REPUBLIC OF NORTH MACEDONIA

AGENCY FOR REAL ESTATE CADASTRE

National Report

Sasho DIMESKI, Bojan MAKSIMOV
Department for Geodetic Works

EUPOS Council and Technical meeting , Berlin 2025

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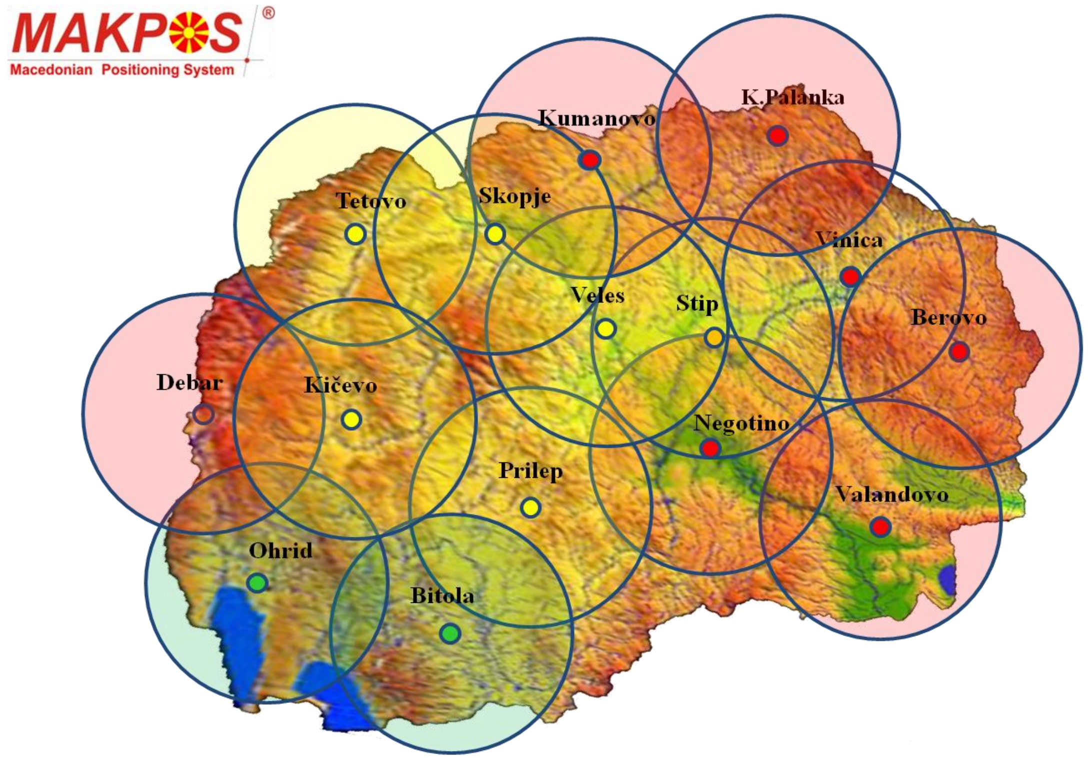
Outline

- Active GNSS network - MAKPOS
- Combined Geodetic Network
- New Geodetic Reference Systems and Cartographic Projection

Active GNSS network - MAKPOS



3G NETWORK: GPS/GLONASS/GALILEO
(BeiDou planned from 2027)

Number of stations: 15
Interdistance: ≈ 50 km
Control center: AREC
Services: DGPS, RTK, PP

