United Nations/Moldova/United States of America
Workshop on the Applications of Global Navigation Satellite System (GNSS)

Development of geodetic databases for real time MOLDPOS service

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Agency for Land Relations and Cadastre (ARLC)

Hochschule Karlsruhe Technik und Wirtschaft
UNIVERSITY OF APPLIED SCIENCES

Participating institutions

Memorandum of understanding between Academy of Science of Moldova and Federal Ministry of Education and research of Germany signed on 14 March 2008

Academy of Science of Moldova (ASM)

Federal Ministry of Education and Research of Germany

Bilateral Research Program to fund 1 year projects: 25 000 EURO from German site and 10 000 EURO from Moldavian site.

Technical University of Moldova (TUM)

Agency for Land Relations and Cadastre (ARLC)

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In 2008-2009 the Technical University of Moldova and in collaboration with Karlsruhe University of Applied Sciences had applied application on Development of a High Capacity Real-Time GNSS Positioning Service using new RTCM 3.1 transformation messages that can be integrated in MOLDPOS - Project launched by Agency for Land Relations and Cadastre (ARLC) funded by Norwegian Government.

Participating institutions

The Karlsruhe University of Applied Sciences has been:

- **Developing complete infrastructure (transformation parameter concepts, computation software and technical standards in GNSS-industry in the recent years)**
- **The scientific member (2003 – 2007) and fully involved into the international RTCM working group on transformation messages**
- **The second German partner has been involved as link between state and private GNSS-services, GNSS-industry and GIS and university into the developments**

The Agency of Land Relation and Cadastre has experience in:

- **Installation, maintenance and operation of EPN GNSS reference station**
- **GNSS network measurement and processing**

The Technical University of Moldova has experience in:

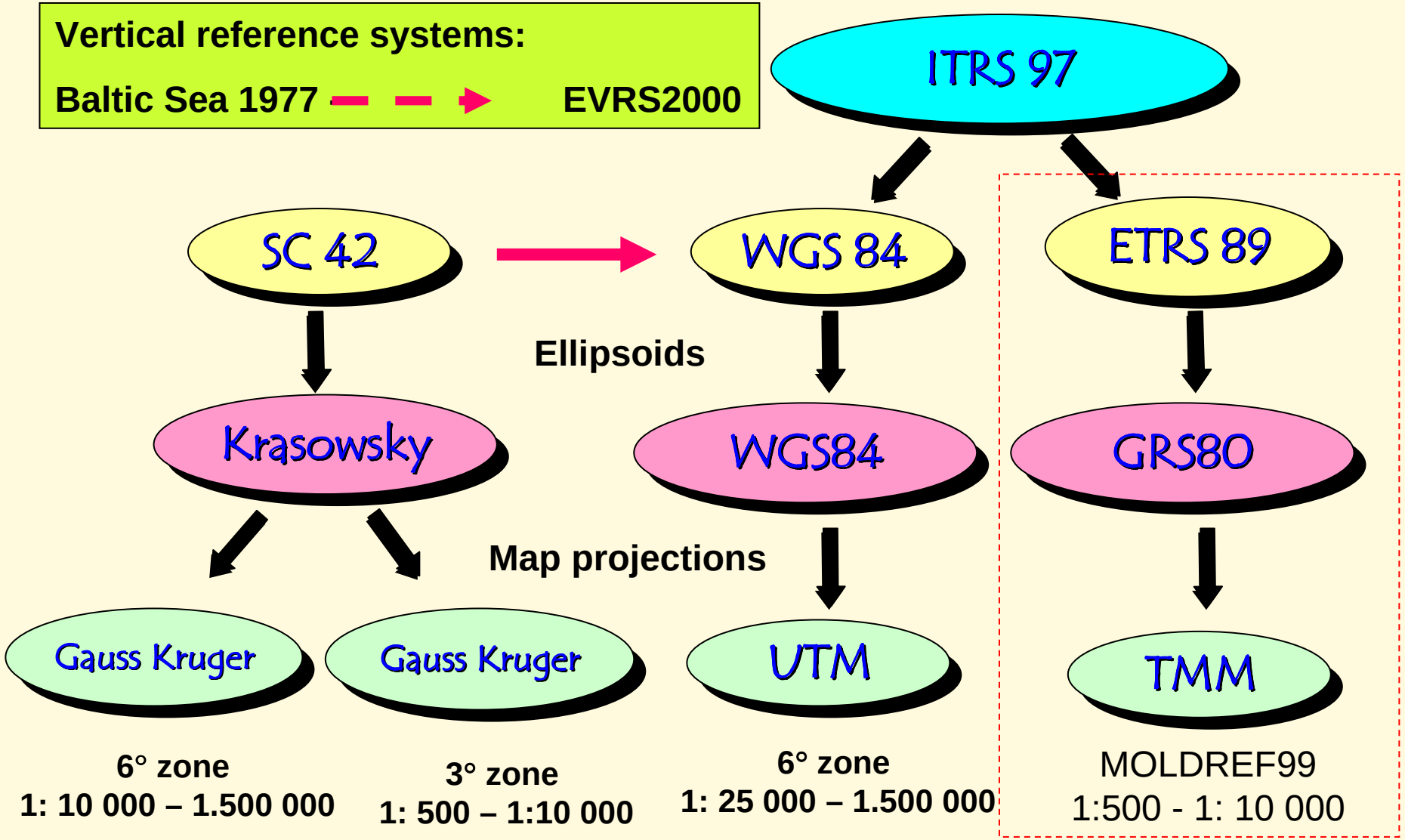
- **Installation, maintenance and operation of EPN GNSS reference station**
- **GNSS/RTK measurements and processing**
- **Generation and distribution of differential corrections**

