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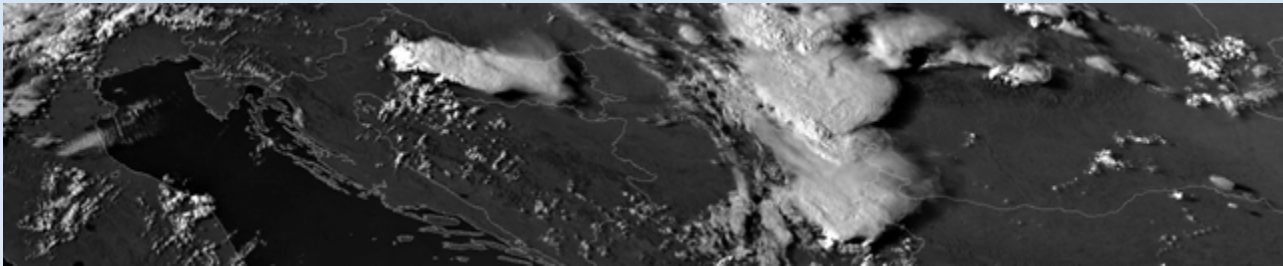


VALIDATION OF MPEF GII PRODUCT AGAINST SOUNDING AND LIGHTNING DATA - IMPLICATIONS ON CONVECTION FORECAST

Ivan Smiljanić

> MOTIVATION

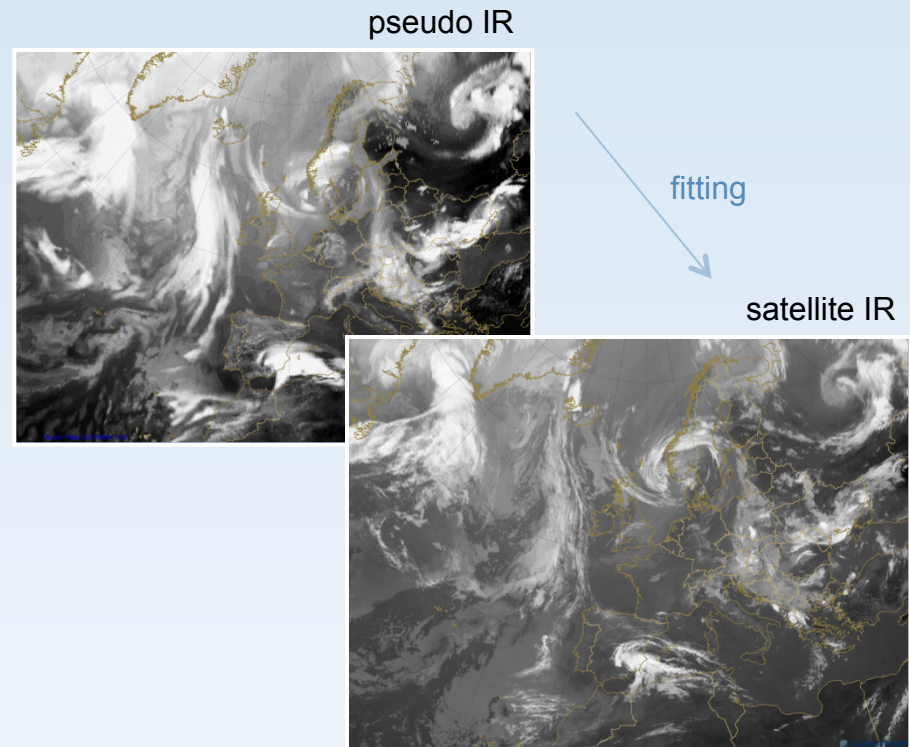
- convection as a frequent and high-impact weather



- satellites – high spatial and temporal resolution, wide are coverage
- suitable for operational usage – continuous tracking and forecasting/
nowcasting of dangerous weather
- emphasis on “clear-air” convection

> GII indices

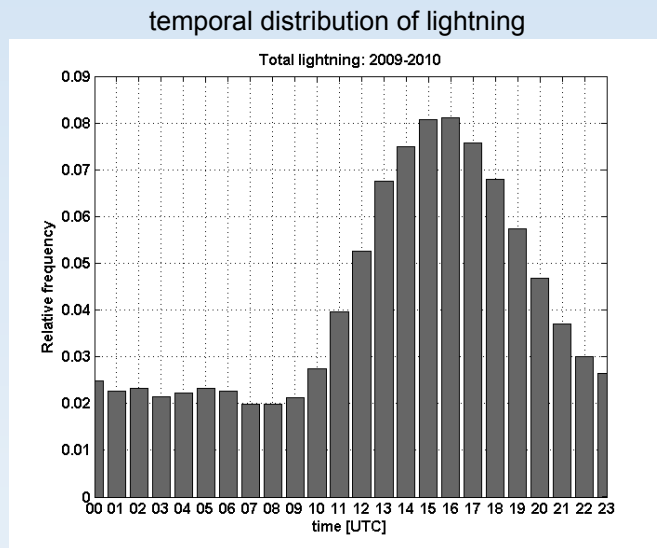
- combination of NWP (ECMWF) and satellite data (MSG satellite)
- observed MPEF GII indices: KO, K, LI, TPW
- SEVIRI instrument resolution: 3x3 (4x4) km/pixel, 5 min (rapid scan)
- obtained by PRM method \longrightarrow
- drawback - applicable only for cloud free are



