



ELEKTROINŠTITUT MILAN VIDMAR

COST P18 - 2009

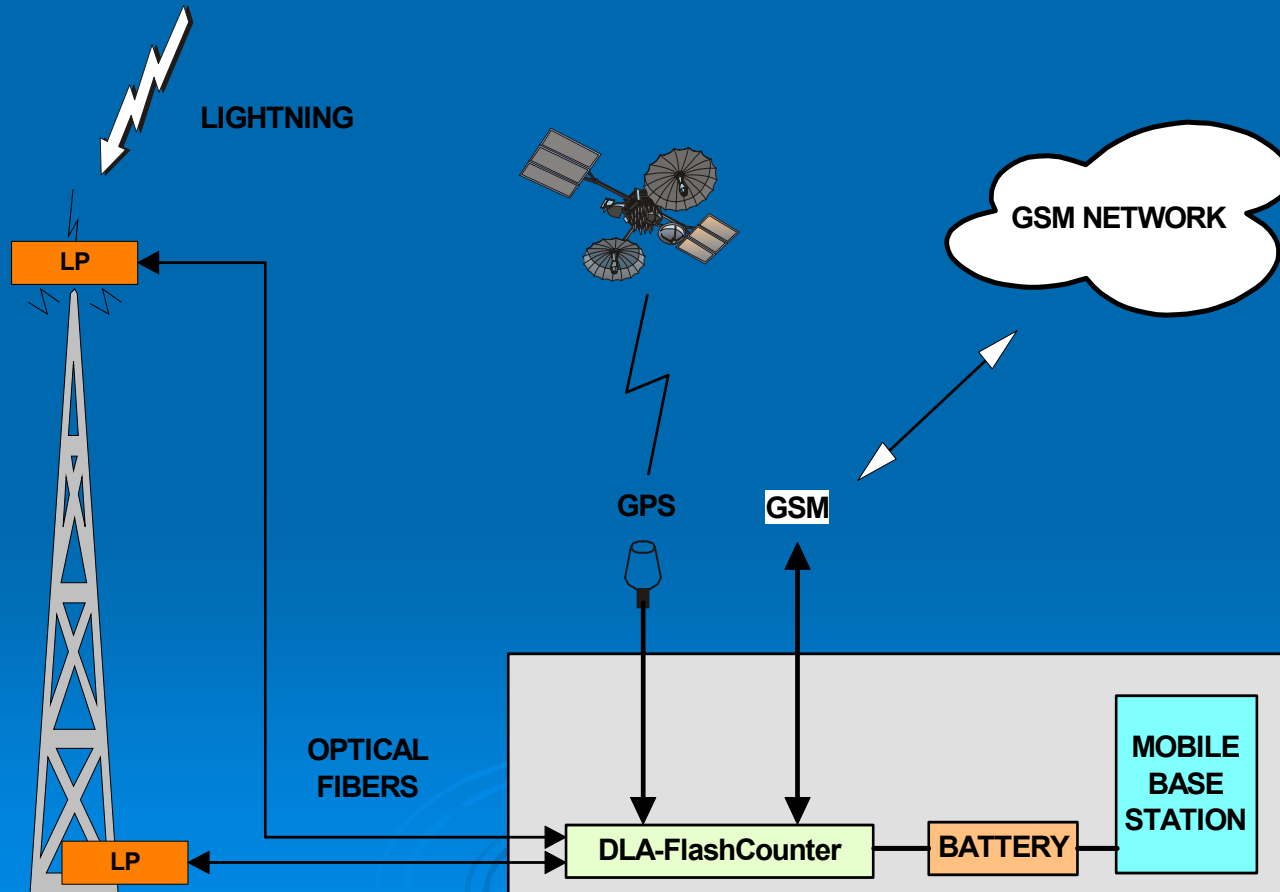
An Evaluation of Accuracy Improvements Considered by Measurements Collected by RLDN

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Goran Milev dipl. ing. el.

Brief overview

- Introduction
- FlashCounter and RLDN network capabilities
- Lightning location sensors time corrections
- Different LLS performance (EUCLID, LINET)
- Real-time power line fault correlator as ground-truth data
- High resolution flash density map
- New method for accuracy validation (error ellipse method)
- Conclusion

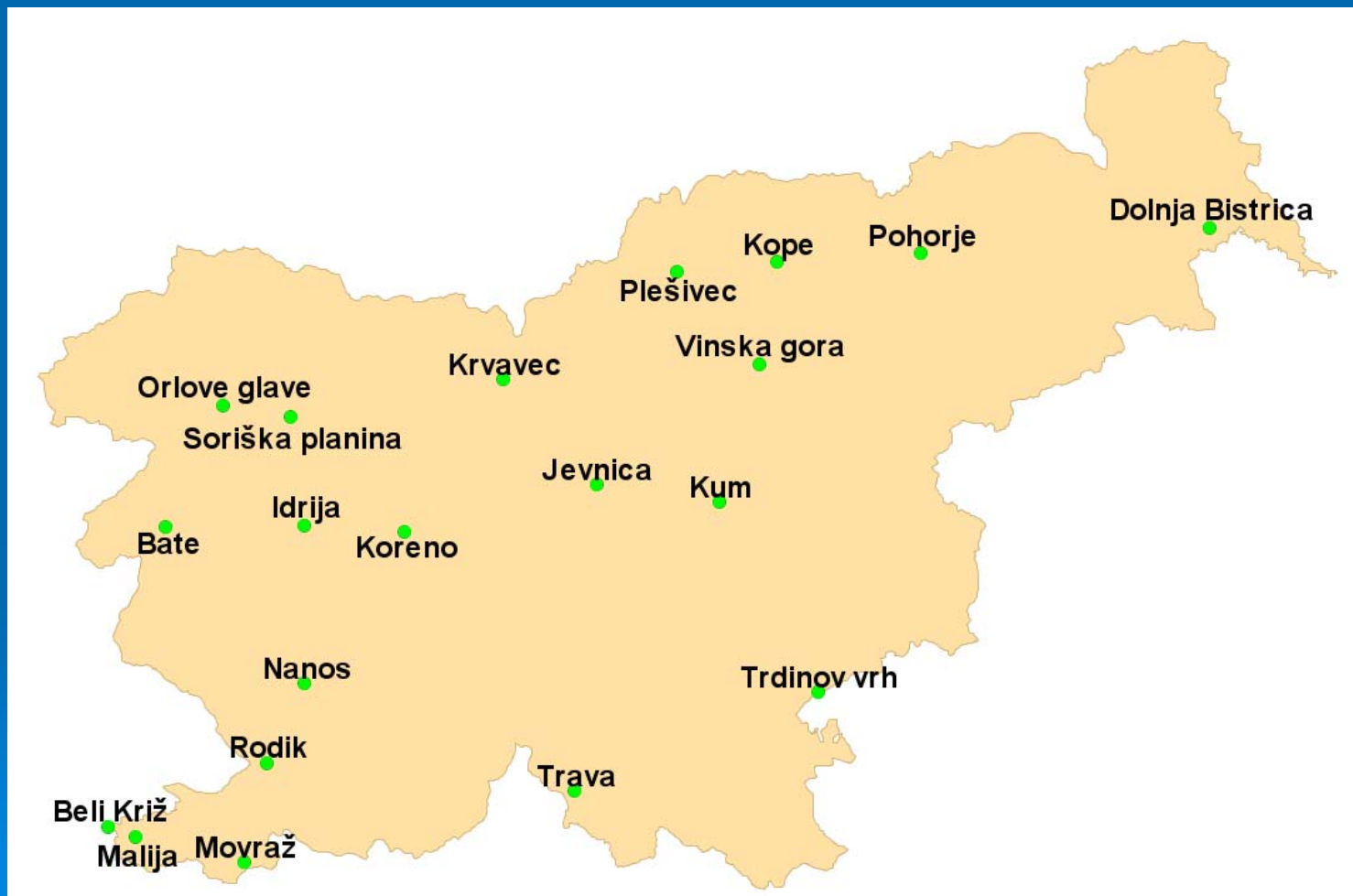
RLDN detection uses an optical connection between devices and battery powered DLA-FlashCounter sensor.



