



NOVÝ PREPOČET SÚRADNÍC SKPOS A ICH PRÍSPEVOK KU GEOKINEMATIKE SLOVENSKA

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MEDZINÁRODNÁ KONFERENCIA TATRY 2022
GLOBÁLNA GEODÉZIA A GEOINFORMATIKA

Štrbské Pleso, 24.-25.11.2022



GKÚ Bratislava

Oddelenie SKPOS®

■ Národné servisné centrum SKPOS:

- ✓ prevádzka polohovej služby SKPOS
- ✓ prevádzka a údržba staníc SKPOS

■ Operačné centrum EPN:

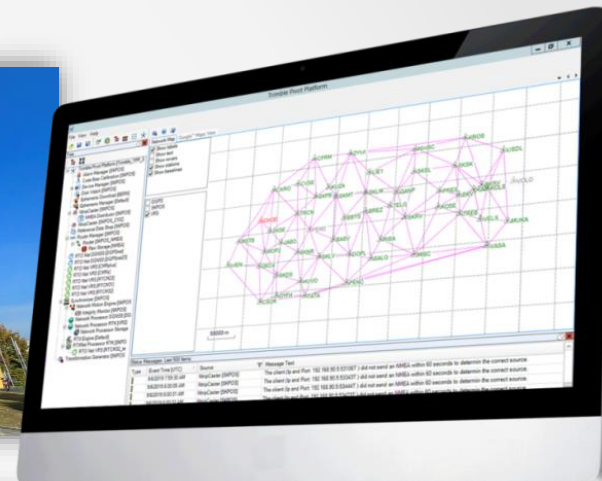
- ✓ správa a distribúcia údajov zo staníc EPN^(SK)

■ Analyzačné centrum EPN Dens:

- ✓ monitoring a analýza staníc SKPOS
- ✓ rutinné spracovanie siete SKPOS

■ Projekty:

- ✓ EUREF-IP
- ✓ EUREF Densifications
- ✓ EUREF Dense Velocities
- ✓ CEGRN
- ✓ E-GVAP
- ✓ EPOS



Motivácia pre nový prepočet súradníc

2011

SKTRF 2009: ETRS89 (ETRF2000) epocha 2008.5

- ✓ 1. multi-ročné spracovanie SKPOS (2007 – 2009)
- ✓ výpočet: **súradnice**
- ✓ národná realizácia ETRS89 (**nebola validovaná EUREF GB**)

2021

SKTRF 2020: ETRS89 (ETRF2000) epocha 2008.5

- ✓ 2. multi-ročné spracovanie SKPOS (2007 – 2020)
- ✓ výpočet: **súradnice + rýchlosti**
- ✓ **nová** národná realizácia ETRS89 (**validovaná EUREF GB**)

NEW

Inšpirované multi-ročným spracovaním siete ESTPOS (EUREF Sympóziu 2019, Tallin)

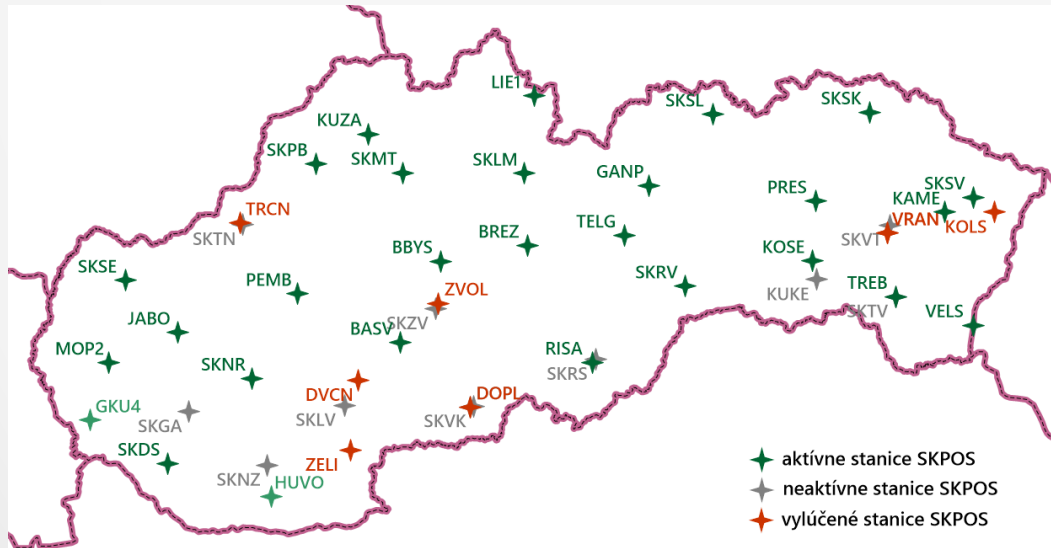
Výber staníc SKPOS do spracovania

■ Súčasťou spracovania (38):

- ✓ 28 aktívnych
- ✓ 10 neaktívnych

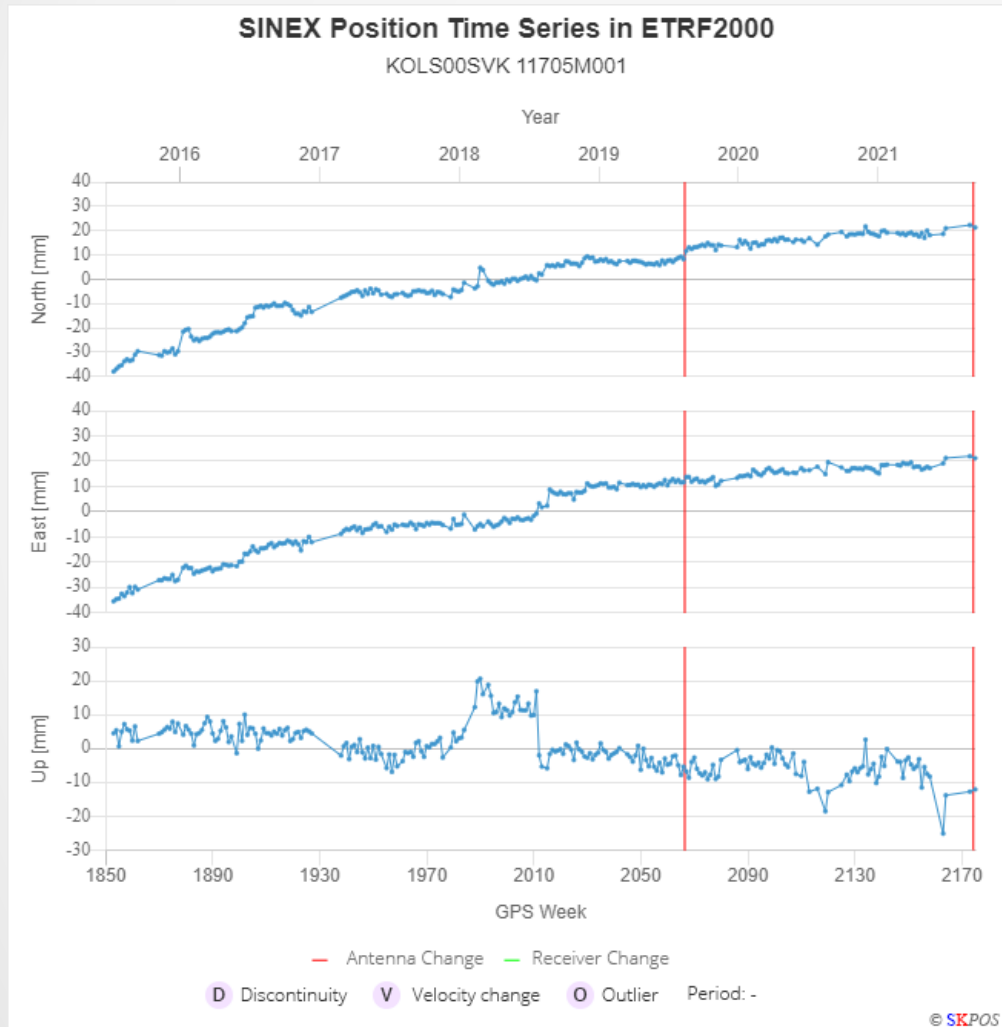
■ Vylúčené zo spracovania (7):

- ✓ krátka prevádzka: DVCN, TRCN, VRAN, ZELI, ZVOL
- ✓ nestabilný ČR: DOPL, KOLS (analyzujeme)



