Impact of Irkutsk IGS station into geodynamics phenomena monitoring

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FIG and SSGA Workshop
Lake Baikal, Listvyanka, 2009

Purposes of presentation -

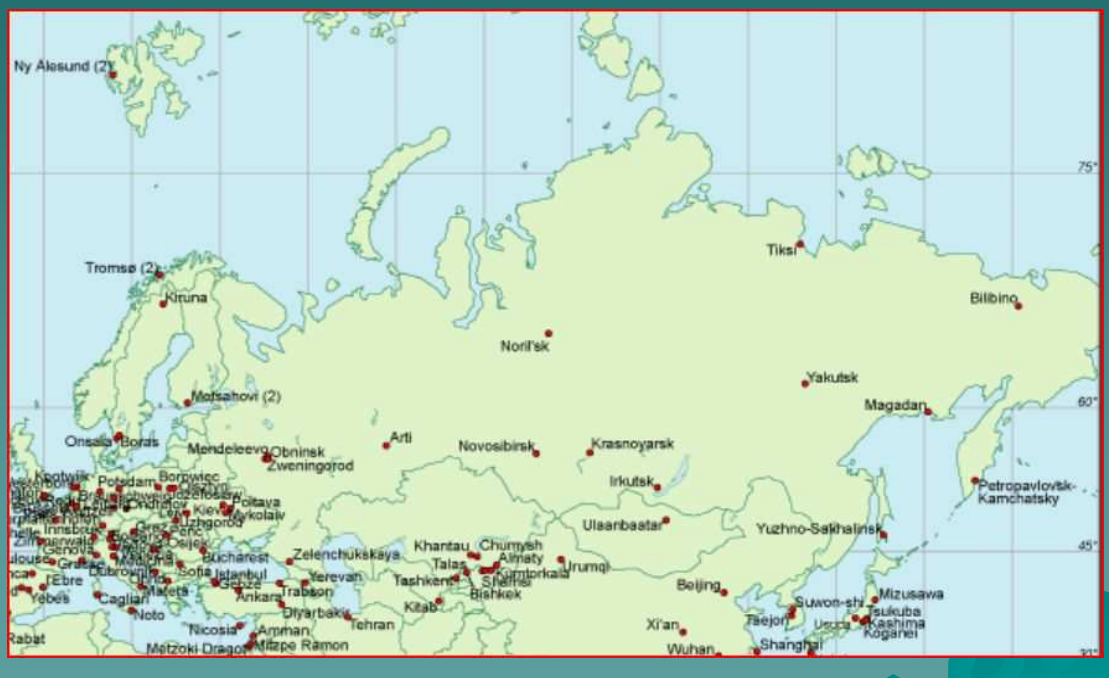
to inform listeners about observation activity of the Irkutsk IGS and FAGS of Russia GNSS station, directed to support the geodynamics phenomena monitoring networks

to make a short review and discussion of main results, deduced by different authors and agencies on a base of application of Irkutsk GNSS station observations