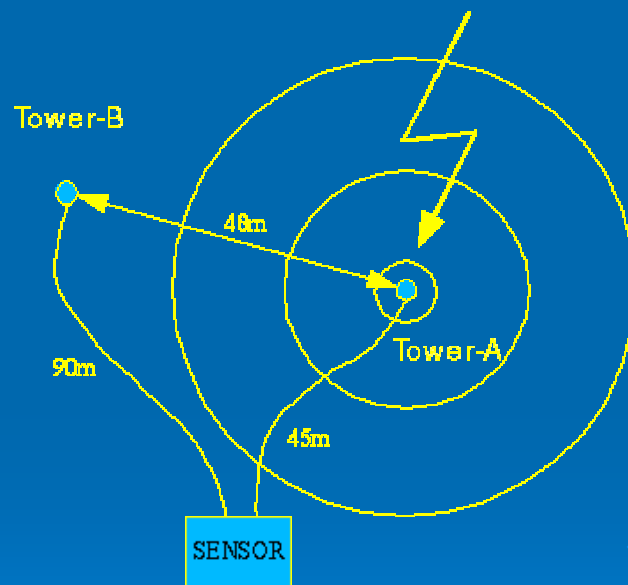
DLA-FlashCounter and DLA-LightningProbe



Configuration of RLDN network in 2009



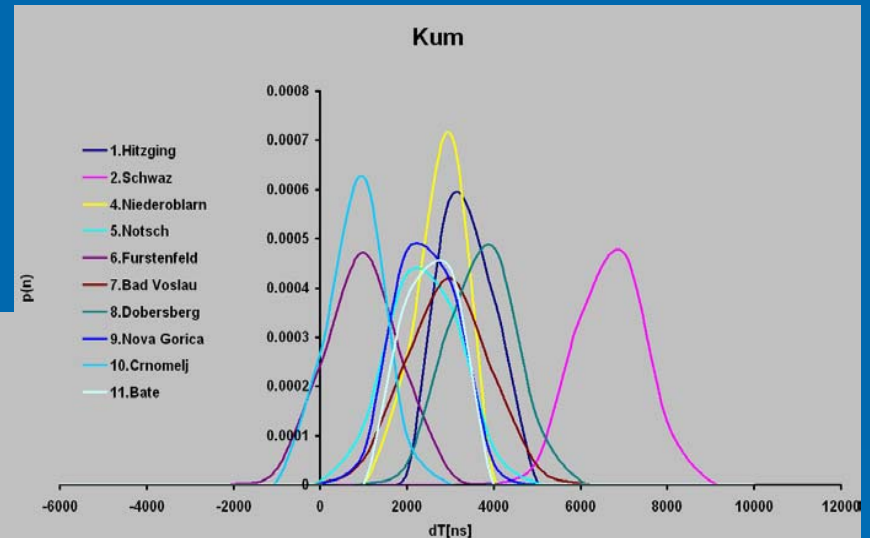
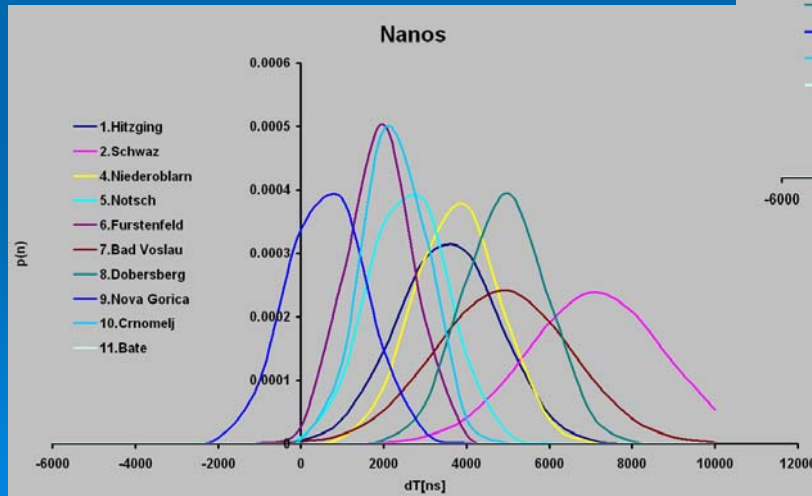
Configuration of RLDN network in 2009 site Nanos



