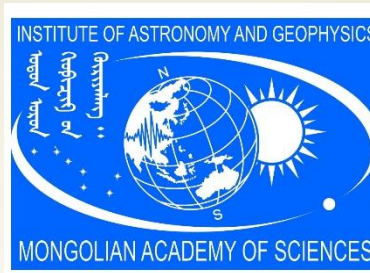




UNITED NATIONS
Office for Outer Space Affairs



МОНГОЛЫН
ГЕО-МЭДЭЭЛЛИЙН
ХОЛБОО

GEODYNAMIC STUDY IN MONGOLIA BASED ON GNSS

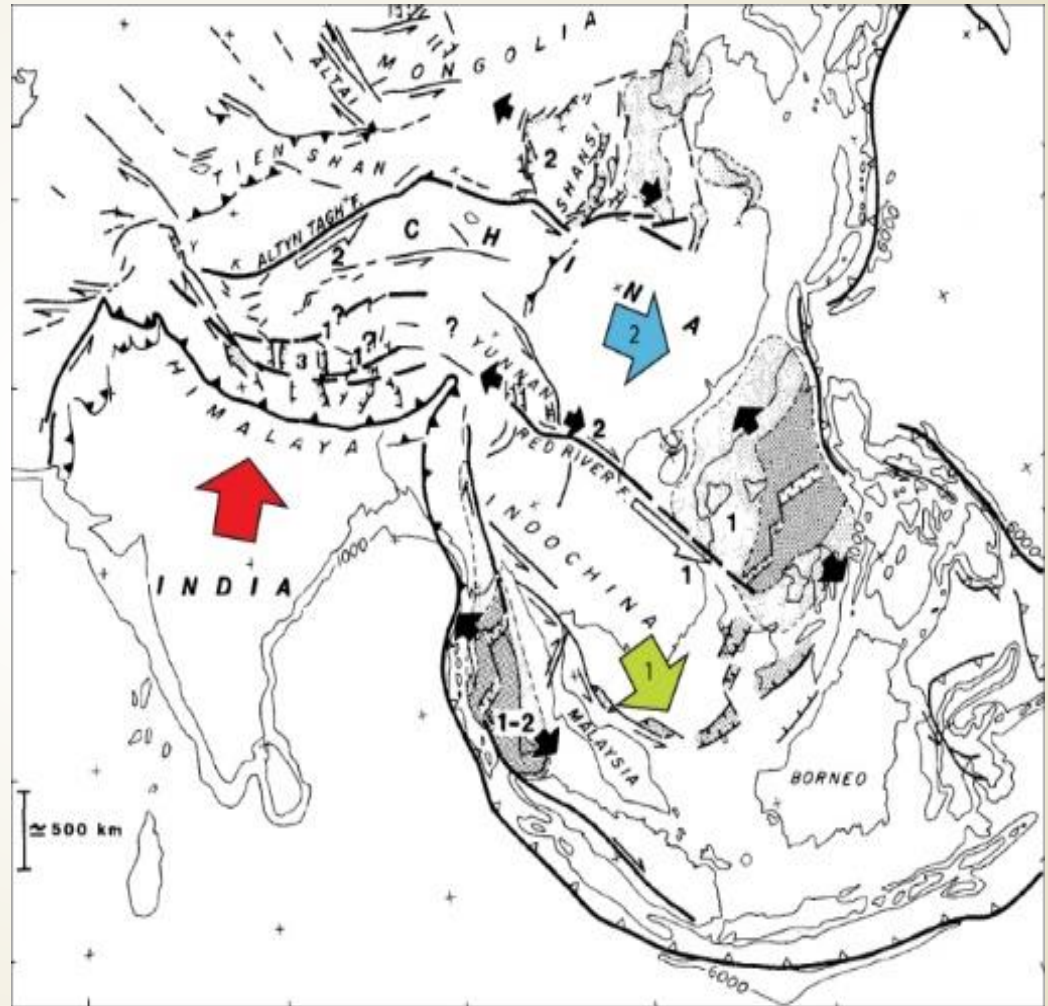