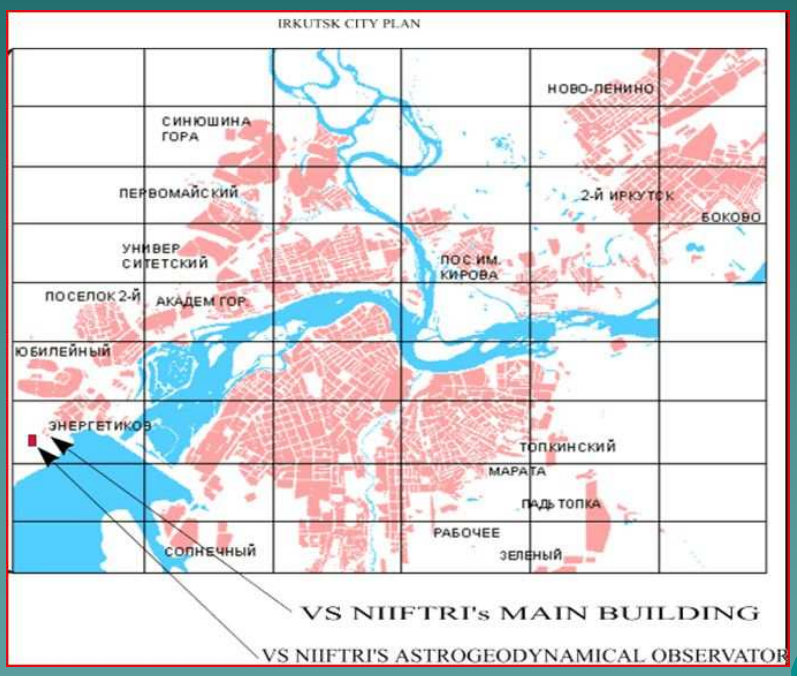
Common information

- Irkutsk GPS/GLONASS station locates on the territory of Astrogeodynamical Observatory, which is a part of the State EOP and Time-Frequency Service Network
- Observatory belongs to East-Siberian Branch of the Research Institute for Physics-Technical and Radio-Technical measurements - metrological Institute in the structure of the Technical Regulation Agency of Russia (formerly State Committee of Metrology, Standardizations and Certification of Russian Federation)
- There are different techniques/instruments co-locating on Observatory
  - Astrometric instruments (3 astrolabes, 2 photoelectric transit instruments)
  - Space geodetic technique – GPS/GLONASS geodetic receivers, Satellite Laser Ranging System (obsolete, modern system is planning to install in 2010)
  - Gravimetric technique– place of absolute and relative gravity measurements
  - Geodetic – State geodetic control network points and leveling bench marks
  - Metrological - testing network points
  - Meteorological – T,P,H,Wind
  - Time and frequency devices
- Another similar stations, supported by TRA, are Mendeleevo(MDVJ), Novosibirsk(NSKM) and Khabarovsk(KHBJ)

Irkutsk GPS/GLONASS station location
1 – position among IGS stations network



Irkutsk GPS/GLONASS station location
2 – position on the Irkutsk City plan



Irkutsk GPS/GLONASS station location
3 – Google view

Observatory common view

WEGENER-Baikal workshop (June of 1995, Lake Baikal, Listvyanka) - starting impulse to create Irkutsk IGS station

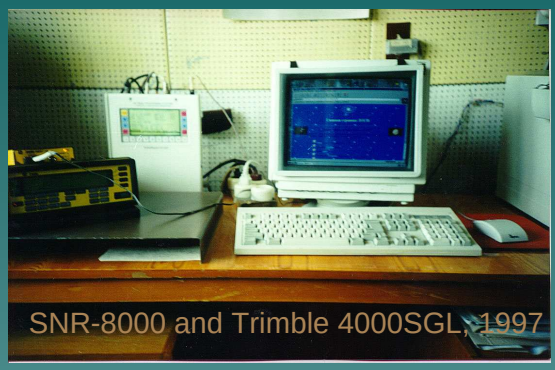
Foreign participants
and Dr. Zalutsky

Prof. Ambrosius B. (DUT) and Dr.Labreck J. (NASA) decided to support an initiative of Russian colleagues to create permanent GPS International station in Irkutsk on a base of VS NIIFTRI observatory