ILDC – 2006

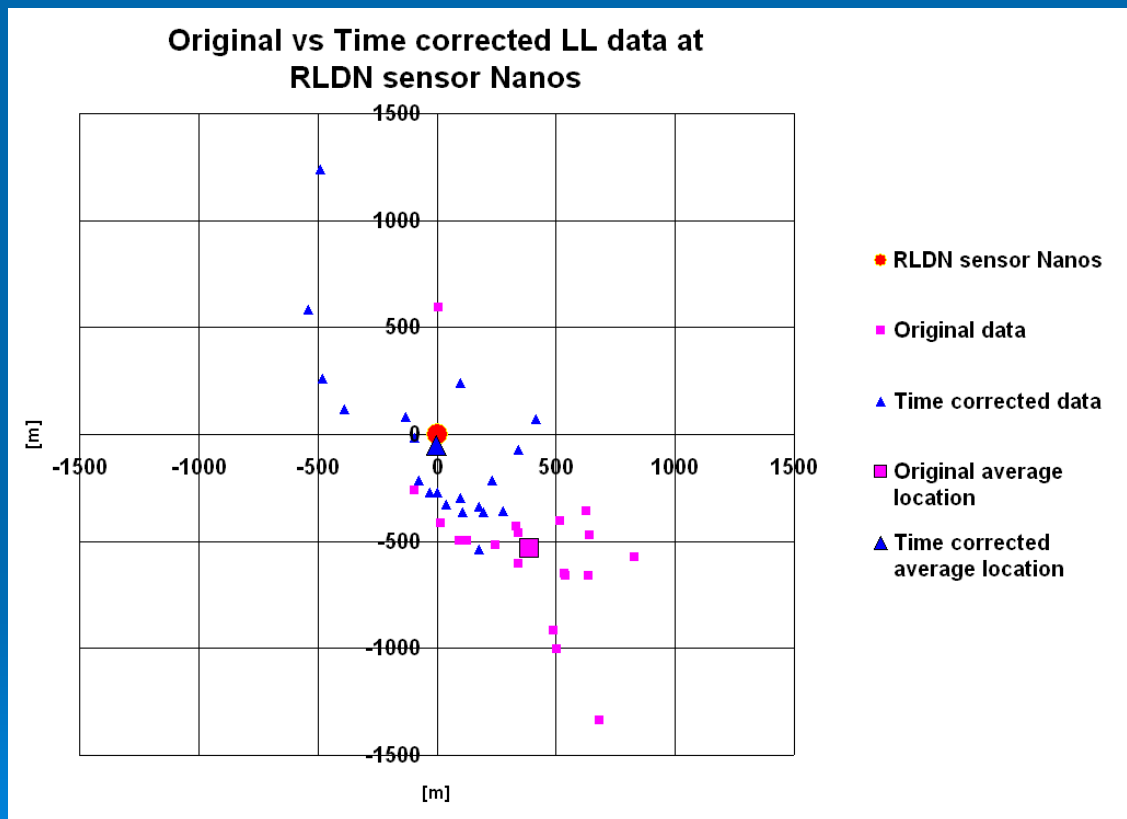
LLS Accuracy Improvements by Measurements Collected by RLDN

- Distribution of time differences dT for LLS sensors as seen from RLDN sensor Nanos



