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STATISTICAL PROPERTIES OF QUIET SPACE WEATHER NOTRHERN ADRIATIC RESIDUAL GPS IONOSPHERIC DELAY

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Content of presentation

- Introduction
- The nature of GPS ionospheric delay
- NA-QSW model
- Residual NA-QSW delay
- Discussion
- Conclusion and future work

Introduction

- Need for accurate and reliable positioning for various systems and services grows
- Space weather and ionsopheric effects as the major causes of satnav performance disruption
- Importance in economy, transport, sustained development, national security, personal affairs etc.
- Demand on high-quality positioning in Croatia -> development of local GPS ionospheric model for Northern Adriatic

The nature of GPS ionospheric delay

- GPS ionospheric delay is caused by charged particles (electrons) in ionosphere
- Amount of GPS ionospheric delay is determined by vertical ionospheric profile N(h)



The nature of GPS ionospheric delay

- A global model attempting to provide partial compensation of the ionospheric effect on GPS positioning
- Two-component model consisting of a bias and a periodical coimponent

$$d_{iono(day)} = F \left[d_{night} + A \cos\left(\frac{2 \Pi \left(t - t_0\right)}{P}\right) \right]$$

$$d_{iono(night)} = F d_{night}$$

NA-QSW model

- Quiet space weather GPS ionospheric model for Northern Adriatic area
- Developed using archived TEC data for reference site in Northern Adriatic
- Klobuchar-like model



NA-QSW model

	SUMMER		WINTER	
	Night-tme	Day-time	Night-time	Day-time
Expression	d = a ₀	d = a ₀ + a ₁ *cos(2*π* (t – 14)/32)	d = a ₀	d = a ₀ + a ₁ *cos(2*π* (t – 14) /24)
Parameter values	a ₀ = 0.982	a ₀ = 0.982 a ₁ = 0.877	a ₀ = 1.003	a ₀ = 1.003 a ₁ = 0.557
Time interval of validity in [h], local time	<0, 6> U <22, 24>	[6, 22]	<0, 8> U <20, 24>	[8, 20]

- NA-QSW model validation through casestudy: quiet space weather period 8 – 17 September 2007
- Comparison with NeQuick model (European ionospheric model)







	NeQuick model	NA-QSW model
Mean [m]	-0.1617	-0.0069
Median [m]	-0.1800	0.0420
Standard deviation [m]	0.2525	0.2113
Skewness	-30.56	4.82
Kurtosis	168.21	23.6





Discussion

- Good correlation between NA-QSW output and actual data
- NA-QSW provides improved performance in targeted area, compared with NeQuick model
- Residual NA-QSW time series provides better fit to normal distribution that residual NeQuick
- Proposal for a three-component local model:

$$d = a_0 + a_1 \cdot \cos\left(\frac{2 \cdot \pi \cdot (t - t_0)}{P}\right) + a_3 \cdot N(0, \sigma)$$

Conclusion and future work

- NA-QSW demonstrates feasibility of local GPS ionospheric model development
- Patterns of local GPS ionospheric delay dynamics identified -> NA-QSW improvements
- Future work aimed to provide quiet space weather GPS ionospheric model for the Adriatic Sea area (A-QSW)

THANK YOU FOR YOUR ATTENTION !

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