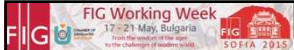





Bashkim IDRIZI

DEVELOPING RASTER DATASETS FOR LENGTH DIFFERENCES BETWEEN TOPOGRAPHY, GEOID, ELLIPSOID AND MAP PROJECTION FOR MACEDONIAN TERRITORY

Presenter: Bashkim IDRIZI 

Overview:

- **Preface**
- **Research objectives**
- **Source data & test model defining**
- **Calculation length differences**
 - Calculation of 1km length differences between topography and geoid, as well geoid and earth ellipsoid
 - Calculation of 1km length differences between ellipsoid and some characteristic map projections for the Macedonian territory
 - UTM 34N
 - Macedonian state map projection
 - Macedonian state map projection with displaced central meridian and changed scale factor
 - Calculation progressive differences of 1km topography horizontal length from topography up to geoid, ellipsoid and map projections
- **Conclusions**

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Geo-SEE

Preface:

- Approximations between surfaces (topography-geoid-ellipsoid/sphere-map projection) - changing of length values between surfaces,
- Whole control to mathematical-geometrical elements and qualitative spatial reference system,
- In past period, only separate analyzes between two surfaces;
- No national dataset with length differences between surfaces,
- Length differences (deformations, distortions) are not errors
- Accuracy of length differences depends accuracy of used surfaces,

Where S = Geoidic Distance
 D = Horizontal Distance
 H = Mean Elevation
 N = Mean Geoid Height
 R = Mean Radius of Earth

$S = D \left(\frac{R}{R + N + H} \right)$
 $\Delta S = D \left(\frac{R + N + H}{R} \right)$

$S = D \left(\frac{R}{R + N} \right)$
 $\Delta S = D \left(\frac{R + N}{R} \right)$

$\Delta S = D \left(\frac{R + N + H}{R} \right)$

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Research objectives:

- Calculating partial and progressive length differences between four surfaces in a case of Macedonian national area;
- Developing and providing vector and raster datasets of length differences between four surfaces in 1km spatial resolution for Macedonian national area;
- Analyzing of mean values, extreme values and dispersion of length differences between four surfaces;
- Analyzing the importance of knowing length differences for many type of field measurements, geodetic and engineering works, as well for defining of spatial reference system, etc...

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Source data and test model defining:

- Source data – open and free data:
 - Macedonian GM data (www.iscgm.org)
 - EGM08 (<http://earth-info.nga.mil/GandG/wgs84/gravitymod/index.html>)
 - ASTER GDEM (<http://asterweb.jpl.nasa.gov/>)
- Test model:
 - Grid of 25635 points in 1km spatial resolution.

NR	EASTING	NORTHING	EGM2008	ASTER
1	460000	4566000	42.0525	2200
2	460000	4567000	42.0807	2099
3	460000	4568000	42.1026	1924
4	460000	4569000	42.1195	1891
5	460000	4570000	42.1325	1829
6	461000	4563000	41.9492	1884
7	461000	4564000	41.9943	1704
8	461000	4565000	42.0337	2101
9	461000	4566000	42.0674	1963
10	461000	4567000	42.0943	1927
11	461000	4568000	42.1158	1802
25628	623000	4673000	46.2104	1755
25629	623000	4674000	46.192	1413
25630	624000	4671000	46.2446	1817
25631	624000	4672000	46.2345	1888
25632	624000	4673000	46.2202	1853
25633	624000	4674000	46.2038	1750
25634	461000	4625000	43.7693	2641
25635	455000	4598000	42.0503	470