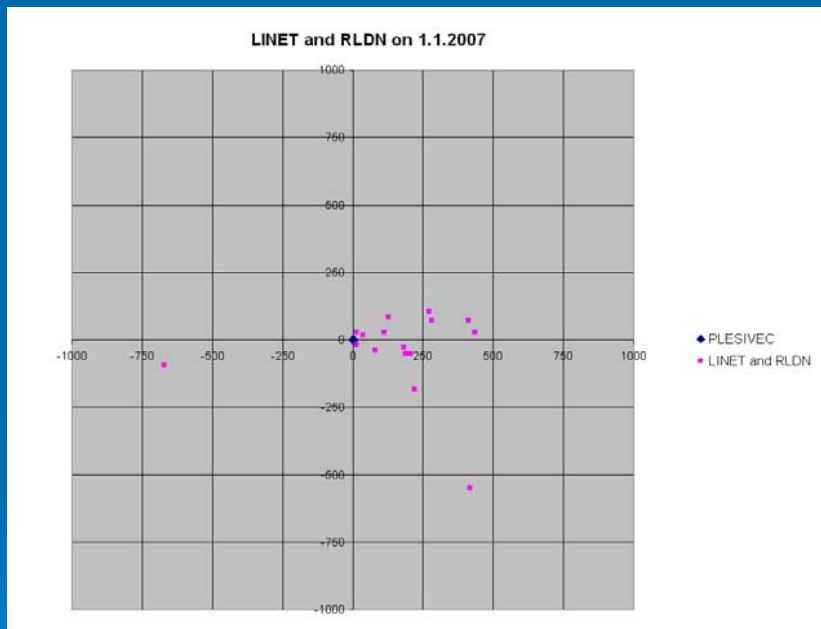
ILDC – 2006

LLS Accuracy Improvements by Measurements Collected by RLDN

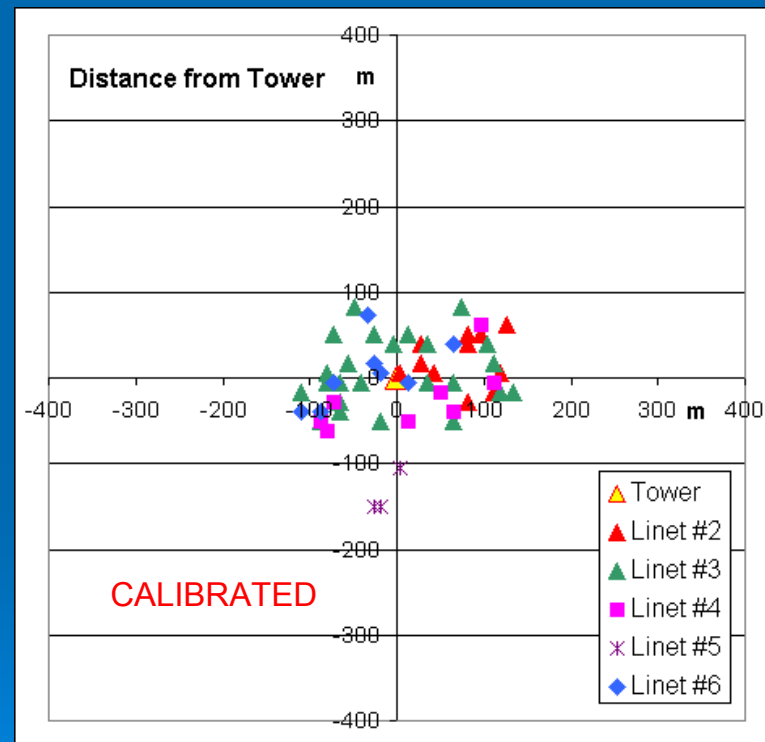


ELDW – 2007

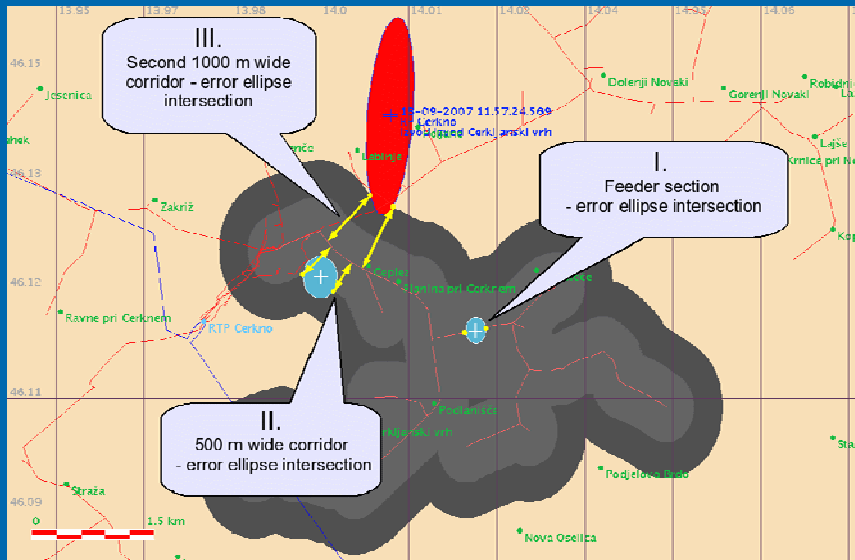
Lightning location networks performance validation with RLDN



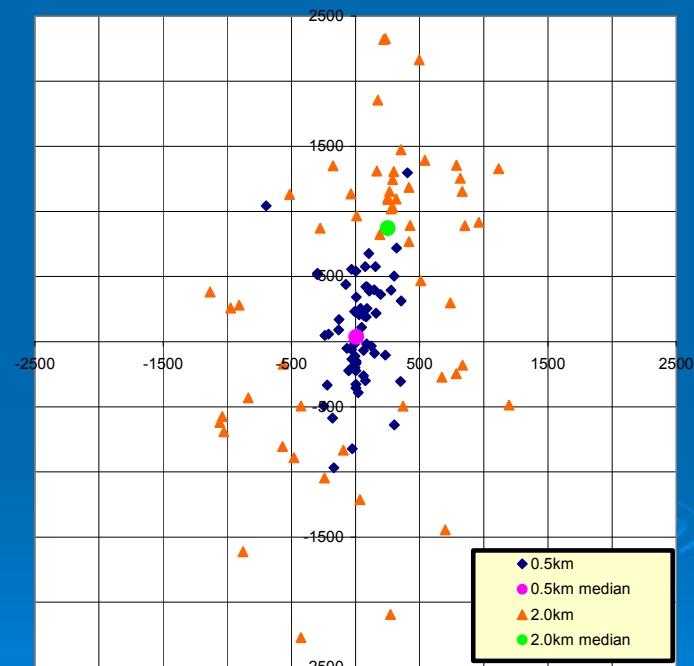
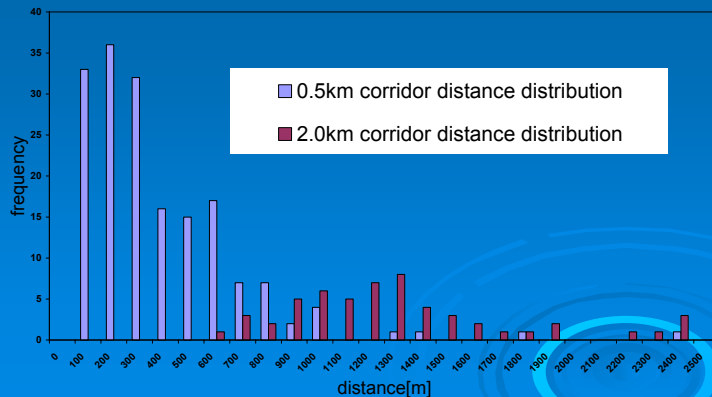
UNCALIBRATED



COST P18 - 2008 and ILDC - 2008 A MULTIPLE POWER LINE CORRIDOR CORRELATOR

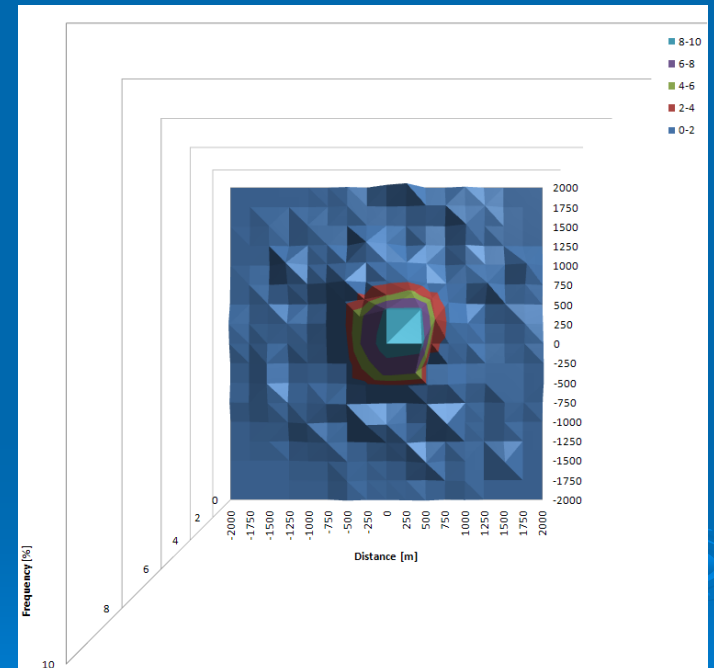
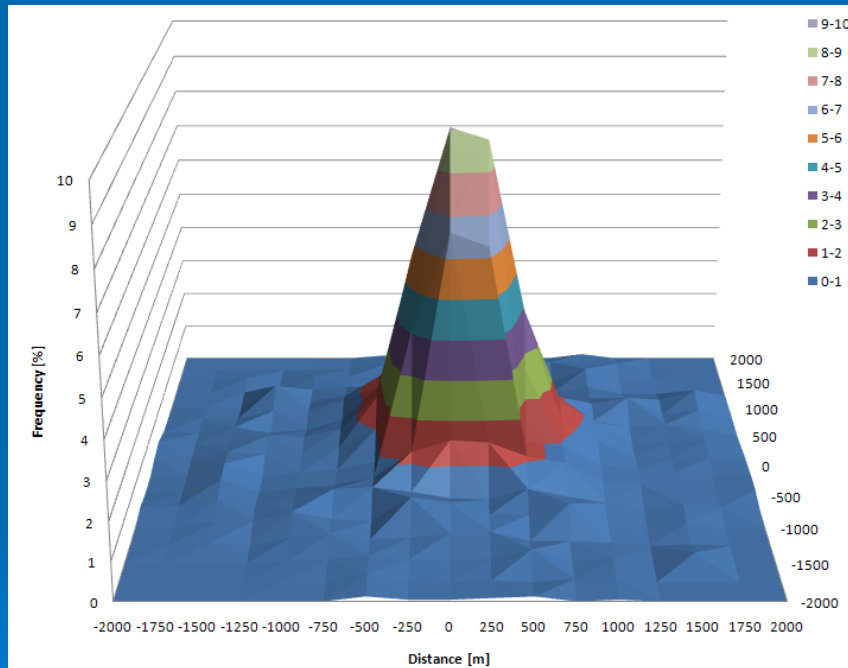


