CI Nowcasting at DLR – Snapshots of ongoing research

by Dennis Stich

2012 Convection Working Group meeting, 27-30 March 2012, Prague
Motivation

Aviation purposes

Cb-TRAM as basic tool

Adding non-satellite fields for further development

NOT(!) especially for forecasters
General idea

Basic Tool (Cb-TRAM)  Verification

Data Fusion

Cb-TRAM + Additional data  Verification

CI-NOW – a CI detection and nowcasting tool

www.DLR.de • Chart 3 • CWG Meeting Prague • Dennis Stich • 28 March 2012
Cb-TRAM - Cumulonimbus TRacking And Monitoring
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Used MSG (rapidscan) data:
- WV 6.2
- IR 10.8
- IR 12.0
- HRV

Detection stages:
1: Convection Initiation (CI)
   development in HRV
   IR 10.8 cooling
2: Rapid development
   WV 6.2 rapid cooling
   (> 1K/15min)
3: Mature storms
   T 6.2 - T 10.8
   HRV texture

Extrapolation up to 60 min
(here 30 minute nowcast plotted)

Description: Zinner et al., 2008
Cb-TRAM - Cumulonimbus TRacking And Monitoring

Detection stages:
1: Convection Initiation (CI) development in HRV IR 10.8 cooling
2: Rapid development WV 6.2 rapid cooling (> 1K/15min)
3: Mature storms T 6.2 - T 10.8 HRV texture

Lightning (LINET)

Extrapolation up to 60 min (here 30 minute nowcast plotted)

Description: Zinner et al., 2008
CI-Verification

Changed a bit,
Improved a bit,
and now skipped due to lack of time!!
Additional data sources

Testing the additional information provided by:

- more satellite channels (SATCAST IFs)
- LINET data
- VERA data
  (e.g. MFC, equivalent potential temperature)
- COSMO-EU data
  (e.g. updraft, KO-Index)
- COSMO-DE data
  (e.g. thunderstorm probability)
Vienna Enhanced Resolution Analysis

Statistics calculated for ~35,000 CI cells over 87 days in summer 2009 (May 15 - 31 August)

$\theta_e < 36^\circ$:
- 1.7% of all hits
- 12.0% of all false alarms

$\theta_e < 41^\circ$:
- 4.8% of all hits
- 22.7% of all false alarms

More information and references:
www.univie.ac.at/amk/vera/
Fuzzy Logic

- KO Index
  - membership grade vs. KO index
  - unstable, neutral, stable

- Omega forcing
  - membership grade vs. omega forcing
  - downward, neutral, upward

- Theta
  - membership grade vs. theta
  - low, middle, high

- Output Fuzzy Sets
  - membership grade vs. CI probability
  - very low, low, medium, high, very high

Images and charts depict concepts in fuzzy logic.
Aims

Reduce the amount of „false alarms“ substantially

Losing as few „hits“ as possible

Using just data where the gain is abundantly clear due to:

- save processing time
- stay easily traceable (selection of data)
Thank you for your attention! Questions?

contact: dennis.stich@dlr.de
CI-Verification

Contingency table

<table>
<thead>
<tr>
<th>Forecast</th>
<th>Observed</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>yes</td>
<td>yes</td>
<td>hit</td>
<td>false alarm</td>
</tr>
<tr>
<td>no</td>
<td>no</td>
<td>miss</td>
<td>correct negative</td>
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</tbody>
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Pixel based
Requires perfect matching!

Object based
double penalty problem

Fuzzy + Object based

DLR
### CI-Verification

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**Object based**

Cb-TRAM analysis used for comparison with the 15, 30, 45, and 60 minutes CI-stage nowcasts and nowcasttracks.