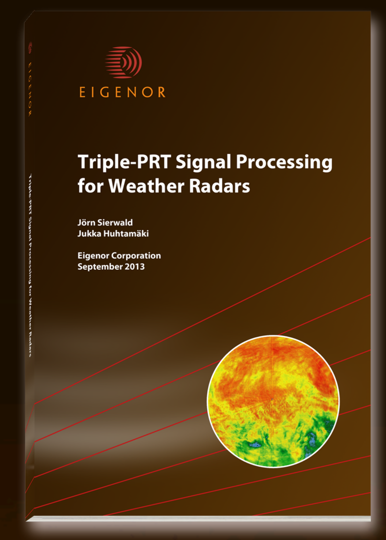
Comparison of single-PRT, dual-PRF and triple-PRT weather radar measurements

We have compared three different pulsing schemes for a Doppler weather radar. The measurements were made using a C-band dual-polarization radar located at Kumpula Campus in Helsinki.

Different pulsing schemes were run consecutively separated by a time interval of a few minutes. Single-PRT and dual-PRF data were analyzed using Vaisala's software in an RVP900 signal processor. Triple-PRT measurements were processed using the latest version of Eigenor WnD software. While all schemes have their own advantages, we demonstrate that best reflectivity, velocity and width estimates are obtained using the triple-PRT scheme.

For more detailed discussion, please check the book titled *'Triple-PRT Signal Processing for Weather Radars'*, Eigenor Corporation 2013.



Pulsing schemes

single-PRT: pulse intervals 2.5 ms
dual-PRF: pulse intervals 1.67 and 2.5 ms
triple-PRT: pulse intervals 1.75, 2.0 and 2.5 ms