Stanica	Názov	9-miestne ID	DOMES #	Status	Doba spracovania (v rokoch)
BASV	Banská Štiavnica	BASV00SVK	11701M001	aktívna	7.0
BBYS	Banská Bystrica	BBYS00SVK	11514M001	aktívna	14.0
BREZ	Brezno	BREZ00SVK	11551M001	aktívna	10.4
DOPL	Dolné Plachtince	DOPL00SVK	11707M001	aktívna	3.7
DVCN	Devičany	DVCN00SVK	11709M001	aktívna	0.0
GANP	Gánovce	GANP00SVK	11515M001	aktívna	14.0
GKU4	GKU Bratislava	GKU400SVK	11505M002	aktívna	14.0
HUVO	Hurbanovo	HUVO00SVK	11706M001	aktívna	3.8
JABO	Jaslovská Bohunice	JABO00SVK	11552M001	aktívna	10.4
KAME	Kamenica n. Cirochou	KAME00SVK	11703M001	aktívna	7.0
KOLS	Kolonica	KOLS00SVK	11705M001	aktívna	5.5
KOSE	Košice	KOSE00SVK	11572M001	aktívna	8.3
KUKE	Košice	KUKE00SVK	11531M001	neaktívna	5.8
KUZA	Žilina	KUZA00SVK	11532M001	aktívna	14.0
LIE1	Liesek	LIE100SVK	11533M001	aktívna	14.0
MOP2	Modra-Piesok	MOP200SVK	11507M002	aktívna	13.1
PEMB	Partizánske	PEMB00SVK	11534M001	aktívna	13.7
PRES	Prešov	PRES00SVK	11535M001	aktívna	14.0
RISA	Rimavská Sobota	RISA00SVK	11541M002	aktívna	7.1
SKDS	Dunajská Streda	SKDS00SVK	11554M001	aktívna	9.1
SKGA	Galanta	SKGA00SVK	11536M001	neaktívna	4.9
SKLM	Liptovský Mikuláš	SKLM00SVK	11537M001	aktívna	14.0
SKLV	Levice	SKLV00SVK	11538M001	neaktívna	13.0
SKMT	Martin	SKMT00SVK	11539M001	aktívna	11.4
SKNR	Nitra	SKNR00SVK	11573M001	aktívna	8.3
SKNZ	Nové Zámky	SKNZ00SVK	11540M001	neaktívna	10.3
SKPB	Považská Bystrica	SKPB00SVK	11577M001	aktívna	8.0
SKRS	Rimavská Sobota	SKRS00SVK	11541M001	neaktívna	7.0
SKRV	Rožňava	SKRV00SVK	11542M001	aktívna	14.0
SKSE	Senica	SKSE00SVK	11543M001	aktívna	14.0
SKSK	Svidník	SKSK00SVK	11544M001	aktívna	14.0
SKSL	Stará Ľubová	SKSL00SVK	11545M001	aktívna	14.0
SKSV	Snina	SKSV00SVK	11546M001	aktívna	14.0
SKTN	Trenčín	SKTN00SVK	11547M001	neaktívna	12.3
SKTV	Trebišov	SKTV00SVK	11548M001	neaktívna	3.7
SKVK	Veľký Krtíš	SKVK00SVK	11549M001	neaktívna	10.5
SKVT	Vranov n. Topľou	SKVT00SVK	11553M001	neaktívna	10.8
SKZV	Zvolen	SKZV00SVK	11550M001	neaktívna	12.3
TELG	Telgárt	TELG00SVK	11702M001	aktívna	7.0
TRCN	Trenčín	TRCN00SVK	11547M002	aktívna	2.1
TREB	Trebišov	TREB00SVK	11548M002	aktívna	10.3
VELS	Veľké Slemence	VELS00SVK	11704M001	aktívna	6.0
VRAN	Vranov n. Topľou	VRAN00SVK	11553M002	aktívna	0.0
ZELI	Želiezovce	ZELI00SVK	11710M001	aktívna	0.0
ZVOL	Zvolen	ZVOL00SVK	11708M001	aktívna	0.2

Vylúčená stanica - KOLS



Podozrenie na svahový pohyb

Vylúčená stanica - KOLS



Rutinné spracovanie siete SKPOS



EUREF AC Workshop 2019

Bernese course 2020

Parameter / Kampaň	REPRO (GPS týždne 1408 - 1933)	OPERATIONAL (GPS týždne 1934 - 2085)	OPERATIONAL (GPS týždne 2086 - 2138)
Referenčný rámec	IGb08	IGS14	IGS14 (since 2106 IGb14)
Kalib. model antény	epn_08.atx	epn_14.atx	epn_14.atx
Produkty CODE	REPRO_2015 (GPS+GLO)	final (GPS+GLO)	rapid (GPS+GLO+GAL)
Orbitálny model CODE	DYX sun-oriented (old)	D2X sun-oriented (new)	D2X sun-oriented (new)
Súbory RINEX	RINEX v2	RINEX v2	RINEX v2 + RINEX v3
Družicové systémy	GPS+GLO	GPS+GLO	GPS+GLO+GAL
Riešenie EPN	EPN_A_IGb08_C1934.SNX	EPN_A_IGb14_C2130.SNX	EPN_A_IGb14_C2130.SNX
Typ spracovania	Network DD		
Strat. sprac. základníc	OBS-MAX		
Strat. riešenia ambiguit	L5/L3, QIF, L1/L2 (v závislosti od dĺžky základnice)		
Model troposféry	VMF1		
Model ionosféry	CODE		
Oceánske slapy	FES2004		
Atmosférické slapy	generované softvérom Bernese 5.2		

■ Nová stratégia výpočtu:

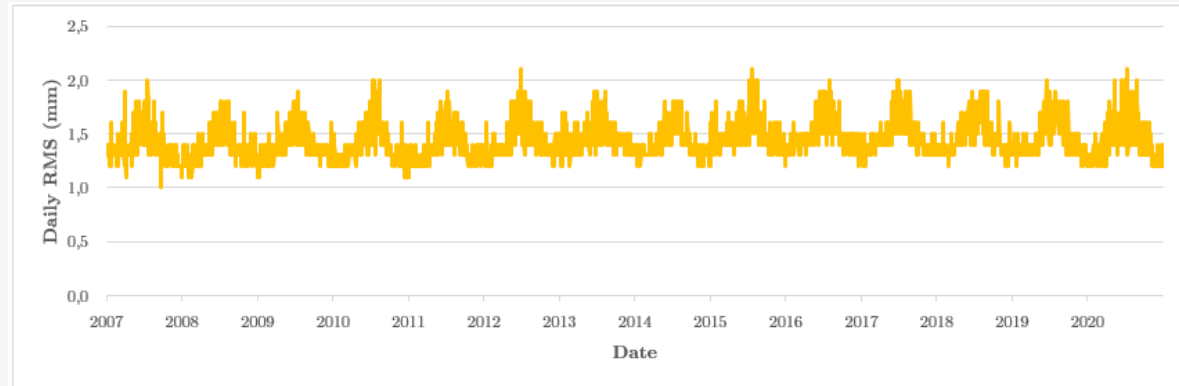
- ✓ v súlade so smernicami EUREF/EPN
- ✓ kampane REPRO/OPERATIONAL
- ✓ nové nastavenia: OBS-MAX, ...
- ✓ nové GNSS produkty: CODE
- ✓ nové referenčné stanice EPN
- ✓ od 01.01.2020: riešenie GPS+GLO+GAL

Referenčné stanice EPN (http://epncb.oma.be/_productsservices/ReferenceFrame/)

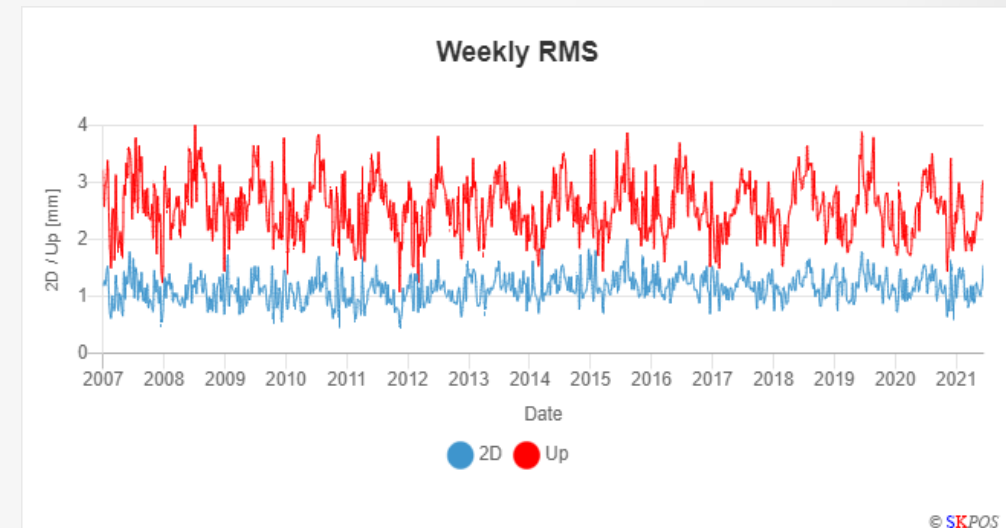
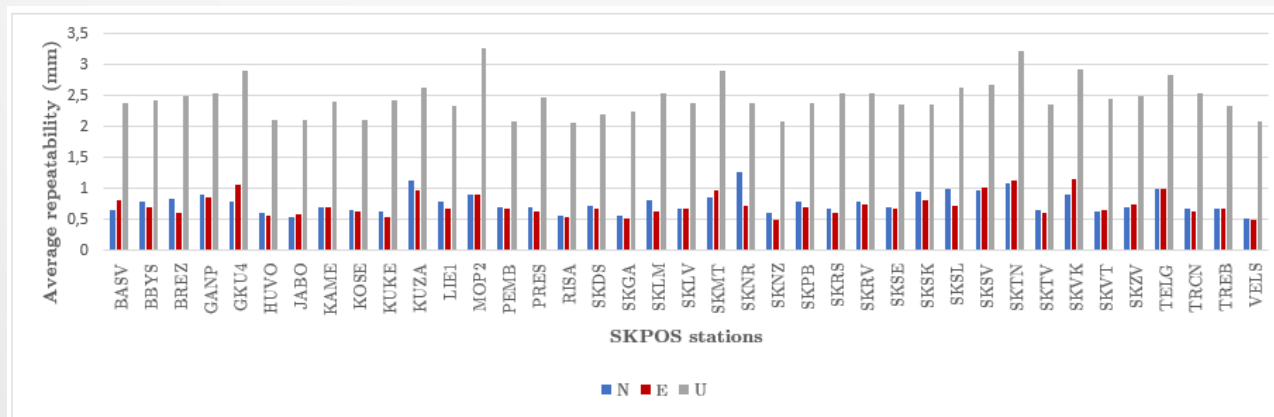
Stanica	Názov stanice	9-miestne ID	DOMES #	Klasifikácia EPN
BAIA	Baia Mare	BAIA00ROU	11406M001	C0
BBYS	Banská Bystrica	BBYS00SVK	11514M001	C3
BOR1	Borowiec	BOR100POL	12205M002	C0
GOPE	Pecný	GOPE00CZE	11502M002	C0
GRAZ	Graz	GRAZ00AUT	11001M002	C0
JOZ2	Jozefoslaw	JOZ200POL	12204M002	C0
OROS	Orosháza	OROS00HUN	11207M001	C2
PENC	Penc	PENC00HUN	11206M006	C0
TUBO	Brno	TUBO00CZE	11503M001	C1
USDL	Ustrzyki Dolne	USDL00POL	12229M001	C0