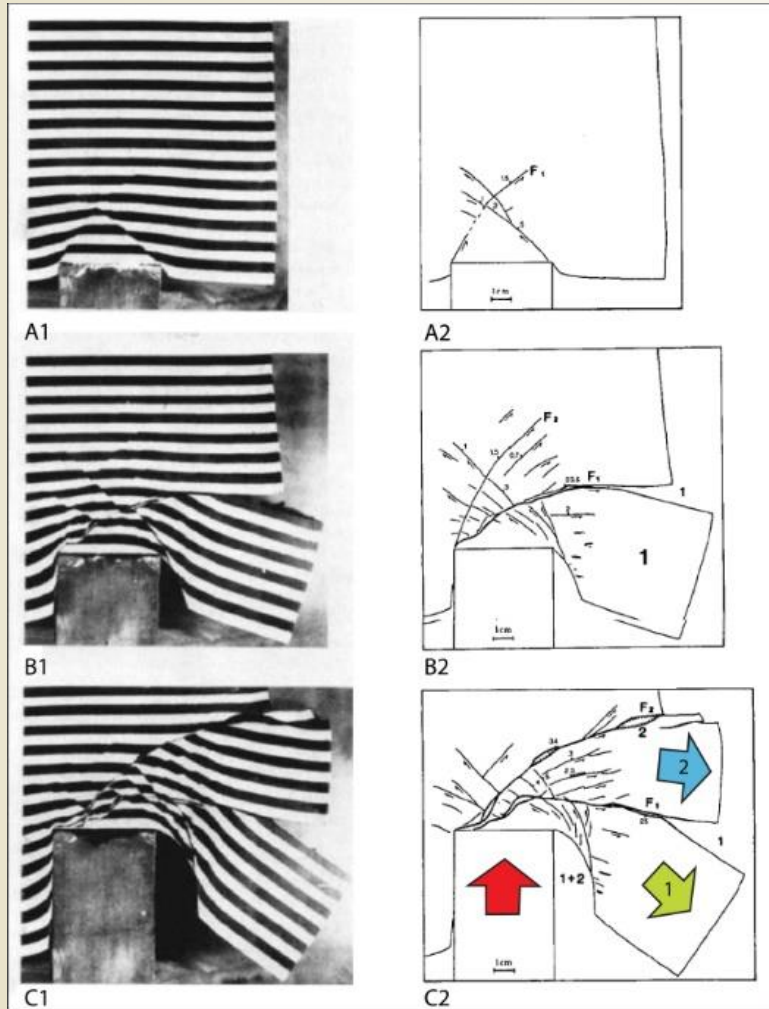
Erdenezul Danzansan
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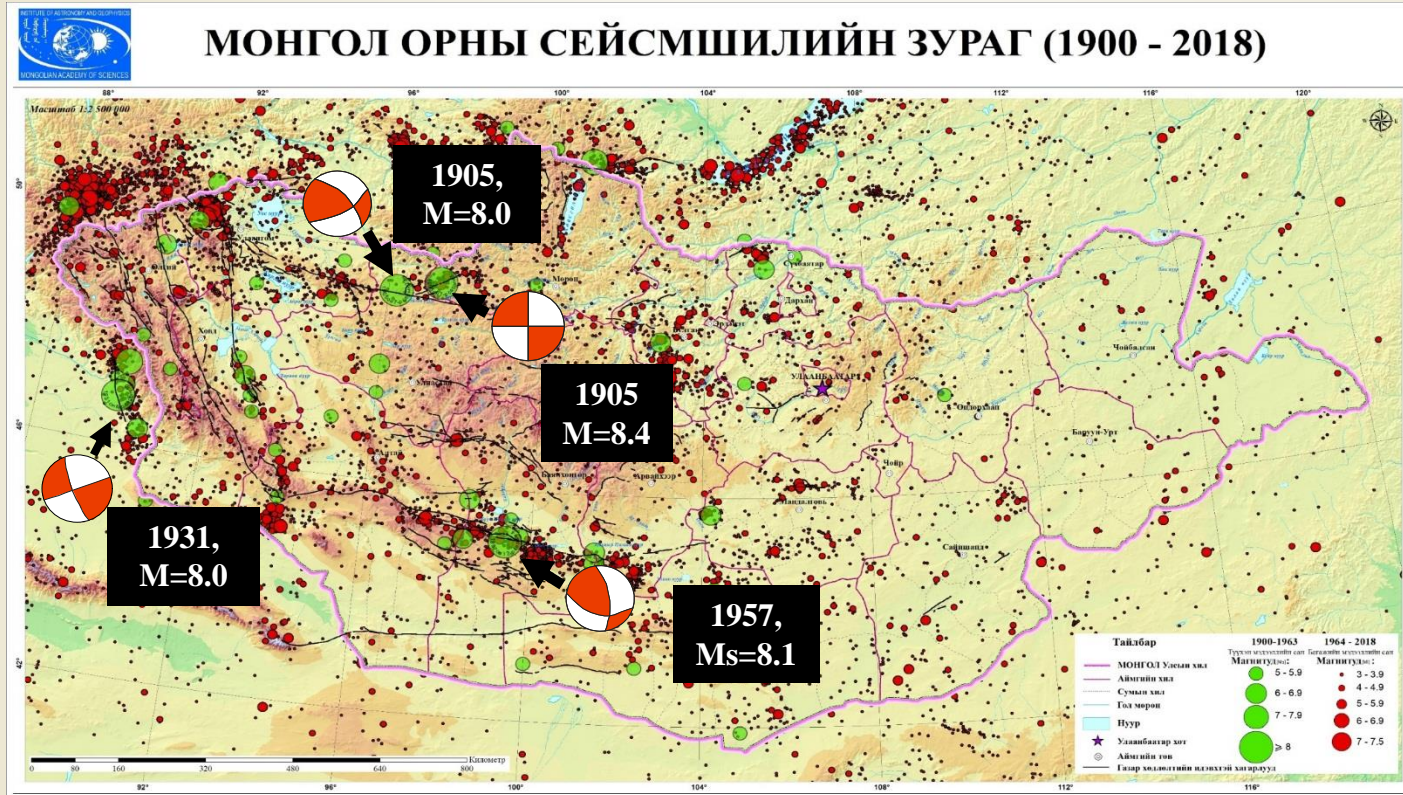
UNITED NATIONS/MONGOLIA WORKSHOP ON APPLICATIONS OF GNSS
25-29 OCTOBER, 2021 (ONLINE)

