history. We also detect two strong reflections from deep interfaces down to ~97 km below the southernmost Pamir. According to our direct observations and waveform modeling, we further explain the two reflections are perhaps a result of underplating of the subducted Asian lower crust below this region. Our observations here will be complementary to other seismic results such as receiver functions.

Keywords: Moho, Intermediate earthquake, Pamir-Hindu Kush, Lower crust, Crustal thickness



©2017. Japan Geoscience Union. All Right Reserved.

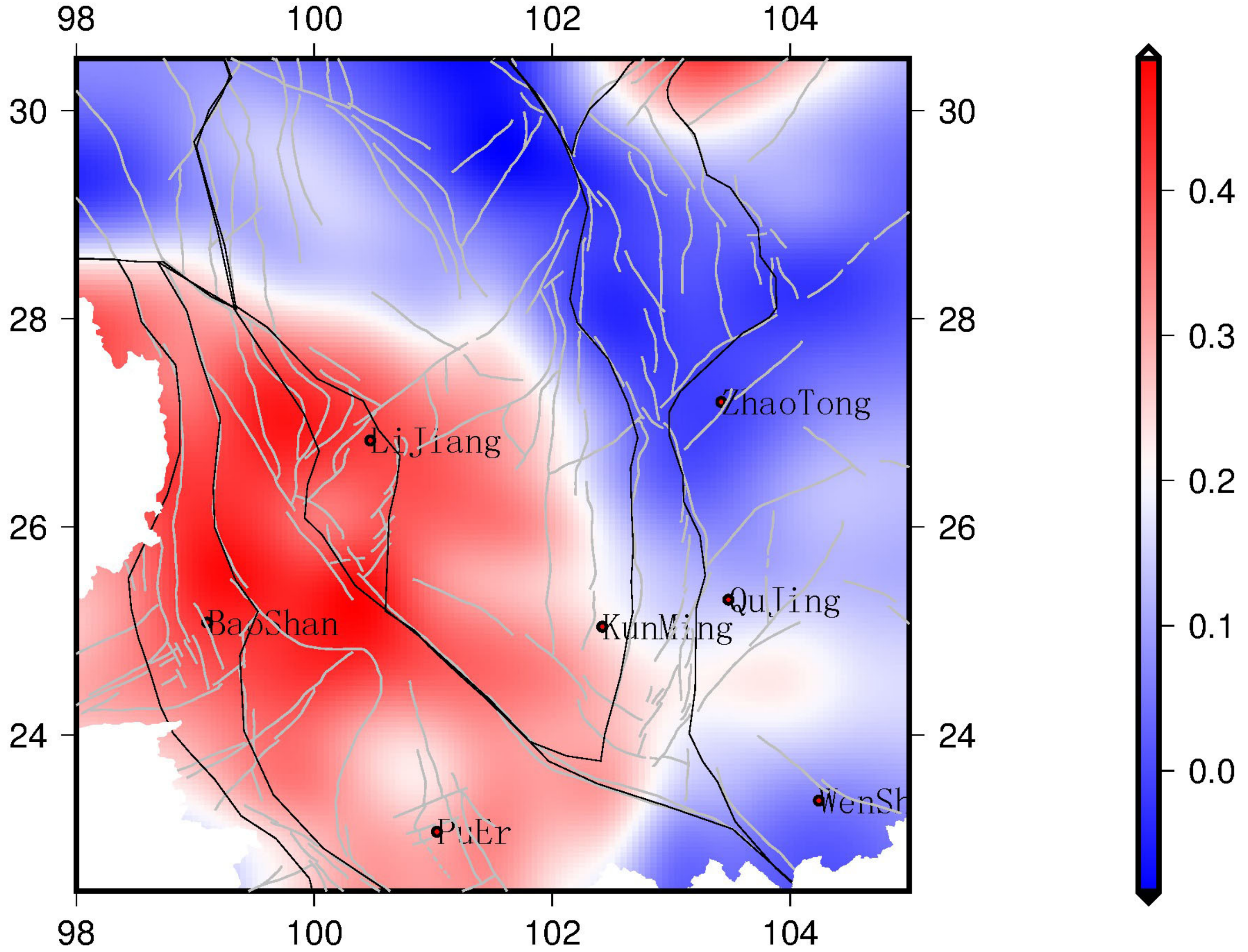
Gravity change in the southeast Tibetan Plateau caused by crustal movement

*Jiapei Wang

Combining crustal movement with gravity change, which is the key problems to analysis and understand the dynamic about the interior of the earth , also is one of the most important ways to study. We can more directly monitor and study the movement process of material inside the earth through plenty of high-precision space-to-ground survey and surface gravity data.Walsh(1975),Reilly, Hunt(1976) analysed the problem combining the surface deformation with gravity change in theory for the first time; Chen .et al(1980) improved the theory and gave the calculation formulas about the surface gravity change caused by deformation and material movement in certain areas; On this basis, Shen et al(2005,2007) propose the thought and theory of coupling movement of crustal deformation and density changes, and derived the equation of gravity potential caused by crustal movement general time-space domain further. On the other hand, Duan(2011) and Liu (2015) simulated the gravity change in the Tibetan Plateau by translational motion of vertical cuboid.In this study, with theory of coupling movement of crustal deformation and density changes and translational motion of vertical cuboid, we separately applied compound trapezoid formula and the latest crustal models to research the gravity change features caused by crustal movement in the Southeast of Tibetan Plateau.