Rutinné spracovanie siete SKPOS

- Denné sieťové riešenia SKPOS



- Týždenné sieťové riešenia SKPOS



Nové multi-ročné spracovanie SKPOS

GPS týždne 1408 - 2138

POSTUP:

- 1. Transformácia REPRO týždenných riešení z IGb08 do IGS14**
 - pomocou latitude-dependent models and skriptov IGS (GPS týždne 1408 – 1933)
- 2. Konverzia SINEX riešení na NEQs**
 - SNX2NQ0 (Bernese 5.2)
- 3. Analýza časových radov**
 - FODITS (Bernese 5.2)
 - odhad diskontinuít EPN a SKPOS staníc
- 4. Výpočet multi-ročného riešenia**
 - ADDNEQ2 (Bernese 5.2)
 - CRD a VEL naviazané na EPN_A_IGb14_C2130
 - Podmienka: „*minimum constraints (No Net Translation)*“

Referenčné stanice EPN v multi-ročnom spracovaní

Stanica	Názov stanice	9-miestne ID	DOMES #	Klasifikácia EPN	Použitá riešenia
BAIA	Baia Mare	BAIA00ROU	11406M001	C0	1, 2
BBYS	Banská Bystrica	BBYS00SVK	11514M001	C3	2, 3, 4, 5, 6, 7
BOR1	Borowiec	BOR100POL	12205M002	C0	2, 3
CFRM	Frýdek-Místek	CFRM00CZE	11525M001	C2	1, 2
GOPE	Pecný	GOPE00CZE	11502M002	C0	5, 6
GRAZ	Graz	GRAZ00AUT	11001M002	C0	6, 7, 8
JOZ2	Jozefoslaw	JOZ200POL	12204M002	C0	1, 2, 3
JOZE	Jozefoslaw	JOZE00POL	12204M001	C0	2, 3
OROS	Orosháza	OROS00HUN	11207M001	C2	3, 4, 5, 6
PENC	Penc	PENC00HUN	11206M006	C0	2, 3
SULP	Lviv	SULP00UKR	12366M001	C2	2, 3
TUBO	Brno	TUBO00CZE	11503M001	C1	2, 3, 4, 5
USDL	Ustrzyki Dolne	USDL00POL	12229M001	C0	1, 2
UZHL	Uzhorod	UZHL00UKR	12301M001	C2	1, 2, 3, 4

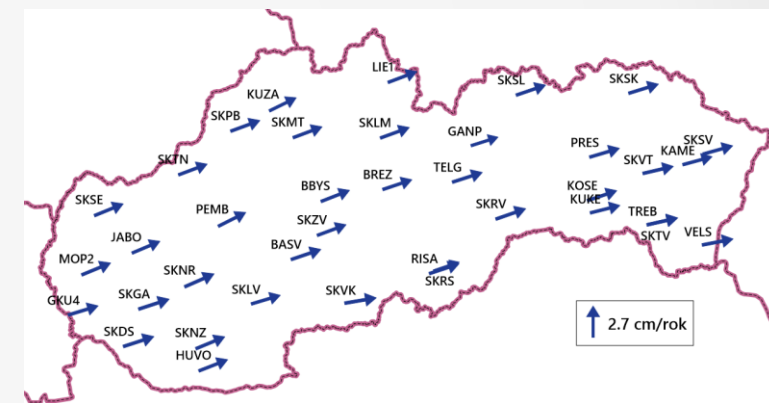
Nové multi-ročné spracovanie SKPOS

GPS týždne 1408 - 2138

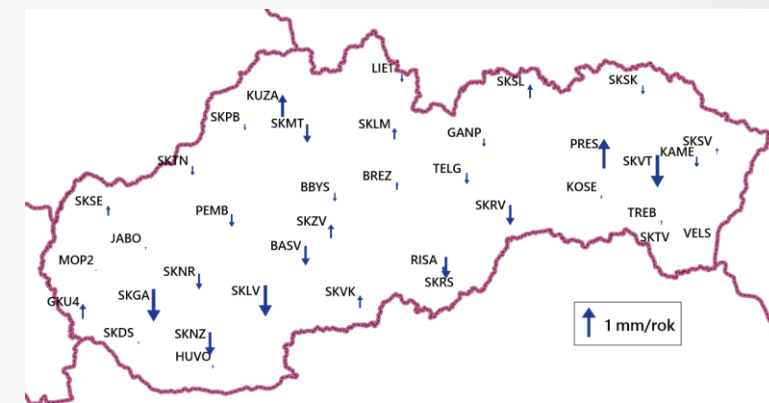
VÝSLEDKY: Súradnice a rýchlosti (IGb14, epocha 2008.5)

Stanica	Číslo riešenia	Súradnice v IGB14			Rýchlosti v IGB14		
		X (m)	Y (m)	Z (m)	v _x (m/rok)	v _y (m/rok)	v _z (m/rok)
BASV	1	4009951.8332	1374556.9296	4750511.5873	-0.01799	0.01701	0.00939
BASV	2	4009951.8315	1374556.9287	4750511.5816	-0.01799	0.01701	0.00939
BASV	3	4009951.8396	1374556.9278	4750511.5833	-0.01799	0.01701	0.00939
BBYS	2	3980358.7396	1382292.1458	4772771.9825	-0.01769	0.01644	0.00959
BBYS	3	3980358.7417	1382292.1439	4772771.9808	-0.01769	0.01644	0.00959
BBYS	4	3980358.7538	1382292.1517	4772771.9947	-0.01769	0.01644	0.00959
BBYS	5	3980358.7587	1382292.1493	4772771.9910	-0.01769	0.01644	0.00959
BBYS	6	3980358.7394	1382292.1507	4772771.9900	-0.01769	0.01644	0.00959
BBYS	7	3980358.7546	1382292.1527	4772771.9916	-0.01769	0.01644	0.00959
BREZ	1	3963888.6204	1414441.1503	4777132.1129	-0.01751	0.01675	0.00980
GANP	2	3929181.4554	1455236.7874	4793653.9309	-0.01706	0.01561	0.00879
GANP	4	3929181.4679	1455236.7865	4793653.9421	-0.01696	0.01561	0.00879
GKU4	1	4072810.6010	1258557.0323	4728707.8337	-0.01660	0.01788	0.01010
GKU4	2	4072810.5926	1258557.0227	4728707.8319	-0.01660	0.01788	0.01010
HUVO	1	4072065.6880	1338280.3857	4707504.5548	-0.01728	0.01693	0.00994
JABO	2	4035865.6366	1285295.3667	4753013.6313	-0.01697	0.01671	0.00991
KAME	1	3892531.9598	1572220.6099	4785952.7944	-0.01820	0.01601	0.00907
KAME	2	3892531.9569	1572220.6092	4785952.7878	-0.01820	0.01601	0.00907
KAME	3	3892531.9608	1572220.6105	4785952.7918	-0.01820	0.01601	0.00907
KAME	4	3892531.9593	1572220.6113	4785952.7942	-0.01820	0.01601	0.00907
KOSE	1	3926968.3513	1526728.7757	4772720.6613	-0.01824	0.01624	0.00963
KOSE	2	3926968.3466	1526728.7730	4772720.6514	-0.01824	0.01624	0.00963
KOSE	3	3926968.3518	1526728.7752	4772720.6614	-0.01824	0.01624	0.00963
KUKE	1	3931776.4637	1530488.3901	4767565.9933	-0.01922	0.01596	0.00758
KUZA	1	3952344.5102	1340788.1770	4807403.2707	-0.01704	0.01603	0.01037
KUZA	3	3952344.5149	1340788.1870	4807403.2738	-0.01704	0.01603	0.01037
LIE1	1	3918778.8129	1401454.5436	4817956.9057	-0.01797	0.01639	0.00948
LIE1	2	3918778.8176	1401454.5460	4817956.9041	-0.01797	0.01639	0.00948
LIE1	3	3918778.8341	1401454.5477	4817956.9175	-0.01797	0.01639	0.00948
LIE1	4	3918778.8356	1401454.5463	4817956.9162	-0.01797	0.01639	0.00948
MOP2	1	4053742.5872	1260569.7222	4744940.1897	-0.01720	0.01723	0.01009
PEMB	1	4009007.5265	1329009.4446	4763668.2648	-0.01790	0.01625	0.00995
PEMB	2	4009007.5374	1329009.4468	4763668.2769	-0.01790	0.01625	0.00995