- $KO = 0.5 [(\Theta_{e 500} + \Theta_{e 700}) - (\Theta_{e 850} + \Theta_{e 1000})]$
- $K = (T_{850} - T_{500}) + Td_{850} - (T_{700} - Td_{700})$
- $LI = T_{500} - T_{p500}$
- TPW = vertical integration of moisture content

> GII vs. lightning

- ▣ domain: 41°N-49°N i 9°E-21°E
- ▣ GII (6-9 UTC) vs. lightning (12-21 UTC)

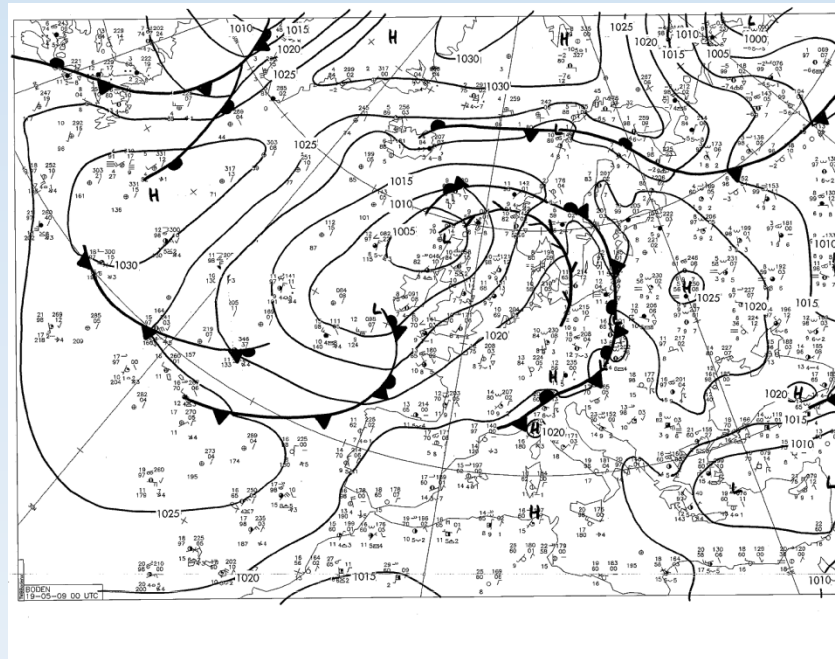


(Mikuš and Strelec-Mahović, 2013)