Keywords: Gravity change, coupling movement, crustal deformation, density changes, Southeast of Tibetan Plateau

©2017. Japan Geoscience Union. All Right Reserved.



©2017. Japan Geoscience Union. All Right Reserved.

Probabilistic seismic hazards for Tibetan Plateau and adjacent regions estimated using multiple seismic source and attenuation models

*Md Moklesur Rahman[1], Ling Bai[1], Nangyal Ghani Khan[1], Guohui Li[1]

1. ITP,CAS, Beijing, China

Tibetan plateau and adjacent region is one of the most seismically active regions of the World. The catastrophic earthquake occurs frequently in this region and causes huge socio-economic losses. For instance, the 2015 Mw7.8 Nepal and the 2008 Mw7.9 Sichuan earthquake caused thousands of casualties and huge unrecoverable damages. The proper seismic hazard quantification is widely used an effective tool to reduce the seismic risk.

In this study, we estimate the probabilistic seismic hazards for the Tibetan plateau and adjacent region based on five attenuation models along with three different seismogenic source models (smoothed gridded, linear, and areal sources). In order to capture the epistemic uncertainties, a logic-tree structure was used assigning different weighting factors for various models. The peak ground acceleration and spectral acceleration at 0.2 s and 1.0 s were quantified for 2% and 10% probability of exceedance over 50 years considering the bed rock site condition. The hazard maps depicted significant spatio-temporal variations. This study provide new constraints on the improvement of seismic zoning map and consequently on the refined seismic building design codes for the Indian-Eurasian continental collision zone.

Keywords: Tibetan plateau, probabilistic seismic hazard, peak ground acceleration, spectral acceleration, logic tree

©2017. Japan Geoscience Union. All Right Reserved.

Teleseismic earthquake relocation and tomography of Tien Shan mountains, northwestern Tibetan plateau.

*Nangyal Ghani Khan[1,2], Ling Bai[1], Junmeng Zhao[1], Guo Hui Li[1], Muhammad Mokleshur Rahman[1]

1. Institute of Tibetan Plateau Research, Chinese academy of sciences, Beijing, P.R. China, 2. COMSATS institute of information technology, Abbottabad, Pakistan

Intra-continental belts have always posed questions regarding the source of seismicity and the controlling factors of the dynamics and formation of the fold and thrust belts. Our study deals with such questions about the world’s most active intra-continental thrust belt i.e. the Tien Shan. We used teleseismic earthquake relocation and regional tomography to evaluate the share of each neighboring unit in the relatively rapid formation of Tien Shan. We relocated 7094 earthquakes. We defined a cluster as a set of 10 events with a maximum distance of 35 km between the hypocenters, we discarded all the events with less than 10 phase recordings, thereby leaving only the well-recorded events. These new precise locations of hypocenters were used as initial locations for the tomographic inversion. Our huge data set produced high-resolution tomographic results, providing an insight into the dynamics of Tien Shan. We found low-velocity zones beneath Tien Shan to the east of Talas-Fergana fault. This low-velocity zone within the lithospheric mantle is associated with differential subduction of Tarim basin beneath Tien Shan. At shallow crustal depths, to the east of Talas-Fergana fault, we found high-velocity zone beneath Tien Shan, in addition, we found much deeper crustal events in western Tien Shan.

Keywords: Teleseismic relocation, Low-Velocity Zone, Differential subduction

©2017. Japan Geoscience Union. All Right Reserved.

Core-mantle boundary structure beneath the Tibetan Plateau and adjacent regions

*Guohui Li[1,2], Ling Bai[1]

1. Institute of Tibetan Plateau Research, Chinese Academy of Sciences, 2. College of Earth Sciences, University of Chinese Academy of Sciences

We use waveforms from the Chinese Digital Seismic Network and 3-D synthetics to study the structure of D” beneath the Tibetan Plateau and adjacent regions. The synthetics are calculated using specfem3d_globle and based on crust1.0 for the crust, S40RTS for the mantle, and ak135 for the lowermost 300 km above the CMB. We use waveform cross correlation between observed and synthetic waveforms to obtain differential travel-time residuals of S and ScS phases.
The corrected ScS-S differential travel time residuals indicate that a high shear velocity anomaly beneath the Tibetan plateau is adjacent to a low shear velocity anomaly to the west of Tibetan plateau. Slant stacks of Scd signals show that a discontinuity on top of D” exists near the boundary of high and low velocity anomalies. Precursors of ScP to the south of this boundary suggest the existence of ultralow velocity zone (ULVZ).