Schematic map of the main structures of the India-Asia collision and then extrusion model (Tapponnier et al., 1982).



Seismicity map of Mongolia

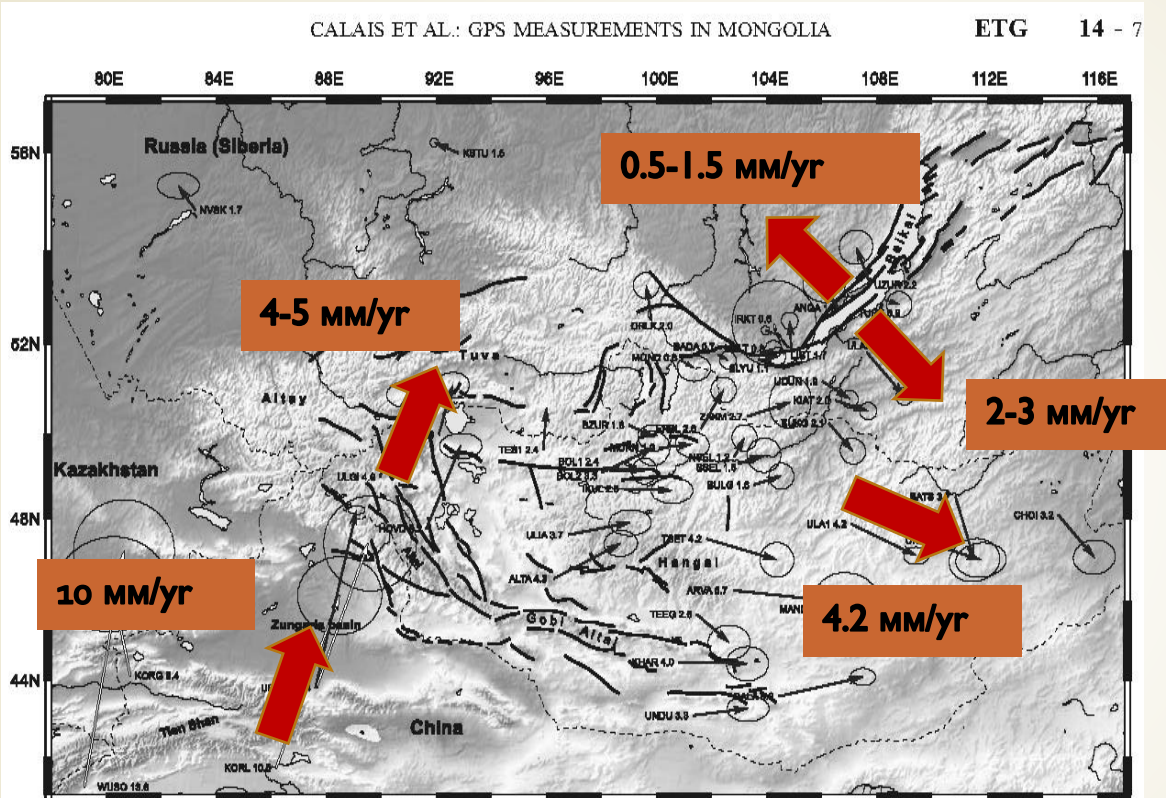
Four earthquakes of magnitude 8 and greater have occurred since 1905 and ruptured three major fault systems along several hundreds of kilometers.



- Bolnai earthquake, M=8.4, July 1905;
- Tsetserleg earthquake, M=8.0, July 1905;
- Fu Yun earthquake, M=8.0, 1931;
- Bogd earthquake, M=8.1, 1957;

Previous study

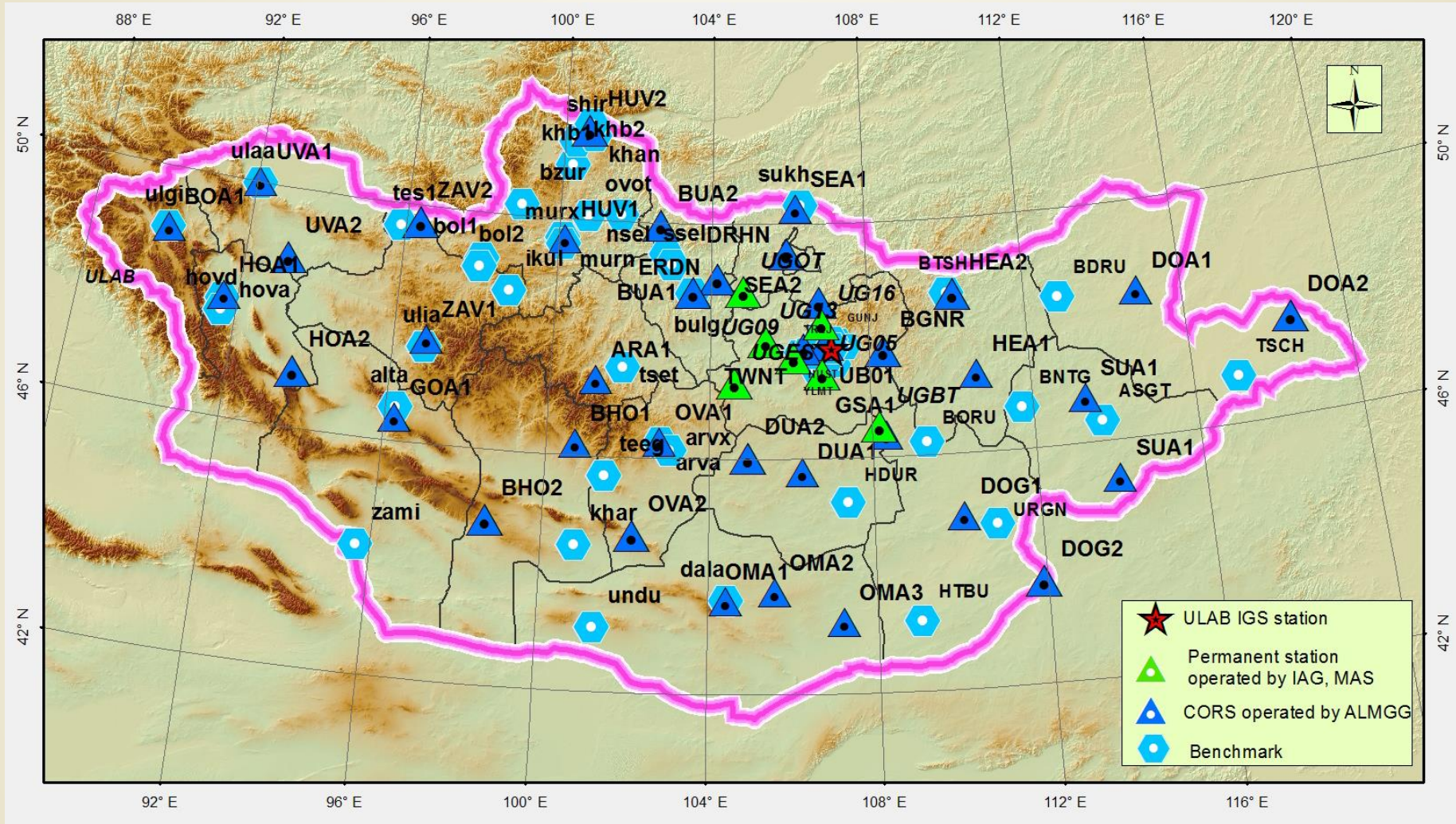
GPS-derived velocities with respect to Eurasia. (Calais et al, 2003,)



Divided into two velocity streaming:

- NNE - SSW shortening
- NW – SE extension

The geographical position of GNSS geodetic network in Mongolia



Permanent station and campaign sites that are used in geodynamics study.