PRES	1	3909048.1223	1521301.4979	4789029.5223	-0.01762	0.01671	0.01025
PRES	2	3909048.1225	1521301.5012	4789029.5171	-0.01762	0.01671	0.01025
RISA	1	3988762.7473	1452240.2352	4744788.0719	-0.01773	0.01687	0.00998
SKDS	1	4075845.8499	1293505.4521	4716694.2046	-0.01763	0.01738	0.01050
SKDS	2	4075845.8490	1293505.4387	4716694.2029	-0.01763	0.01738	0.01050
SKGA	1	4057833.9910	1297134.0516	4731114.5289	-0.01812	0.01768	0.00927
SKGA	2	4057833.9969	1297134.0547	4731114.5281	-0.01812	0.01768	0.00927
SKGA	3	4057833.9935	1297134.0523	4731114.5309	-0.01812	0.01768	0.00927
SKLM	1	3943154.5497	1405526.2812	4796851.7325	-0.01755	0.01664	0.00993
SKLM	2	3943154.5546	1405526.2808	4796851.7335	-0.01755	0.01664	0.00993
SKLV	1	4035647.0347	1358582.8057	4732883.3622	-0.01754	0.01678	0.00877
SKLV	2	4035647.0396	1358582.8101	4732883.3767	-0.01754	0.01678	0.00877
SKLV	3	4035647.0377	1358582.8150	4732883.3805	-0.01754	0.01678	0.00877
SKMT	1	3959341.5691	1358186.7778	4796892.9065	-0.01798	0.01665	0.00932
SKNR	1	4039951.0789	1319218.0641	4740290.1459	-0.01819	0.01712	0.01004
SKNZ	1	4063433.4382	1333643.0252	4716233.1588	-0.01792	0.01686	0.00963
SKNZ	2	4063433.4368	1333643.0271	4716233.1552	-0.01792	0.01686	0.00963
SKPB	1	3968081.1415	1323422.1898	4799236.2281	-0.01765	0.01698	0.00962
SKRS	1	3987412.2988	1453204.0483	4745629.9926	-0.01825	0.01640	0.00912
SKRV	1	3953193.5654	1480301.0342	4765817.7446	-0.01864	0.01654	0.00943
SKSE	1	4026909.4674	1259882.9922	4767332.7559	-0.01708	0.01721	0.01018
SKSE	2	4026909.4679	1259882.9943	4767332.7516	-0.01708	0.01721	0.01018
SKSK	1	3874879.0109	1531897.7371	4813203.5056	-0.01850	0.01623	0.00932
SKSL	1	3898822.5082	1472199.1959	4812907.3472	-0.01790	0.01651	0.00993
SKSV	1	3883835.4534	1581339.8647	4790061.3564	-0.01821	0.01625	0.00956
SKSV	3	3883835.4551	1581339.8662	4790061.3561	-0.01821	0.01625	0.00956
SKSV	4	3883835.4620	1581339.8677	4790061.3625	-0.01821	0.01625	0.00956
SKTN	1	3995512.9257	1300761.8806	4782649.4659	-0.01734	0.01682	0.00949
SKTN	2	3995512.9258	1300761.8835	4782649.4724	-0.01734	0.01682	0.00949
SKTV	1	3924504.1042	1563219.7000	4762831.1394	-0.01822	0.01693	0.00957
SKVK	1	4018088.9501	1410974.8167	4732589.9012	-0.01726	0.01813	0.00970
SKVT	1	3904652.8752	1552694.1820	4782421.1171	-0.01876	0.01643	0.00859
SKZV	1	3994941.2088	1385136.6635	4759661.2368	-0.01725	0.01677	0.01011
TELG	1	3947395.8319	1451396.2967	4780198.0638	-0.01824	0.01673	0.00948
TREB	1	3924512.6352	1563232.1831	4762817.8309	-0.01822	0.01693	0.00957
TREB	2	3924512.6369	1563232.1866	4762817.8360	-0.01822	0.01693	0.00957
VELS	1	3920780.4094	1596275.1053	4754941.2203	-0.01819	0.01685	0.00941



Horizontálne rýchlosti v IGB14



Vertikálne rýchlosti v IGB14

Nové multi-ročné spracovanie SKPOS

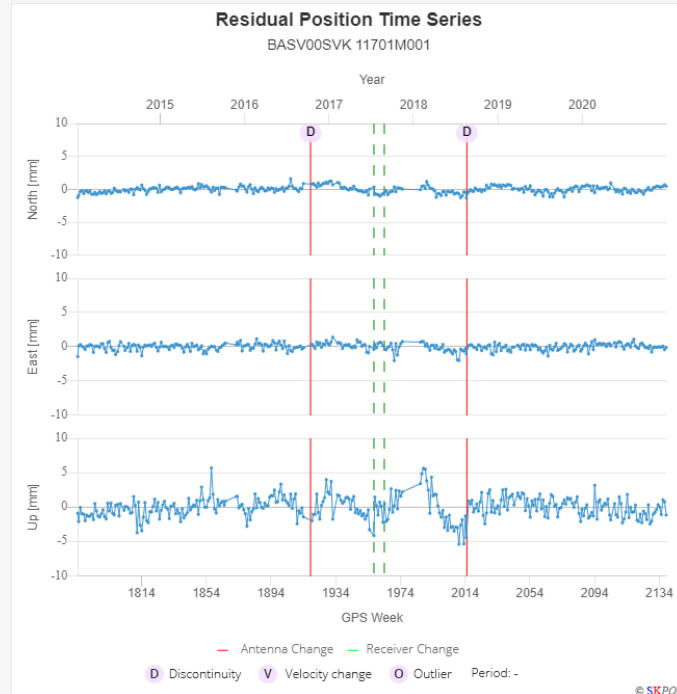
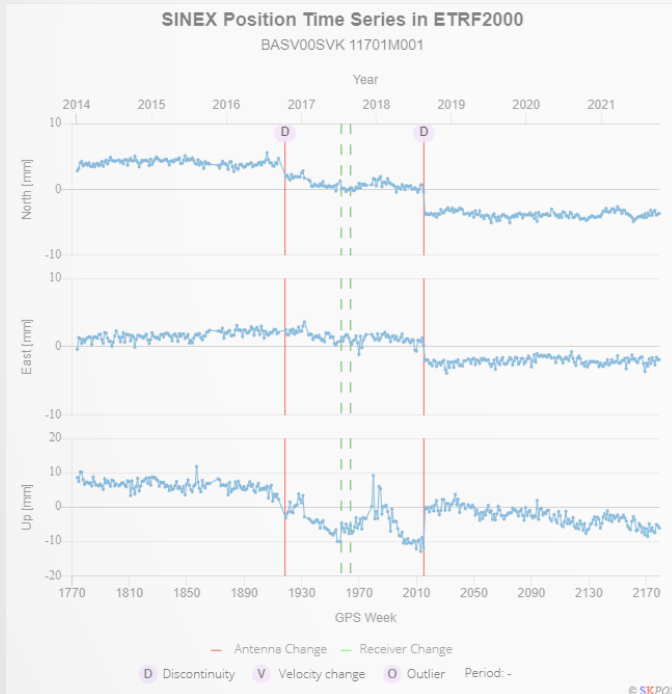
GPS týždne 1408 - 2138

VÝSLEDKY:

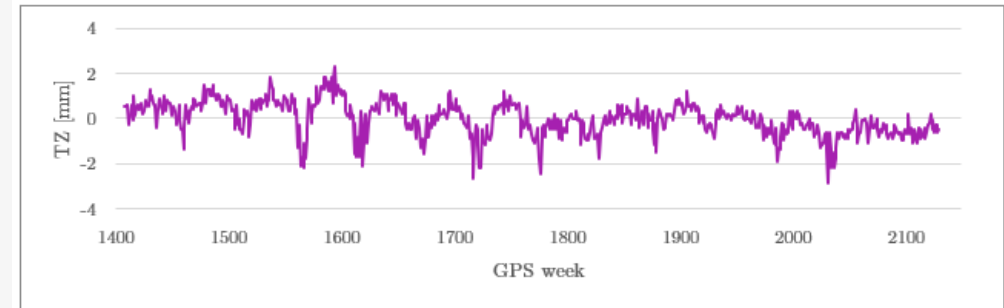
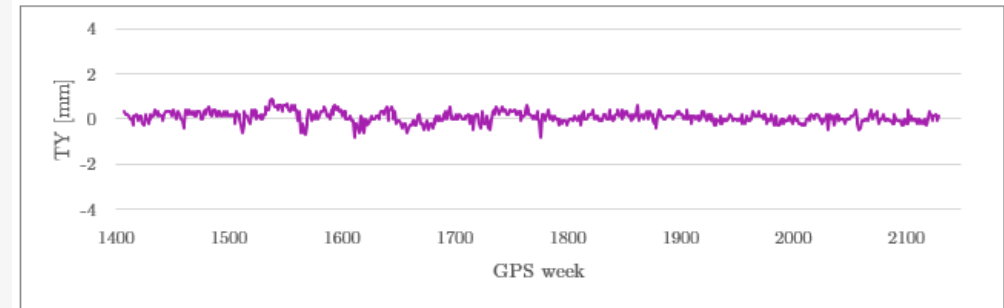
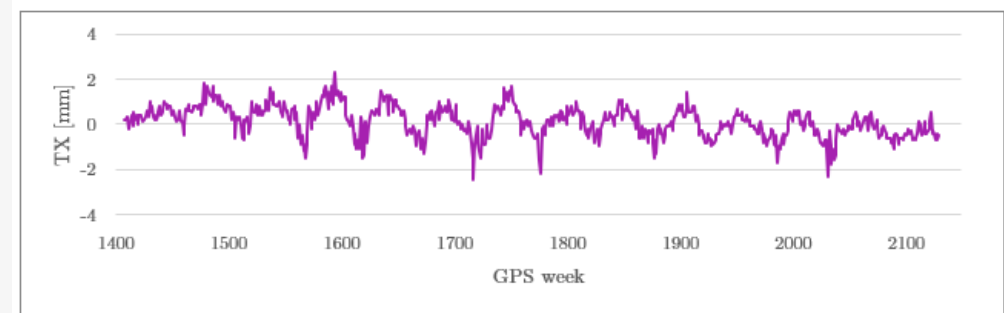
Časový rad v ETRF2000



Reziduálny časový rad



Helmertové transformačné parametre



Overenie výsledkov s EPN/EPN D

- Výsledky multi-ročného riešenia SKPOS sa porovnali s tromi kumulatívnymi riešeniami EPN/EPN D:

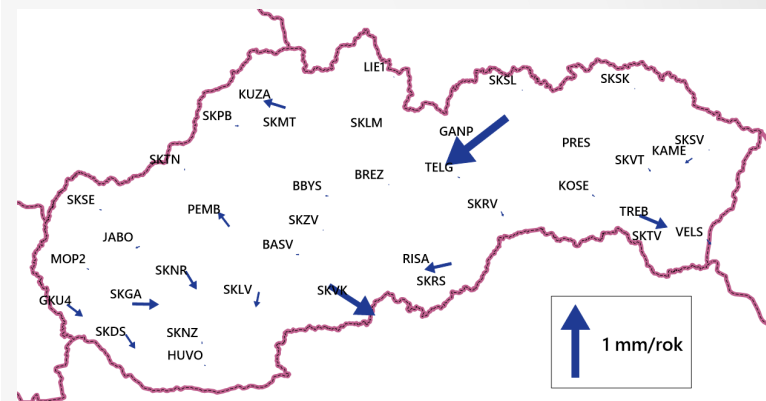
Kumulatívne riešenie	Autor	Porovnávané stanice (#)	Rozdiely v polohe > 5 mm	Rozdiely v rýchlosti > 0.5 mm/rok
EPN (C2130)	Juliette Legrand	EPN (18)	0x	0x
EPN Densification (C2145)	Joaquin Zurutuza	SKPOS (38)	1x	2x
EPN Densification (D2100)	Ambrus Kenyeres	SKPOS (28)	2x	4x

Nové súradnice a rýchlosti SKPOS staníc

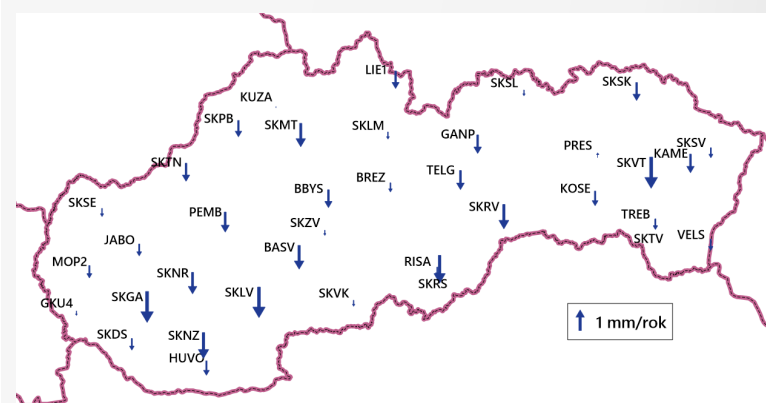
ETRF2000 (epocha 2008.5)

Stanica	Číslo riešenia	Súradnice v IGb14			Rýchlosti v IGb14		
		X (m)	Y (m)	Z (m)	v _x (m/rok)	v _y (m/rok)	v _z (m/rok)
BASV	1	4009952.2186	1374556.6477	4750511.3501	-0.00089	-0.00000	-0.00097
BASV	2	4009952.2168	1374556.6468	4750511.3444	-0.00089	-0.00000	-0.00097
BASV	3	4009952.2250	1374556.6459	4750511.3461	-0.00089	-0.00000	-0.00097
BBYS	2	3980359.1265	1382291.8660	4772771.7467	-0.00051	-0.00047	-0.00070
BBYS	3	3980359.1287	1382291.8641	4772771.7451	-0.00051	-0.00047	-0.00070
BBYS	4	3980359.1407	1382291.8719	4772771.7590	-0.00051	-0.00047	-0.00070
BBYS	5	3980359.1457	1382291.8695	4772771.7552	-0.00051	-0.00047	-0.00070
BBYS	6	3980359.1263	1382291.8709	4772771.7543	-0.00051	-0.00047	-0.00070
BBYS	7	3980359.1415	1382291.8729	4772771.7558	-0.00051	-0.00047	-0.00070
BREZ	1	3963889.0099	1414440.8718	4777131.8782	-0.00019	-0.00009	-0.00044
GANP	2	3929181.8486	1455236.5114	4793653.6981	0.00045	-0.00110	-0.00135
GANP	4	3929181.8611	1455236.5105	4793653.7094	0.00055	-0.00110	-0.00135
GKU4	1	4072810.9768	1258556.7457	4728707.5927	0.00001	0.00062	-0.00046
GKU4	2	4072810.9684	1258556.7360	4728707.5909	0.00001	0.00062	-0.00046
HUVO	1	4072066.0688	1338280.0994	4707504.3144	-0.00041	-0.00031	-0.00059
JABO	2	4035866.0155	1285295.0827	4753013.3922	-0.00020	-0.00041	-0.00055
KAME	1	3892532.3614	1572220.3369	4785952.5642	-0.00026	-0.00054	-0.00093
KAME	2	3892532.3584	1572220.3362	4785952.5576	-0.00026	-0.00054	-0.00093
KAME	3	3892532.3624	1572220.3375	4785952.5616	-0.00026	-0.00054	-0.00093
KAME	4	3892532.3609	1572220.3383	4785952.5640	-0.00026	-0.00054	-0.00093
KOSE	1	3926968.7489	1526728.5001	4772720.4292	-0.00051	-0.00044	-0.00047
KOSE	2	3926968.7443	1526728.4974	4772720.4192	-0.00051	-0.00044	-0.00047
KOSE	3	3926968.7495	1526728.4997	4772720.4292	-0.00051	-0.00044	-0.00047
KUKE	1	3931776.8614	1530488.1142	4767565.7609	-0.00148	-0.00074	-0.00253
KUZA	1	3952344.8956	1340787.8990	4807403.0360	0.00006	-0.00079	0.00014
KUZA	3	3952344.9002	1340787.9090	4807403.0392	0.00006	-0.00079	0.00014
LIE1	1	3918779.2033	1401454.2680	4817956.6731	-0.00061	-0.00030	-0.00065
LIE1	2	3918779.2079	1401454.2705	4817956.6715	-0.00061	-0.00030	-0.00065
LIE1	3	3918779.2244	1401454.2722	4817956.6848	-0.00061	-0.00030	-0.00065
LIE1	4	3918779.2260	1401454.2708	4817956.6836	-0.00061	-0.00030	-0.00065
MOP2	1	4053742.9638	1260569.4369	4744939.9496	-0.00054	0.00004	-0.00042
PEMB	1	4009007.9091	1329009.1626	4763668.0273	-0.00094	-0.00077	-0.00043
PEMB	2	4009007.9199	1329009.1648	4763668.0394	-0.00094	-0.00077	-0.00043
PRES	1	3909048.5202	1521301.2236	4789029.2910	0.00013	0.00009	0.00019
PRES	2	3909048.5205	1521301.2268	4789029.2857	0.00013	0.00009	0.00019