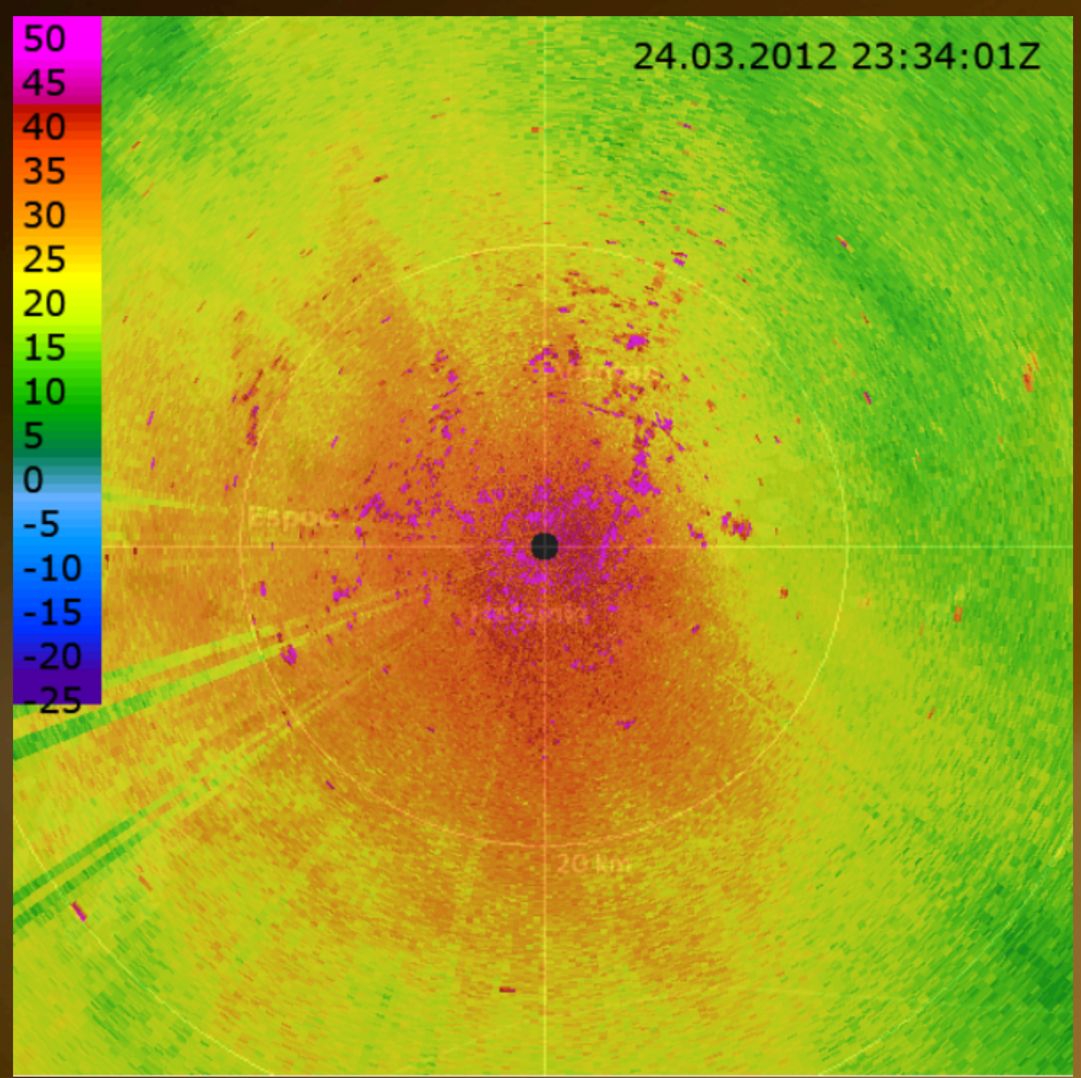
Ground clutter filters

single-PRT: GMAP
dual-PRF: notch filter
triple-PRT: adaptive WnD

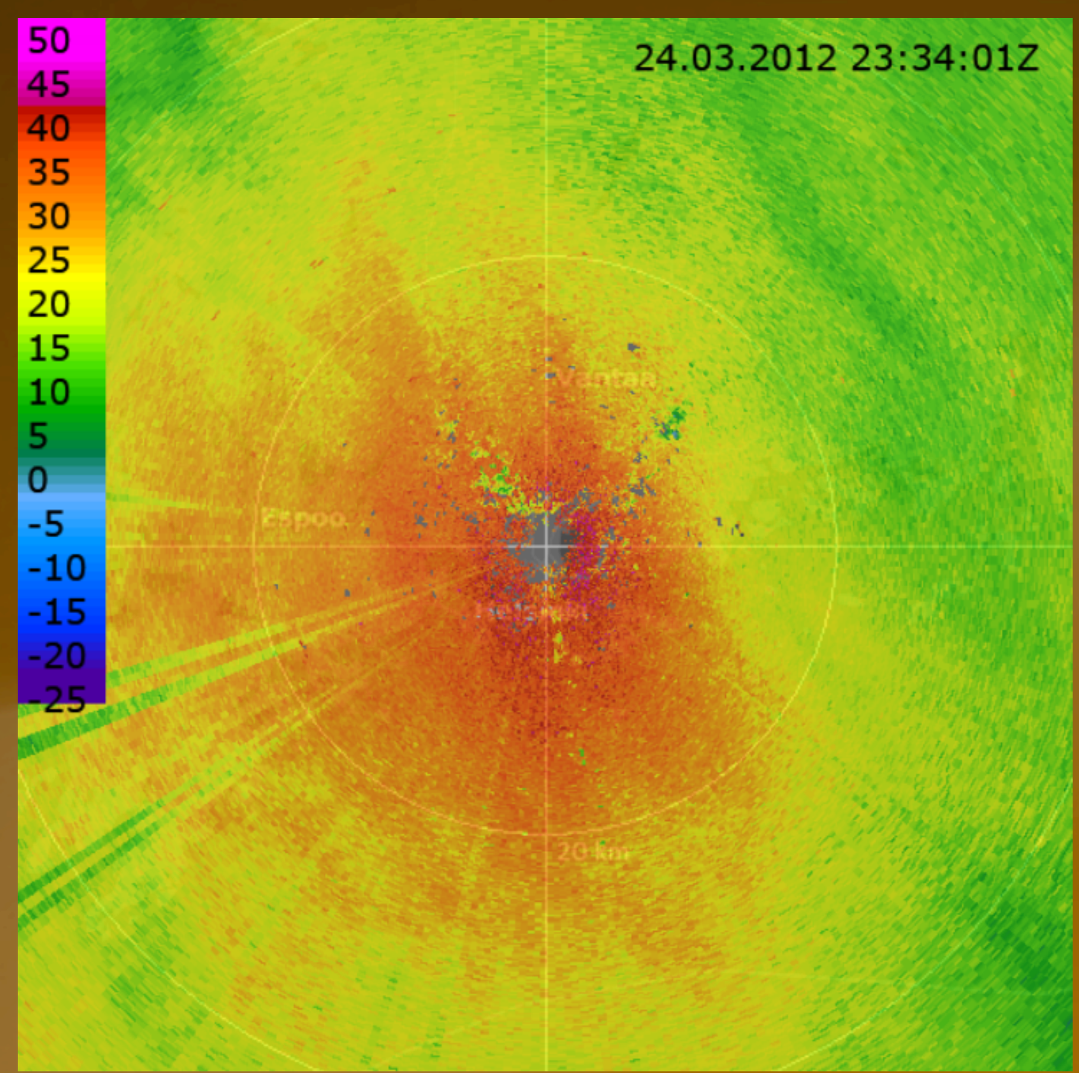
Worst-case scenario for clutter removal: low-speed, low-width snowfall at 0 °C