Instruments for GNSS measurements

Trimble 5700 with Geodetic antenna



Trimble NetR 9 receiver with Choke Ring antenna



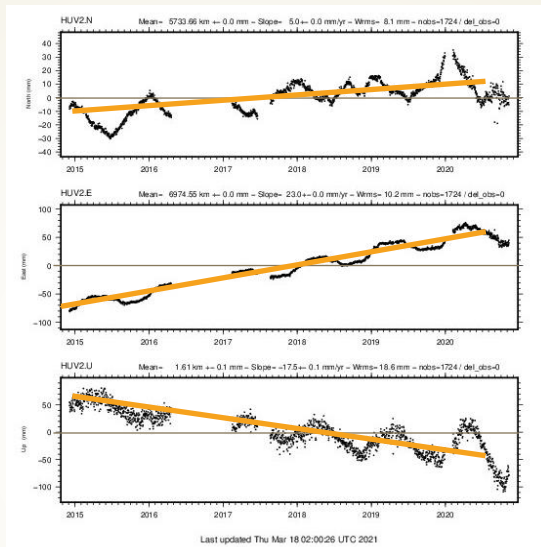
This new technology is suitable for both horizontal and vertical movement along the active fault zone.

Preliminary results

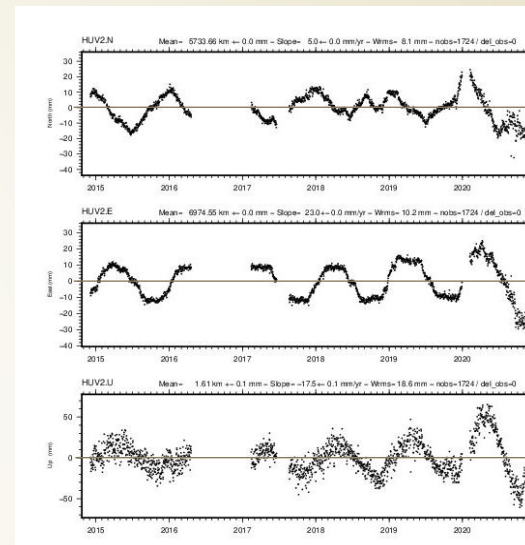
- ✓ **Gamit/Globk by MIT**
- ✓ **ITRF2014 reference frame**