RISA	1	3988763.1382	1452239.9551	4744787.8363	-0.00034	-0.00005	-0.00030
SKDS	1	4075846.2278	1293505.1654	4716693.9636	-0.00091	0.00012	-0.00006
SKDS	2	4075846.2268	1293505.1520	4716693.9619	-0.00091	0.00012	-0.00006
SKGA	1	4057834.3697	1297133.7661	4731114.2889	-0.00135	0.00048	-0.00124
SKGA	2	4057834.3757	1297133.7692	4731114.2880	-0.00135	0.00048	-0.00124
SKGA	3	4057834.3723	1297133.7668	4731114.2909	-0.00135	0.00048	-0.00124
SKLM	1	3943154.9394	1405526.0040	4796851.4987	-0.00022	-0.00013	-0.00026
SKLM	2	3943154.9443	1405526.0036	4796851.4998	-0.00022	-0.00013	-0.00026
SKLV	1	4035647.4181	1358582.5220	4732883.1237	-0.00054	-0.00032	-0.00166
SKLV	2	4035647.4230	1358582.5263	4732883.1381	-0.00054	-0.00032	-0.00166
SKLV	3	4035647.4211	1358582.5313	4732883.1420	-0.00054	-0.00032	-0.00166
SKMT	1	3959341.9553	1358186.4993	4796892.6716	-0.00083	-0.00019	-0.00093
SKNR	1	4039951.4597	1319217.7799	4740289.9069	-0.00132	-0.00001	-0.00042
SKNZ	1	4063433.8190	1333642.7394	4716232.9187	-0.00105	-0.00035	-0.00088
SKNZ	2	4063433.8176	1333642.7414	4716232.9151	-0.00105	-0.00035	-0.00088
SKPB	1	3968081.5252	1323421.9106	4799235.9925	-0.00063	0.00011	-0.00066
SKRS	1	3987412.6898	1453203.7683	4745629.7571	-0.00086	-0.00051	-0.00116
SKRV	1	3953193.9592	1480300.7566	4765817.5108	-0.00110	-0.00025	-0.00076
SKSE	1	4026909.8450	1259882.7087	4767332.5171	-0.00037	0.00011	-0.00027
SKSE	2	4026909.8455	1259882.7108	4767332.5128	-0.00037	0.00011	-0.00027
SKSK	1	3874879.4107	1531897.4652	4813203.2760	-0.00066	-0.00027	-0.00065
SKSL	1	3898822.9036	1472198.9221	4812907.1160	-0.00028	-0.00009	-0.00012
SKSL	2	3898822.9085	1472198.9210	4812907.1155	-0.00028	-0.00009	-0.00012
SKSV	1	3883835.8558	1581339.5923	4790061.1267	-0.00023	-0.00027	-0.00042
SKSV	3	3883835.8575	1581339.5939	4790061.1264	-0.00023	-0.00027	-0.00042
SKSV	4	3883835.8644	1581339.5954	4790061.1328	-0.00023	-0.00027	-0.00042
SKTN	1	3995513.3070	1300761.5994	4782649.2289	-0.00044	-0.00016	-0.00086
SKTN	2	3995513.3071	1300761.6023	4782649.2354	-0.00044	-0.00016	-0.00086
SKTV	1	3924504.5041	1563219.4248	4762830.9076	-0.00037	0.00026	-0.00052
SKVK	1	4018089.3374	1410974.5344	4732589.6638	-0.00006	0.00110	-0.00067
SKVT	1	3904653.2752	1552693.9081	4782420.8862	-0.00091	-0.00017	-0.00145
SKZV	1	3994941.5953	1385136.3827	4759661.0004	-0.00009	-0.00019	-0.00021
TELG	1	3947396.2242	1451396.0194	4780197.8301	-0.00078	-0.00004	-0.00070
TREB	1	3924513.0351	1563231.9079	4762817.5992	-0.00037	0.00026	-0.00052
TREB	2	3924513.0368	1563231.9114	4762817.6042	-0.00037	0.00026	-0.00052
VELS	1	3920780.8114	1596274.8305	4754940.9889	-0.00023	0.00020	-0.00065

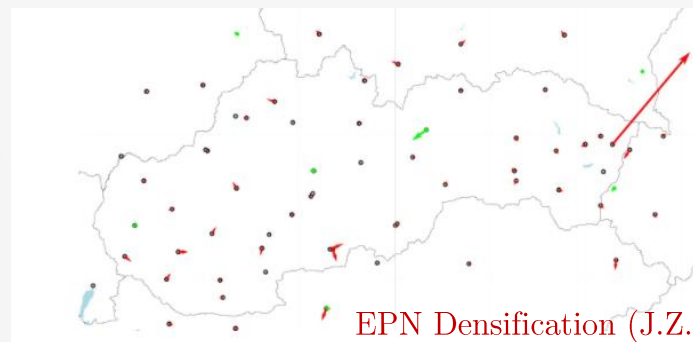
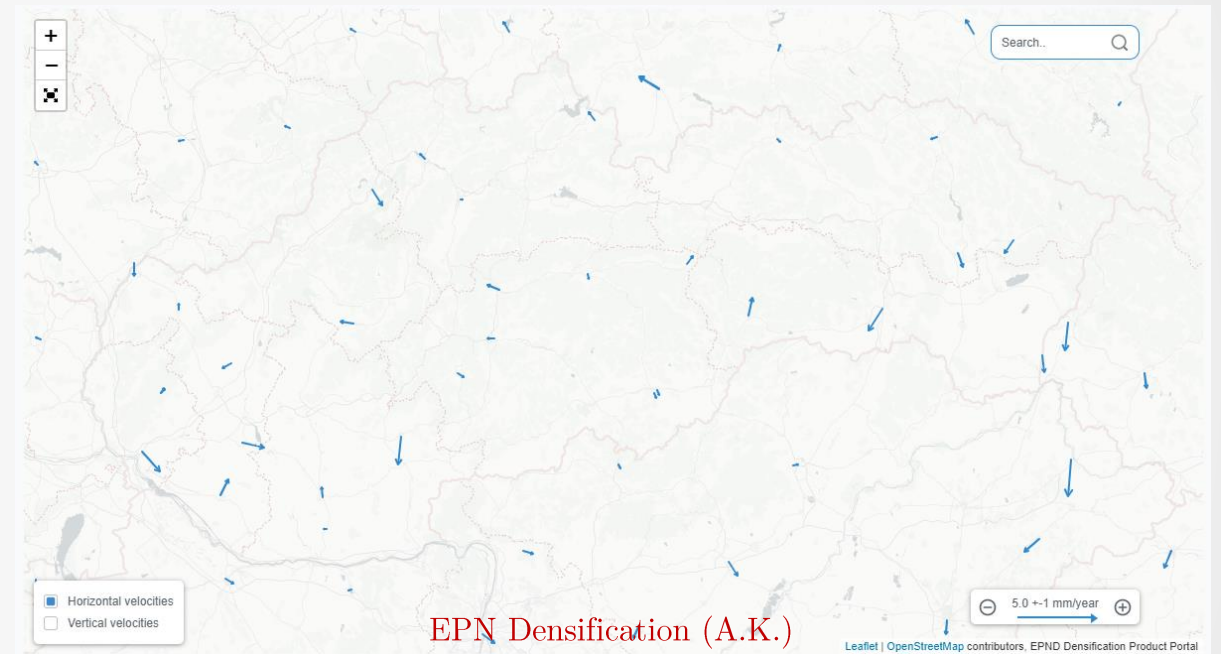
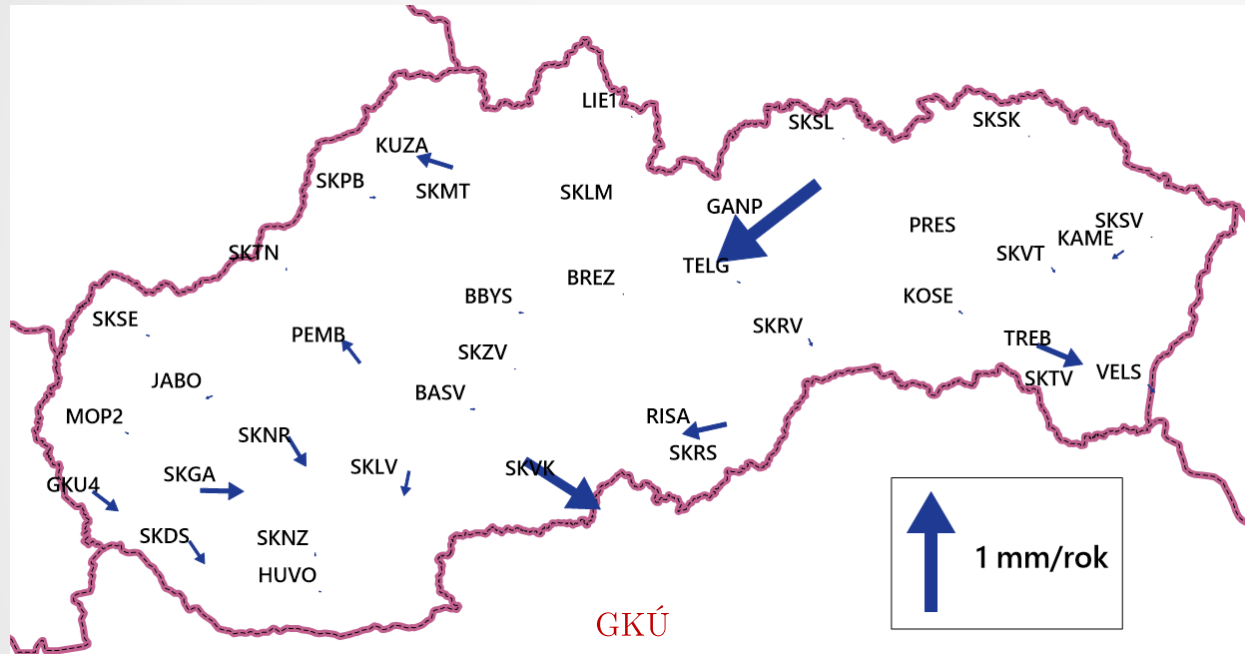


