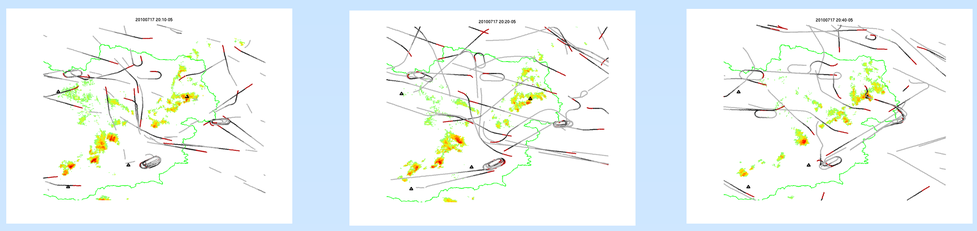
Weather Radar Detection of Local Severe Storms in Austria and their Impact on Aviation

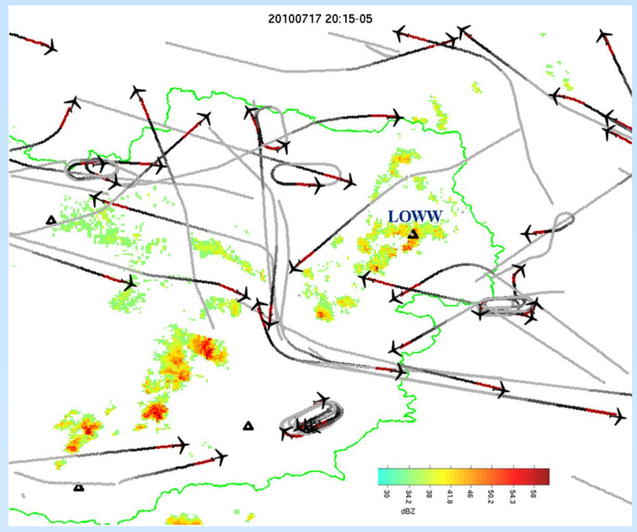
R. Kaltenboeck

Austrocontrol - Aviation Weather Service, Vienna, Austria, rudolf.kaltenboeck@austrocontrol.at

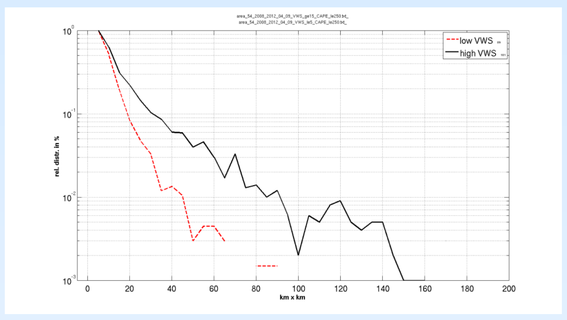
Thunderstorms - Aviation:



Austria composite of weather radar maximum projected reflectivity Z_H (>35dBZ) overlaid by aircraft trajectories (10 minutes history, latest position in red). Circumnavigation and holding patterns are evident due to the hazardous thunderstorms over the Alps and close to Vienna int. airport (LOWW). Austrian border lines drawn in green, Austrian international airports indicated as black triangle. 17th May 2010 2010, 2020 and 2040 UTC respectively.

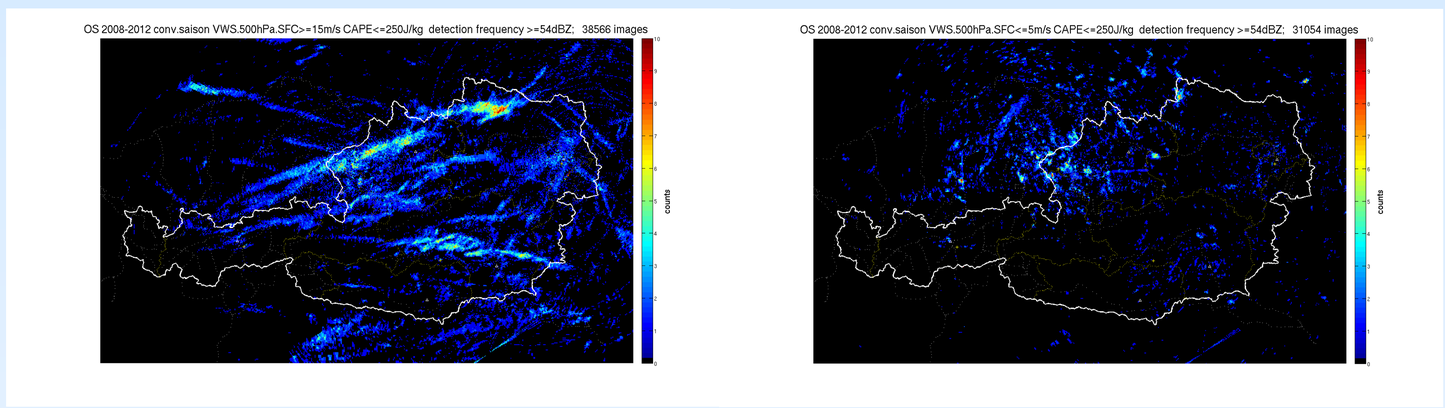


Climatology:



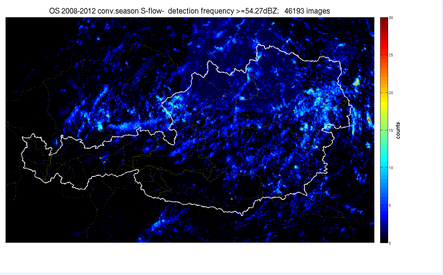
Cell area distribution for classification: $Z_H \geq 54$ dBZ ; low CAPE; weak (red) and strong (black) deep-layer vertical shear

Deep-layer vertical wind shear:



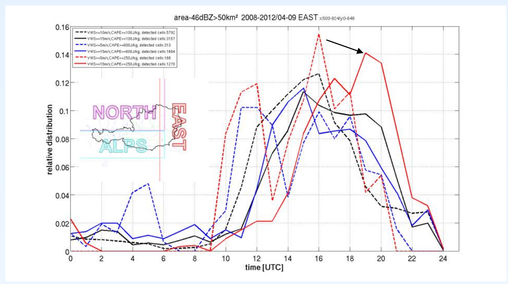
5 year frequency distribution of maximum projected radar reflectivity $Z_H \geq 54$ dBZ for low CAPE environment. Strong (left) vs. weak (right) deep-layer vertical shear classification are shown.

Southern synoptic flow:

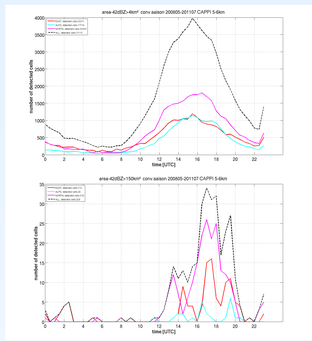


5 year frequency distribution of $Z_H \geq 54$ dBZ.

Cell area - diurnal cycle - subareas:

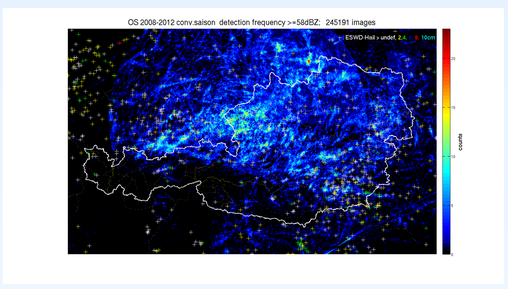


Diurnal cycle of Z_H contour exceeding 46 dBZ and an area of 50 km² for the eastern part of Austria. See legend for different CAPE and deep-layer shear classification.



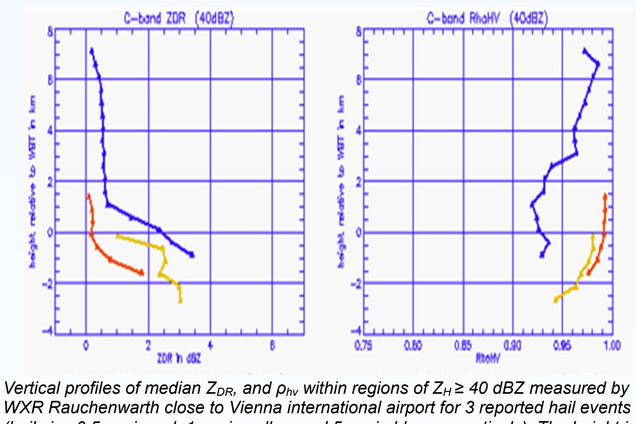
Diurnal cycle of Z_H contour exceeding 42 dBZ and an area of 4 and 150 km² respectively. CAPPI level height is 5-6 km msl. For regional separation see legend.

ESWD hail reports:



5 year frequency distribution of $Z_H \geq 58$ dBZ overlaid by ESWD hail reports.