**The permanent station -
HUV2
Khankh, Hubsugul province**

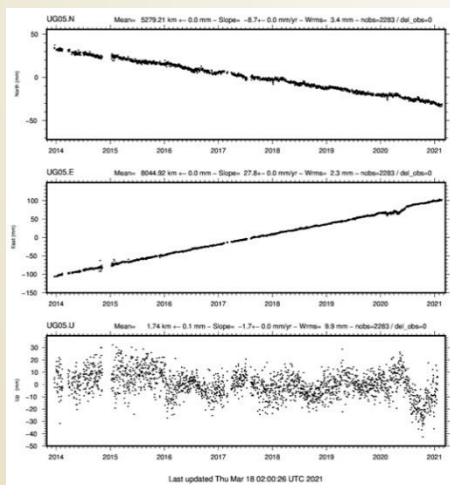
Trended time series



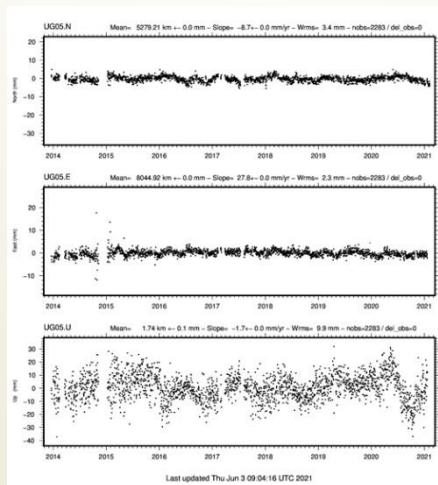
Detrended time series



Trended time series



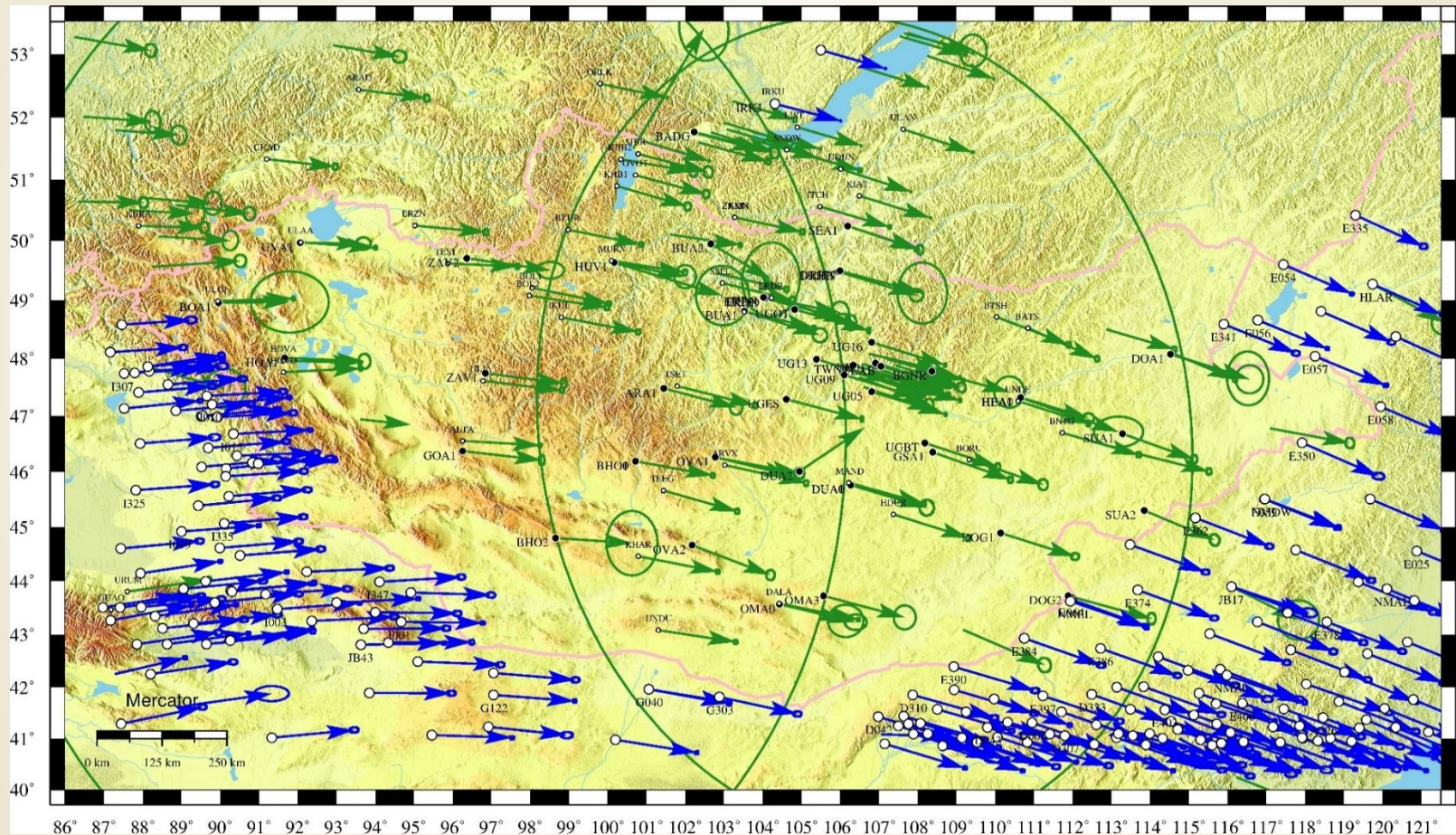
Detrended time series



**The permanent station
UG05
Altanbulag, Tov province**