Project objectives

- Development of a communication architecture for providing RTCM 3.1 transformation messages
- Development of a general geodetic transformation databases concept
- Analysis and further scientific developments of bilateral approaches for the Height Reference Surface (HRS) modeling methods and numeric conversion procedure of ellipsoidal heights into normal heights
- Study of possibilities of Digital Finite Element Height Reference Surface (DFHRS) concept Implementation in MOLDPOS data-base
- Study of possibilities of concept and software Implementation in MOLDPOS to monitor permanently the coordinate integrity of the GNSS reference stations
- Testing out of the final DFHRS and COPAG/ DFLBF databases based on the Karlsruhe state of the art of the mathematical models

Preconditions for new geodetic infrastructure development

Introduction of New Reference Systems and Map Projections

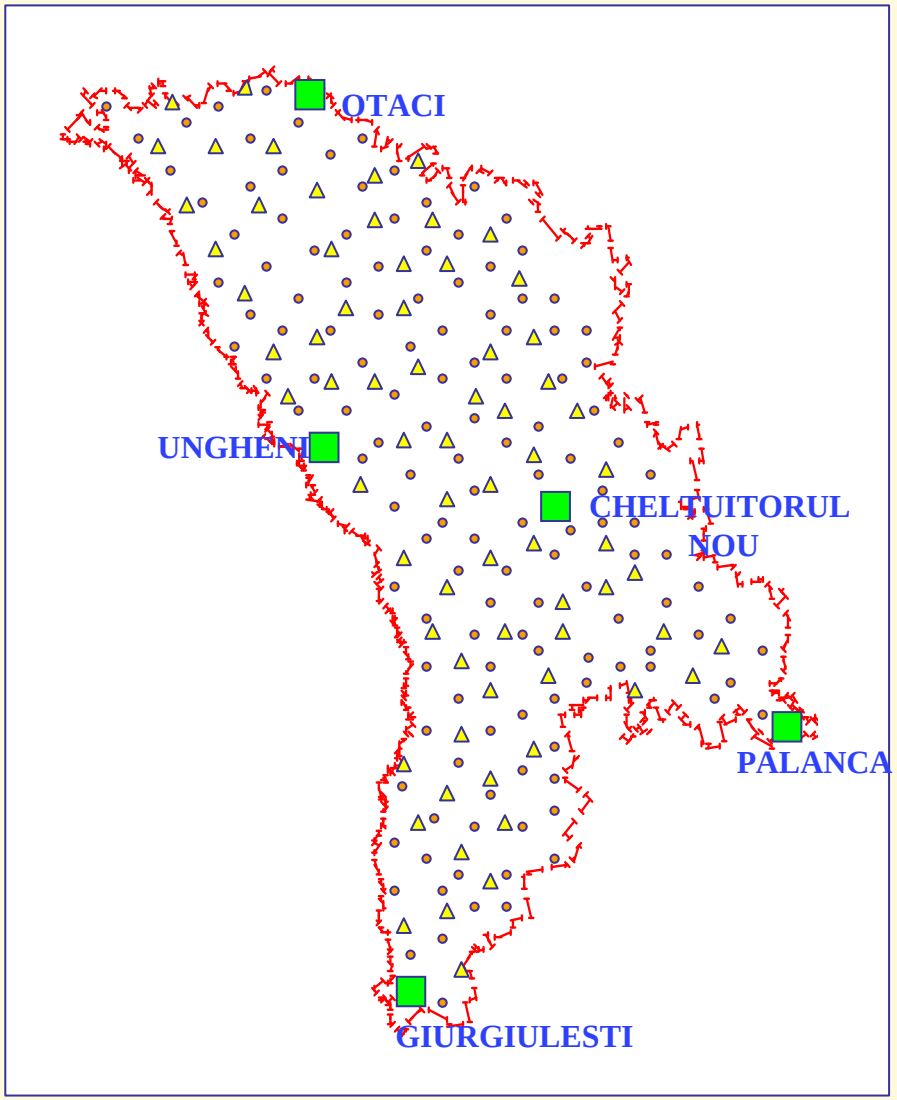


Preconditions for new geodetic infrastructure development

Development of the National GPS Network

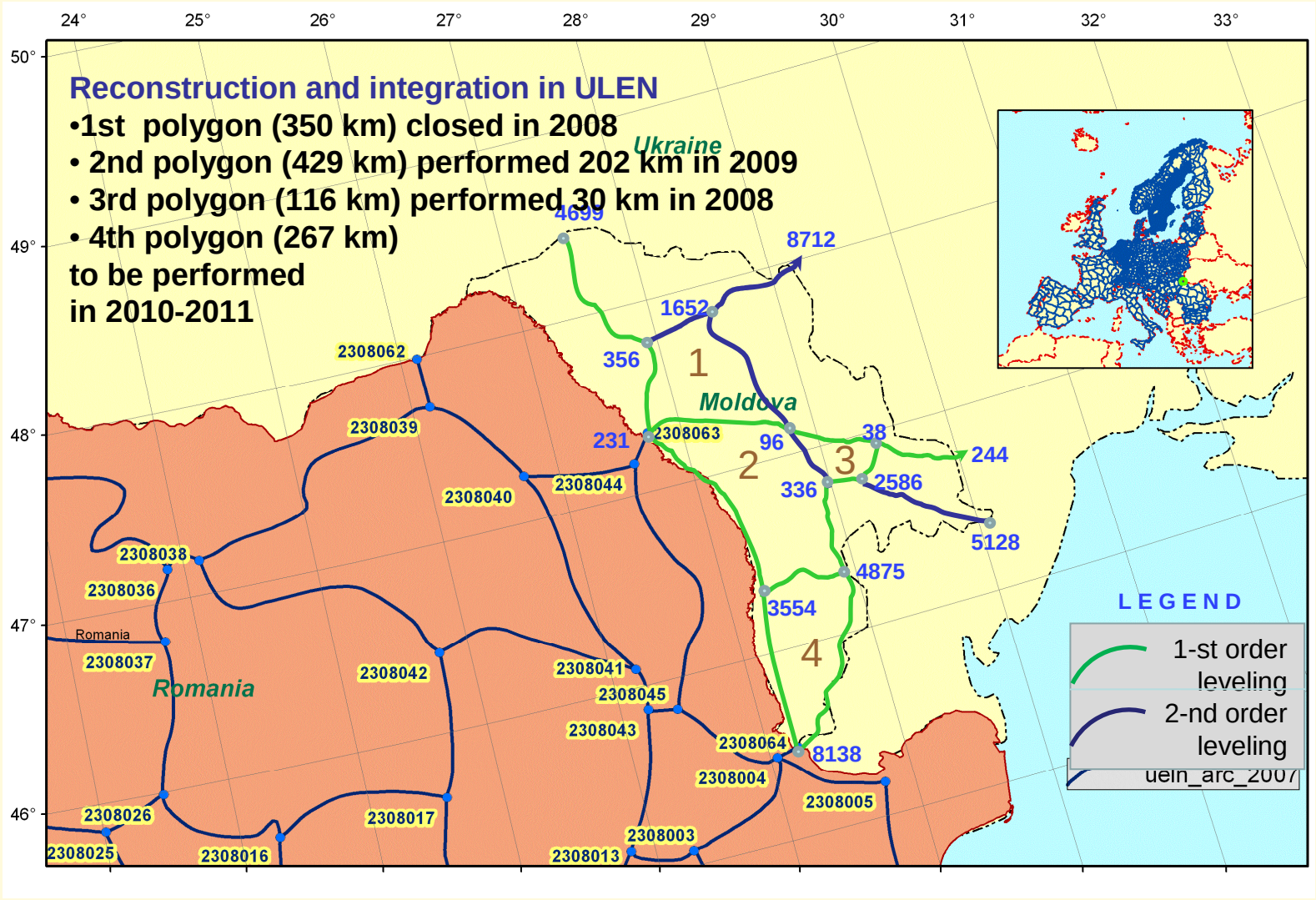
GPS measurements (1999-2002)

- **EUREF sites (5)**
- **first-order sites (72)**
- **second-order sites (418)**