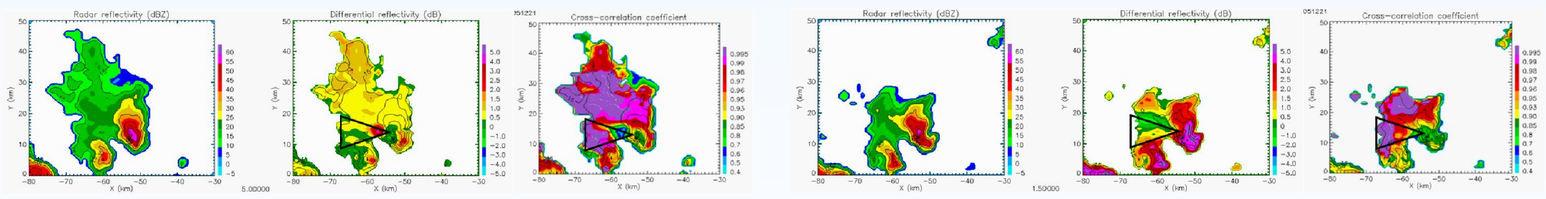
Dual Polarization (C band):



Vertical profiles of median Z_{DR}, and ρ_{hv} within regions of $Z_H \geq 40$ dBZ measured by WXR Rauchenwarth close to Vienna international airport for 3 reported hail events (hail size 0,5 cm in red, 1 cm in yellow and 5 cm in blue respectively). The height is given with respect to the zero wet bulb temperature level.

Hail signature:

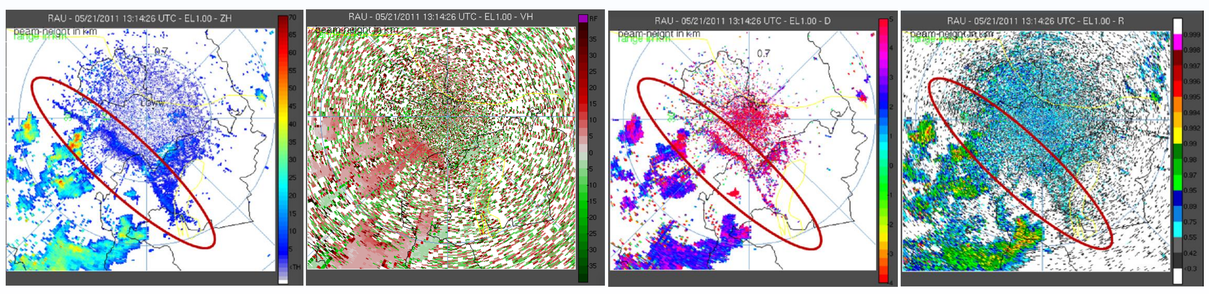
-10°C level …….. high Z_H, low ρ_{hv}, Z_{DR} ~ 0 /pos.
below freezing level….high Z_H, low ρ_{hv}, high Z_{DR}, high ϕ_{DP}



Composite plots of Z_H, Z_{DR}, and ρ_{hv} at -10°C wet bulb temperture height. (CAPPI height is 5 km) obtained by WXR Rauchenwarth on 5th Sep. 2011 1221 UTC. Reported hail size diameter is 3 cm. Arrows indicate polarimetric hail signature within cell core center accompanied by depression of Z_{DR}(0 dB), and ρ_{hv} (0.85) -> «Z_{DR} / ρ_{hv} hole“.

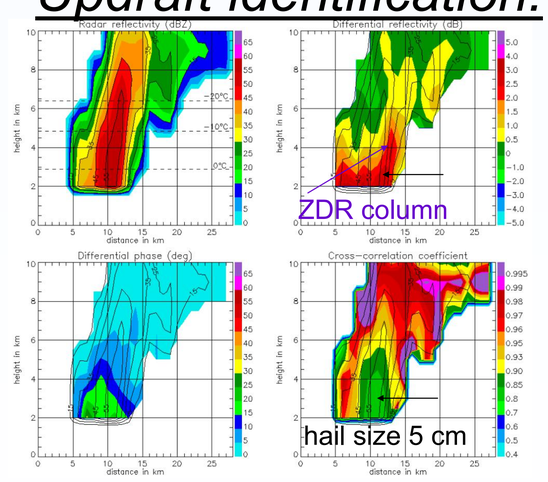
Polarimetric hail signature below freezing level at CAPPI height 1.5 km. Arrows indicate hail signature within cell core center accompanied by high values of Z_{DR} (>5 dB) and low values of ρ_{hv} (0.7). Note the hook and size sorting of the nontornadic supercell.

Convergence line:



Convergence line as fine line in Z_H (marked by red ellipse) from 21st May 2011 1314 UTC at PPI elevation 1° WXR Rauchenwarth. From left to right: Z_H, V_H, Z_{DR}, and ρ_{hv}. Range ring distance is 25 km. This convergence line caused wind shift at Vienna airport and triggered thunderstorms about 2 hours later.

Updraft identification:



References:
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