- ▣ verification by lightnings - LINET network

> METHODS OF VERIFICATION

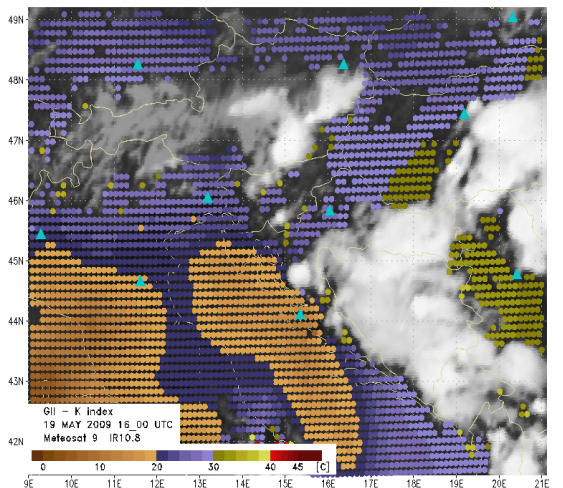
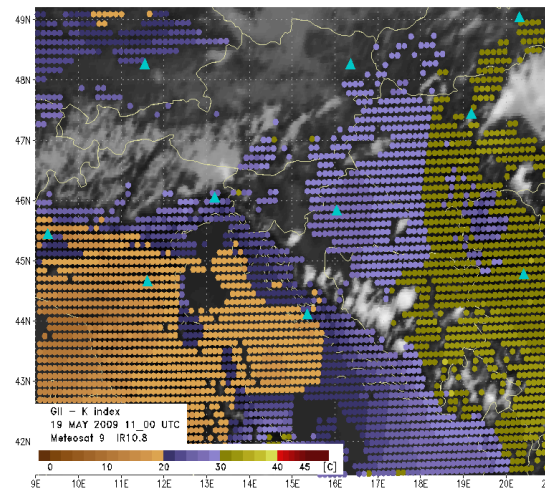
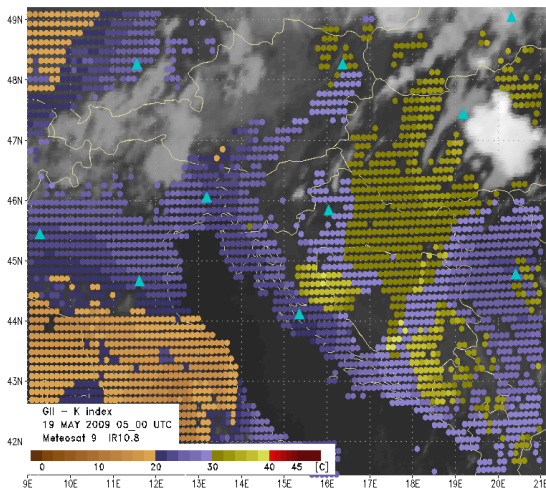
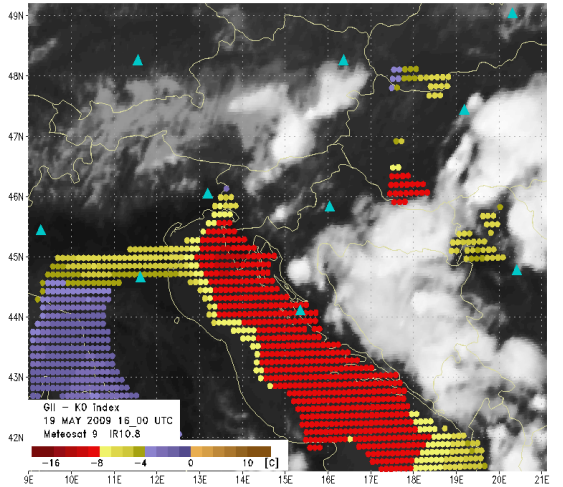
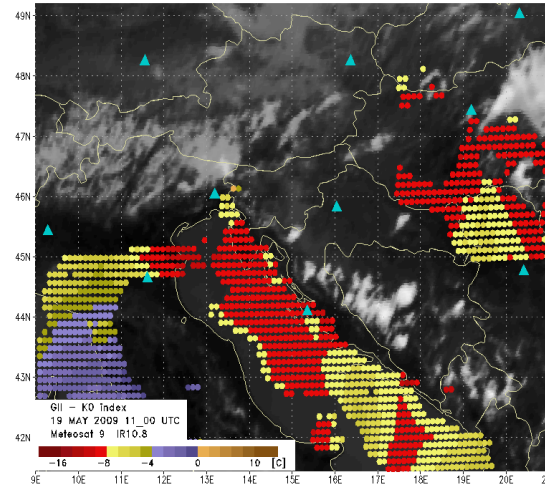
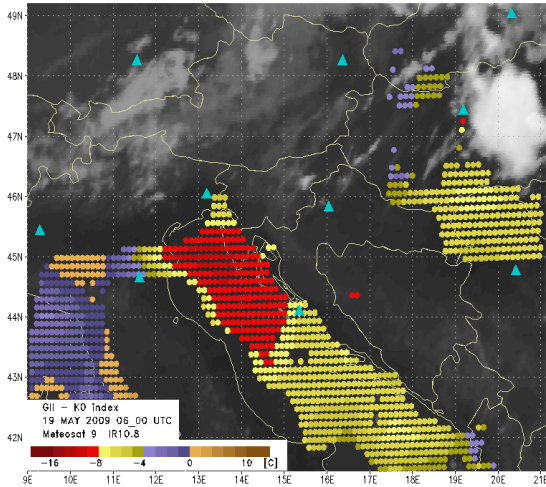
□ Example: 19 May 2009.