Lightning location distance distribution comparison

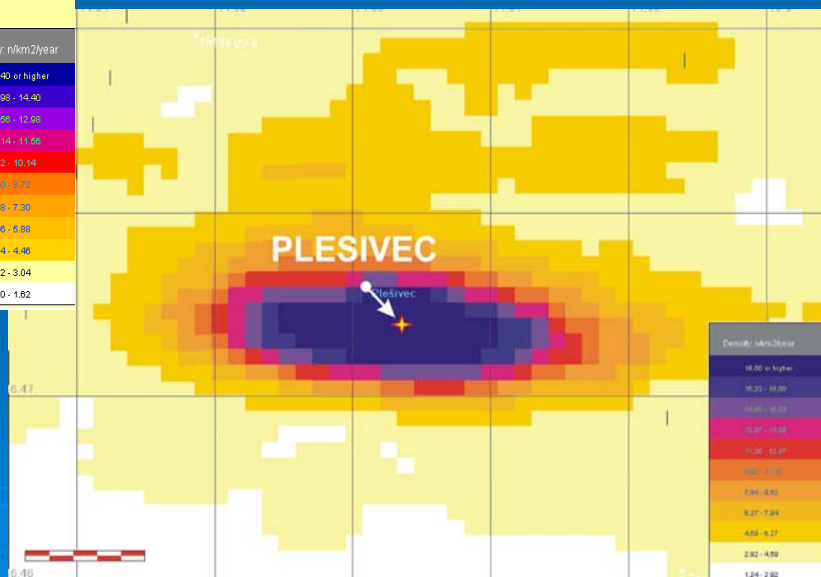
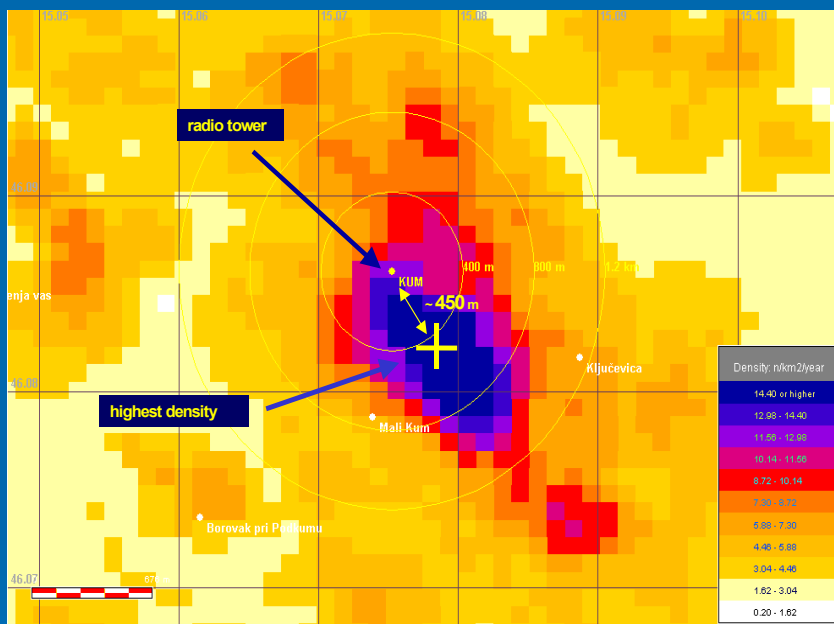