Preconditions for new geodetic infrastructure development

Reconstruction of the National Leveling Network



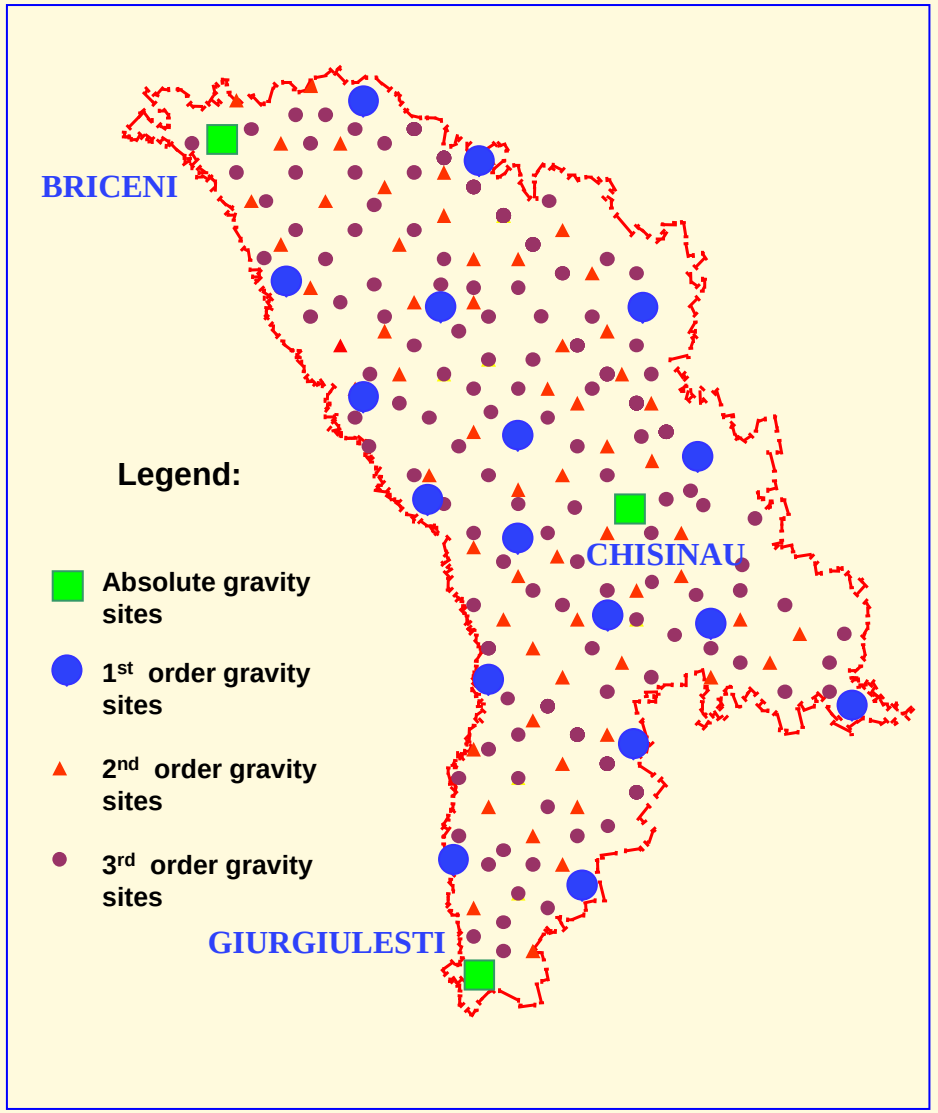
Preconditions for new geodetic infrastructure development

Development of The National Gravity Network

3 absolute gravity stations (2006) with RMS < 5 μGal

- **17 first order gravity stations (2006) with RMS < 10 μGal**
- **112 second order gravity stations (2007-2008) with RMS < 20 μGal**
- **271 third order gravity network performed (2008-2009) with RMS < 40 μGal**
- **1511 third order gravity network to be performed (2010-2011)**

Total: 2012 gravity stations (4x4 km)



Preconditions for new geodetic infrastructure development

Installation and maintenance of the permanent GNSS reference station in Technical University of Moldova

Starting from August 2006 CTIG station in Technical University of Moldova was installed in the frame of educational project JEP-24243-2003, TACIS-TEMPUS (http://ctig.utm.md/?module=projects&action=1&project_id=6);

Preconditions for new geodetic infrastructure development

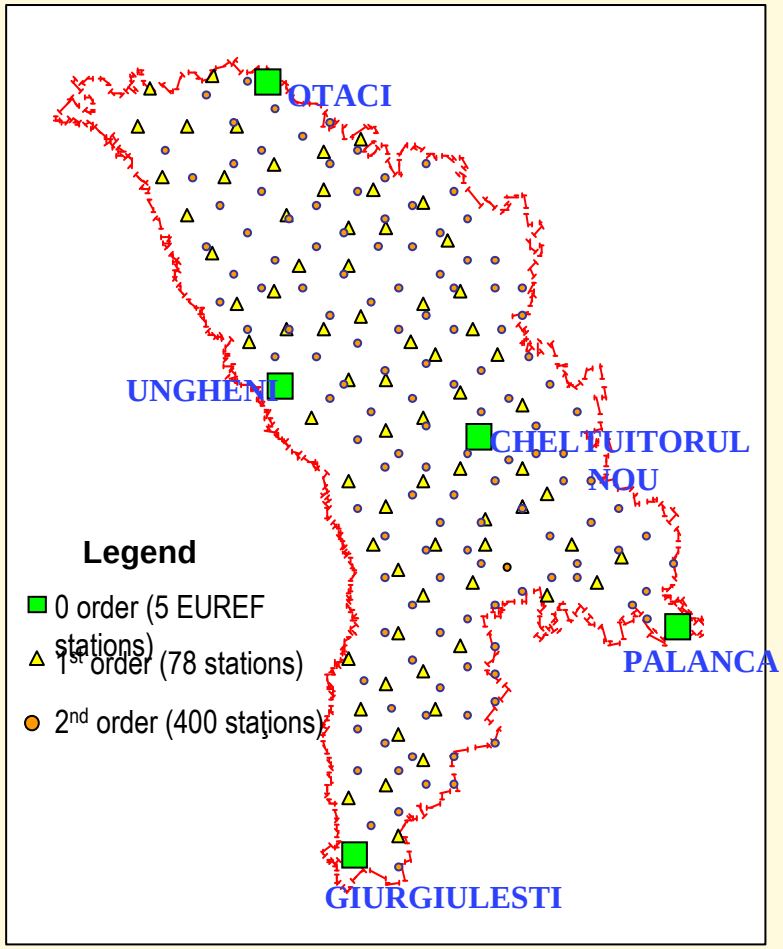
Installation and maintenance of the EPN GNSS reference station