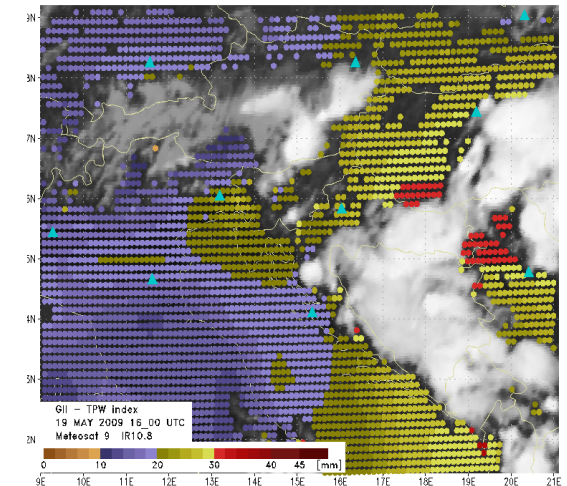
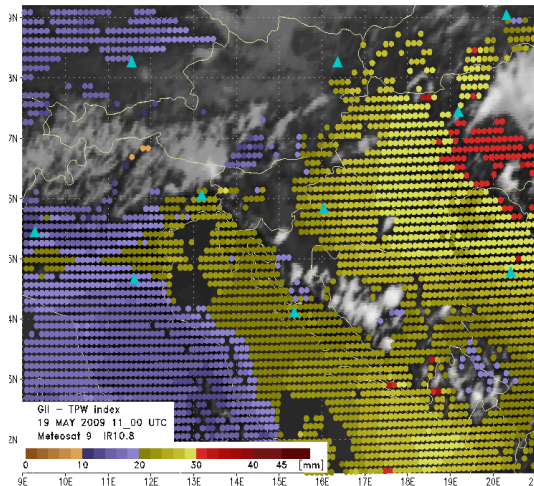
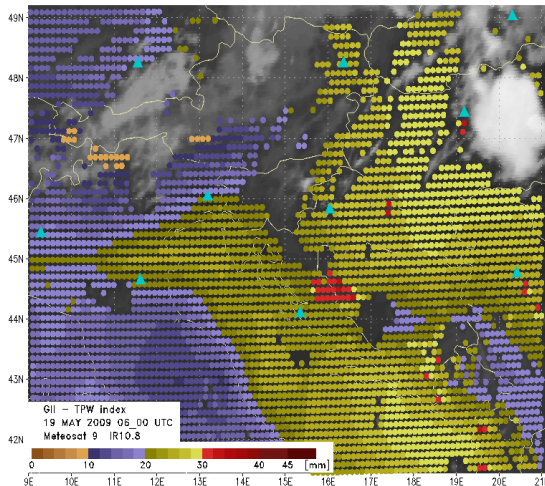
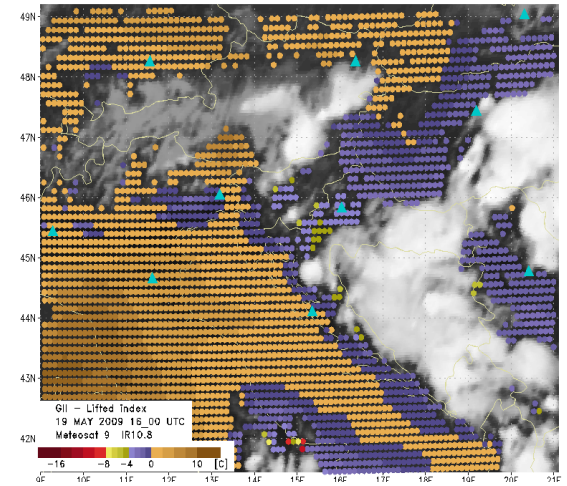
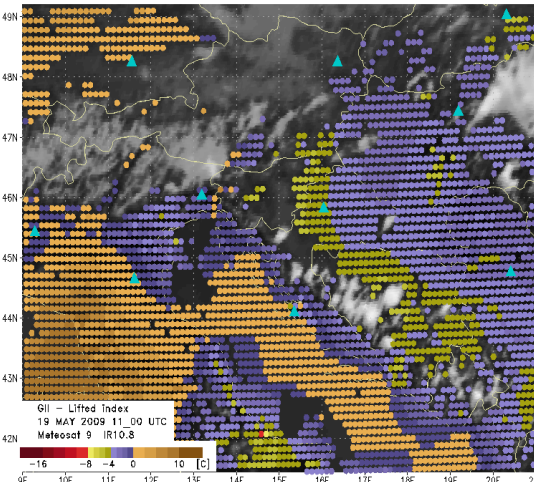
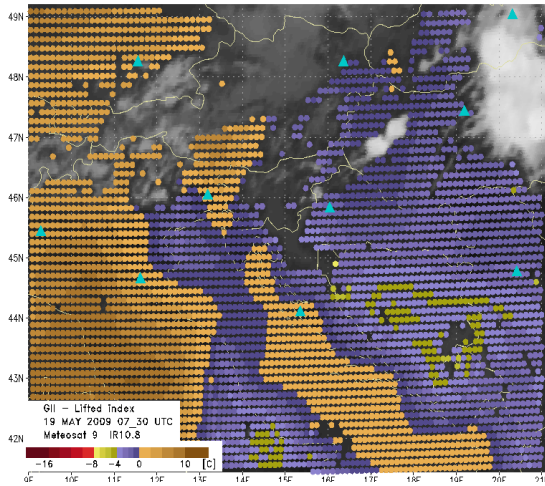
□ *non-gradient pressure field*