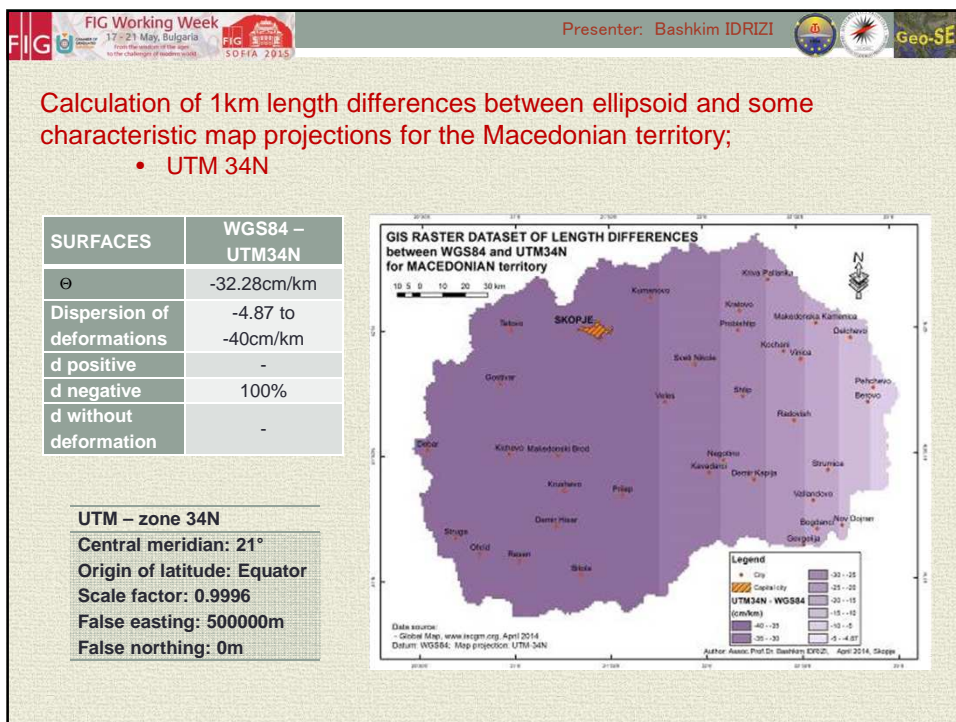
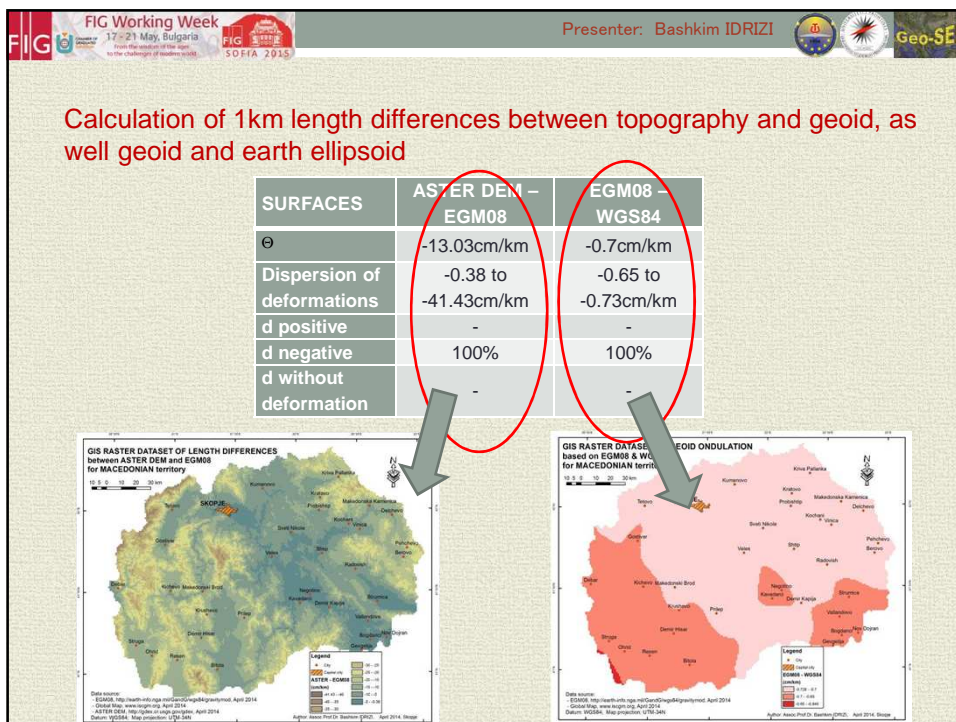
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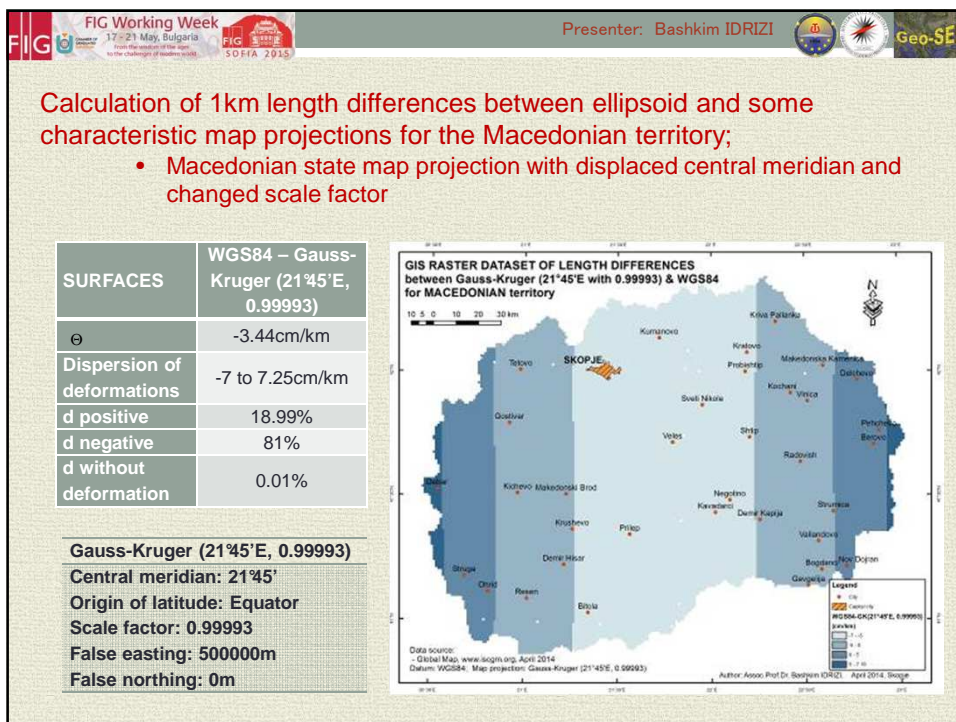
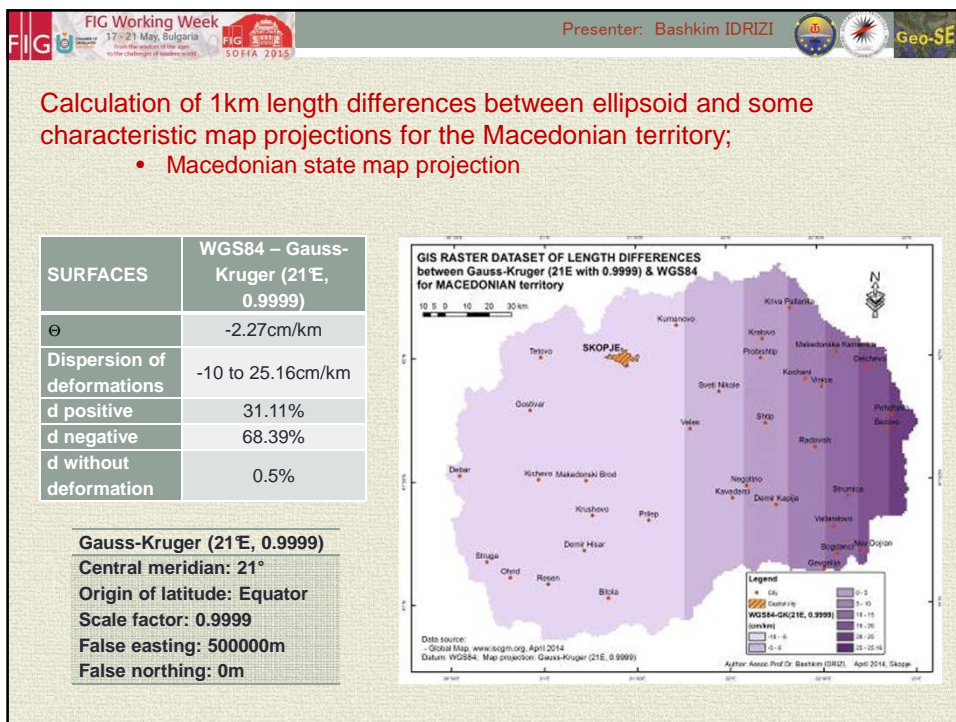
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CALCULATION LENGTH DIFFERENCES

