"Солнечно-земные связи и физика предвестников землетрясений"
XIV международная конференция,
с. Паратунка, Камчатский край, 29 сентября – 03 октября 2025 г
"Solar-terrestrial relations and physics of earthquakes precursors"
XIV International Conference,
Paratunka, Kamchatka, September 29 – October 03, 2025

Small effects in magnetic measurements at observatories: possible impact of car traffic on highways

Sergey Y. Khomutov, Alexey A. Gvozdarev

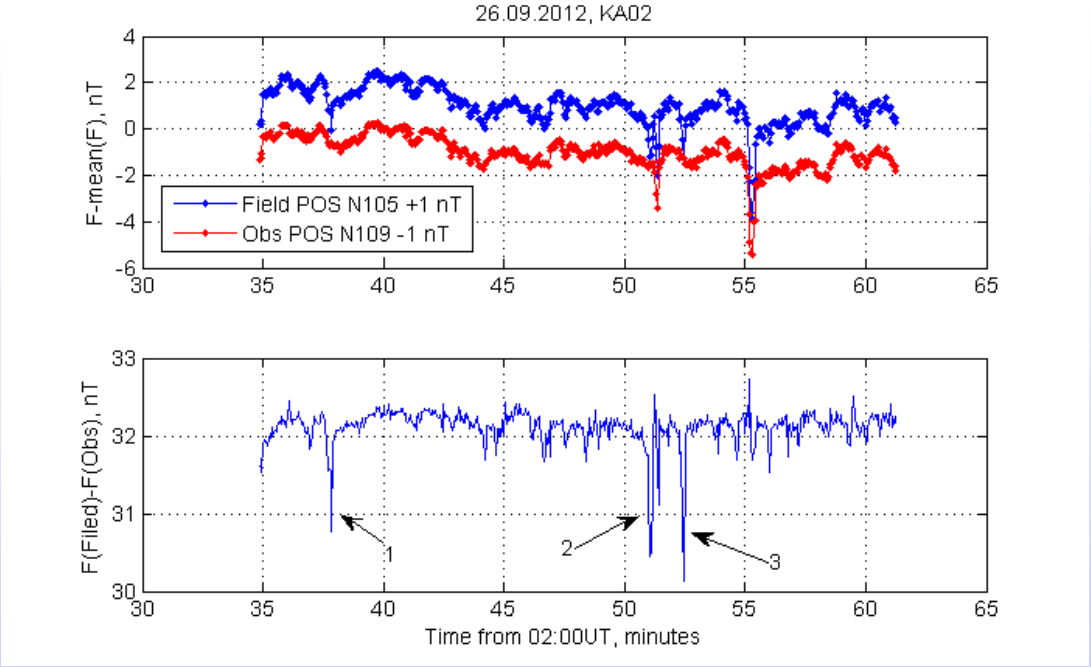
Institute of Cosmophysical Research and Radio Wave Propagation FEB RAS, Paratunka, Kamchatka, Russia

Examples of car effect

F measurements along the route from the Klyuchi Observatory (Novosibirsk) to Akademgorodok (about 10 km), 26.09.2012:

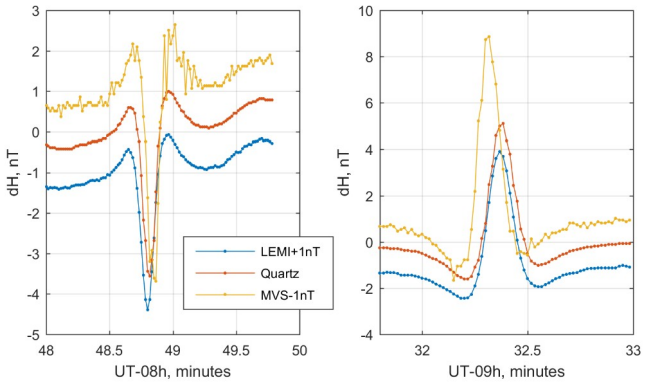
Point 02: The sensor is about 50 m away from the road. Heavy traffic (recorded): "1" – truck, "2" – KAMAZ, "3" – bus PAZ – effect 1.5-2.0 nT, passenger cars – no more than 0.3 nT