Participants on the excursion

Irkutsk GNSS station instrumentation history from 1995 to 2009

Turbo Rogue SNR-8000, sept.1995

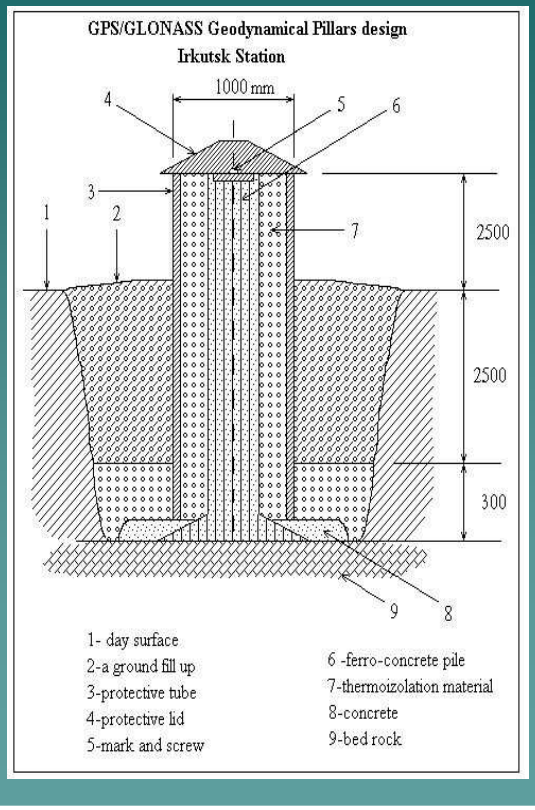


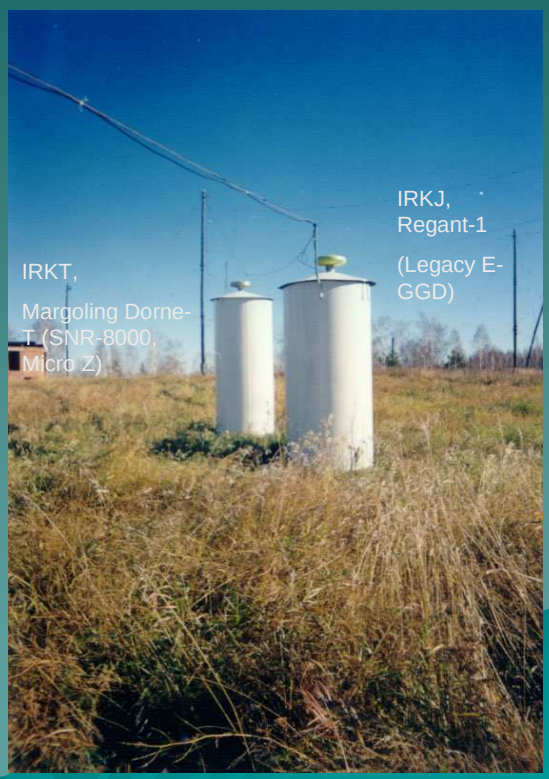
SNR-8000 and Trimble 4000SGL, 1997

SNR-8000, T4000SGL, Ashtech Z-18, 1998-2000

SNR-8000, Javad Legacy E-GGD (from 2001)+ Ashtech Mirco Z (from 2003)

Antennas installations





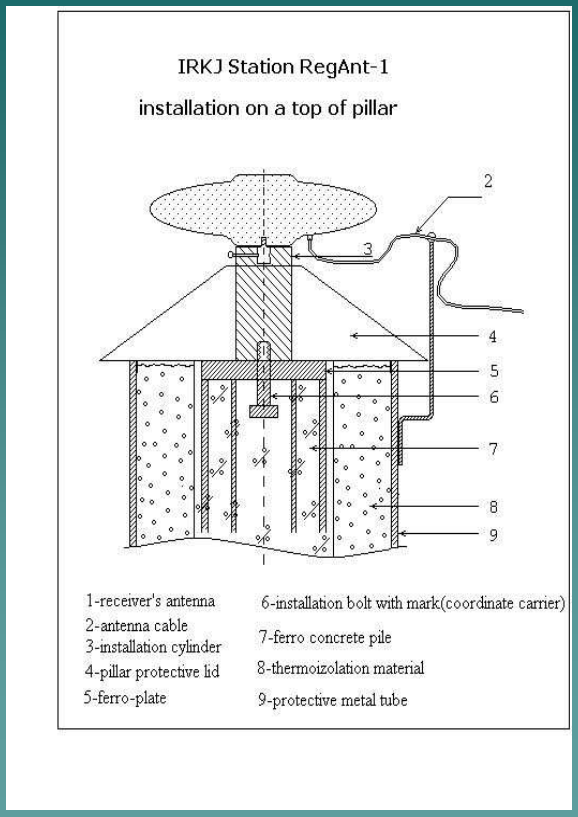
IRKT,

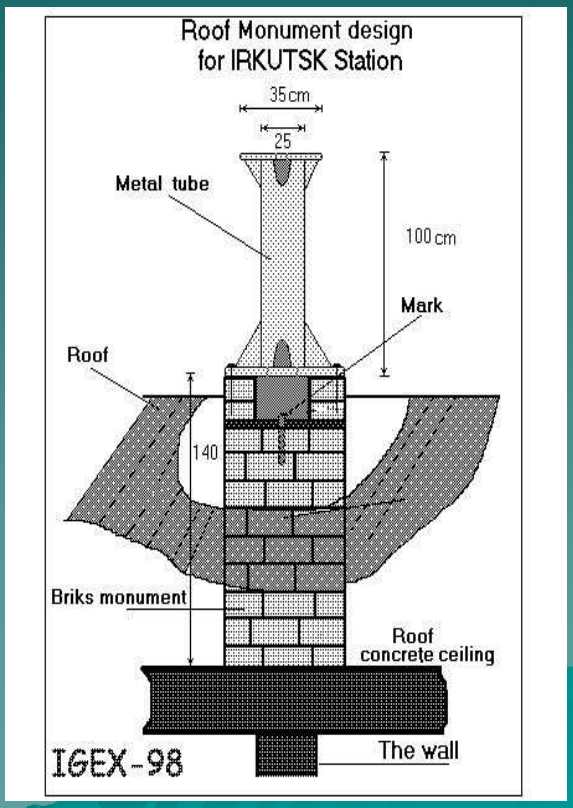
Margoling Dorne-T (SNR-8000, Micro Z)