Horizontálne rýchlosti v ETRF2000



Vertikálne rýchlosti v ETRF2000

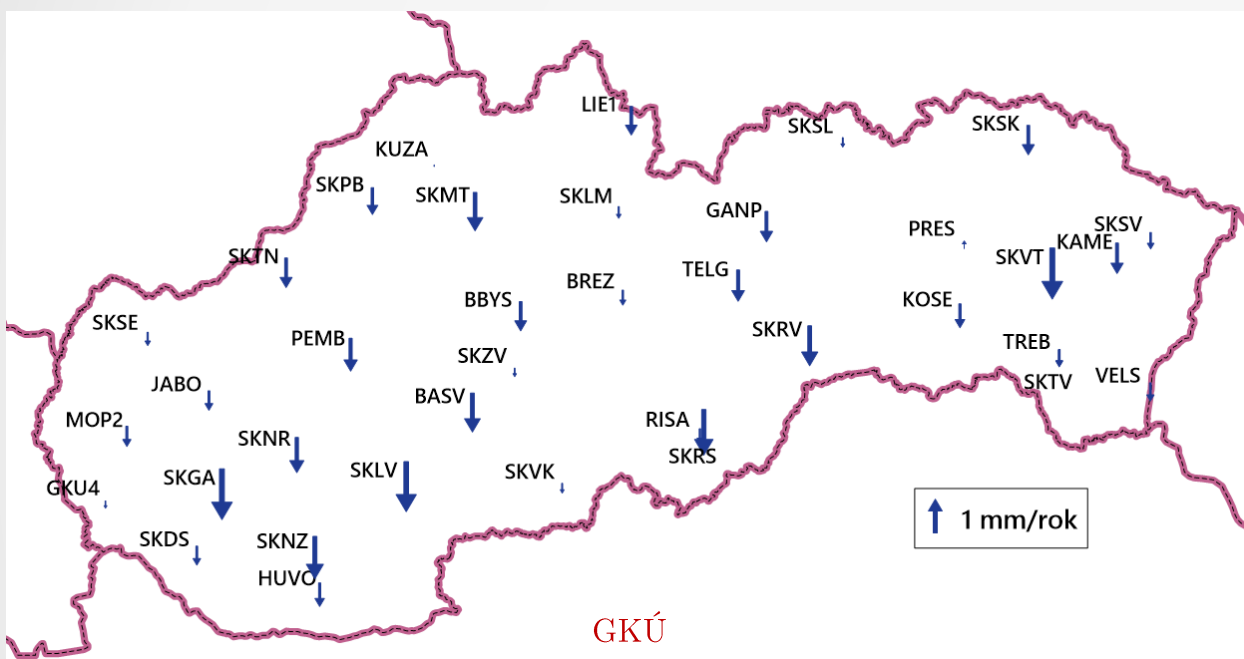
Porovnanie ETRF2000 rýchlostí s EPN Densification horizontálne



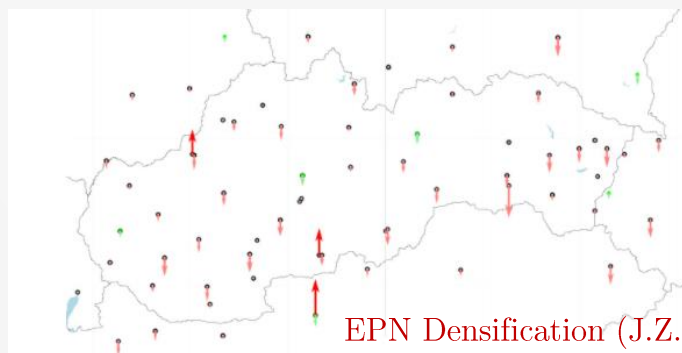
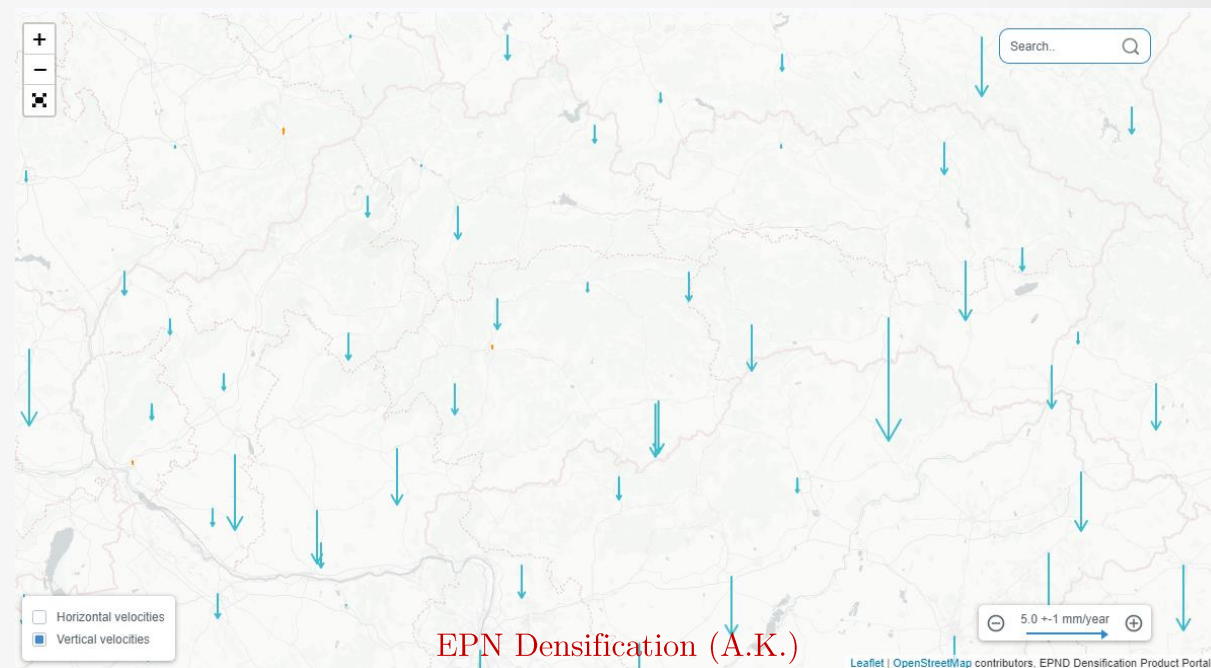
ETRF2000 Velocities

