Correlating locations of the overshooting tops with occurrence of severe weather

Petra Mikuš, Nataša Strelec Mahović

EUMeTrain

Meteorological and Hydrological Service, Croatia

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Outline

- On Overshooting tops (OT)
- Satellite based detection methods
- Comparison with automatic station data
- Comparison with hailpad data
- Results
 - Outlook

On Overshooting Tops

- domelike protrusions above thunderstorm's anvil
- often penetrating into lower stratosphere
- manifestation of very strong updraft
- existing for less than 30 min
- diameter ~ 15 km





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Satellite-based detection methods

- Channel differences:
 - $> 6.2 10.8 \,\mu m \,(WV-IRW)$
 - > $9.7 10.8 \ \mu m (O_3 IRW)$
 - > $13.4 10.8 \ \mu m \ (CO_2 IRW)$
 - COMB- combination of the WV-IRW and O₃-IRW methods

BTD	Threshold			
WV-IRW		>4K		
CO ₂ -IRW	IRW brightness temperature <215K	>3.5K		
O ₃ -IRW		>13K		
COMB		>4K & >13K		

Poster: 8/53 Satellite-based overshooting tops detection methodscomparison and validation



Comparison with automatic station data

- parallax correction → applied to automatic station location
- cloud height \rightarrow based on soundings data
- parallax correction tables for 80 different cloud heights for NE image section (0° satellite position)

http://www.convectionwg.org/parallax.php)



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Parallax shift(°)						
	Croatia Slovenia Austria S		Slovakia	Hungary	Bosnia and Herzegovina	
Ν	0,14	0,14	0,15	0,16	0,15	0,14
E	0,08	0,07	0,08	0,12	0,11	0,08

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Results

• 2009 and 2010 warm seasons (May – September) analyzed

• > 750 matching OT-station pairs found

Type of automatic station data	Number of detected OTs in the vicinity of the station	Number of OTs matching data extremes	(%)	
wind gust	1352	951	70	
precipitation	1165	936	80	
rel. humidity	1352	776	57	
temperature	1380	880	64	

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• Wind

(wind gusts

	5 to 10.8 m/s	10.8 to 17.2 m/s	>17.2 m/ s	total
Absolute frequency	281	428	242	951
Relative frequency	30	45	25	

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• Precipitation
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10-min precipitation amounts)

	0-5mm	5-10mm	>10m m	total
Absolute frequency	704	162	70	936
Relative frequency	75	17	8	

• Temperature

(temperature drop)

	2 to 4°C	4 to 6°C	6 to 8°C	>8° C	total
Absolute frequency	263	276	212	129	880
Relative frequency	30	31	24	15	

Comparison with hailpad data

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hailpad data are available for north Croatia



Conclusions

 significant correlation between OT detected from satellite data and the appearance of abrupt changes in weather elements

best correlation with **precipitation and wind** gusts

• correlation with hail occurence not statistically relevant but on case-to-case basis looks promising

Outlook

 all detection methods will be veryfied using HRV data for daytime OT occurence

analysis of 5-year data

lightning data will be included in the analysis

nowcasting application \rightarrow to be tested

Thank you for your attention!

petra.mikus@cirus.dhz.hr natasa.strelec.mahovic@cirus.dhz.hr

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