Keywords: core-mantle boundary, Tibetan Plateau, slant stack

©2017. Japan Geoscience Union. All Right Reserved.

Block boundries of uppercrust in the North-Eastern Tibet from Pg-wave velocity and anisotropy joint tomography

*Shunping Pei[1], Quan Sun[1], Yanbing Liu[1], Xiaotian Xue[1], Zhigang Shao[2]

1. ITP Institute of Tibetan Plateau Research, Chinese Academy of Sciences, 2. Institute of Earthquake Science, China Earthquake Administration

The northern growth of Tibetan Plateau is a improtant scientific question and attract most attention from geologist and geophsicist. The sturcture of three blocks, Ordos, Alax and Tibetean Plateau, and their relationship is a key to resolve this question. We used Pg-wave travel time data from year 1980 to 2015 in this region, to obtain high resolution struction of upper crust by applying 2D velocity and anisotropy. The results show dominent low velocity beneath Tibetan Plateau, high velocity beneath Alax block and very high velocity beneath Ordos block. The anisotropy result show fast direction along fault strike in the three blocks, but fast direction almost pendic to the fault in the boundary zone between three blocks which may be resulted from consitent princinple compress stress effect on the many near random micro-cracks in the active zone. The clear boundies can be determined by tomographic velocity and anistropy, and which suggest northern growth of Tibetan Plateau is a serial process of uplifting, faulting and thrusting effect on the margin of Alax block and Ordos block.

Keywords: North-East Tibetan Plateau, Tomography, Joint inversion , Pg velocity and anisotropy

©2017. Japan Geoscience Union. All Right Reserved.

Internal deformation of lithosphere beneath the central Tibet

*heng zhang[1,2], Dapeng Zhao[3], Junmeng Zhao[1], hongbing Liu[1]

1. Institute of Tibetan Plateau Research, Chinese Academy of Sciences , 2. Department of Earth, Atmospheric and Planetary Sciences, MIT, 3. Department of Geophysics, Tohoku University

We use P-wave data from the Hi-CLIMB and ANTILOPE-II project to determine azimuthal and radial anisotropy tomography in central Tibet. Beneath the Himalayan block, variant FVD (fast velocity directions) are observed between crust and upper mantle. In contrast, the FVD in the Lhasa block exhibits only a slight variation between the lower crust and upper mantle, reflecting a coherent deformation there. Different FVD are revealed near the Bangong-Nujiang suture, which may reflect different parts of the underthrusting Indian plate. In the upper mantle of the Qiangtang block, a E-W trending azimuthal anisotropy with positive radial anisotropy is revealed in the shallower part, whereas a weak anisotropy appears in the deeper part, implying a two-layer anisotropic model. A two-layer lithosphere is detected in the Lhasa block, and both layers are located in high velocity zones. Moreover, the character of lithosphere shows significantly E-W variations beneath the Lhasa block. Our results support a geodynamical model that strong deformation has occurred on both Indian and Eurasian lithosphere.

Keywords: anisotropy, tomography, geodynamics

©2017. Japan Geoscience Union. All Right Reserved.

Upper mantle anisotropy beneath western Tibet revealed by shear wave splitting measurements

*Changhui Ju[1,2], Junmeng Zhao[1], Qiang Xu[1]

1. Key Laboratory of Continental Collision and Plateau Uplift, Institute of Tibetan Plateau Research, Chinese Academy of Sciences , 2. University of Chinese Academy of Sciences

We analyze seismic waveforms recorded by the Y2 array (IRIS) through shear wave splitting (SWS) technique to investigate the upper mantle deformation beneath western Tibetan Plateau. First, STA/LTA method and time frequency analysis are adopted to detect clear SKS wave and determine the frequency band of filtering, respectively. Second, cluster analysis method is selected to determine the optimal time window. Third, an automatic minimum transverse energy method is applied to calculate the fast polarization directions and delay times of the SKS waves. Finally, visual checking is used to ensure the reliability of the results.
After calculating the SWS parameters for every event, we analyze the results for each single station and decide if the SWS can be depicted by a two-layer model or not. Our results indicate the relationship between the upper mantle deformation of western Tibetan Plateau and Indian plate subduction beneath Tibetan Plateau.

Keywords: shear wave splitting, western Tibet, upper mantle anisotropy

©2017. Japan Geoscience Union. All Right Reserved.