□ *SW flow*

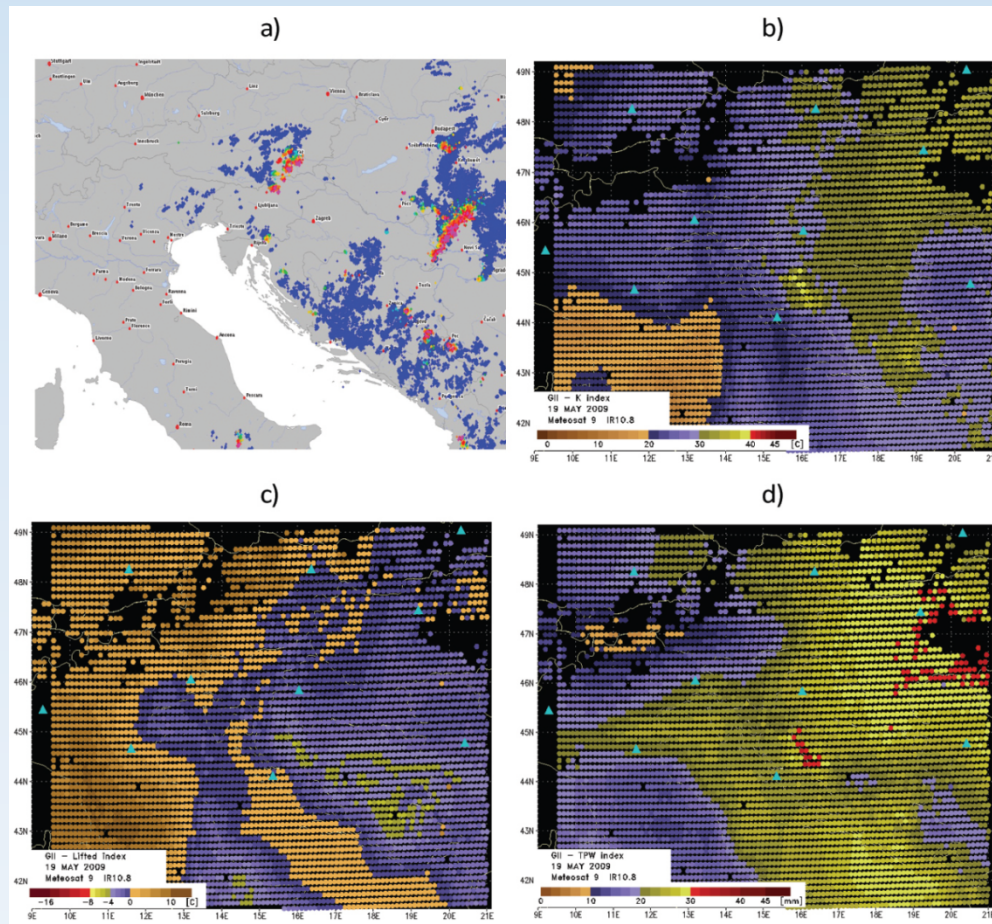
> METHODS OF VERIFICATION



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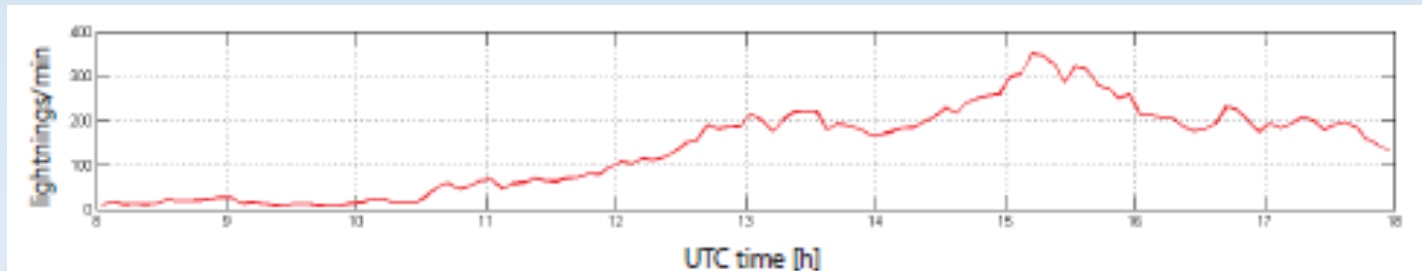