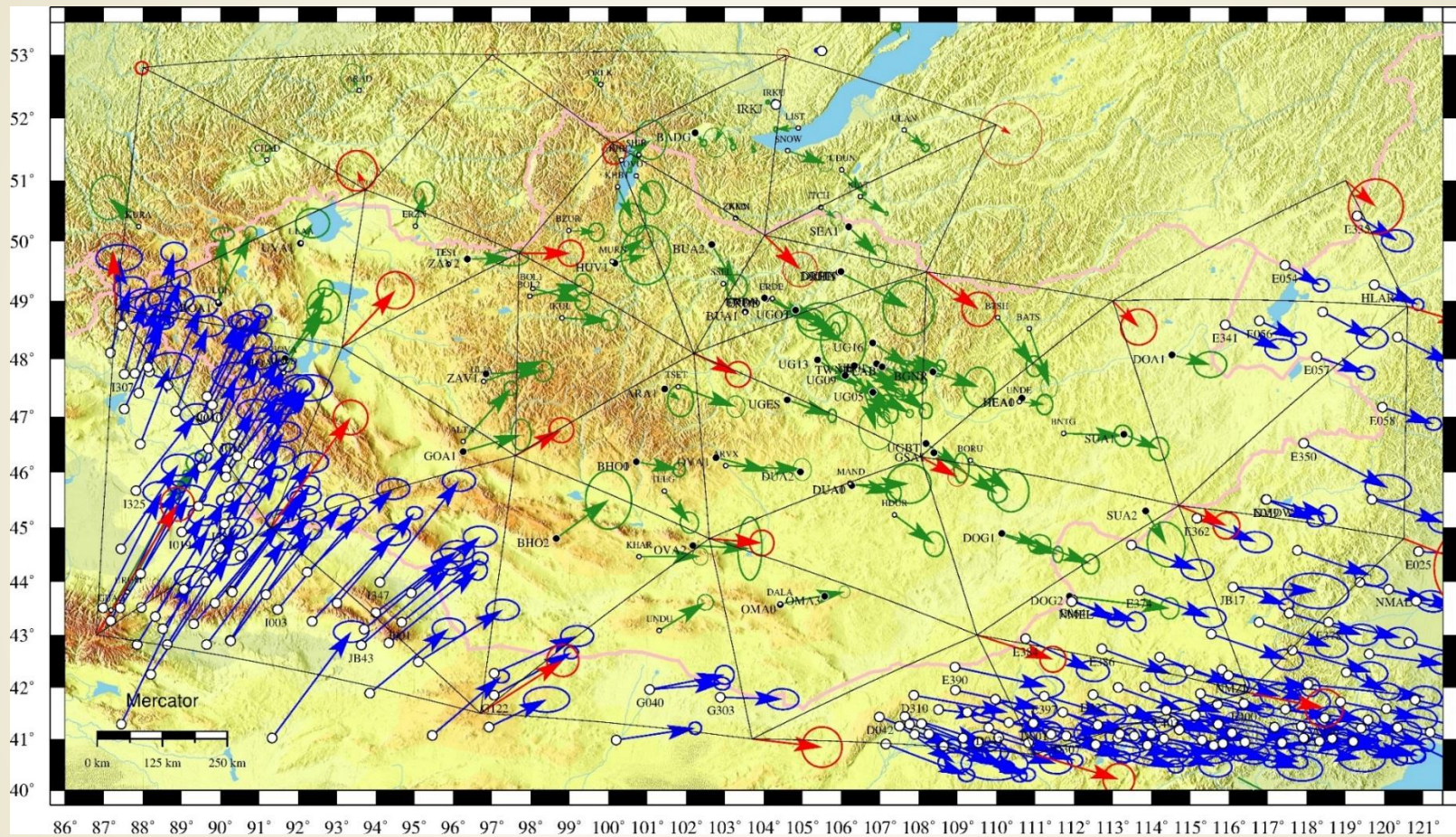
Preliminary results

- ✓ **Gamit/Globk by MIT**
- ✓ **ITRF2014 reference frame**



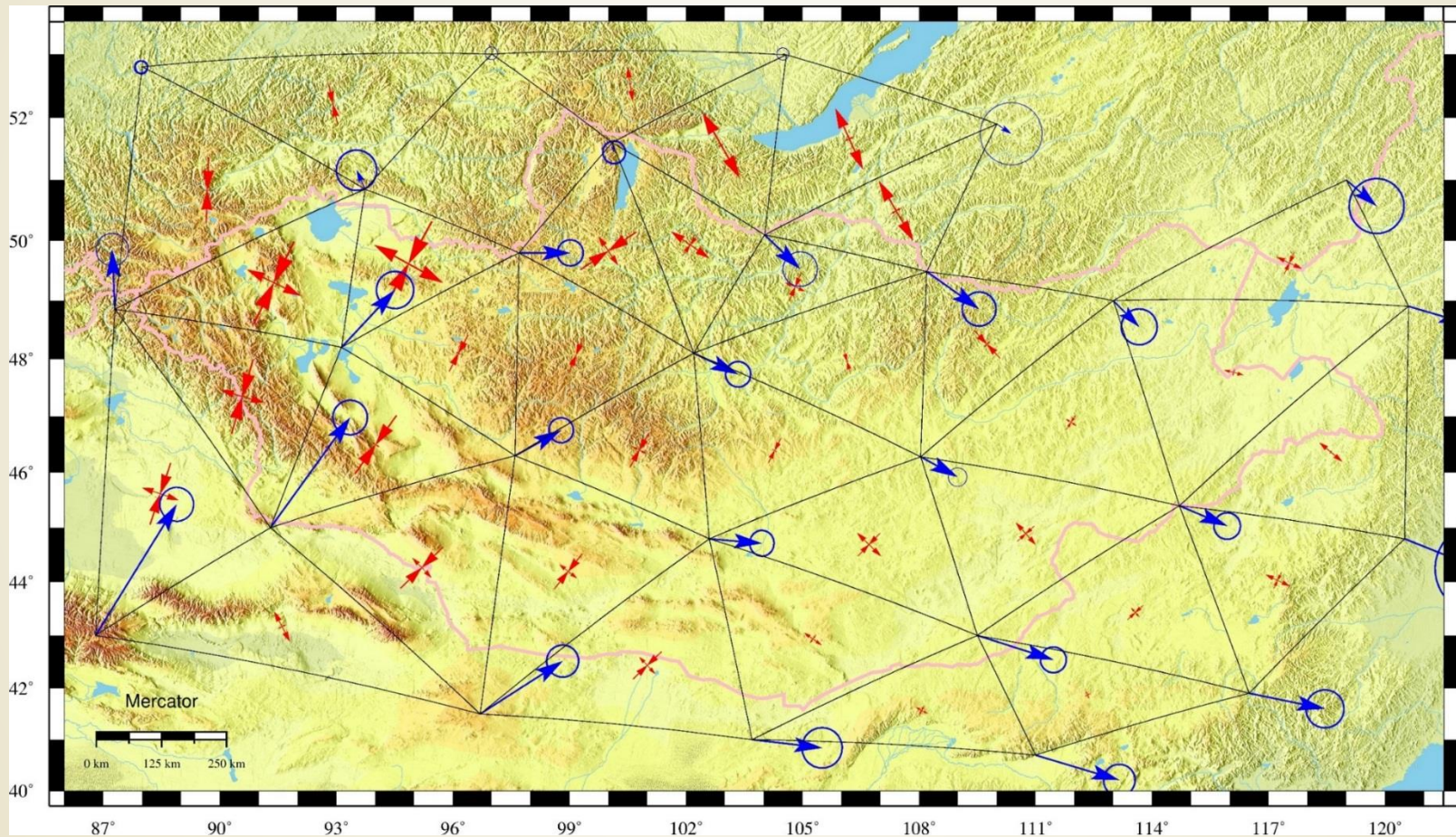
➤ Moving about 28 mm/yr to the southeastward direction

Velocity of modern horizontal movements by GNSS-measured data, for the period 1997-2020.