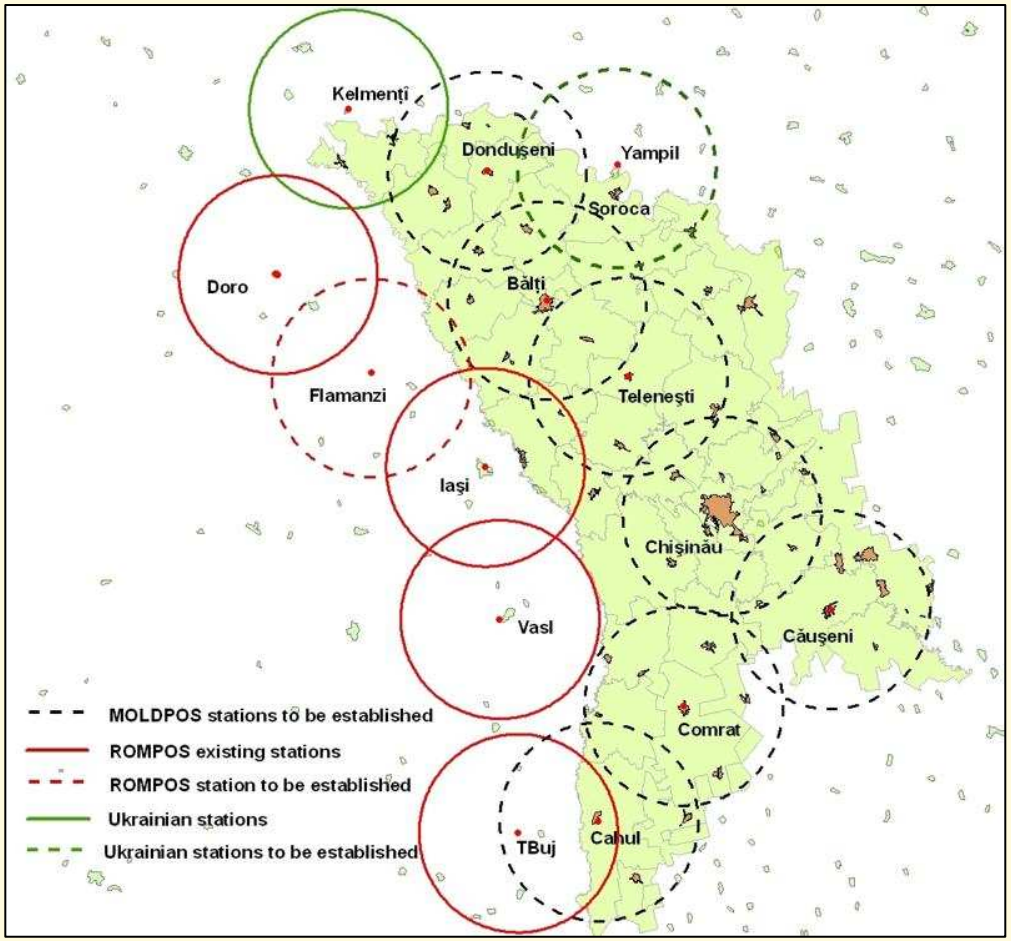
Starting from August 2007 the Agency of Land Relations and Cadastre in collaboration with BKG installed and jointly operate a GNSS permanent tracking station IGEO (Chisinau) integrated into EPN and will be integrated in MOLDPOS (www.ingeocad/igeo)