> METHODS OF VERIFICATION

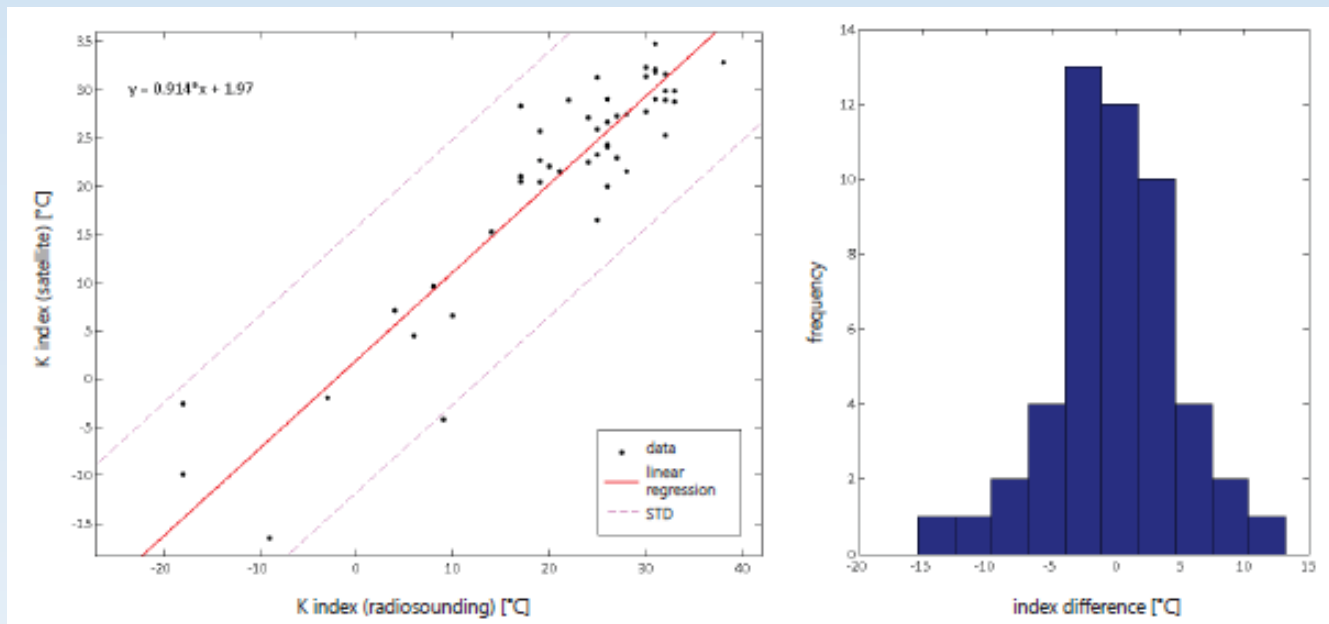


> METHODS OF VERIFICATION

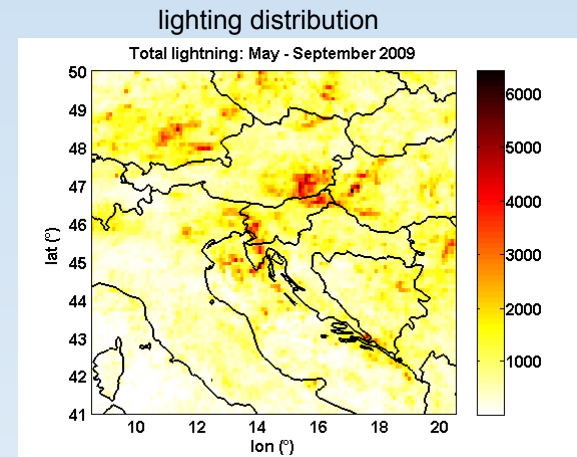
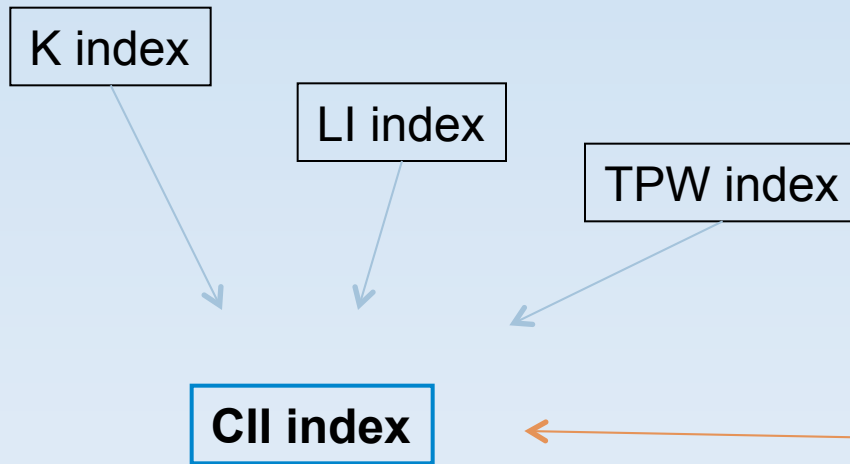
temporal distribution of lightning