IRKJ, Regant-1

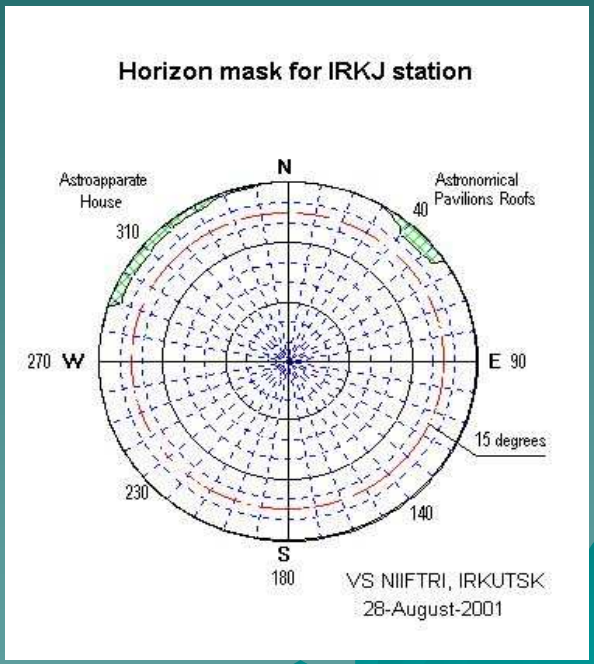
(Legacy E-GGD)

Antennas installations (cont.)





Antennas installation (cont.)

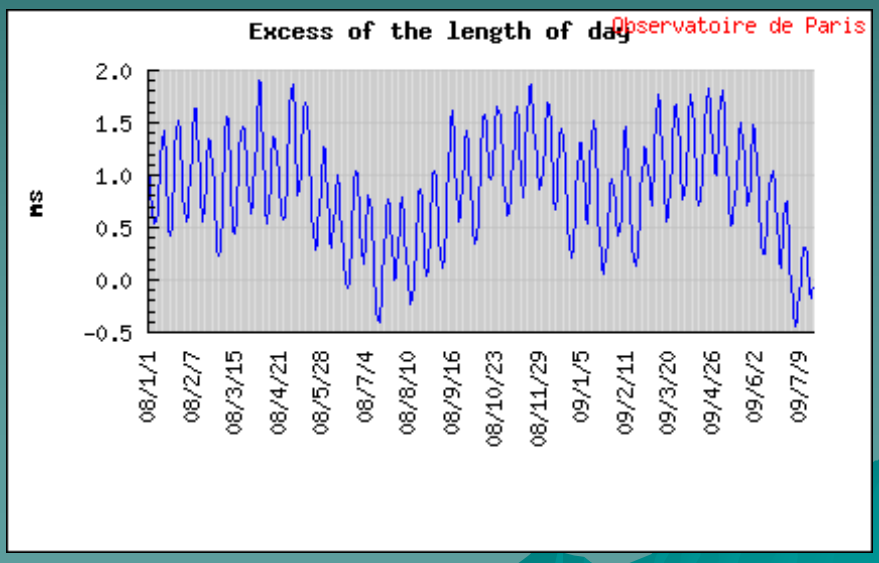


Main features of the IRKUTSK station activity:

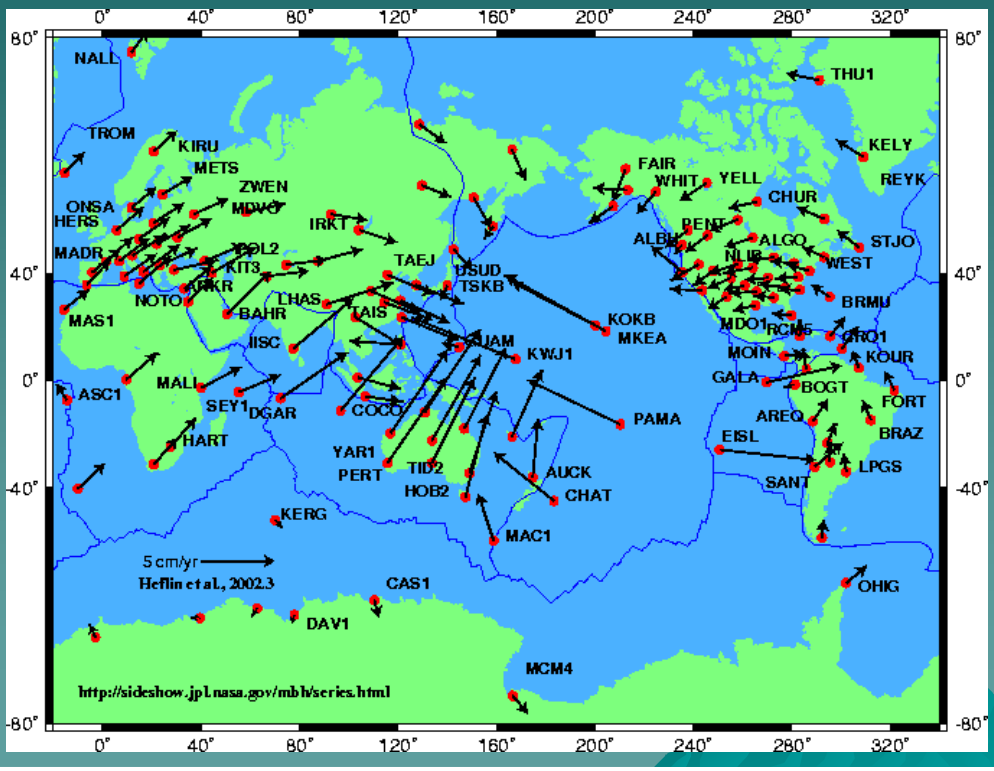
- Permanent and uninterrupted GPS/GLONASS measurements conducting in the mode of metrological service;
- Application of at least two different receivers of the different creators;
- Utilization of the reference frequency from the output of H-masers of the Secondary Time-Frequency Standard of Russia;
- Operative data transfer by means of FTP and INTERNET;
- Complexity of the different techniques measurements;
- Complexity of the measurements results application (in the field of time-space metrology, geodynamics, geodesy);
- "open station" and "open data";
- DGNSS ready (Legacy E-GGD receiver) ;
- High-rate GNSS measurements service ready (Legacy E-GGD receiver);
- National and International cooperation ready;
- Weak official technical policy and government financial support.

Impact of IRKUTSK station into supporting of Global and Large Scale geodynamics phenomena monitoring networks(1)

- Monitoring of the Earth rotation (in the frames of National EOP service and IGS/IERS networks);



Impact of IRKUTSK station into supporting of Global and Large Scale geodynamics phenomena monitoring networks(2)



IGS network

Kinematics of the lithosphere plates:

Parameters of IRKT vector of movements

Vx= - 27.4 mm/yr
Vy= 0.8mm/yr
Vz= - 5.1mm/yr

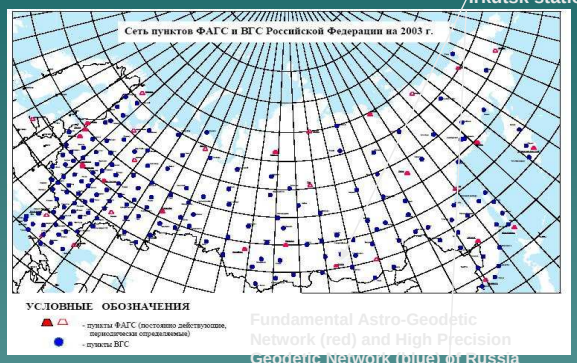
Vlat= - 11.1mm/yr
Vlong= 26.9mm/yr
Vh= - 3.1mm/yr

Impact of IRKUTSK station into supporting of Global and Large Scale geodynamics phenomena monitoring networks(3)