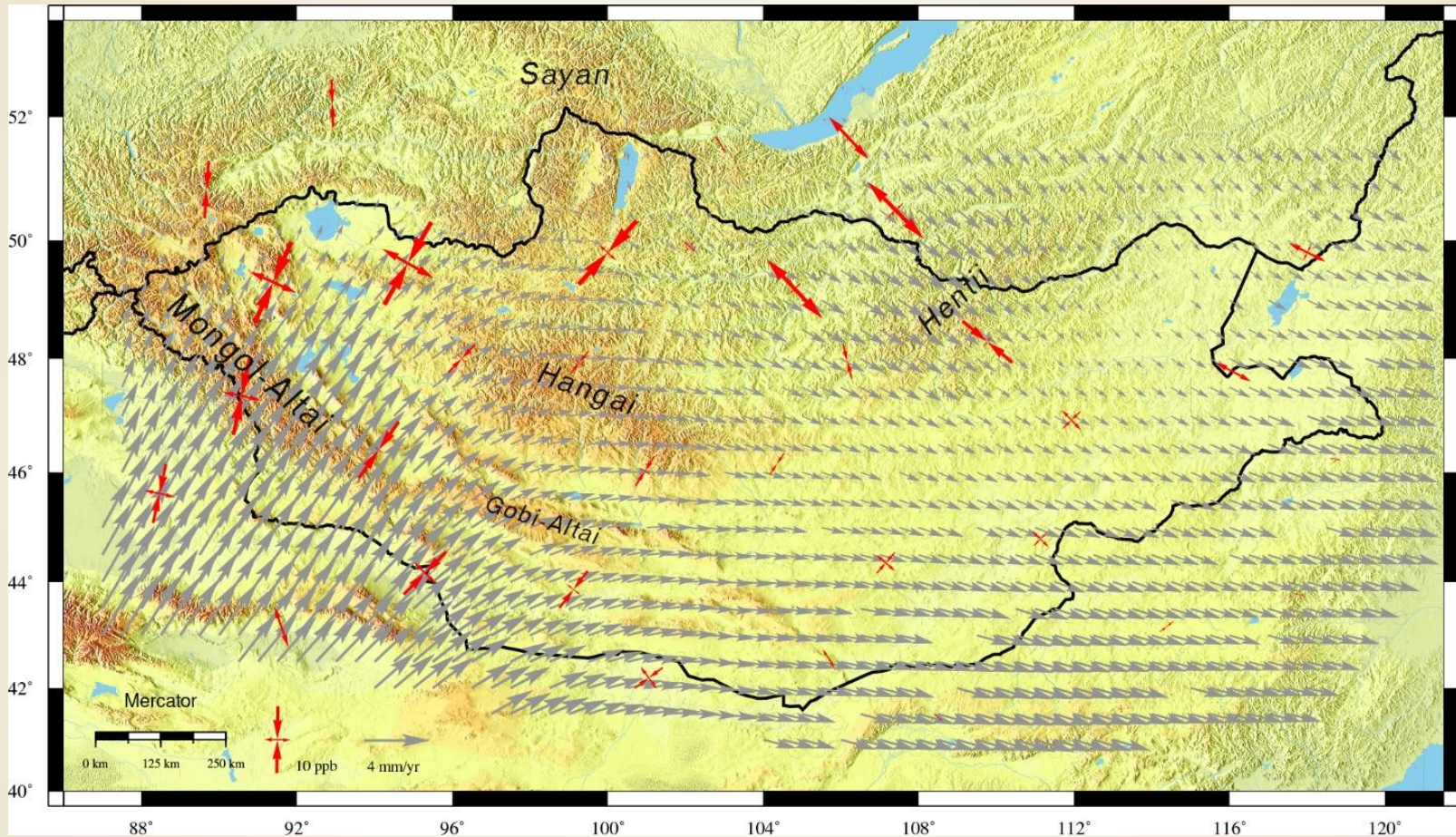


- Arrows show directions and velocities (mm/year) with respect to stable Eurasia:
- Only sites with uncertainty less than 1.5 mm/year are shown here by green arrows and they used for the strain analysis.
 - Red arrows are velocities at the nodes of the model,
 - Blue arrow are shown the data of GNSS stations in China, (Institute of Geology of China Earthquake Administration)

Relative horizontal crust strain patterns of the territory of Mongolia derived from velocities both of the permanent and campaign GNSS sites