- Calculation of 1km length differences between topography and geoid, as well geoid and earth ellipsoid;
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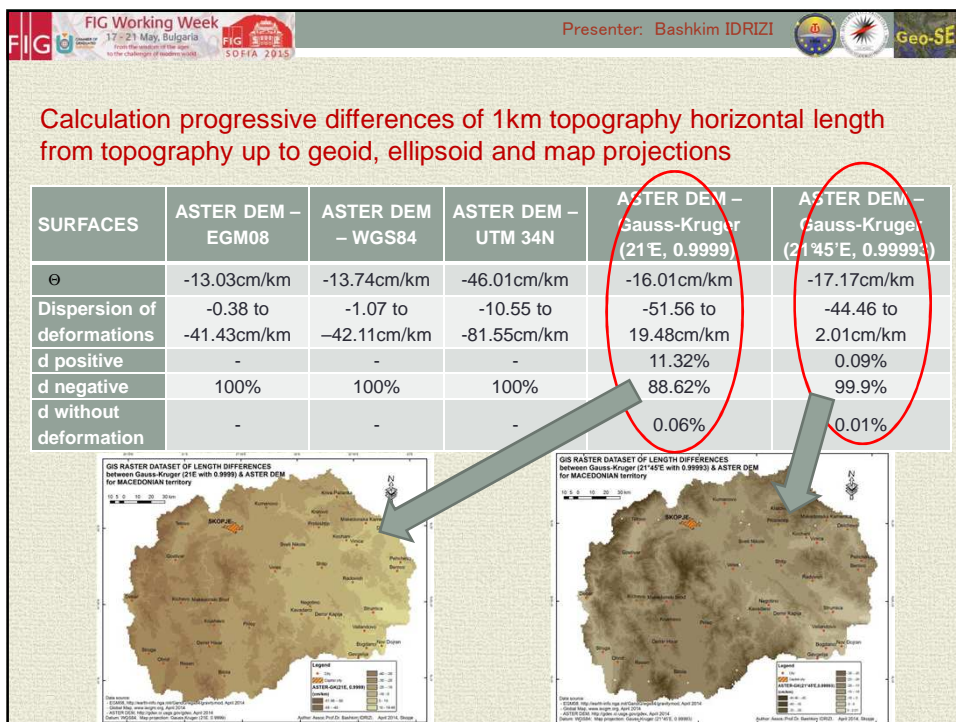
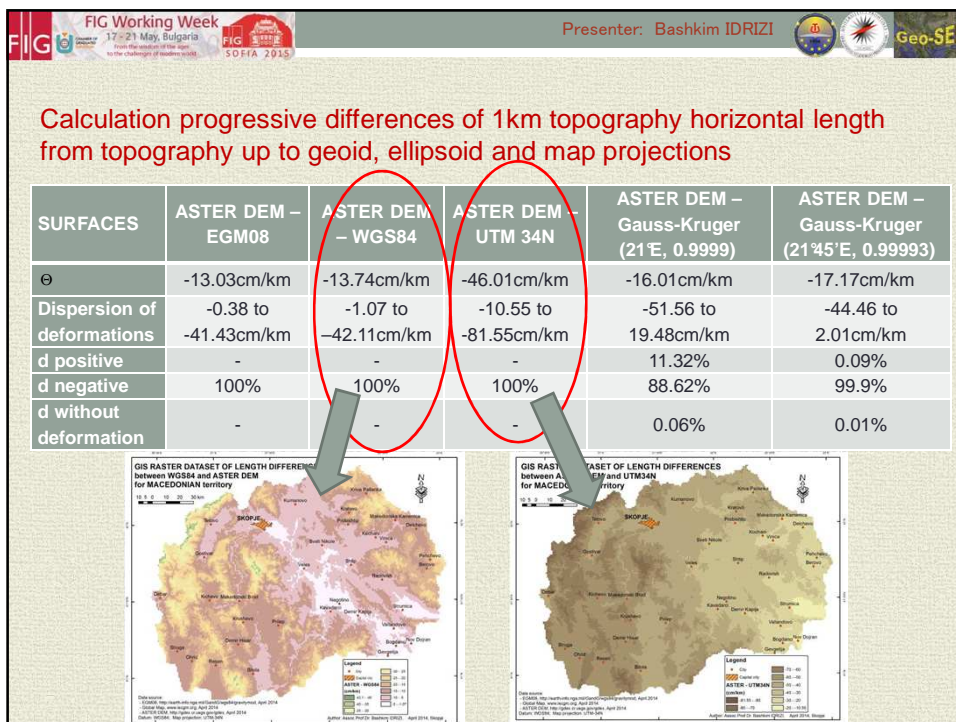