with 0.5 degree elevation angle

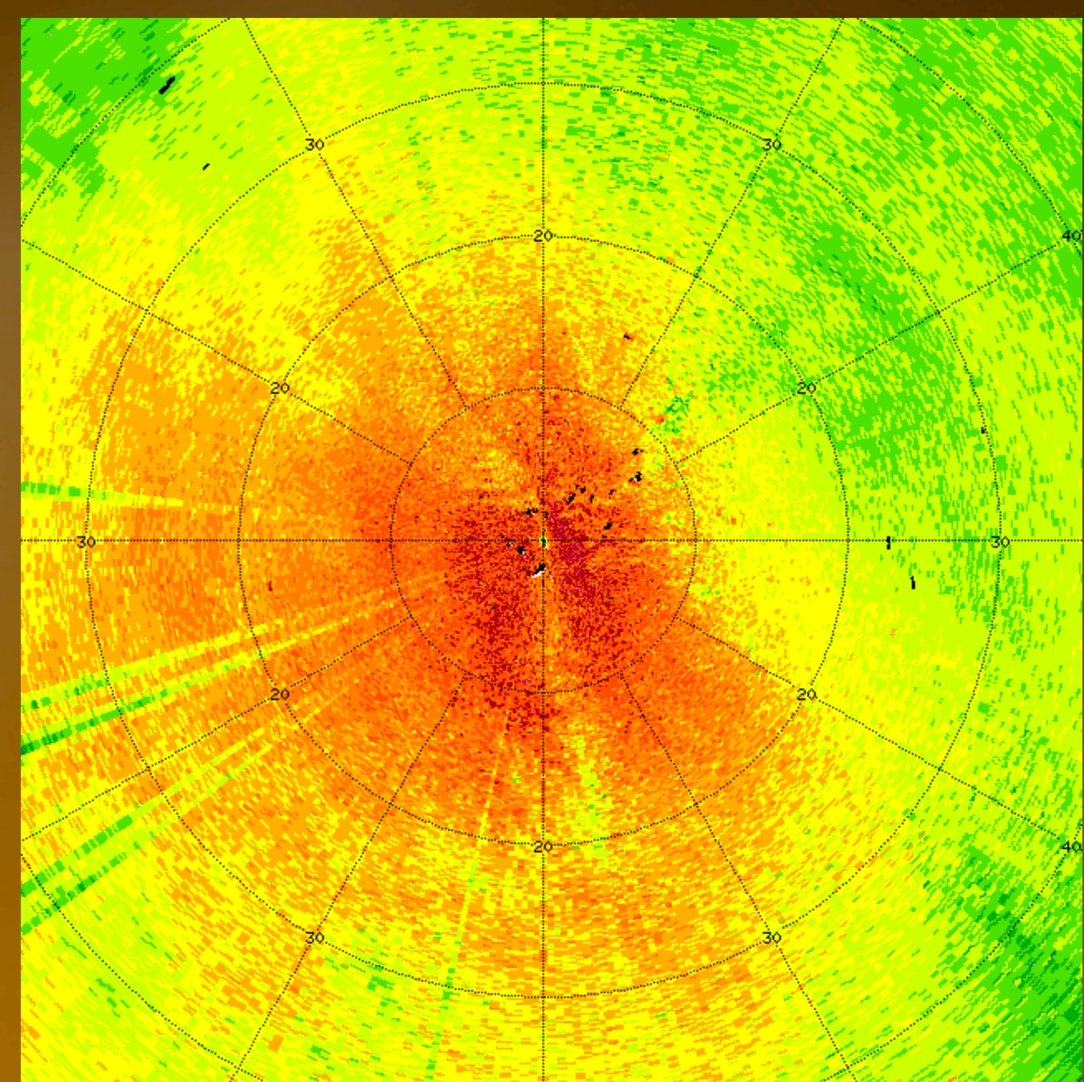
received power



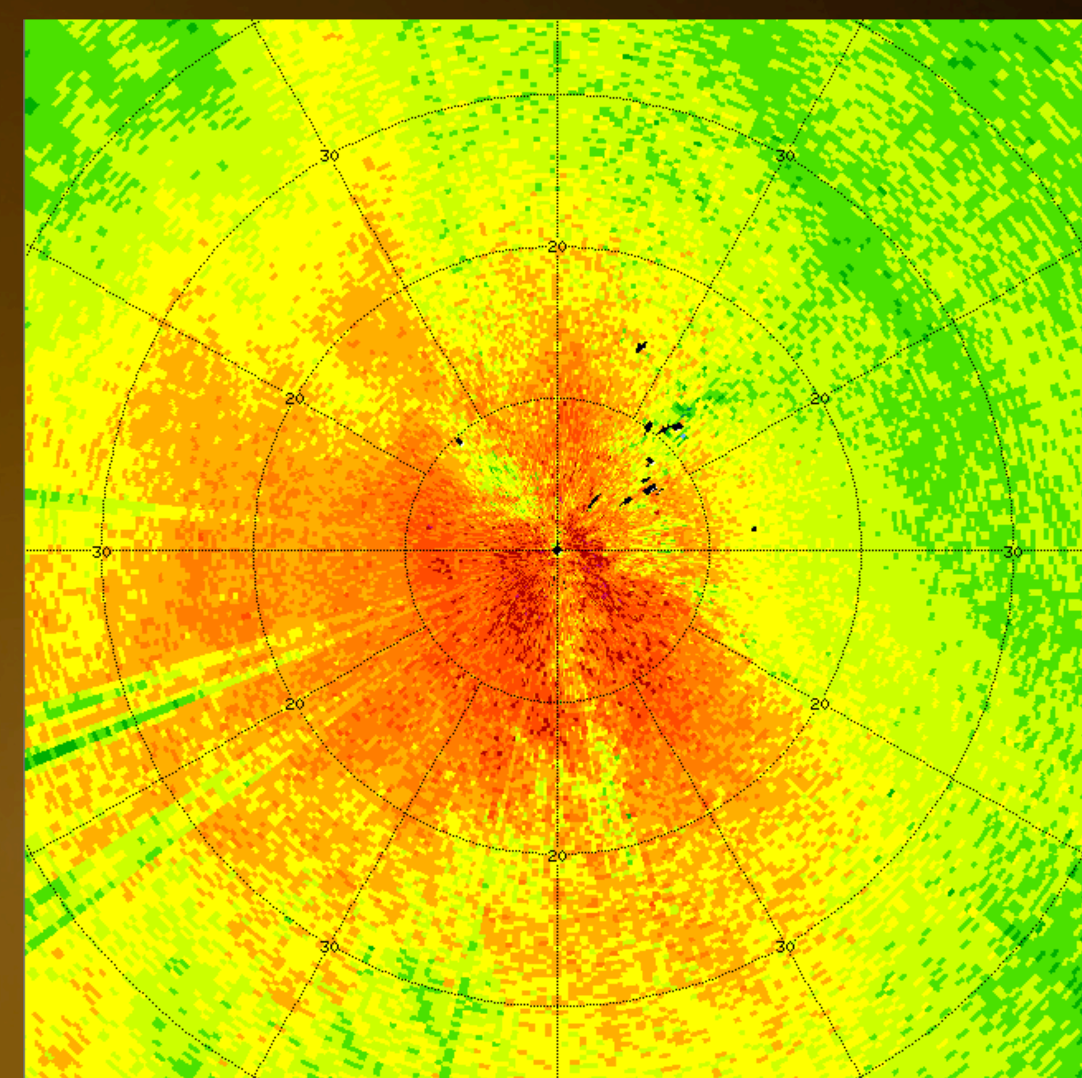
Z: triple-PRT