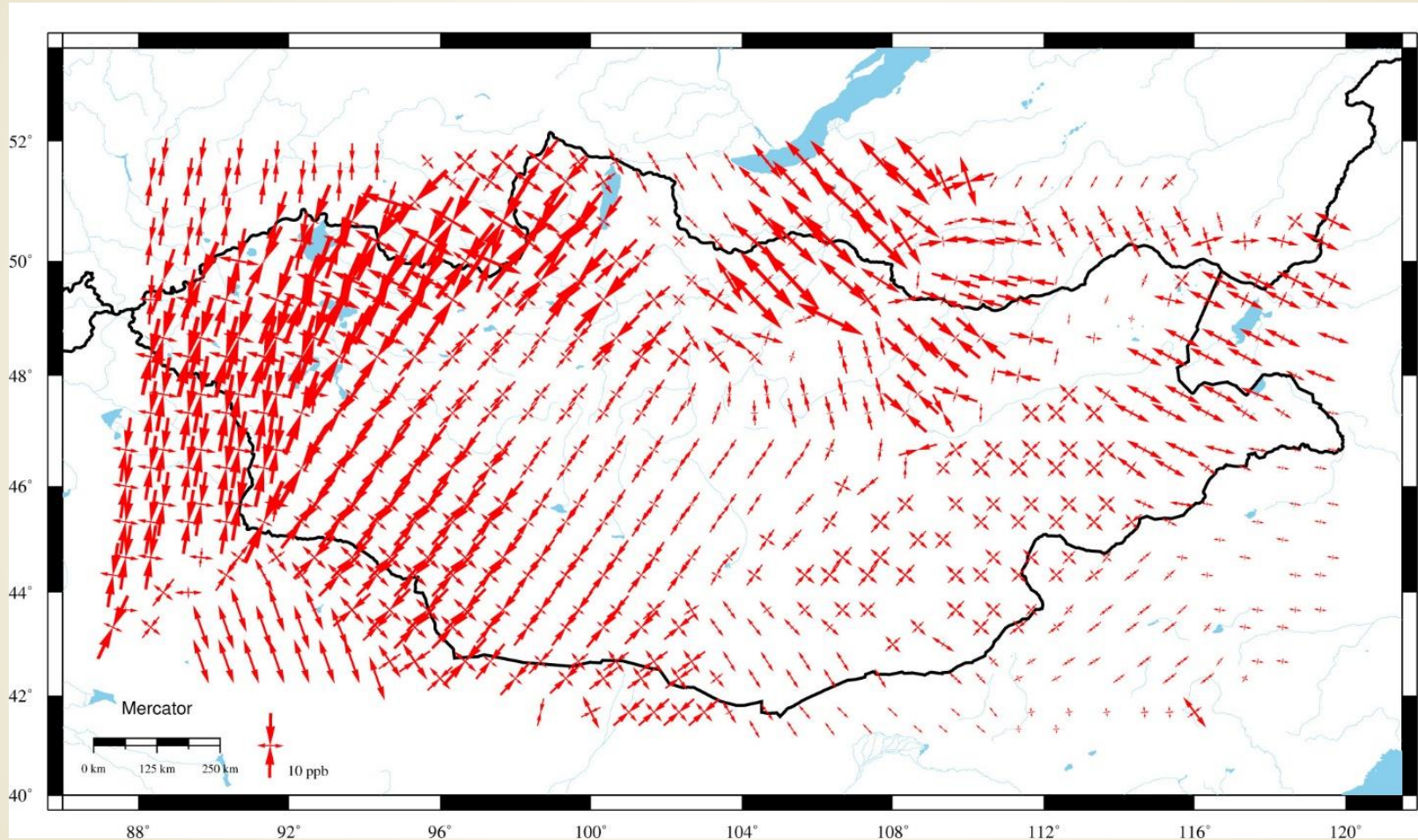


Relative horizontal crust strain patterns



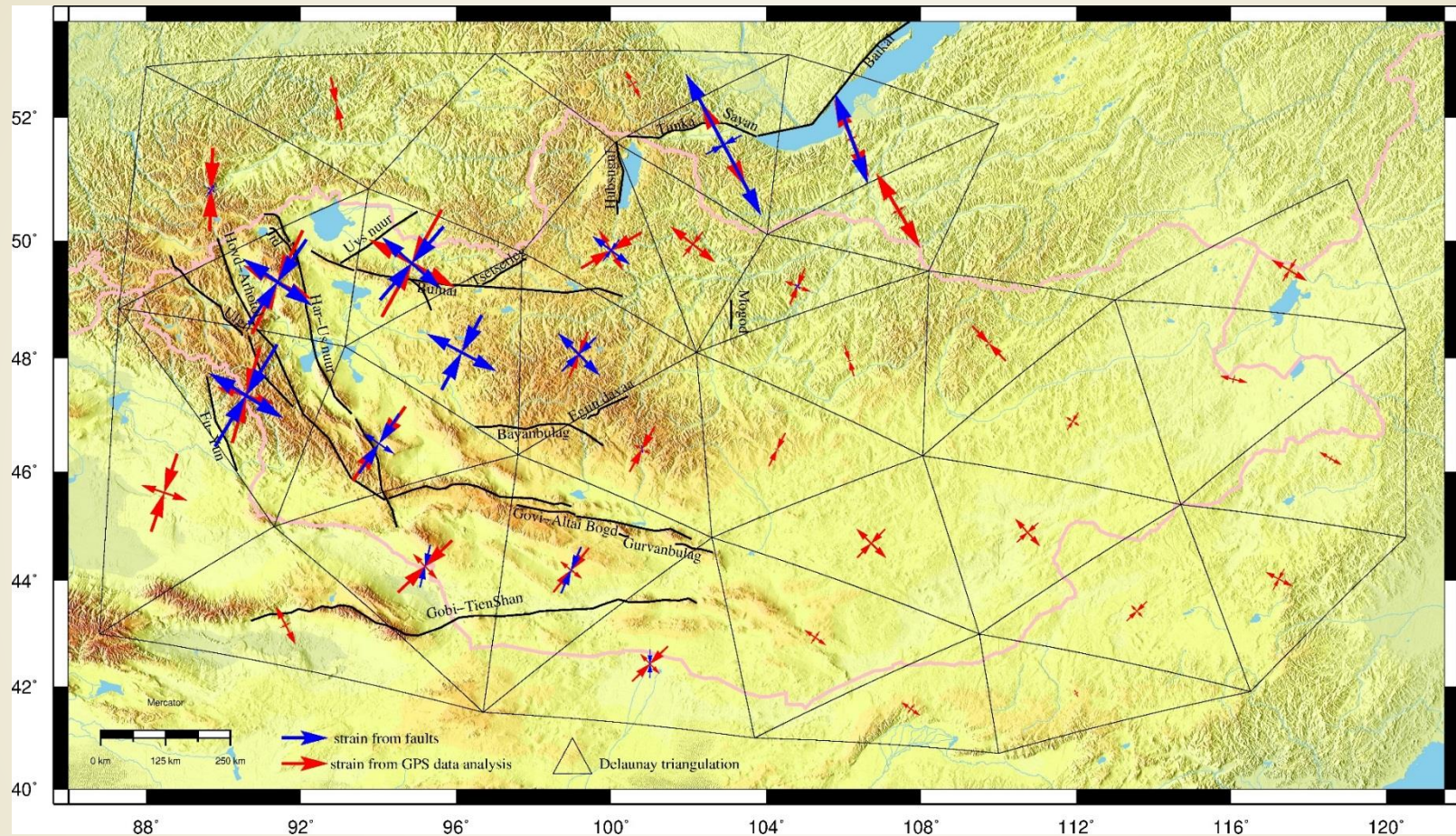
Grey arrows show vectors averaged at **0.5-degree** latitude by **0.5-degree** longitude resolution

Straining model of the study area



The vectors shown tension and compression averaged at **0.5-degree** latitude by **0.5-degree** longitude resolution.

Comparison GNSS result with the active faults



This part of the work was carried out in collaboration with J.F. Ritz (Montpellier). The joint inversion method was coded following the method described in England and Molnar (1997, 2005).

Faults	Lat ₁	Long ₁	Lat ₂	Long ₂	strike	dip	rake	V (mm/yr)	Ref
Govi-Altai I	97.55	45.39	98.97	45.36	120	70	0	0.6±0.1	
Noyan Uul	99.09	45.19	100.03	45.1	95	70	0	0.4±1.4	
Bituut	100.03	45.1	100.86	44.96	105	50	0	0.52±0.12	
Zadgai Sair	100.86	44.96	101.16	44.92	95	85	0	1.26±0.34	
West Baga Bogd	101.16	44.92	101.53	44.96	75	90	0	1.26±0.34	
North Baga Bogd	101.53	44.96	102.07	44.77	115	60	0	1.26±0.34	
Gurvanbulag	100.2	44.87	102.62	44.53	100	50	90	0.21±0.07	

Summary

- ✓ The GNSS networks for the geodynamic study have been designed and established in the territory of Mongolia since 1997.
- ✓ The result of the data analysis of the sites in Mongolia has confirmed with the previous study that the rate of movement in the territory of Mongolia, while retaining features of deformation observed in China is divided into two streams: One of them can be traced from the region of India-Eurasia collision to the southern districts of Tuva, and decreasing to low levels in the Siberian platform. The second stream is deflected to the east in central Mongolia, then to the south-east in the territory of Trans-Baikal and North China.
- ✓ The method of research of geodynamic parameters fulfilled in plate tectonics of active regions of Mongolia. It will be used for an assessment of environmental, social and economic risks of development of Mongolia and will be implemented for assessment of deformation of the Earth's surface.
- ✓ The result of the preliminary analysis is being used to evaluate the stress accumulation and the earthquake probability on the Mongolian territory.

Thank you for your attention,