ISH – 2009

Evaluation of lightning parameters correlated with distribution line faults

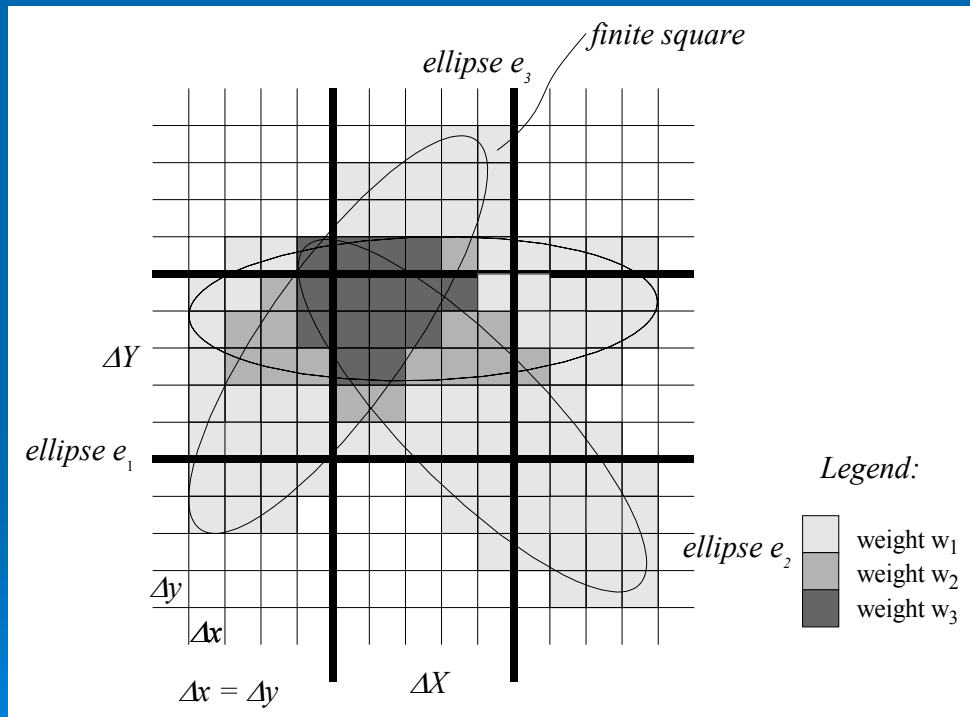


Shift of highest flash density of tower Plešivec



IEEE - 2006

Error ellipse decomposition and weight summing



weighting

$$w_n = \frac{W_n}{k_i}$$

$$w_i \leq \frac{1}{k_i}$$

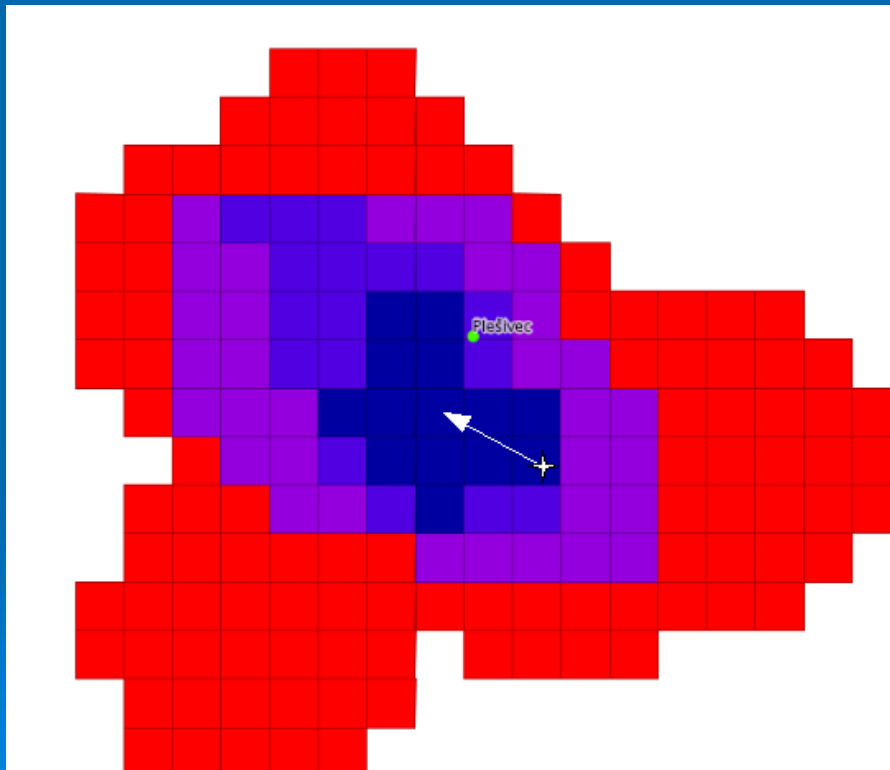
composition:

$$W(x,y) = \sum_{j=1}^M w_{j,x,y}$$

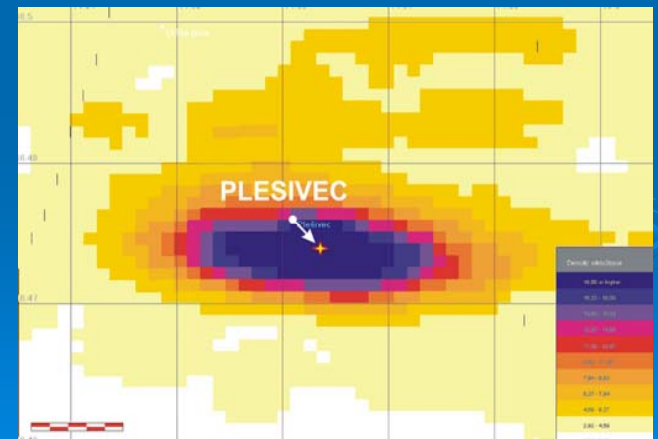
New method for LLS accuracy validation (error ellipse method)

- the data between RLDN and EUCLID was compared
- filtering in spatial domain ($\pm 0,005$ - $\pm 0,03$ degrees)
- filtering in time domain (± 500 ns)
- error ellipse method from HRFD map was applied
- the map resolution of 100 m X 100 m was produced

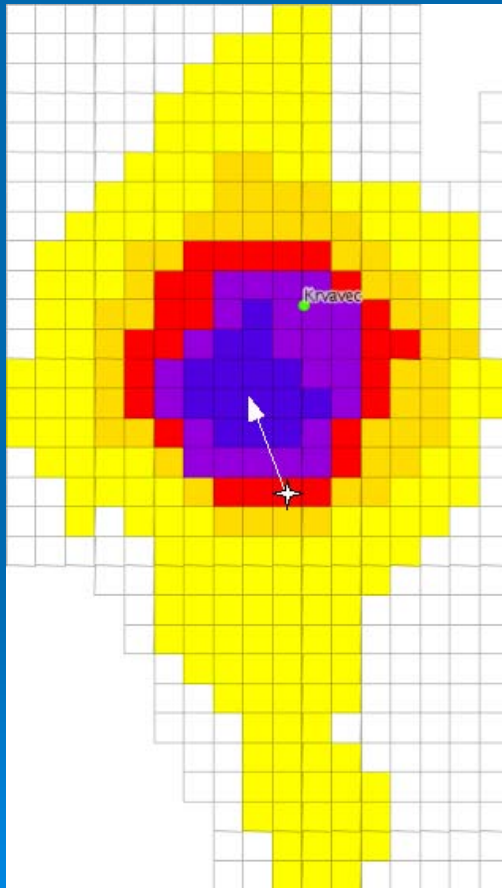
New method for LLS accuracy validation (error ellipse method)