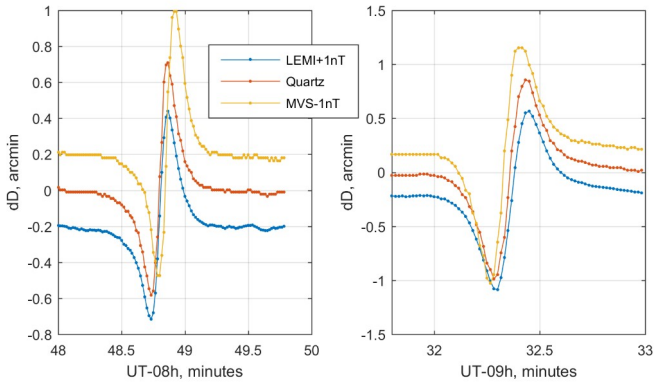
Point 03: Sensor at a distance of about 120 m. Heavy truck traffic. The effect does not exceed 0.5 nT

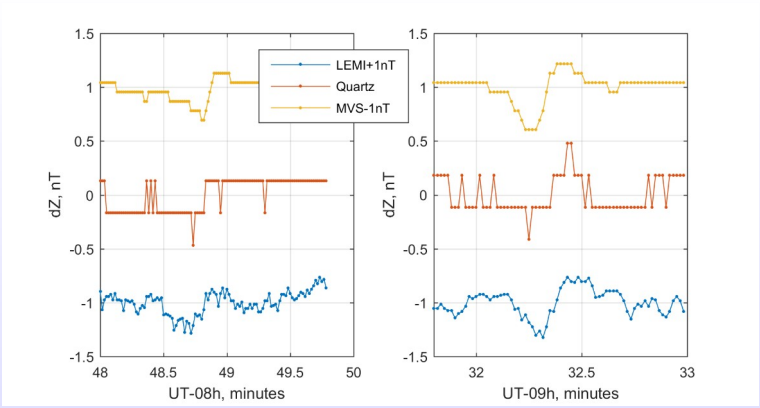


Examples of car effect (observatory Patrony, Irkutsk)

Measurements at the magnetic observatory "Patrony" 08.07.2017



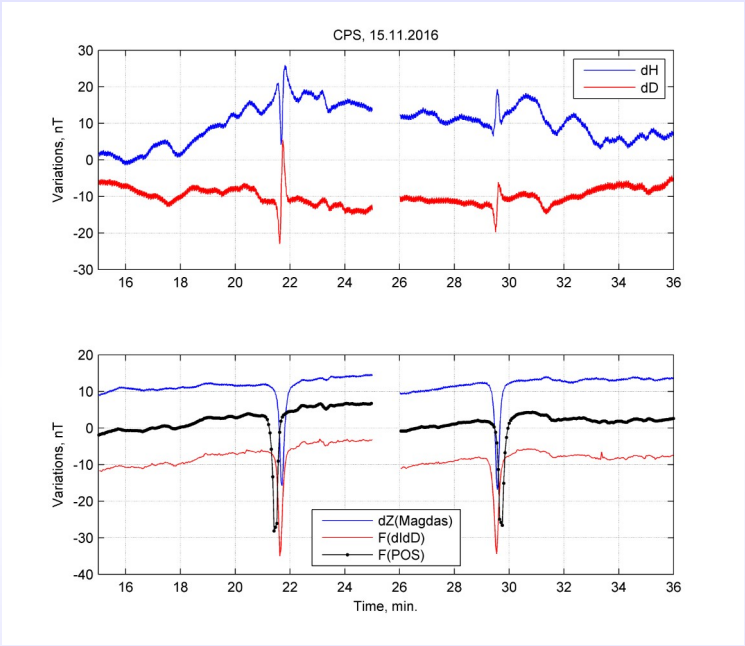




the distance from the magnetometers to the road:
- LEMI, Quartz – about 95 m
- MVS – about 85 m

Examples of car effect (observatory Cape Schmidt)

Measurements at the magnetic observatory "Cape Schmidt" 15.11.2016



the distance from the magnetometers to "summer" road:
- Magdas, dIdD (variational hut) – about 80 m
- POS-1 (absolute hut) – about 55 m

