Characterization of the life cycle of convection from initiation to decay on the basis of case study from July, 15th 2007

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Outline

Detection of Convective Initiation
- Radar data
- Satellite data (Brightness temperature)
- Lightning data

Dynamic structure in mature state
- Wind field
- Classification of Hydrometeors

Description of decay process

http://www.sueddeutsches-klimabuero.de/cops/pictures/gallery/IOP_8b/cbarthlott_dscf0533.jpg
Situation on July, 15th 2007 (IOP 8b)

Number of radar sites: 4

Black: First radar cell
    14:20 UTC
Green: Largest cell size
    14:30 UTC
Red: Last radar cell
    15:30 UTC

Cell: reflectivity > 20 dBz
Evolution of convection

Cell initiation (CI) at 14:20 UTC

<table>
<thead>
<tr>
<th>CI</th>
<th>Critical value</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.7 µm TB</td>
<td>&lt; 0 °C</td>
</tr>
<tr>
<td>10.7 µm TB time trend</td>
<td>&lt; -4 °C / 15min</td>
</tr>
<tr>
<td>6.5 – 10.7 µm difference</td>
<td>-35 to -10 °C</td>
</tr>
<tr>
<td>6.5 – 10.7 µm time trend</td>
<td>&gt; 3 °C / 15 min</td>
</tr>
</tbody>
</table>

Mecikalski and Bedka, 2006
Comparing of the radial velocities of all four radar data
Relative far length between radar sites
Relative small cell size
Estimation of the wind field by using dual-doppler method

- Data gridded to a common volume by using SPRINT
- U and V wind components computed by using CEDRIC
Radial velocity, Feldberg radar

Divergence and convergence structure

PPI at 14:37:36
elevation: 1.5°

CAPPI
height: 2.0 km

Vertical cross section
Divergence Line?

DOW, Fessenheim
Origin: -6, -93

IMK, Karlsruhe
Origin: 61, 39
3D wind field

Convergence structure at ground?

Poldirad (DLR) PPI taken at
14:40:50 (elevation: 1°)
14:41:34 (elevation: 2°)
Investigation of microphysical processes

Range height indicator scan at 14:44:10, 128°

Classification of hydrometeors after Höller et al. 1994

<table>
<thead>
<tr>
<th>Stroke No.</th>
<th>Time [UTC]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>14:41:12.599</td>
</tr>
<tr>
<td>2</td>
<td>14:43:05.328</td>
</tr>
<tr>
<td>3</td>
<td>14:43:05.330</td>
</tr>
<tr>
<td>4</td>
<td>14:43:05.333</td>
</tr>
<tr>
<td>5</td>
<td>14:44:23.836</td>
</tr>
<tr>
<td>6</td>
<td>14:44:23.878</td>
</tr>
</tbody>
</table>

Spatial and temporal overlay in a very small range
Future plans

• Better calculation of the 3D wind field, in- and outside of the radar cells
• Second case study: 20.07.2007 with additional wind data, e.g. LIDAR-airborne data
Conclusion

- Description of life cycle from initiation to decay

- Wind field estimated while mature state by using Dual-doppler method with data of 4 radar sites

- Investigation of microphysical processes
Lidar data

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MAP

Backscatter Ratio at 1064 nm (|| Polarisation)

Water Vapour Mixing Ratio [g/kg]

Preliminary quick-look data. Processed on 16-07-2008. Contact: DLR Institute of Atmospheric Physics. Gerhard.Ehret@dlr.de

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