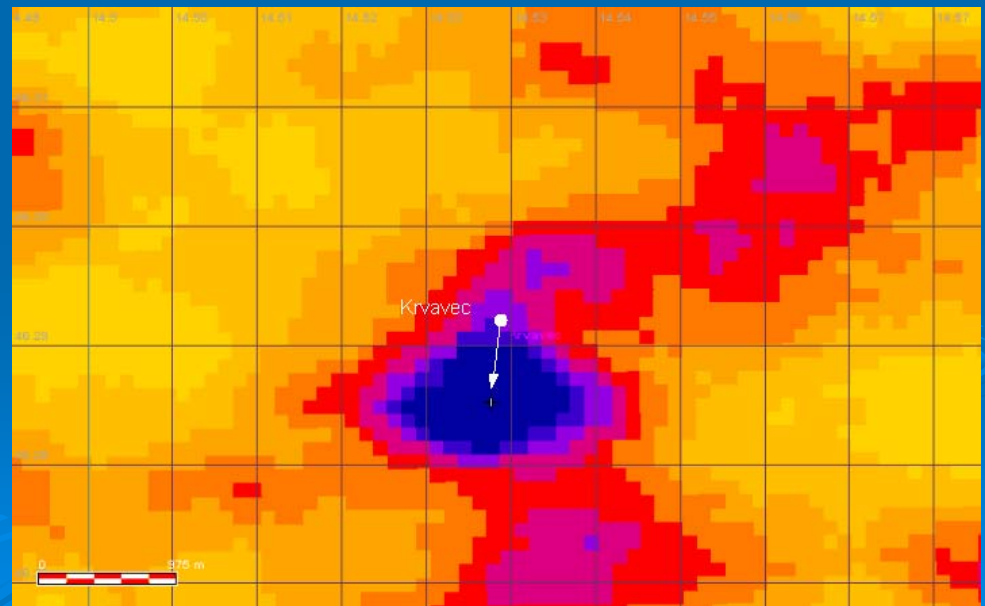
RLDN and high resolution flash density approach confirm a 300m LLS correction after location algorithm upgrade



New method for LLS accuracy validation (error ellipse method)

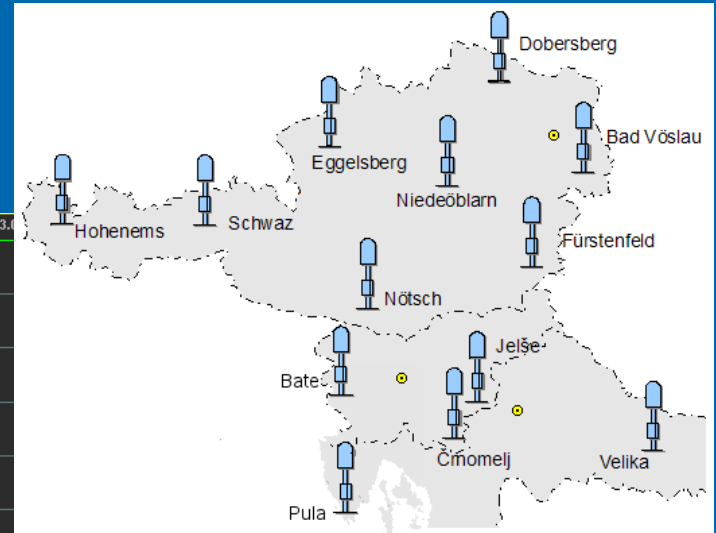
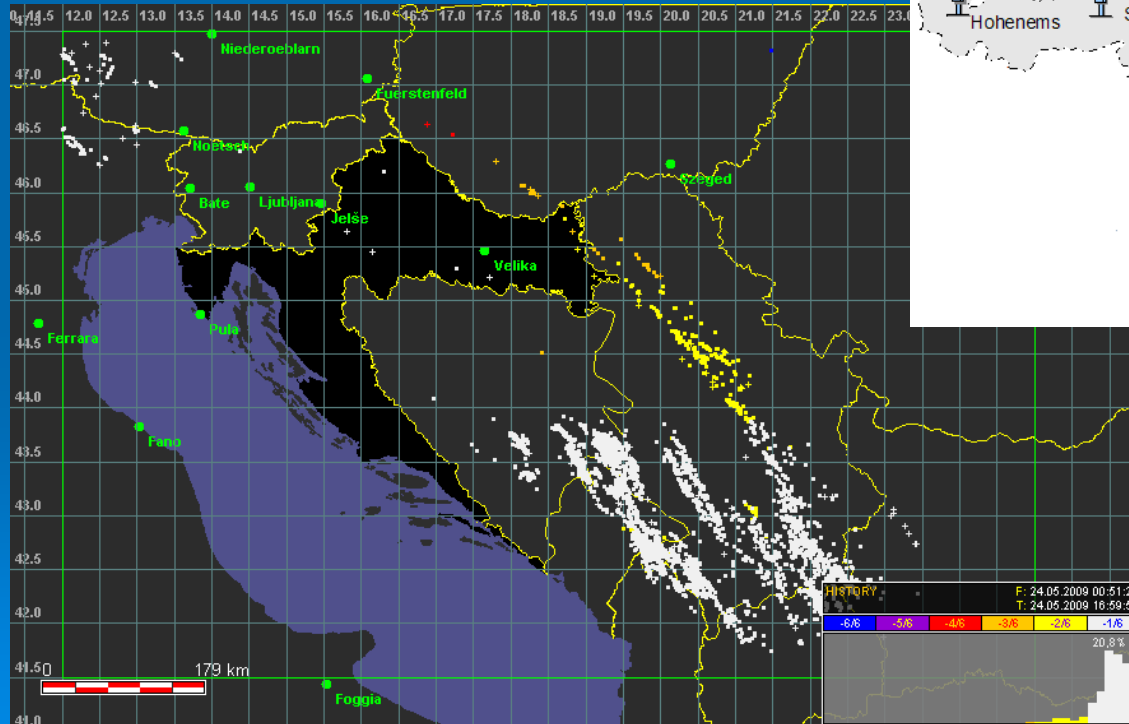


Almost the same direction and
300m lightning location
improvements on Krvavec site.