Car effect (observatory Paratunka)

Motivation:

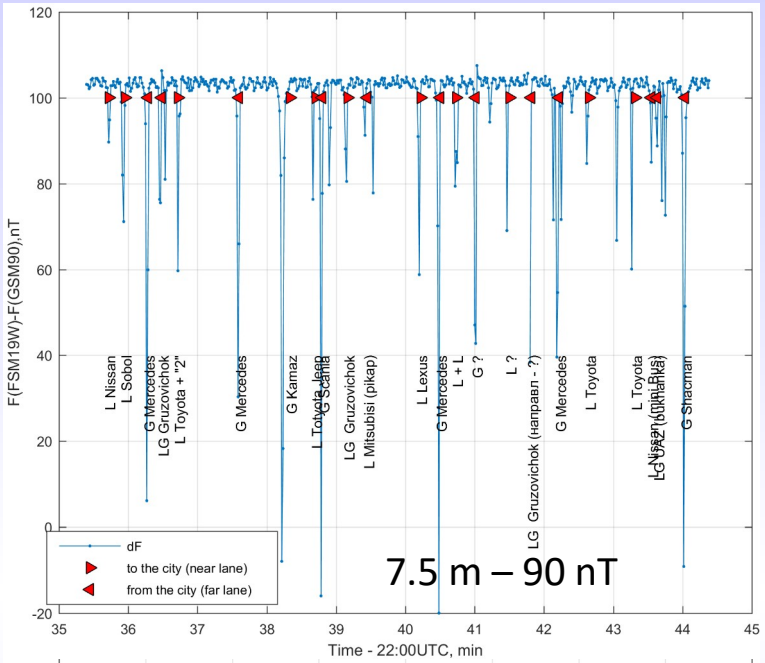
1) A few years ago, the construction of a road towards the Mutnovskaya geothermal power plant began. Trucks with a load capacity of several tens of tons are used to deliver the soil. They could potentially create anomalies in the magnetic field measured at the Paratunka Geophysical Observatory

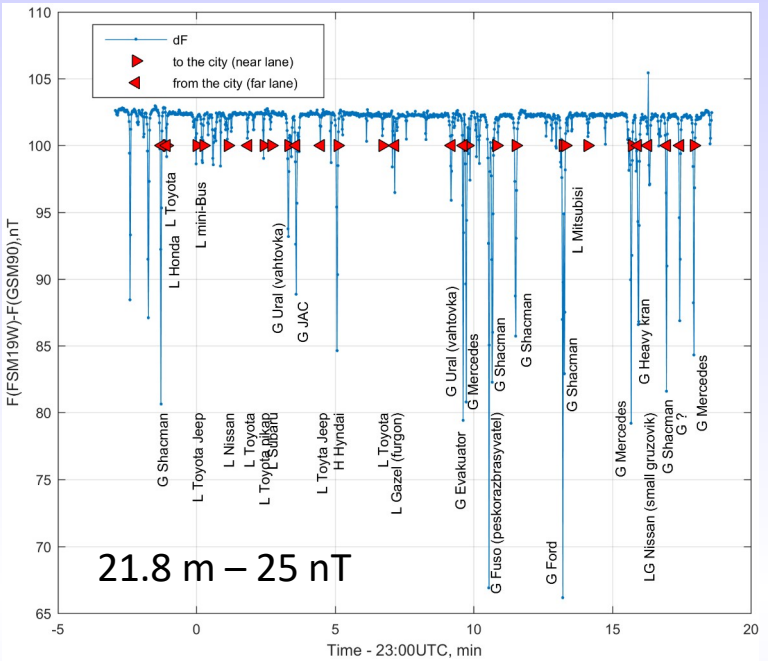
2) In October 2023, a school of physics was held in Kamchatka, within the framework of which IKIR FEB RAS was to conduct thematic lectures and master classes.