> METHODS OF VERIFICATION



> COMBINED INDEX



(Mikuš
and Strelec-Mahović, 2013)

- $CII = 0.8 \times [Mixed\ K\ Index\ contribution + Mixed\ Total\ Totals\ contribution + Lifted\ Index\ contribution + Precipitable\ Water\ contribution] + 0.2 \times [Topography\ contribution]$

(de Coning et al., 2010)

> COMBINED INDEX

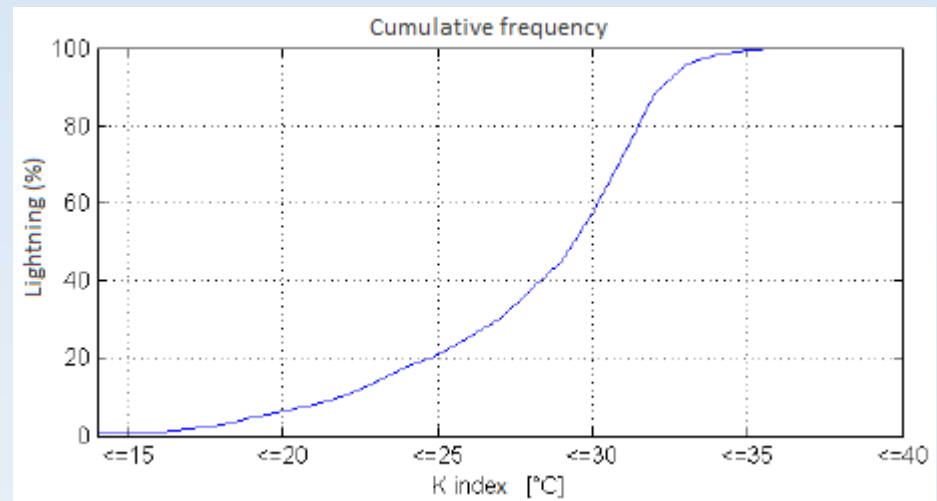
- construction problem: different units, different scales, nonlinearity index-lightning...
- solution: Hanssen-Kuipers (HK) discriminant

| Event Forecasted | Event Observed | | Total |
|------------------|----------------|-----|-------|
| | YES | NO | |
| YES | a | b | a+b |
| NO | c | d | c+d |
| Total | a+c | b+d | n |

$$HK = \frac{(ad - bc)}{[(a + c)(b + d)]}$$

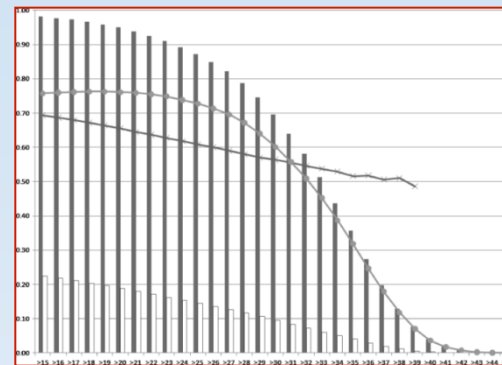
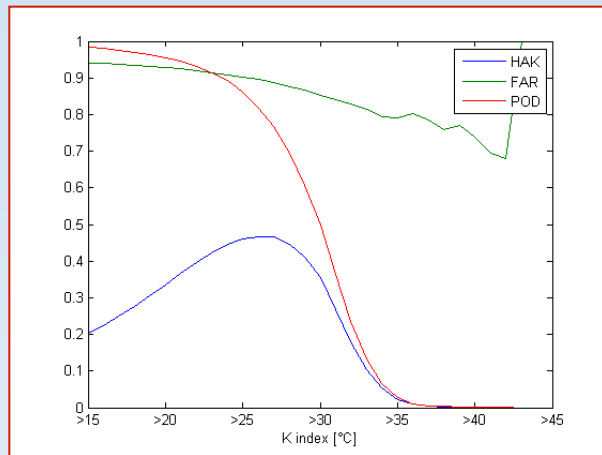
$$POD = \frac{a}{a + c}$$