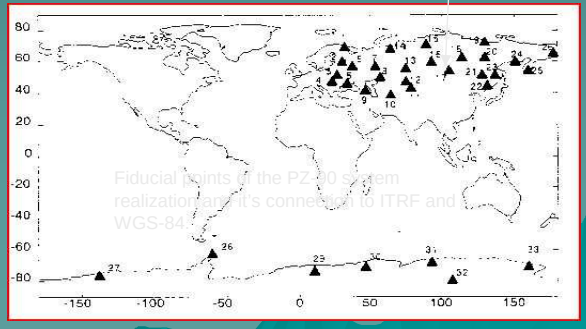
Supporting of the ITRF integrity and monitoring of the parameters transformation variations between ITRF, WGS-84 and PZ-90:

- IRKT is a part of IGS "core" network and a fiducial point of ITRF;
- IRKUTSK is a point of Fundamental Astro-Geodetic Network (FAGS) of Russia;
- IRKT/IRKJ were a fiducial points to install connection between Russian PZ-90 geodetic system and ITRF/WGS-84 during IGEX-98 and special investigations.

Irkutsk station

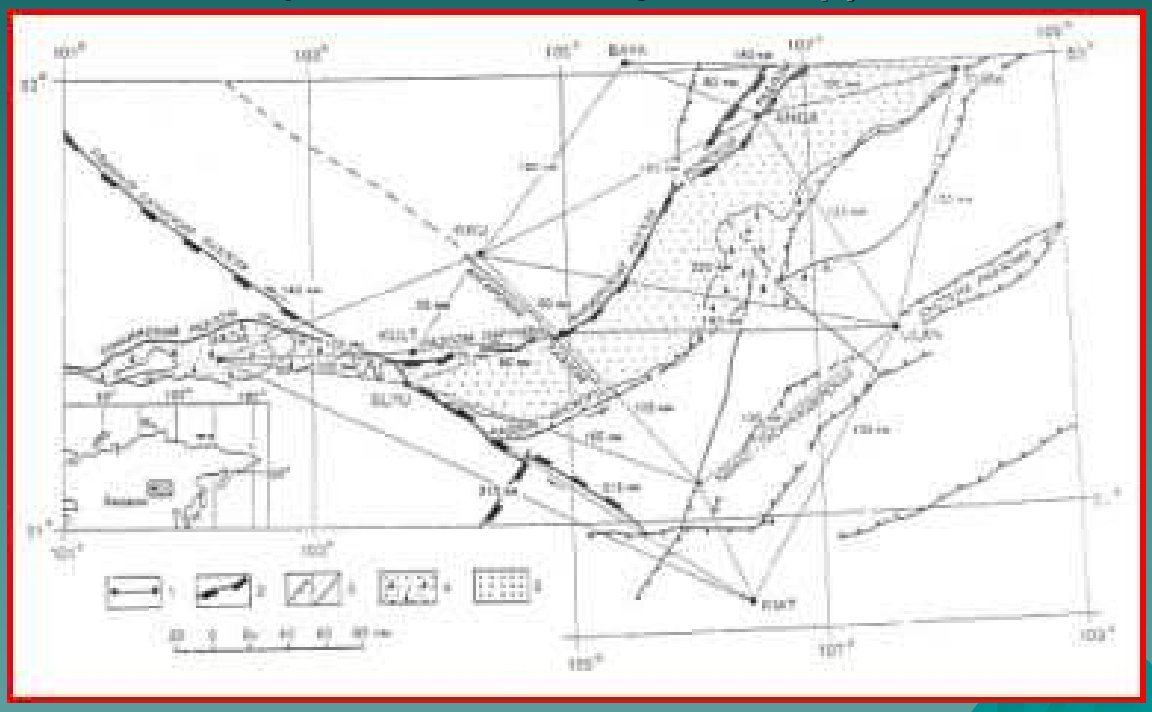


Fundamental Astro-Geodetic Network (red) and High Precision Geodetic Network (blue) of Russia



Fiducial points of the PZ-90 system realization, their's connection to ITRF and WGS-84

Impact of IRKUTSK station into supporting of Regional geodynamics phenomena monitoring networks (1)