Preconditions for new geodetic infrastructure development

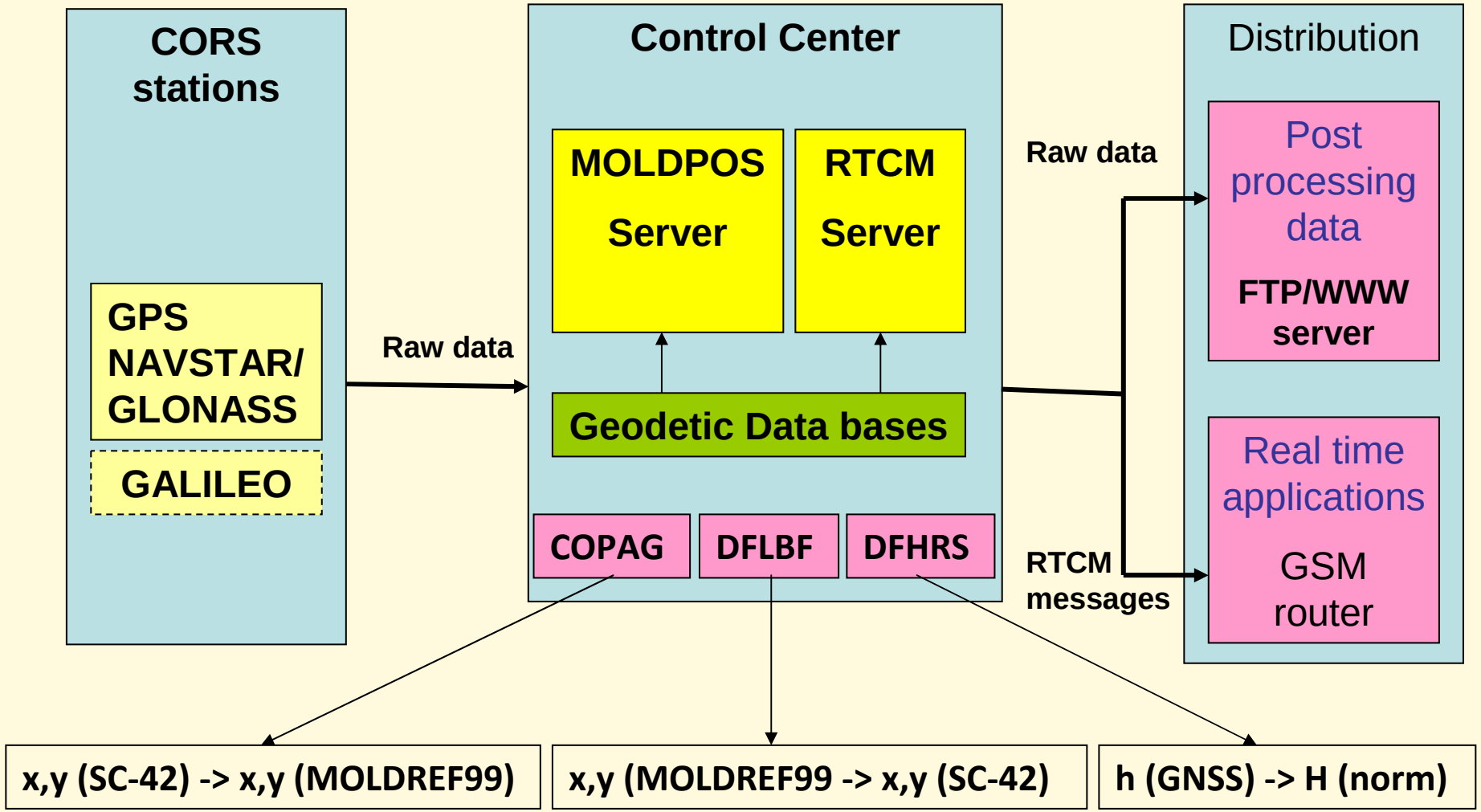
Decision of GNSS Permanent Network Establishment