Z: single-PRT



Z: dual-PRF



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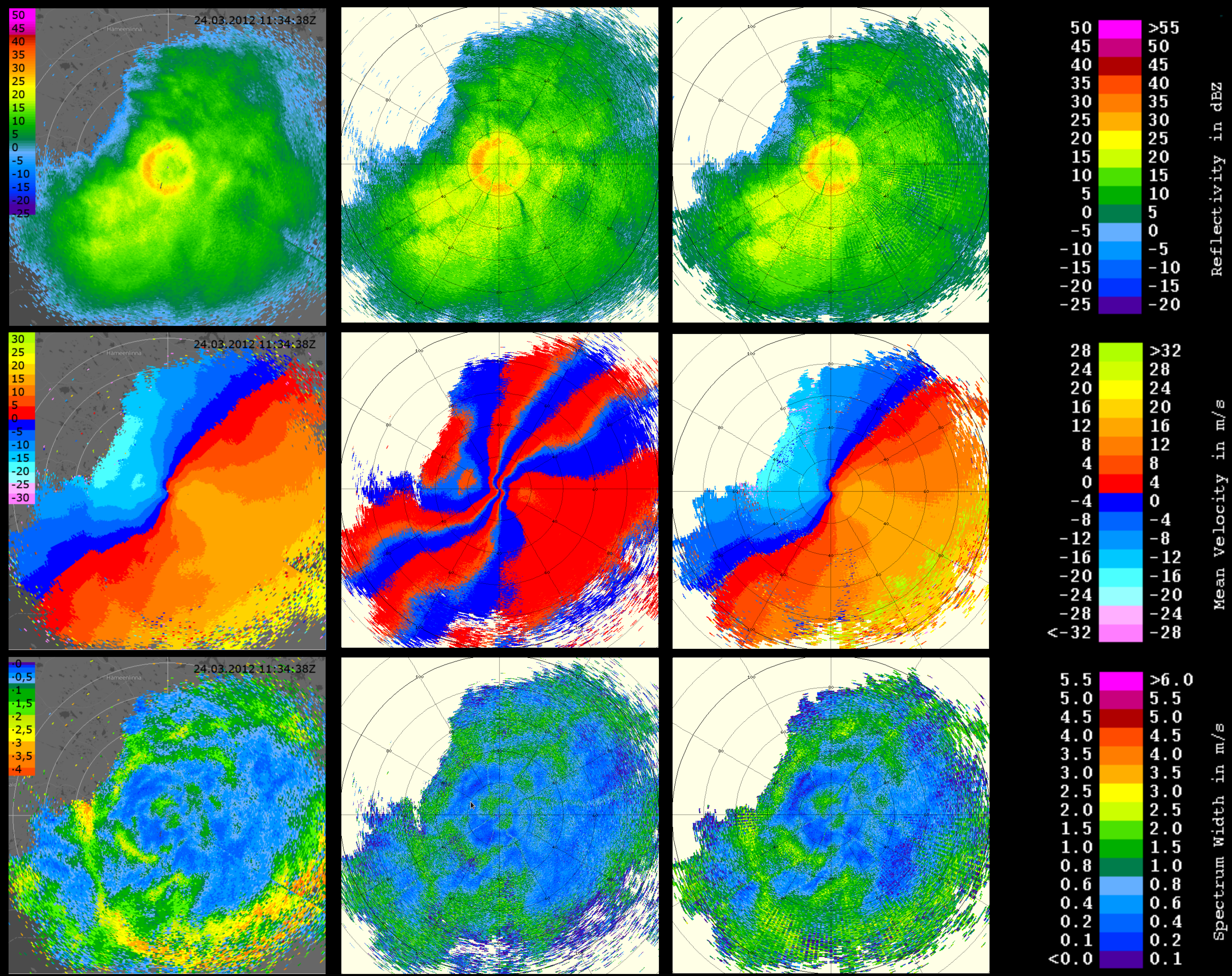
Snowfall in March 2012