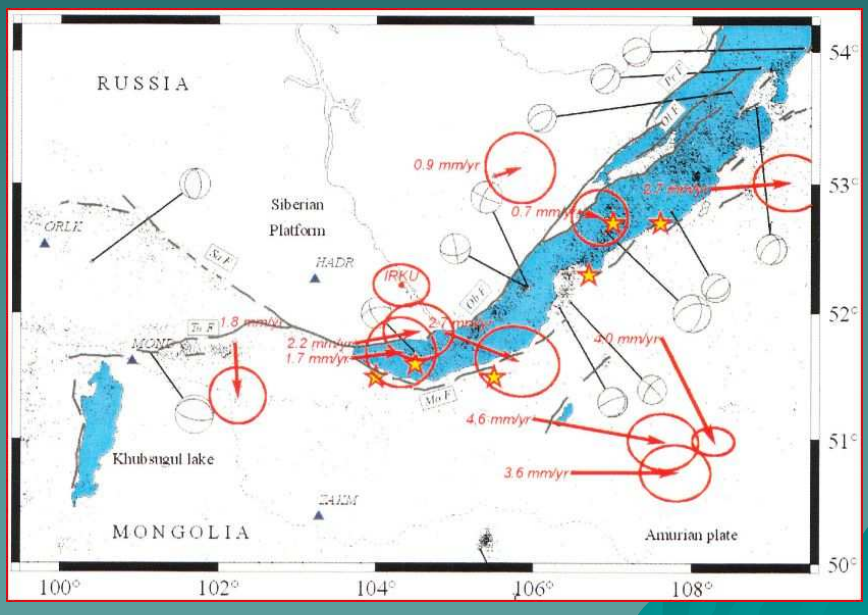


- South Baikal GPS geodynamical network created by Russian and French specialists during 1994 -1995 (later extended to 13 sites)

Impact of IRKUTSK station into supporting of Regional geodynamics phenomena monitoring networks (2)

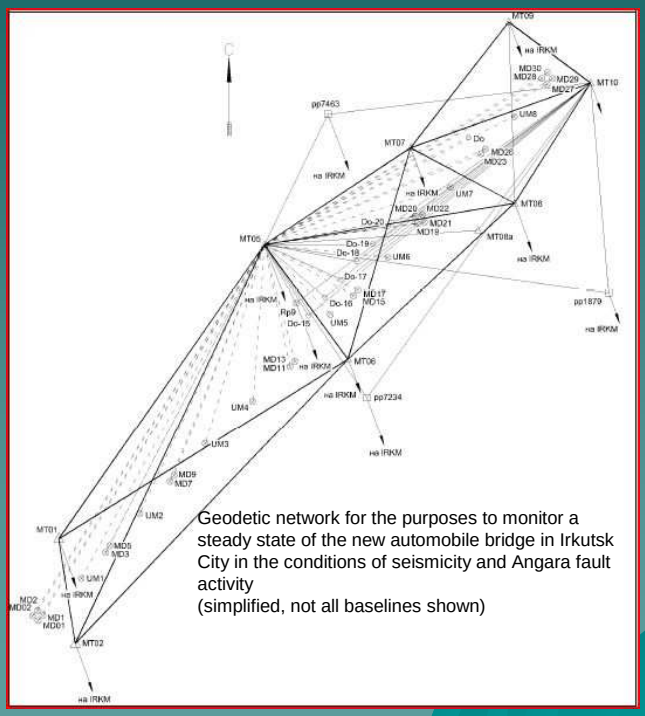
Quantification of crustal strain rates in the Baikal Rift region, using an integrated approach (GPS geodesy –historical seismicity – seismotectonic analysis). Results of cooperative work of the Earth Crust Institute RAS, CNRS-Geosience Azur and other organizations:

Crustal extensions at a rate 4.5mm/yr (+- 1.2mm/yr) in WNW-ESE direction. The GPS-derived extension rate is at least two times greater then prediction of most deformation models of Asia.



Calais E., Lesne O., Deverchere J., San'kov V., et al. // GRL -1998.,-v.25.,-N.21, -p.4003 - 4006.
San'kov V.A., Levi K.G., Deverchere J., Calais E., et al . //Journal of Earthquakes Prediction Research. – 1998, v.7, No.4, pp.443-448.

Impact of IRKUTSK station into supporting of Local geodynamics phenomena monitoring networks



Geodetic network for the purposes to monitor a steady state of the new automobile bridge in Irkutsk City in the conditions of seismicity and Angara fault activity
(simplified, not all baselines shown)

Conclusion

- IRKUTSK GNSS station still permanently working during last 14 years;
- Station is an important part of IGS/IERS Global, National (FAGS of Russia), Regional and Local geodetic monitoring networks;
- There are good opportunities and potential to improve station observation activity. Perhaps, FIG and SSGA Workshop will serve as an additional impulse of the improvements and cooperation.

Thank you for attention!

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