GPS “passive” network (1999-2002) → **GNSS “active” network (2010)**

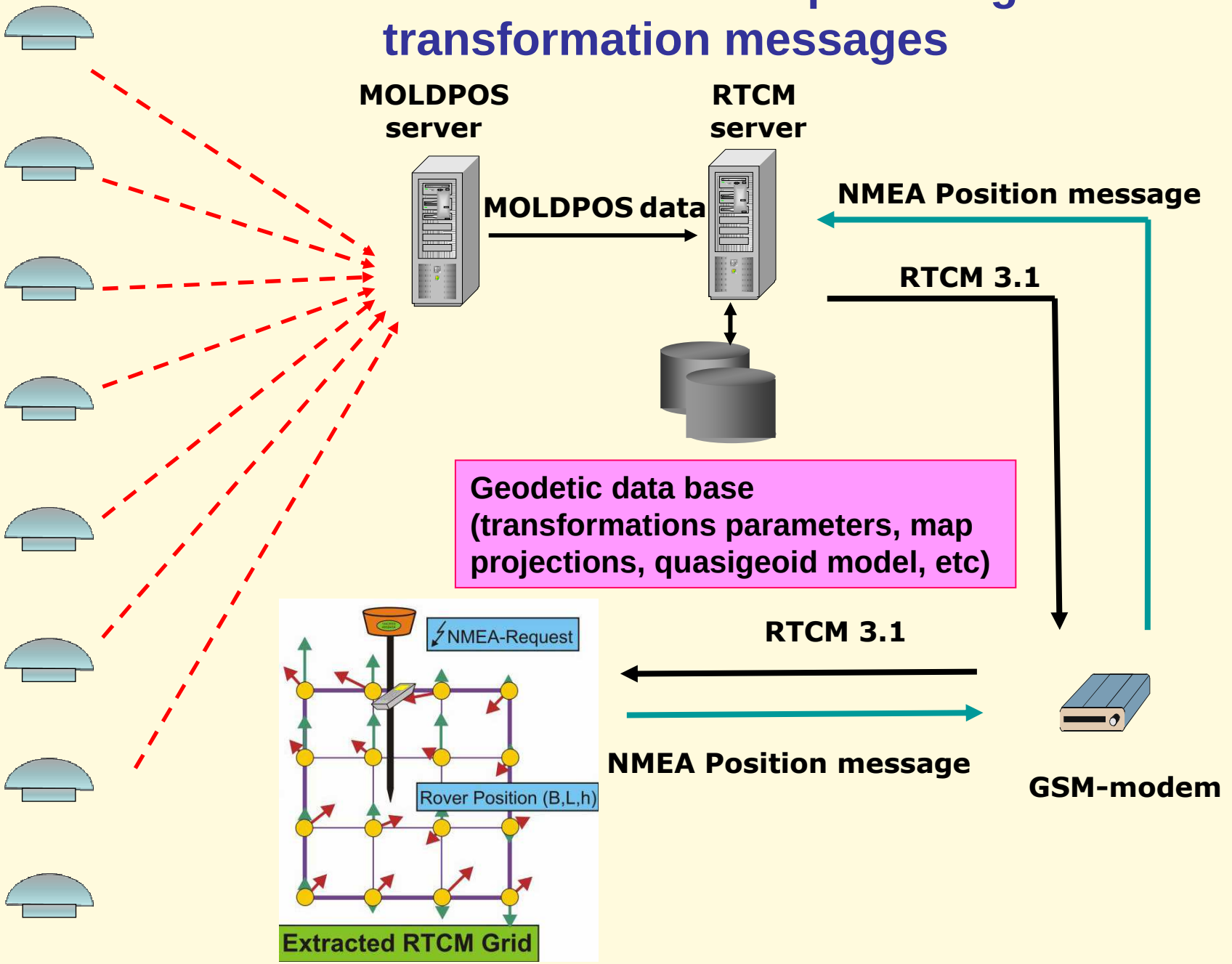




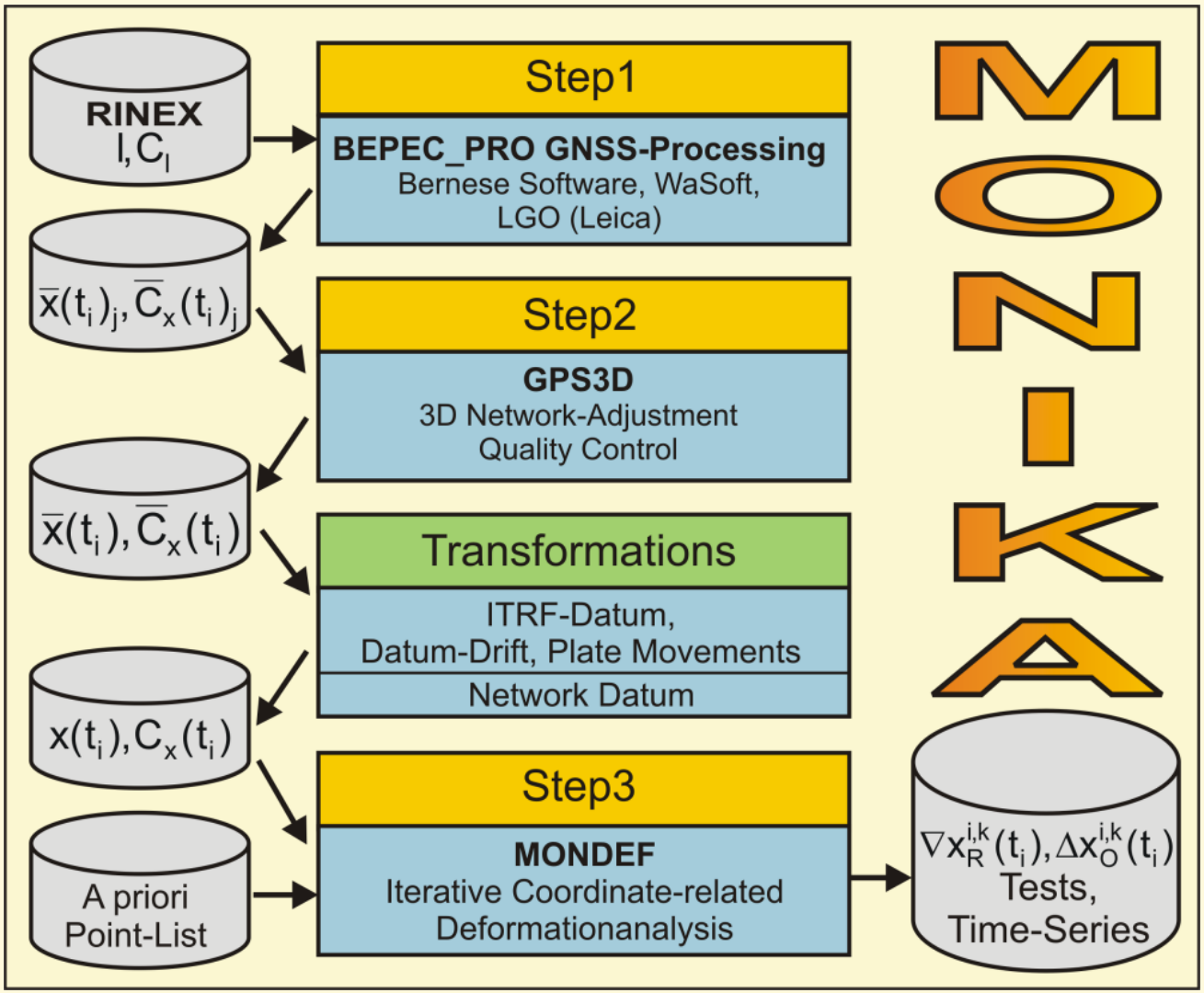
Geodetic databases development



Communication architecture for providing RTCM 3.1 transformation messages

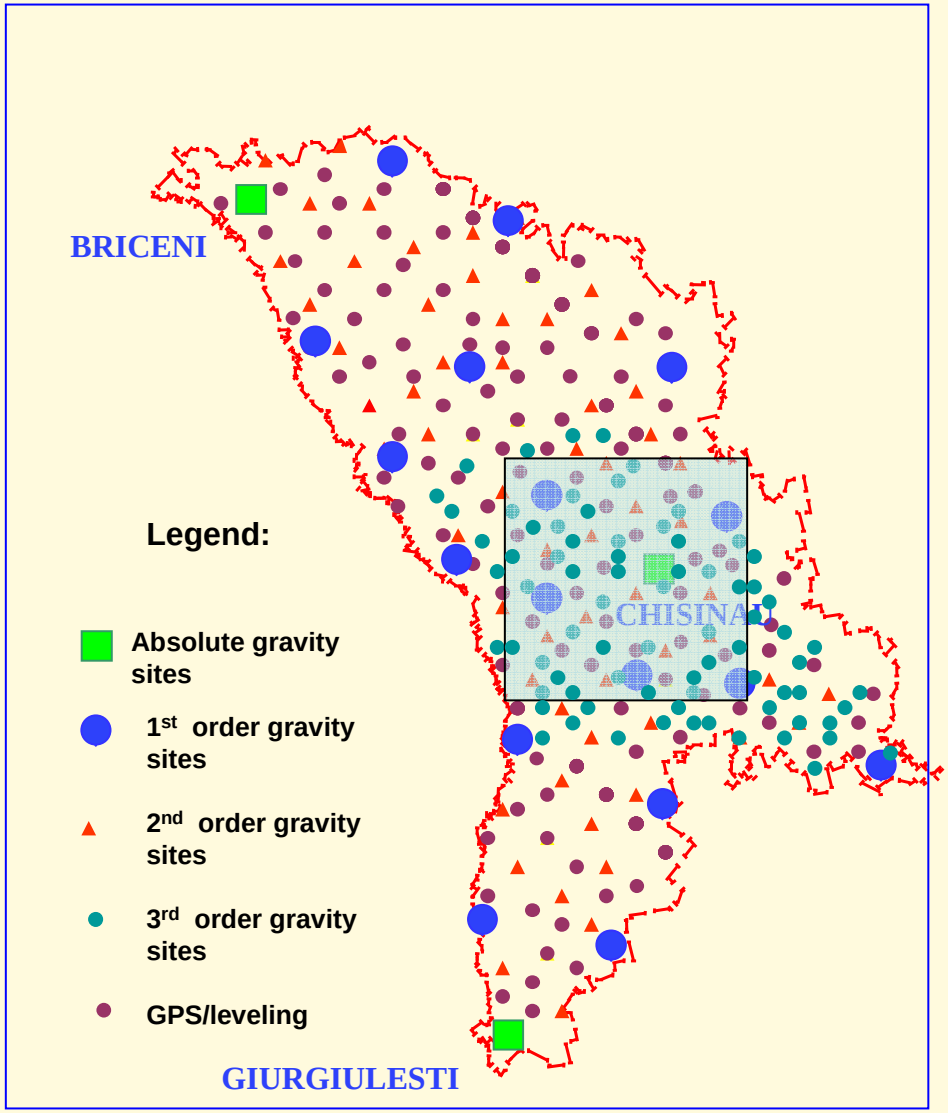


Monitoring by the Karlsruhe approach (MONIKA) service



Testing out of geodetic databases

- Computation of quasigeoid model and HRS for testing zone using gravity and GPS/leveling measurements
- 2D Transformation parameters computation using GNSS measurements on the old network SC-42
- Generation of RTCM 3.1 transformation messages and testing the accuracy of RTK measurements using existing permanent GNSS stations
- Testing of MONIKA software on the planned MOLDPOS permanent GNSS stations



Conclusions

- **The new RTCM 3.1 transformation messages allows the GNSS service to provide their users with all necessary information for 2D positioning and GNSS-based height computation related to the national HRS**
- **Improvement of normal height determination accuracy from GNSS measurements and organizing the MOLDPOS service to generate and distribute differential corrections and height anomalies generated from the high precision quasigeoid model**
- **Transformation Parameters data bases can be used by a large spectrum of users (geodetic works, cadastral surveying, GIS applications, mapping and boundary marking, etc.)**
- **MONIKA Monitoring system can be the basis of support of scientific applications (landslide and floods monitoring, environmental research, geohazard prediction, geodynamic investigations etc.)**

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Thank you for attention

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