with 2 degree elevation angle



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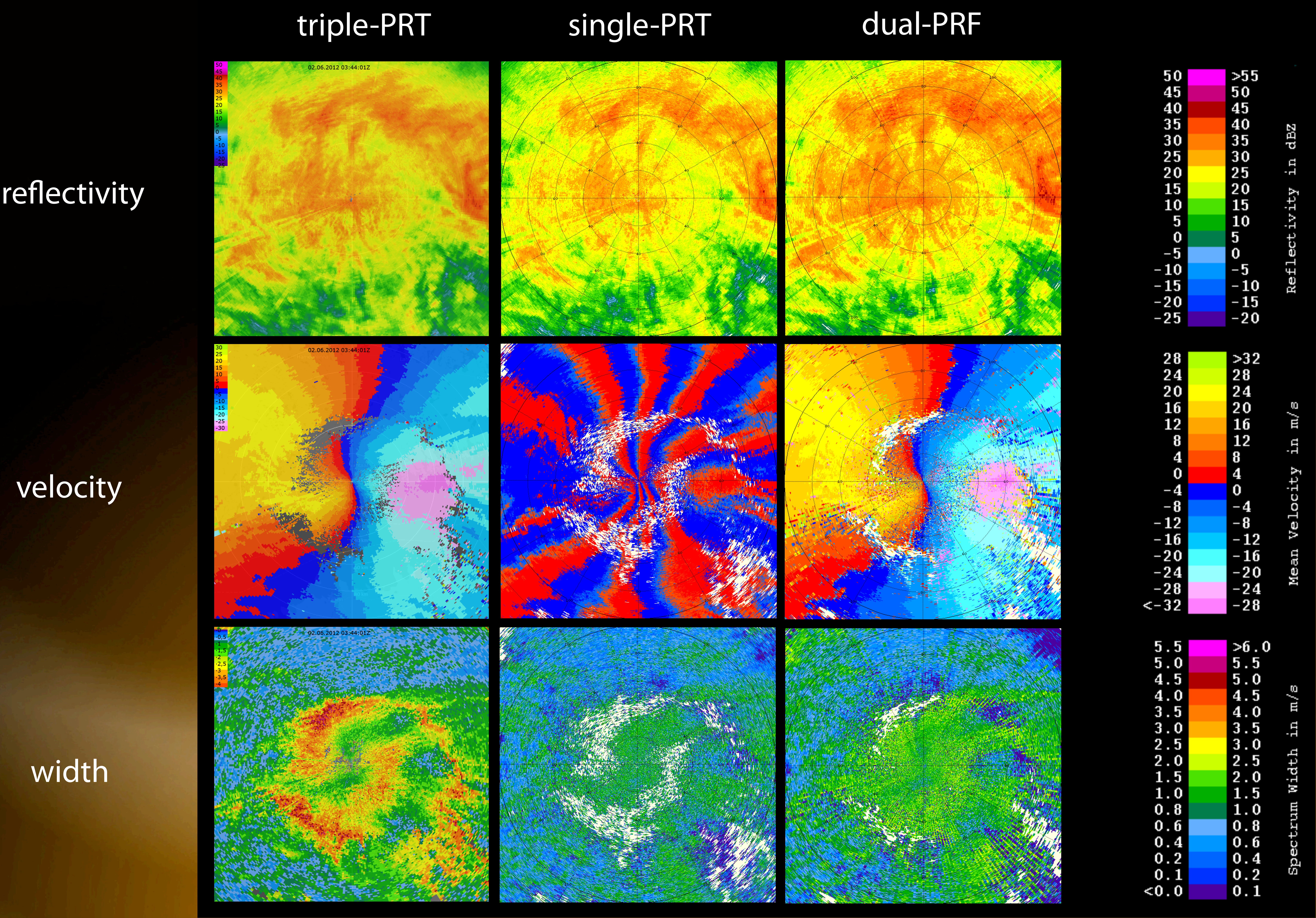
Rainstorm in June 2012