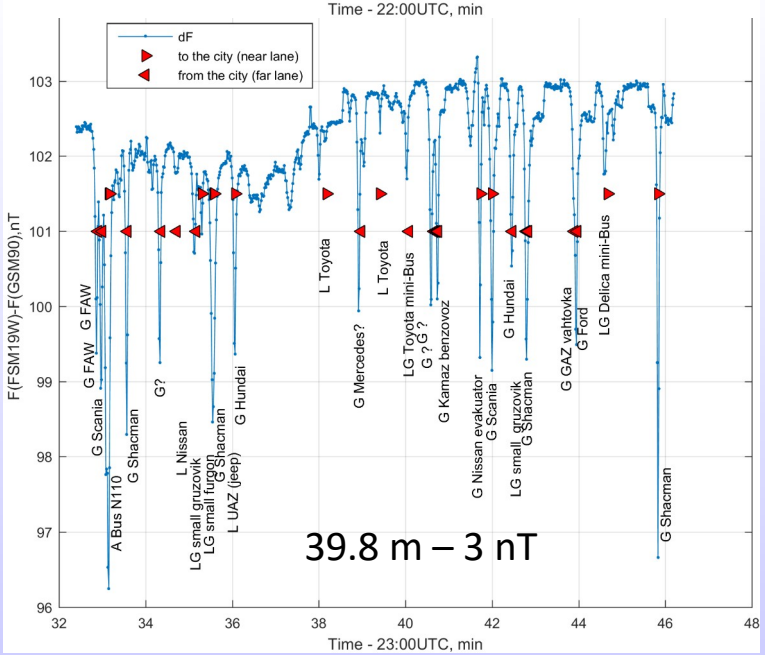
Car effect (observatory Paratunka)

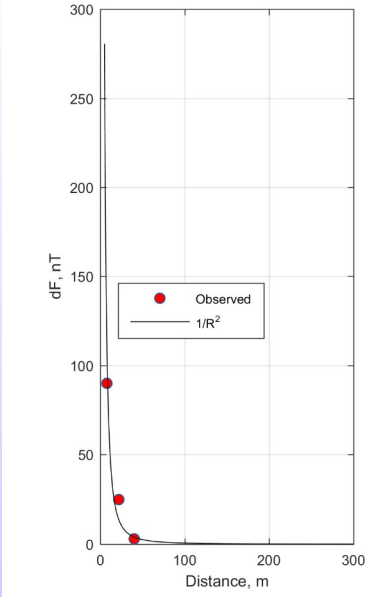
1) Three points were set up, at a distance of 7.5, 22 and 40 m from the highway
2) Total intensity F was measured using a GSM-19W field magnetometer, frequency 1 Hz
3) the time of passage of cars, primarily trucks, the car's brand, and the direction (south or north) were recorded to protocol (Shacman, Scania, Man, JAC, Mersedes, FAW, Volvo, Ural)
4) natural geomagnetic variations were excluded by the GSM-90 magnetometer records

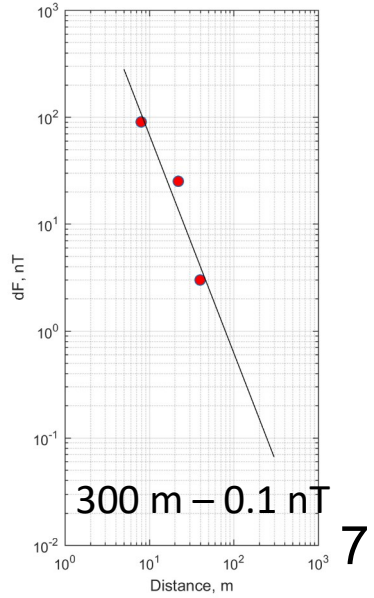
Car effect (observatory Paratunka)











Conclusions

1) despite the rather rough work with the data (the estimates were made manually), we gained confidence that car traffic on the highway near the observatory does not affect our measurements at the level when we need to think about it

2) such measurements with subsequent processing and analysis of the results are not very suitable for a master class, as they require more time to prepare participants than is usually allocated within the framework of a master class. This was shown by an attempt to repeat these measurements in 2024

3) There is another point related to heavy trucks - they create vibrations that affect magnetometers with free-hanging elements. For example, the theodolite of the declinometer-inclinometer uses a vertical circle scale compensator (a pendulum with a prism). When driving a heavy truck, we observe fluctuations in the reference system of this scale (as in an earthquake)

Thank you for your attention!