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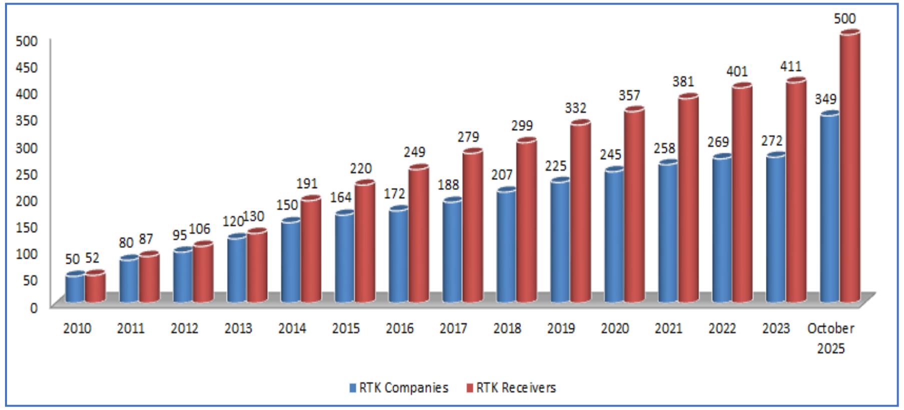
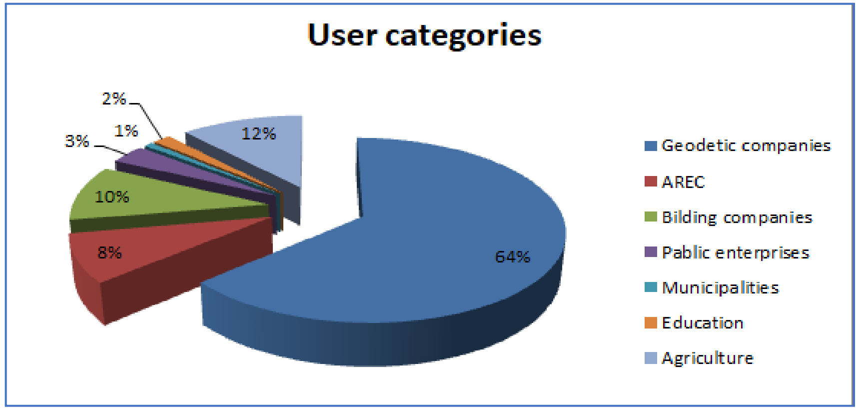
Active GNSS network - MAKPOS

MAKPOS Users





International contribution:

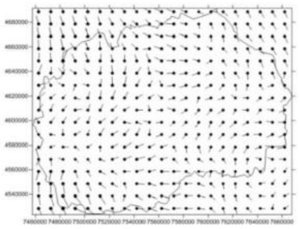
- **Ohrid** station ORID00MKD - IGS/EPN/EPOS
- **Valandovo** station VLDV00MKD – EPOS
- **EPN Dencification** project - all MAKPOS stations (data processing - Belgrade University)

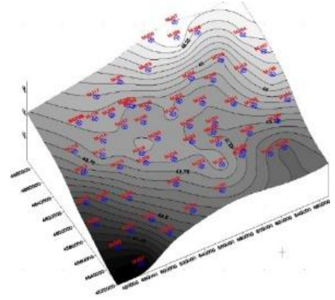
Cross-border data exchange: Serbia, Albania, Kosovo

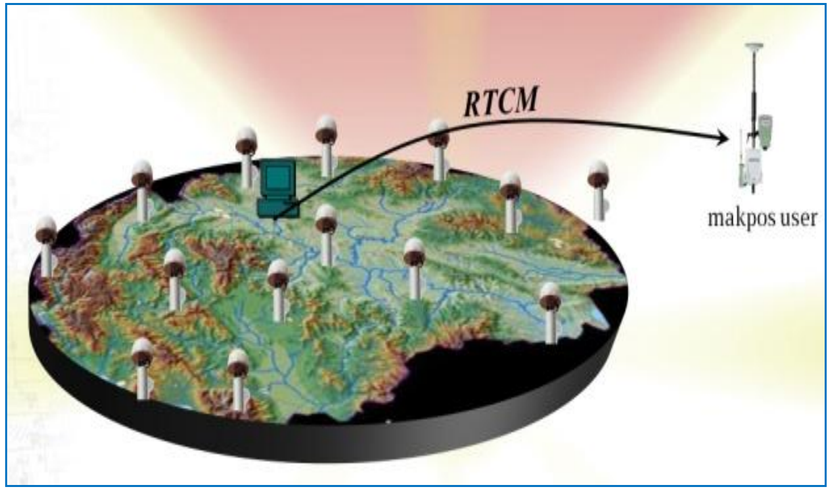
Active GNSS network - MAKPOS

Transformation models implemented in MAKPOS

- MKD_GRID (grid model)
- MKD_GRID_QGEO (grid + geoid model)