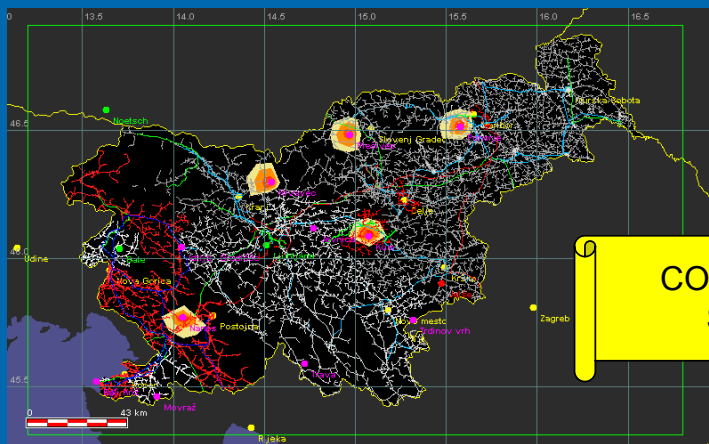


LLS accuracy improvements background

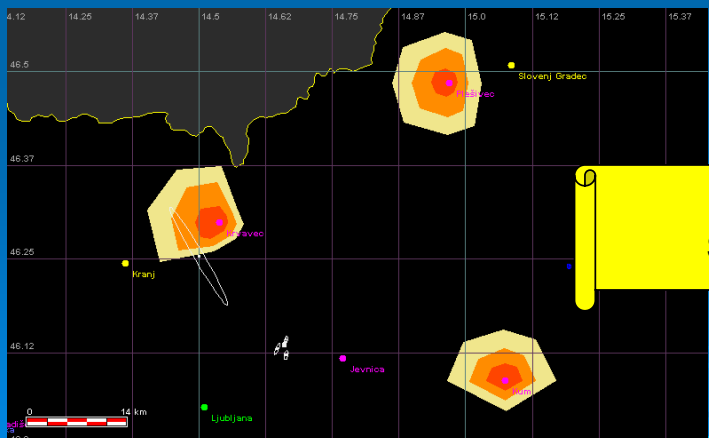
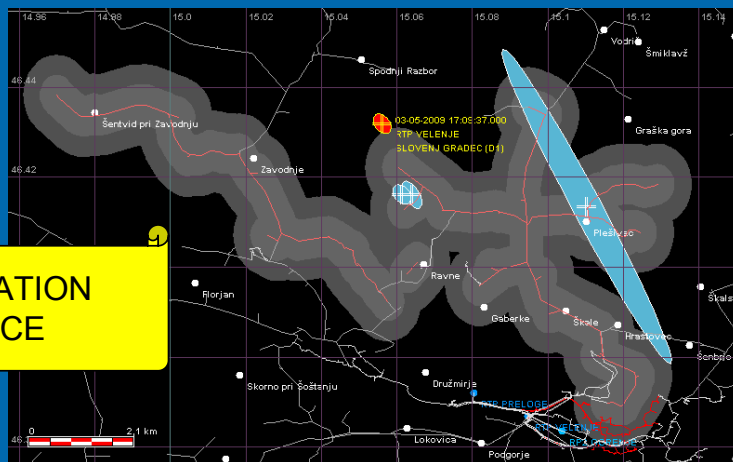
- LLS network upgrade
- LL algorithm improvements



Why is high LLS accuracy needed?



CORRELATION SERVICE



ALARM SERVICE

Flash Alarm

Meni Pomoč

SCALAR

RADIO TELEVIZIJA SLOVENIJA

11:30:51

Filter: Vse lokacije Potri alarme

Štev.	Čas	Lokacija	Opis	Status	Lokacija	Stopnja
132	04.05.2009 18:50	Kum	PREKLIČ ALARMA II : Nevhita je blizu	PRISPTEL	Kranj	
131	04.05.2009 18:43	Kum	PREKLIČ ALARMA III : Nevhita se približuje	PRISPTEL	Plešivec	
		Kum	ALARM III : Nevhita se približuje	PRISPTEL	Nanos	
		Kum	ALARM II : Nevhita je blizu	PRISPTEL	Kum	
		Nanos	PREKLIČ ALARMA II : Nevhita je blizu	PRISPTEL	Pahonje	
		Nanos	PREKLIČ ALARMA III : Nevhita se približuje	PRISPTEL		
		Nanos	ALARM III : Nevhita se približuje	PRISPTEL		
		Nanos	ALARM II : Nevhita je blizu	PRISPTEL		
		Plešivec	PREKLIČ ALARMA II : Nevhita je blizu	PRISPTEL		
		Plešivec	PREKLIČ ALARMA III : Nevhita se približuje	PRISPTEL		
		Plešivec	ALARM III : Nevhita se približuje	PRISPTEL		
		Plešivec	ALARM II : Nevhita je blizu	PRISPTEL		
118	04.05.2009 18:41:51	Prabovo	ALARM : Nevhita	OPREDELJEN		
118	03.05.2009 18:36:52	Kum	PREKLIČ ALARMA I : Nevhita	PRISPTEL		
117	03.05.2009 18:29:53	Kum	PREKLIČ ALARMA II : Nevhita je blizu	PRISPTEL		
116	03.05.2009 18:16:52	Kum	PREKLIČ ALARMA III : Nevhita se približuje	PRISPTEL		
115	03.05.2009 18:05:52	Kum	ALARM : Nevhita	OPREDELJEN		
114	03.05.2009 18:02:14	Kum	ALARM II : Nevhita se približuje	PRISPTEL		
113	03.05.2009 18:00:13	Kum	PREKLIČ ALARMA III : Nevhita se približuje	PRISPTEL		
112	03.05.2009 17:50:13	Kum	ALARM II : Nevhita je blizu	PRISPTEL		
111	03.05.2009 17:49:08	Kum	ALARM III : Nevhita se približuje	PRISPTEL		
110	03.05.2009 17:48:08	Kum	ALARM I : Nevhita	OPREDELJEN		

29.04.2009 10:56:49 Povezava s strežnikom vzpostavljena
 29.04.2009 10:56:33 Povezava s strežnikom prekinitvenjal
 29.04.2009 10:56:33 Povezava ni uspela (CNF)

Conclusion

- The results of analysis show that the systematic lightning location offset observed in years up to 2008 almost disappeared and the location dispersion was also reduced.
- The results indicate that improvements in location algorithm turn LLS for the better.
- New method for LLS accuracy validation gives high quality results.



THANK YOU