- A sites, 3.0 mm/yr →
- Other sites, 3.0 mm/yr →
- No vel: time span < 2 yr ·

Porovnanie ETRF2000 rýchlostí s EPN Densification vertikálne



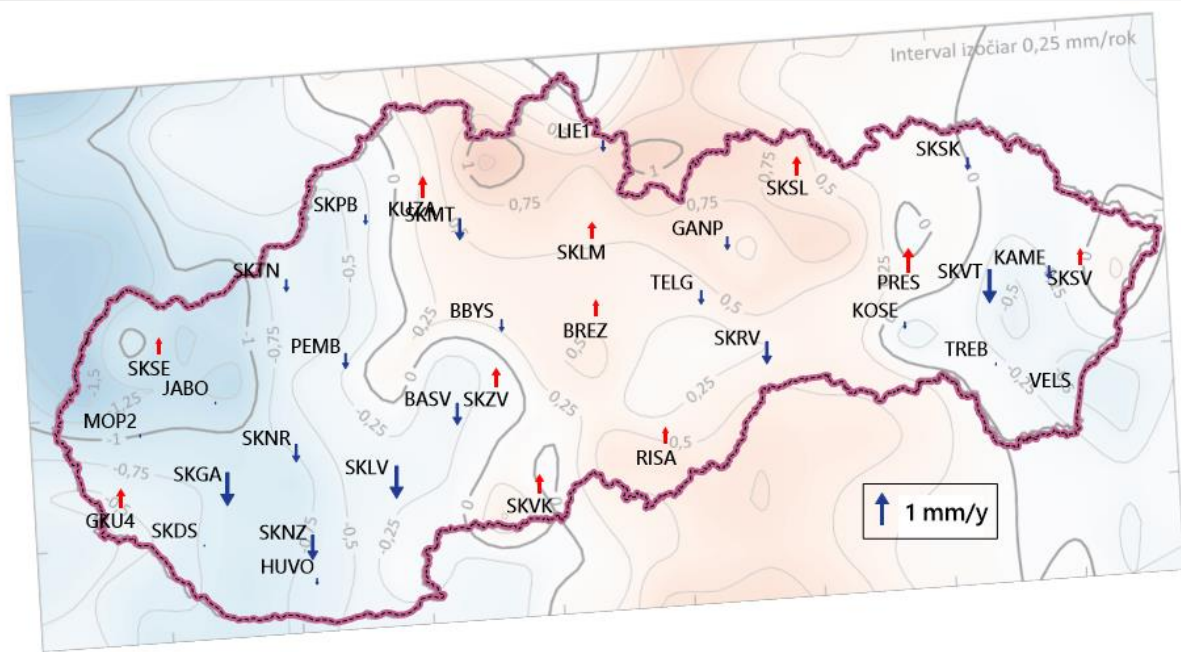
GKÚ



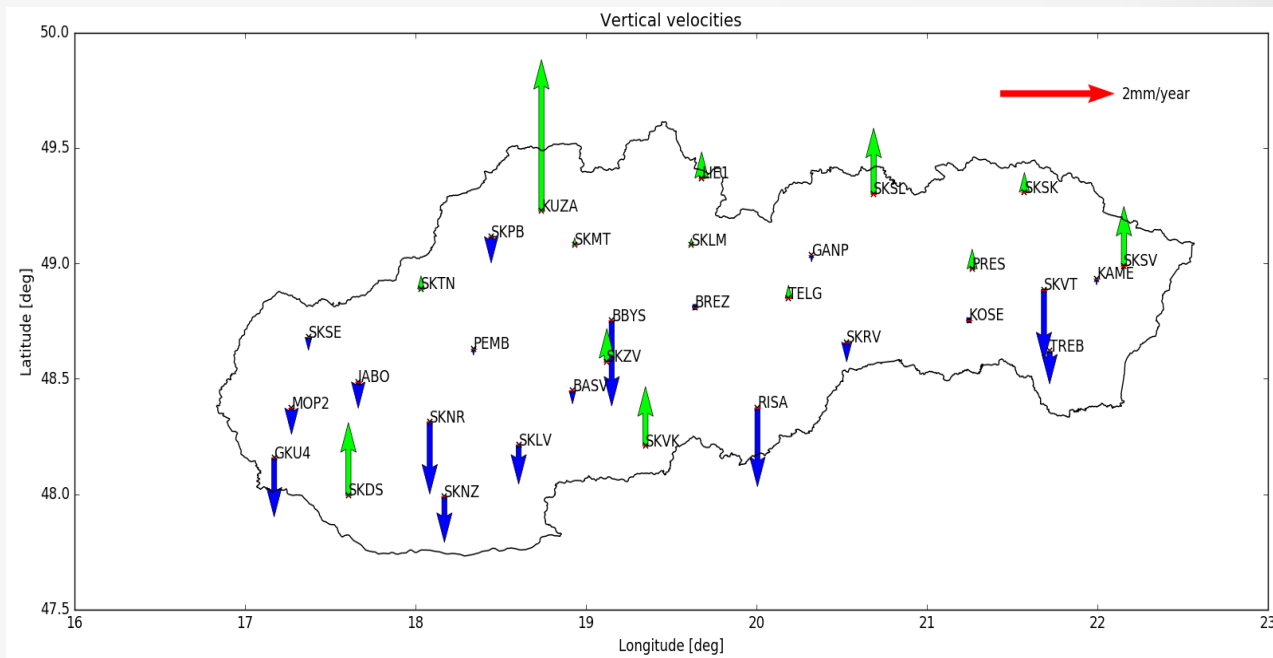
ETRF2000 Velocities

- A sites, 3.0 mm/yr
- Other sites, 3.0 mm/yr
- No vel: time span <2 yr

Porovnanie ETRF2000 rýchlostí s pôvodnými výpočtami vertikálne



Nové spracovanie „naftované“ na nivelačné merania (2007 – 2021)



Staršie spracovanie „naftované“ na nivelačné merania VPN (2007 – 2019)

Záver

- Nové multi-ročné riešenie SKPOS
 - ✓ 11/2021 - obhájené pred EUREF Governing Board
 - ✓ 06/2022 - akceptované na sympóziu EUREF 2022 ako A trieda národného zhustenia EUREF pre Slovensko

=> SKTRF2020



Geodetic and Cartographic Institute Bratislava

**REPORT OF COMPUTATION
OF THE SKPOS MULTI-YEAR SOLUTION
AS EUREF DENSIFICATION FOR SLOVAKIA**

For the validation to the EUREF Governing Board

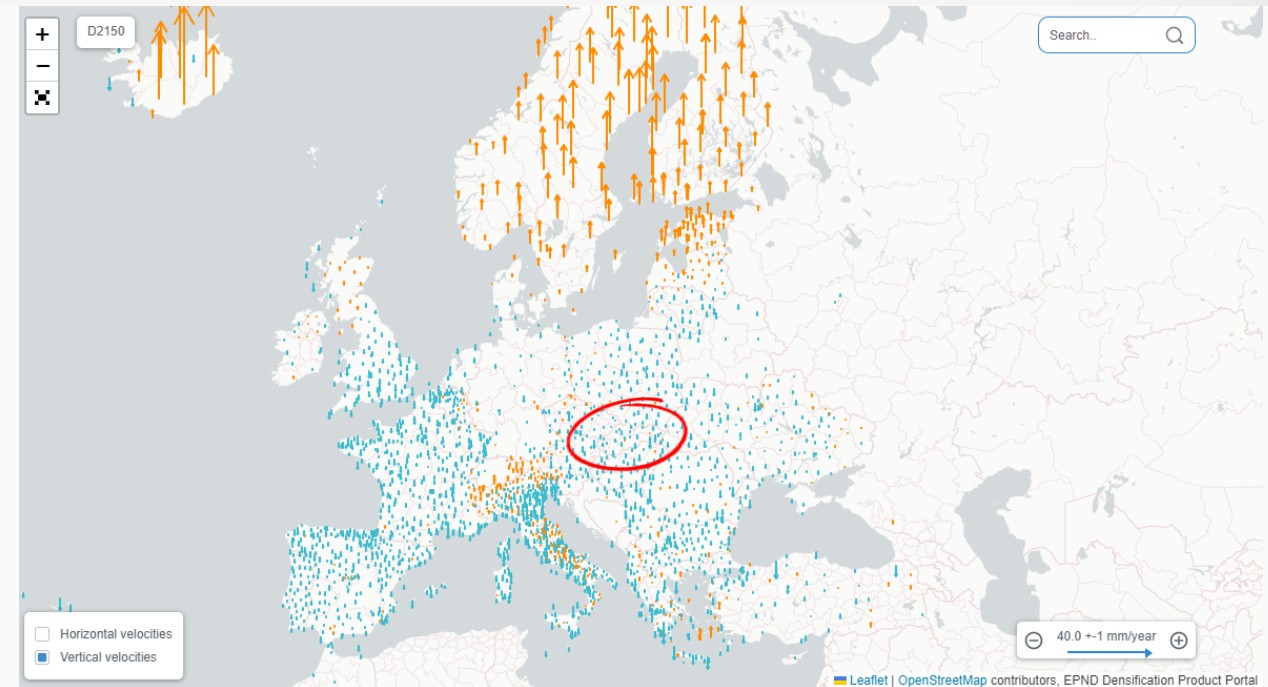
Authors: Martin Ferienc, Branislav Droscak, Karol Smolik,
Miroslav Rohacek, Miroslav Steinhübel

Bratislava
2021

Záver

■ Geokinematika Slovenska

- ✓ Slovensko sa nachádza na stabilnej časti Eurázijskej tektonickej platne





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Geodetický a kartografický ústav Bratislava



MEDZINÁRODNÁ KONFERENCIA TATRY 2022
GLOBALNA GEODÉZIA A GEOINFORMATIKA

Štrbské Pleso, 24.-25.11.2022

