Crustal Movement Observation Network of China and its Phase II Project

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Phase I of CMONOC

In the vast region of China continent, all kinds of active faults are well developed with the interactions of the surrounding plates. Because devastating earthquakes frequently occur along these active faults, China content is a region with serious earthquake hazard. In order to use GPS to monitor crustal deformation and reduce earthquake hazards, we established the Crustal Movement Observation Network of China (CMONOC) during 1997-2000. The network has 27 continuous GPS stations to serve as fiducials, and more than 1100 campaign mode stations distributed all over the Chinese continent with a relatively higher density around tectonically active fault zones. The continuous stations have been observed since 1998, and six of them (i.e. BJFS, LHSA, KMIN, SHAO, URUM, WUHN) are serving as IGS tracking stations. The campaign mode stations were observed completely 3 times in 1999, 2001, and 2004, respectively. In each campaign, stations were occupied continuously for at least 4 days. Because all the concrete monuments were uniformly designed with forced-centering GPS antenna mount and the campaigns were well organized on a large scale with more than 80 sites occupied simultaneously with the same type of GPS receiver and choke-ring antenna, the data quality was well guaranteed.

Using the CMONOC GPS data, and combining the GPS data from other projects carried out around the Himalayas [*Paul et al., 2001; Banerjee and Burgmann, 2002*], we derived a crustal movement velocity field of central Asia with the following steps [*Wang et al., 2003; Niu et al.,2005*]:

1) All the observation data of each day were put together to solve for the daily loosely constrained station coordinates and satellite orbits with the GAMIT software.

2) The daily solution of regional stations was combined with the loosely constrained global solutions of ~80 IGS tracking stations produced at the Scripps Orbital and Position Analysis Center (SOPAC) with the GLOBK software.

3) Station positions and velocities were estimated in the ITRF2000 reference frame with the QOCA software. The QOCA modeling of the data was done through sequential Kalman filtering, which allows adjustment for global translation and rotation of each daily solution. When solving station velocities with QOCA, we use ITRF2000 velocities as constraints. The strategy is as follows: Choosing 16 IGS tracking stations (7 in North America, 3 in Australia, 4 in Eurasia, 1 in Pacific and 1 in Antarctica) as fiducial stations. The fiducial stations are distributed all over the

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world with their standard deviations of horizontal components less than 0.5mm/a in ITRF 2000. When constraining the velocities of the fiducial stations to their ITRF2000 values, we allow 2, 2 and 4 mm/a uncertainties for the east-west, south-north and vertical components, respectively.

4) The velocity solution from QOCA was transformed into a Eurasia-fixed reference frame by using the Euler vector of Eurasia relative to the ITRF2000 inferred from 11 IGS stations (9 in West Eurasia, and 2 in Siberian) located in the stable Eurasia [*Shen et al., 2000, 2001*]. After the transformation to the Eurasia-fixed reference frame, the residuals of horizontal velocities of the 11 stations are all less than 1.5 mm/a.

Figure 1 shows the GPS velocity field of crustal movement of central Asia in a Eurasia-fixed reference frame. It clearly demonstrates the characteristics of crustal movement and deformation of various tectonic regions in China continent, especially the deformation pattern in and around the Tibetan Plateau. The kinematic information from the velocity field provides vital constraints on modeling of continental dynamics.