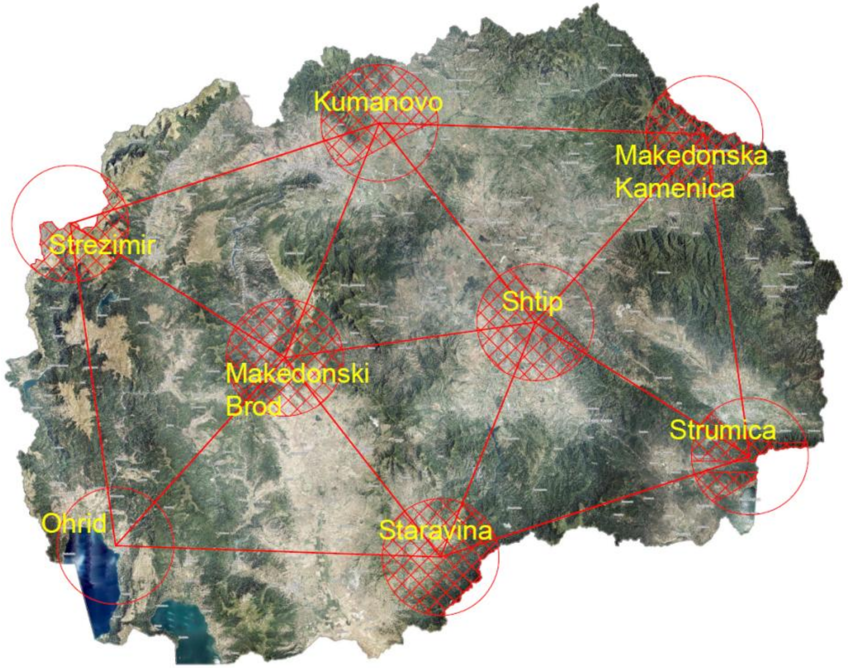




Combined geodetic network – planned

EUREF Recommendation: Combining different types of geodetic measurements on the co-located stations = Combined (zero order) geodetic network

Multi-purpose network - geodesy, geodynamics, seismology, meteorology …



Study prepared

- Network design - 8 stations
- Criteria for selection of micro locations
- Building the stations
- Station equipment
- Establishment of control and analytical center

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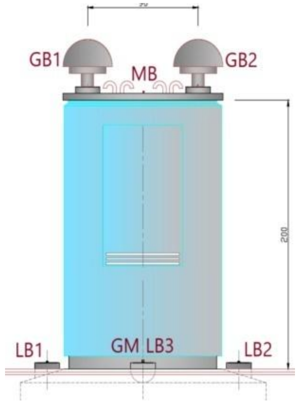
Combined geodetic network – planned

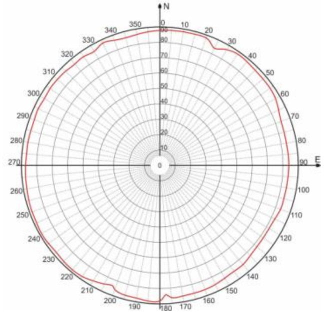
Construction projects for all stations completed, applied for building permissions

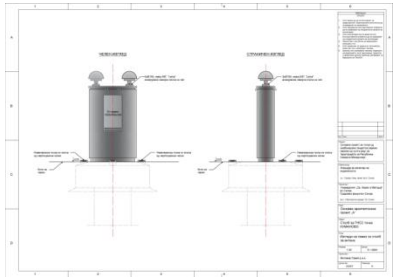
УНИВЕРЗИТЕТ "СВ. КИРИЛ И МЕТОДИЈ"
ГРАДЕЖЕН ФАКУЛТЕТ - СКОПЈЕ
КАТЕДРА ЗА ВИША ГЕОДЕЗИЈА

