GPS Developments in China and Its Applications in Geodynamic Studies of Continental Asia

Zhang Peizhen and Niu Zhijun

Institute of Geology
China Earthquake Administration
Beijing 10029, China
GPS developments in China

- GPS observation started in late 1980s
- Significant advance occurred in 1998 when the first phase of national GPS network was implemented
- There will be second phase of national GPS network in 2005(?)
Management structure of Chinese national GPS network

- China Earthquake Administration
- National Bureau of Mapping and of Surveying
- Chinese Academy Sciences
- Military Survey Agency
- National GPS Network (CMONOC)
Crustal Movement Observation Network of China (CMONOC)

- Fiducial Network: 25 continuous GPS stations
- Basic Network: 56 regularly occupied GPS stations
- Regional Network: 1000 GPS stations
- Data Center: data archiving, processing, and analysis
CMONOC Fiducial Network
CMONOC  Basic Network
CMONOC Regional Network
Second Phase of CMONOC
260 Continuous GPS Station
VLBI and SLR stations
Relative Gravity Network
Continuous Gravity Network
Applications in China

- Positioning
- Navigation
- Engineering
- Geodynamic studies
- Natural disaster reduction
- Earthquake prediction researches
Indian data are taken from Banerjee and Burgmann (2002)
Example of application in geodynamics

A premise for geodynamic study is to understand the kinematics of crustal deformation.

GPS provides a powerful means to measure the kinematics.

The best example is geodynamics of the Tibetan Plateau.
How does the Tibetan Plateau deform in response to the collision between India and Eurasia?

Or, does the Tibetan Plateau deform in the fashion of rigid plate-like or viscous fluid-like?
Two end-member models of Tibetan dynamics

“Continental Escape” (Tapponnier et al., 1982)

“Continuum Deformation” (England and Houseman, 1986)

GPS observation offers critical test of geodynamic models
Eastern Tibet absorbs between 85-94% 

Western Tibet absorbs between 70-91% 

Smoothly varying velocity gradients indicate distributed deformation 

Distributed rather than localized deformation within Tibetan Plateau 

Component of velocity parallel to N20E (mm/yr) 

Distance across the Tibetan Plateau along N20E (km)
Outward flow of crustal material in the interior of Tibetan Plateau
Vortical fluid rotation around the eastern Himalaya
Conclusion

National GPS network in China was established in 1998, and its second phase will probably begin in 2005.

Applications of GPS technology has been in various fields including navigation, positioning, engineering, and scientific researches.

GPS results demonstrate that the present-day tectonics in the Tibetan Plateau is characterized by crustal shortening along its margins, outward flow of crustal material in the plateau interior, and clockwise rotation around eastern end of Himalaya, rather than by rigid block rotation.