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CONCLUSIONS

- Computed linear deformation values, in most of cases have largely avoided from expected values;
- Extreme length differences in all cases doesn't reached same values with opposite prefix,
- Mean linear differences in all cases didn't have values nearby zero (all of them are with negative prefix),

Mean linear deformations of 1km length

ASTER DEM – EGM08	EGM08 – WGS84	WGS84 – UTM34N	WGS84 – Gauss- Kruger (21°E, 0.9999)	WGS84 – Gauss- Kruger (21°45'E, 0.99993)	ASTER DEM – WGS84	ASTER DEM – UTM 34N	ASTER DEM – Gauss- Kruger (21°E, 0.9999)	ASTER DEM – Gauss- Kruger (21°45'E, 0.99993)
-13.03	-0.7	-32.28	-2.27	-3.44	-13.74	-46.01	-16.01	-17.17

- Dispersion of length differences didn't reach the criteria of uniform dispersion which was resulted with to large differences between areas with negative and positive linear deformations

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- During establishing of the state coordinate systems were not taken in to account all length reductions beginning from the topography up to map projection;
- Database in national level has to be developed, and it has to be open and free for usage by geo community;
- Database of length differences is very important for high accuracy geodetic measurements, combination of measurements by GPS and total station, as well transformation of local networks from free oriented in to state coordinate system;
- Contemporary technic and technology enables us realizing the calculation methodology of length differences with such a big number of test model points, which in past period was not possible;
- Obtained results generated further researches, mainly by performing analyses for defining of state coordinate systems by including of successive length reductions from topography up to map projections surface through geoid and earth ellipsoid, to be done in next period!

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