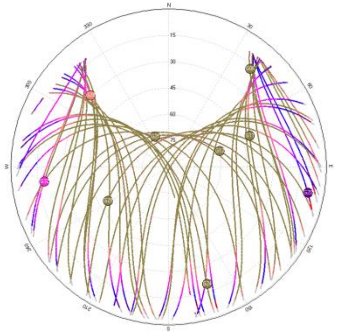
ГЕОДЕТСКИ ПРОЕКТ ЗА ВОСПОСТАВУВАЊЕ НА ТОЧКИТЕ *КУМАНОВО, ОХРИД* И *ВАЛАНДОВО* ОД КОМБИНИРАНАТА ГЕОДЕТСКА МРЕЖА

СКОПЈЕ, 2024









Geodetic reference systems and State cartographic projection in use in North Macedonia

Horizontal reference system

Reference ellipsoid : Bessel, 1841

Horizontal datum: Hermannskogel

Cartographic projection: Gauss Kruger

Vertical reference system

NVT1 – Normal orthometric heights in practical use
Vertical datum: Mean see level – mareograph in Trieste (1875.0)

NVT2 – in legislation
Vertical datum: Mean see level – 6 mareographs at Adriatic Sea

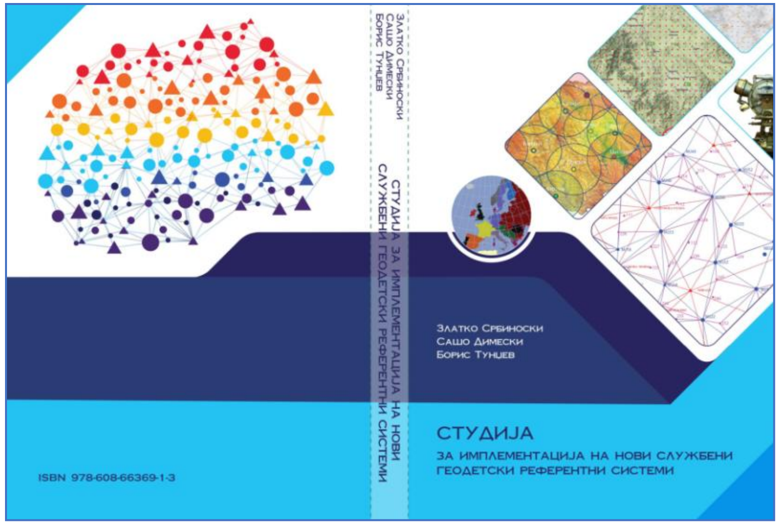
Gravimetric reference system

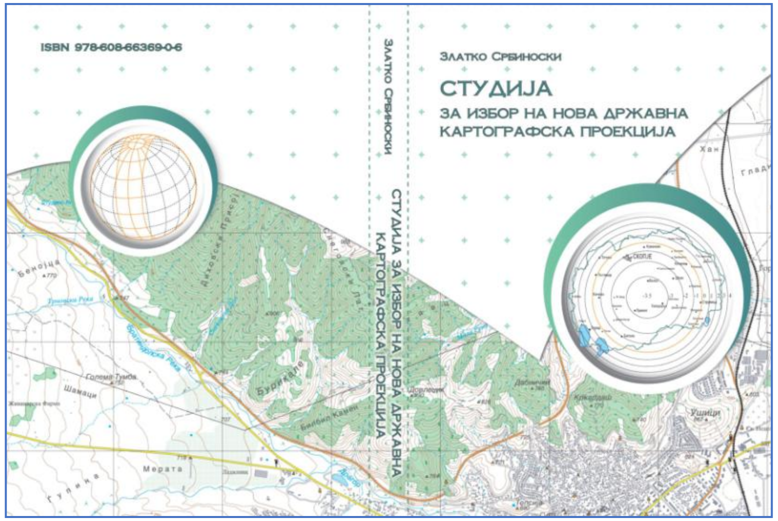
Absolute values of g measured at the AGP