with 0.5 degree elevation angle



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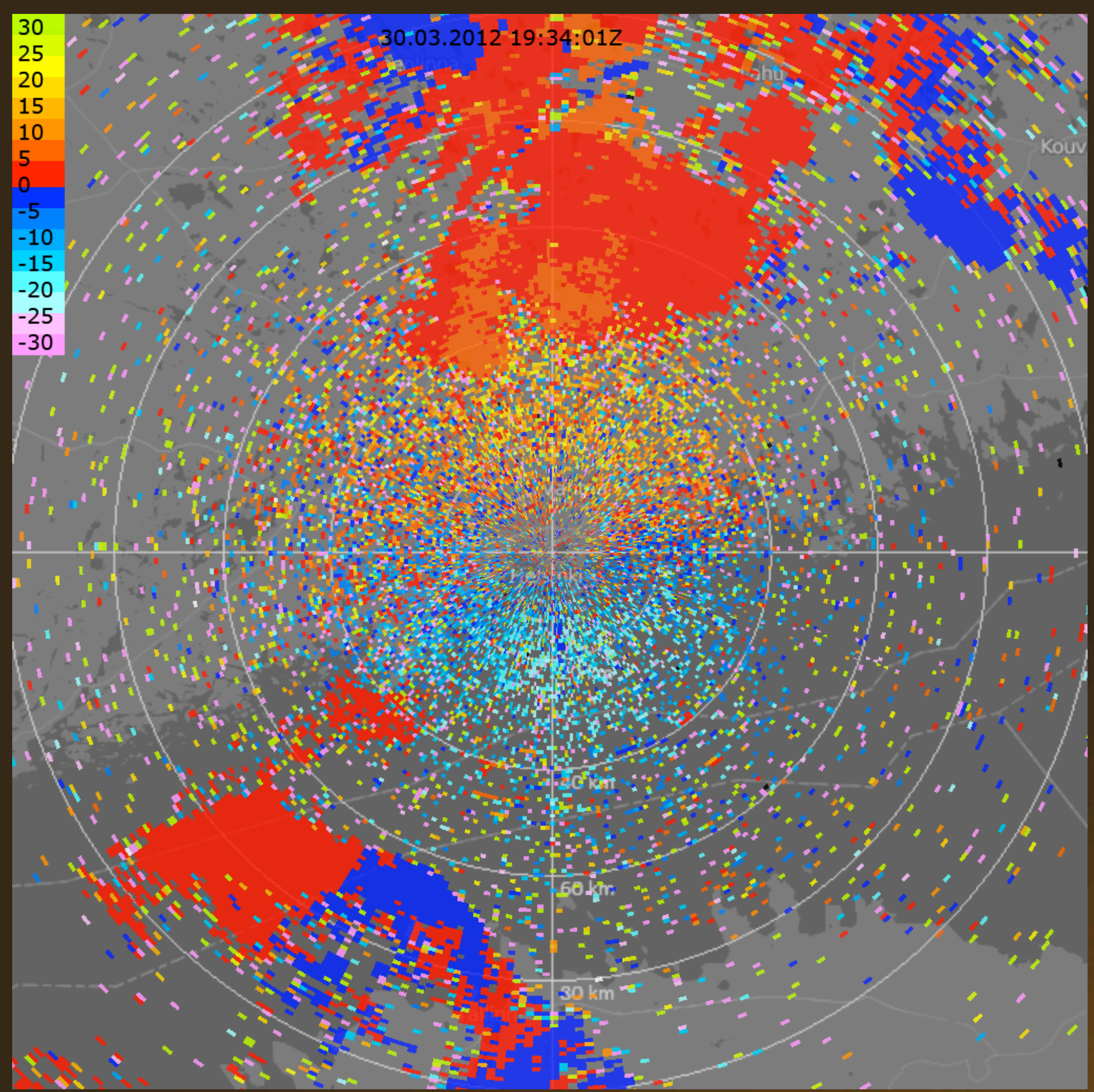
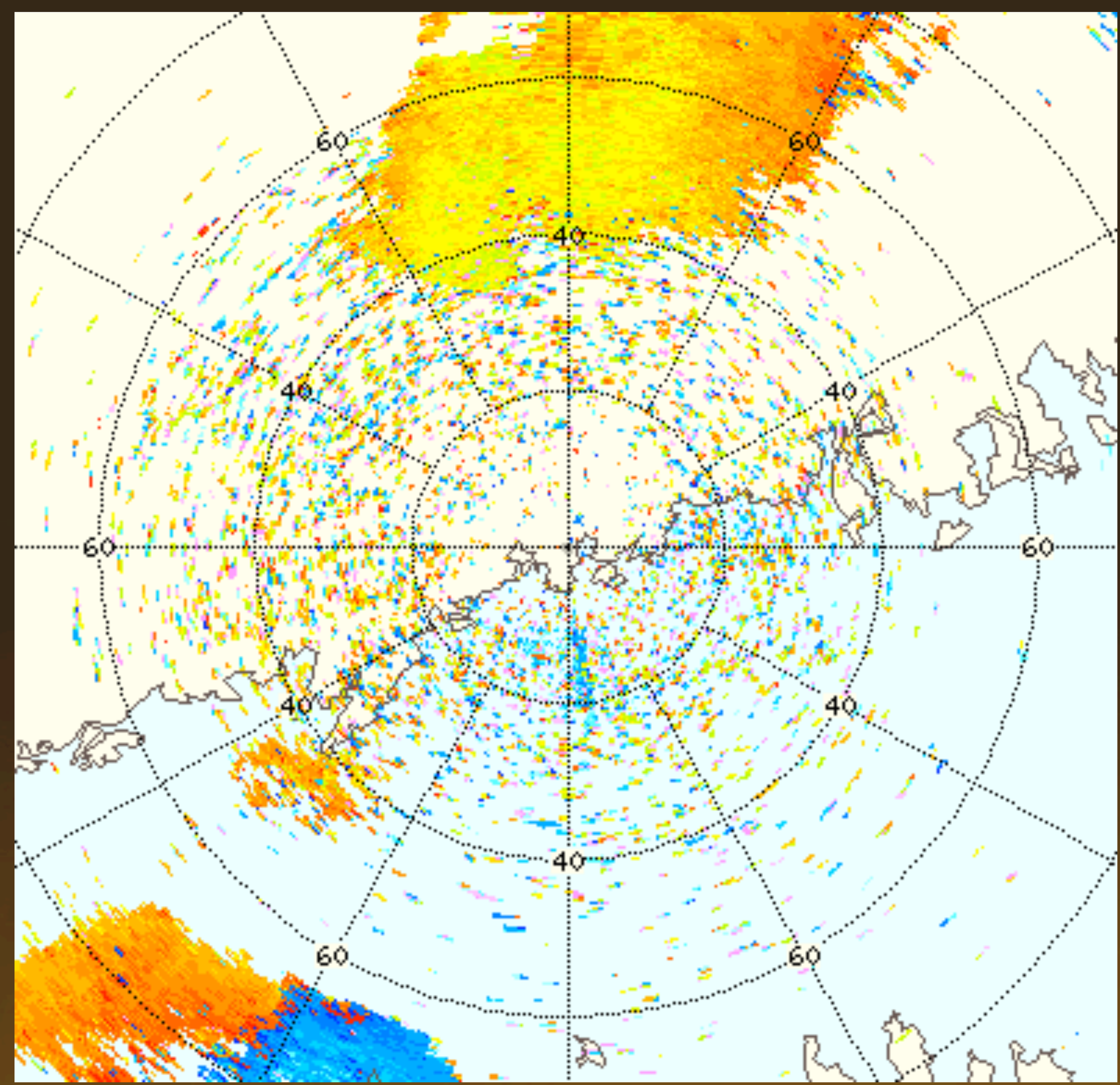
Examples of triple-PRT advantages