$$FAR = \frac{b}{a + b}$$



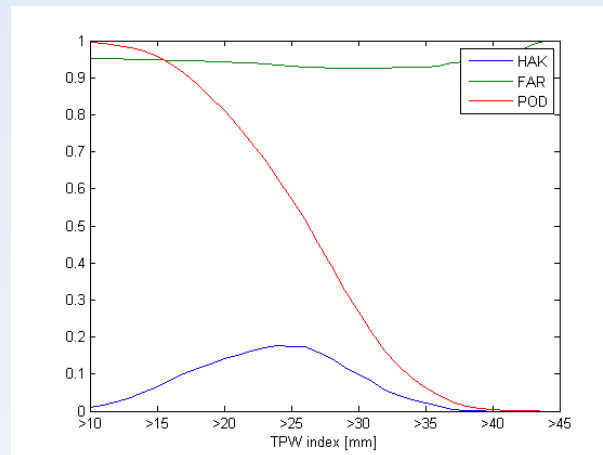
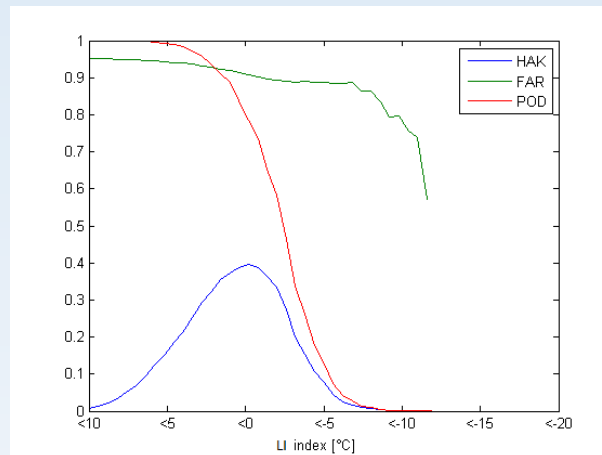
> COMBINED INDEX

> statistical parameters for indices (Summer season 2009)



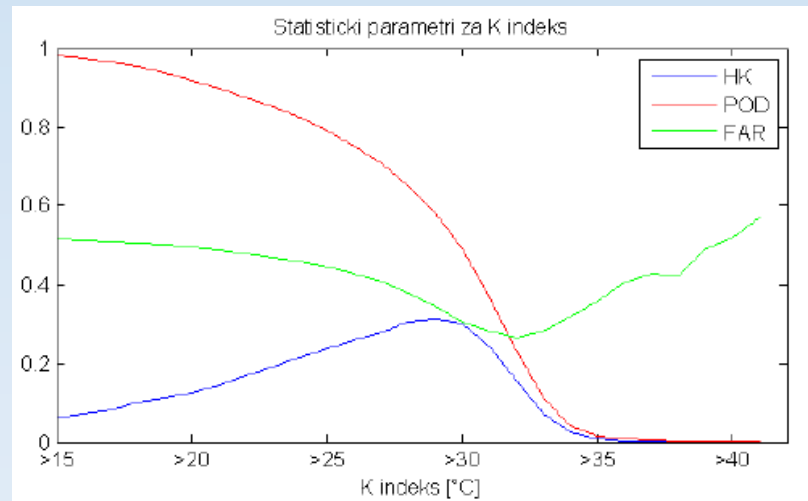
(de Coning et al., 2010)

K index

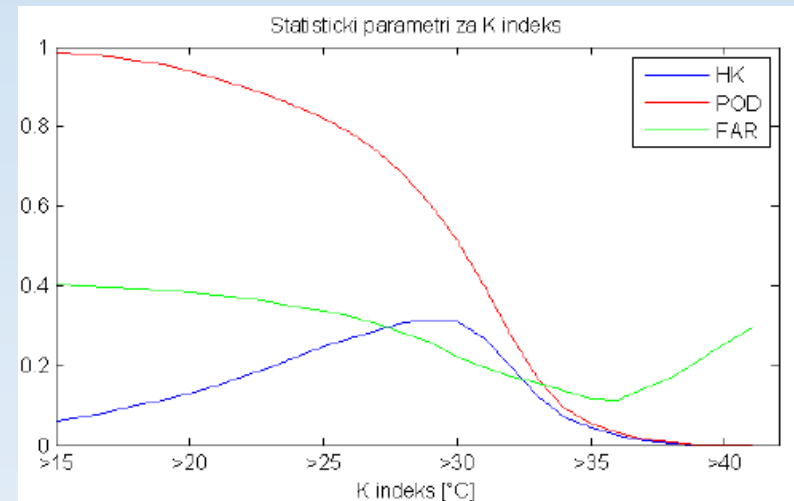


> COMBINED INDEX

2009, 27 cases



2009 and 2010, 40 cases



> CONCLUSION

- good overlapping of instability areas (GII) with lightning
- forecasting/nowcasting of convection from 3 to more than 12 hours
- time tracking significance of GII
- high correlation between GII and radiosounding indices
- high temporal and spatial resolution, wide area
- applicable only for cloud-free area

- meaningful statistics to calculate CII index
- topography contribution to discuss
- need more data to extract HK discriminant (problem of small domain)

Kiitos!