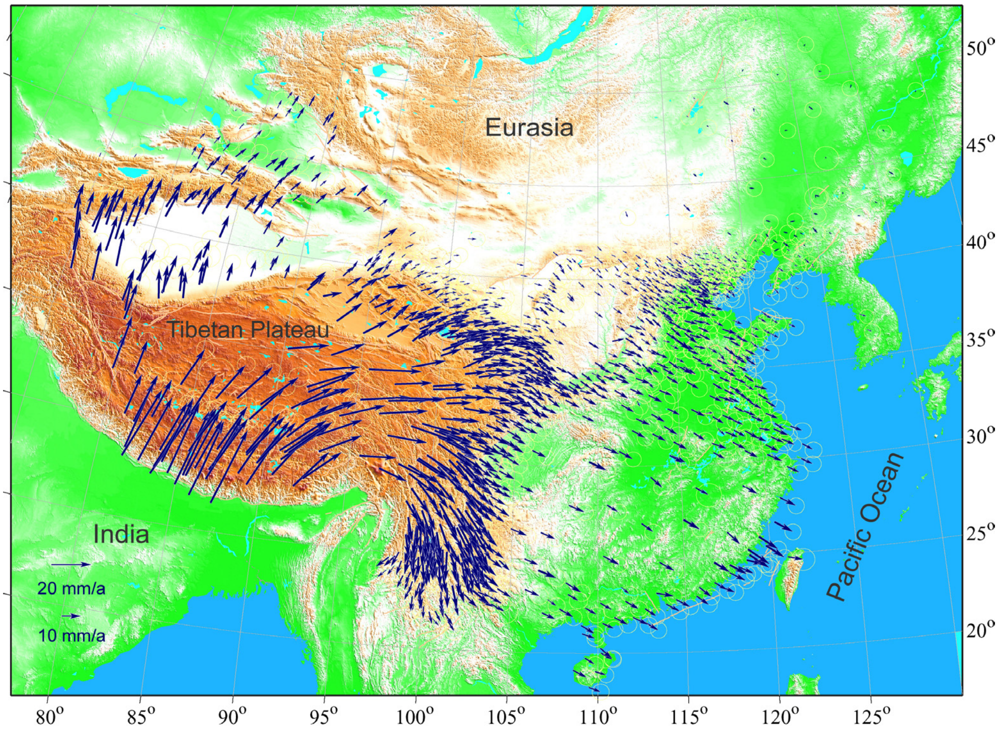

Fig. 1 GPS Velocity field of crustal movement of central Asia relative to stable Eurasia. The velocity is shown by blue arrow with 95% confidence ellipse at the tip.

Phase II of CMONOC

In order to monitor the crustal deformation with a higher resolution both in space and time, and provide a nationwide infrastructure for multiple applications such as GPS meteorology, networked RTK, space weather research, and so on, we are now preparing to launch the phase II of CMONOC, and planning to expand the amount of continuous GPS stations to 260 and add another 1000 campaign mode GPS stations to the network (Figure 2). In addition, a nationwide gravimetric network will be added to complement the continuously observed GPS fiducial network. Proposal of the phase II project has been approved by the National Science and Education Council of China, and the project is expected to start in later 2006.

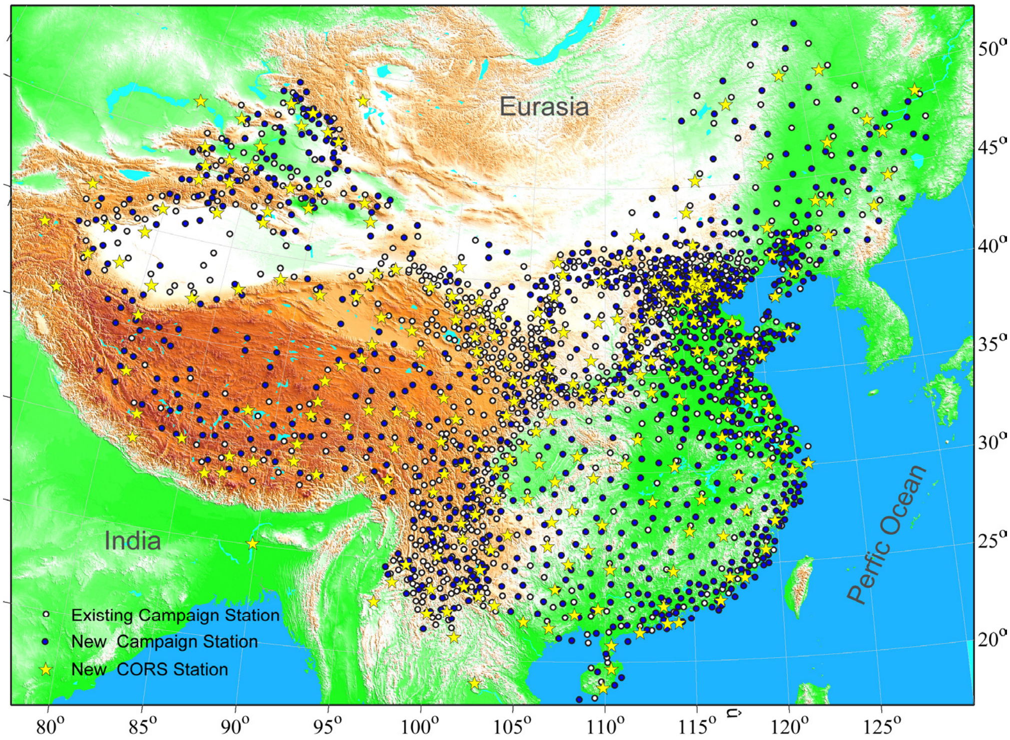

Fig. 2 GPS stations of CMONOC after the Phase II project.

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