Bird migration in March 2012

triple-PRT



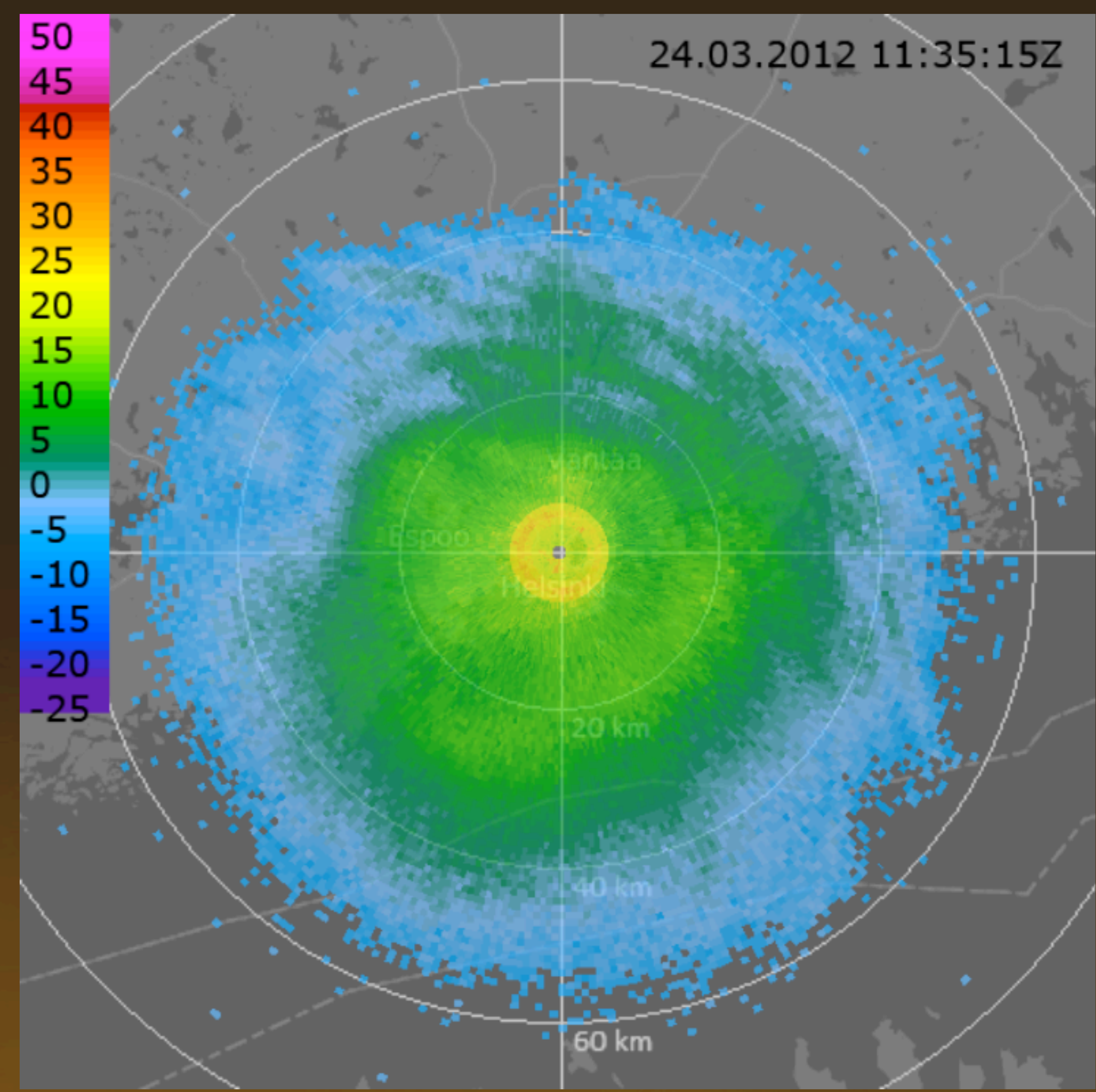
single-PRT



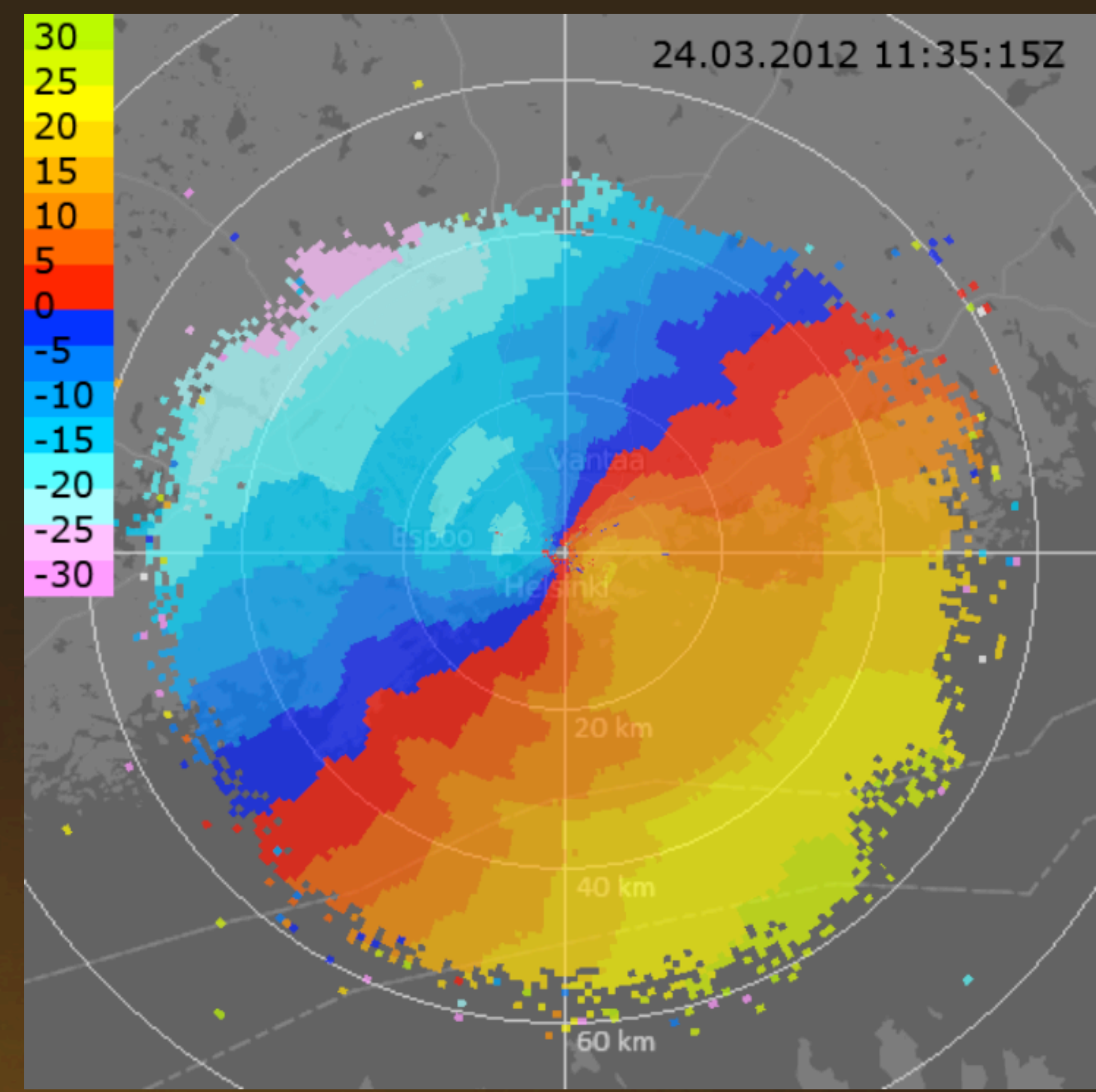
with 0.5 degree elevation angle

Accurate velocity estimates to SNR = -5 dB

reflectivity



velocity

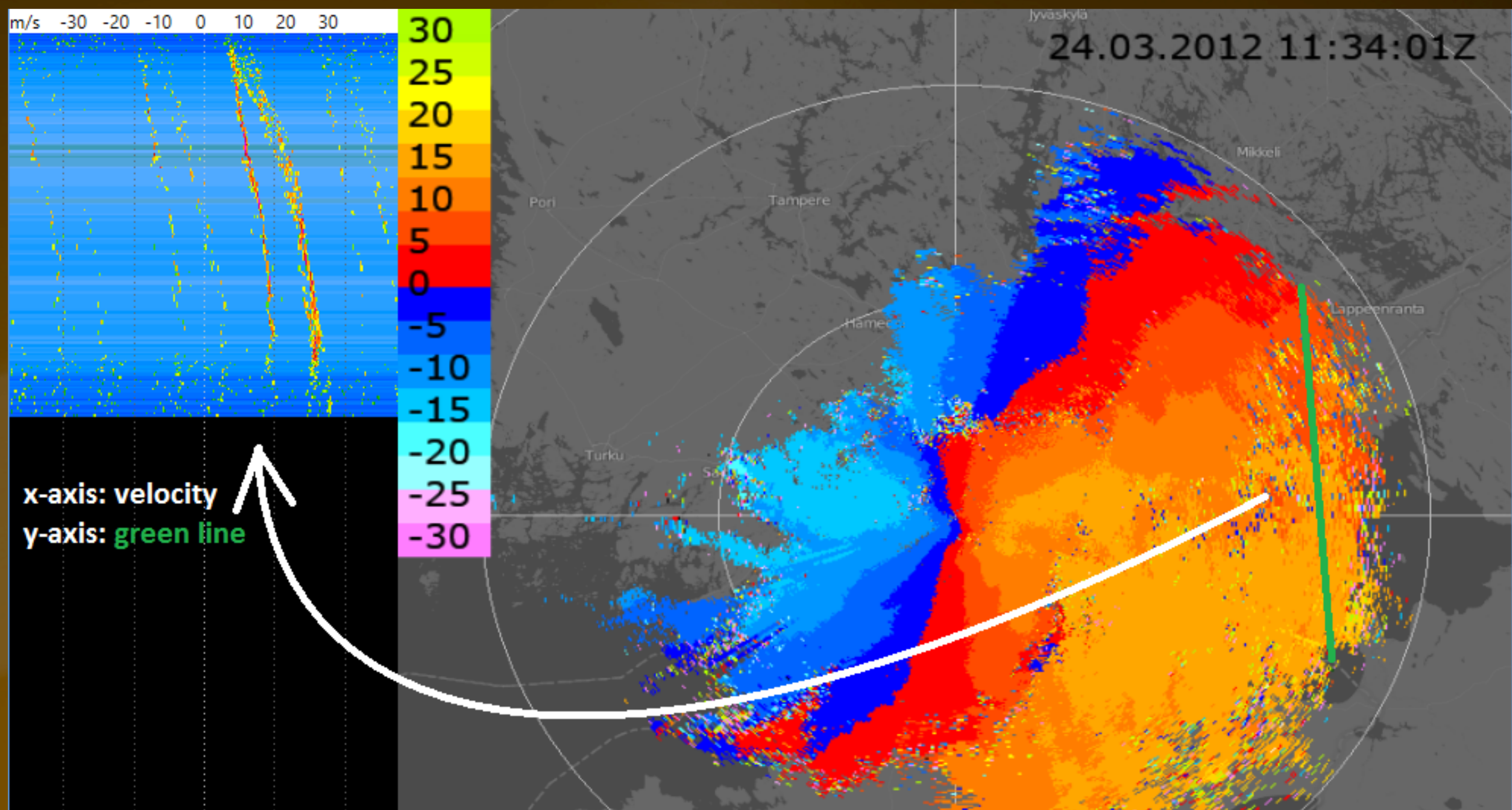


with 6 degree elevation angle

In triple-PRT measurements, meteorological products are estimated for each range bin separately. This enables accurate velocity analysis for small targets, such as birds or patchy precipitation.

ACF-based velocity and width estimation yields low error rates even from noisy data. Scan of snowfall shown in the upper right corner.

Unique method of calculating the velocity distribution reveals, for example, atmospheric boundary layers, as shown on the right. In this example there are two air masses moving at different velocities within the radar beam.



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