Prepared Studies

Cooperation between AREC and Faculty of Geodesy

- Study for implementation of new official geodetic reference systems
- Study for selection of new state cartographic projection



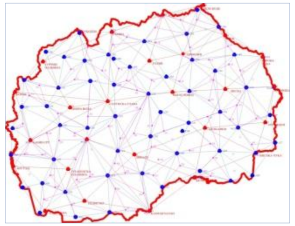


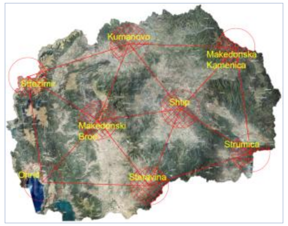
New geodetic reference systems - proposal

<u>Horizontal reference system</u>

ETRS 89, epoch 1989.0
GRS80 – reference ellipsoid
MK_ETRS 89/TM


MAKPOS


MAKREF


CGN

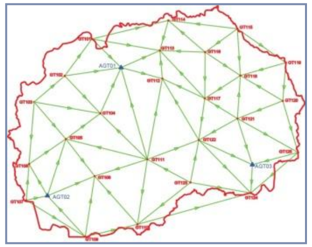
<u>Vertical reference system</u>

EVRS 2019 (NAP)
Normal heights
Vertical datum: FR Skopje (EVRS 2019)
(MK_EVRS 2019/NH)


NVT3

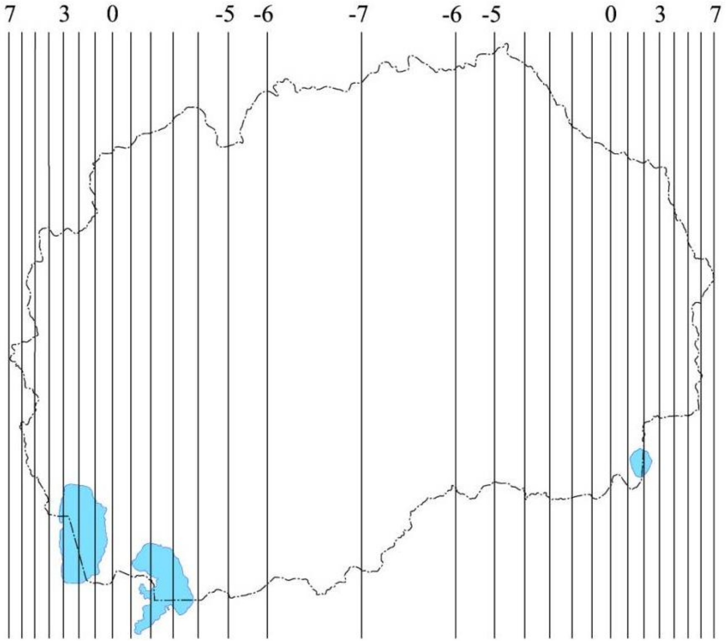
<u>Gravimetric reference system</u>

Absolute values of g measured
at the Absolute Gravity Points
(MK_GRS 2010)


Basic Gravity Network

New state cartographic projection - proposal

Transversal Mercator Projection- TM



Main characteristics

- Identical mathematical model with Gauss Kruger projection:
- Central meridian close to the center of the country: $\lambda = 21^{o}45' 00''$
- Isolines are parallel lines symmetrical to the central meridian;
- Maximal linear deformations: Δd = 14.3cm/km.
- Constant linear module: m = 0.99993 (-7cm/km),
- Reduced value of the linear deformations: Δd = +/- 7.3cm/km.

TM will follow the new horizontal geodetic reference system - **MK_ETRS89/TM**

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Ongoing activities

- Preparations for introduction of the new State geodetic reference systems and new State cartographic projection started, including debates/discussions with interested parties
- Implementation strategy need to be developed

THANK YOU FOR YOUR ATTENTION

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