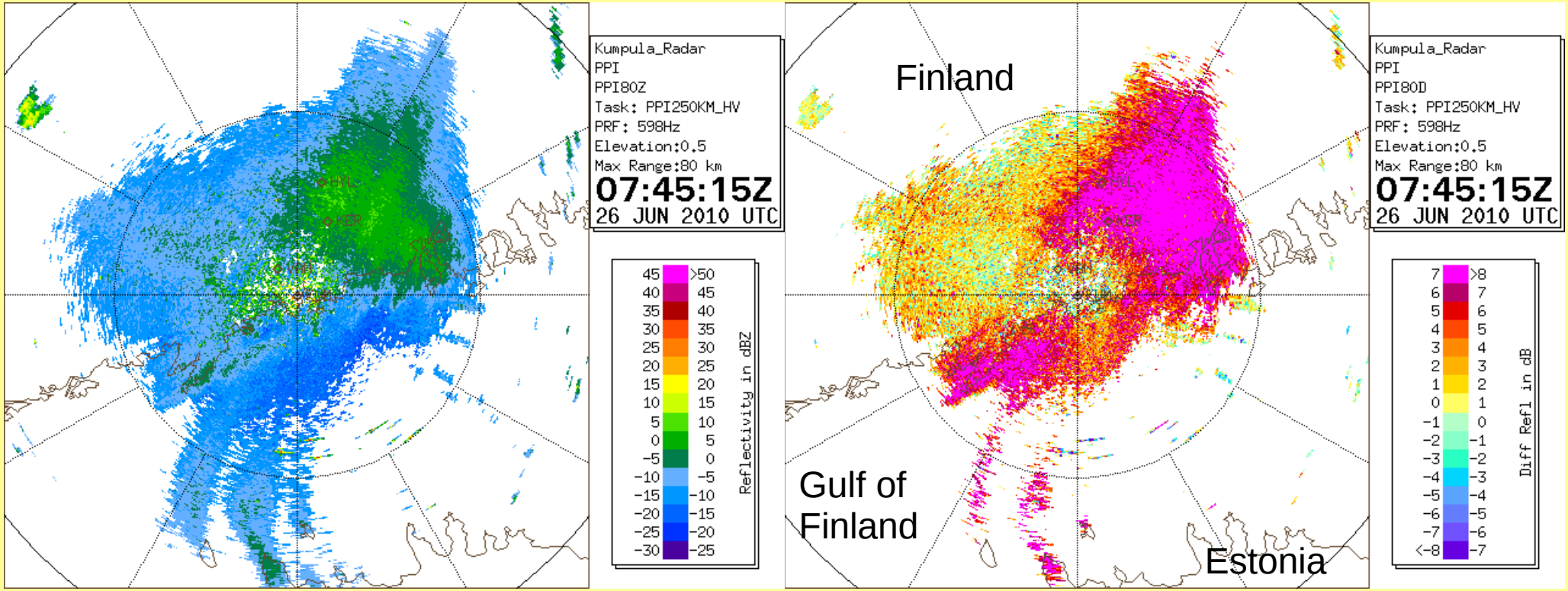
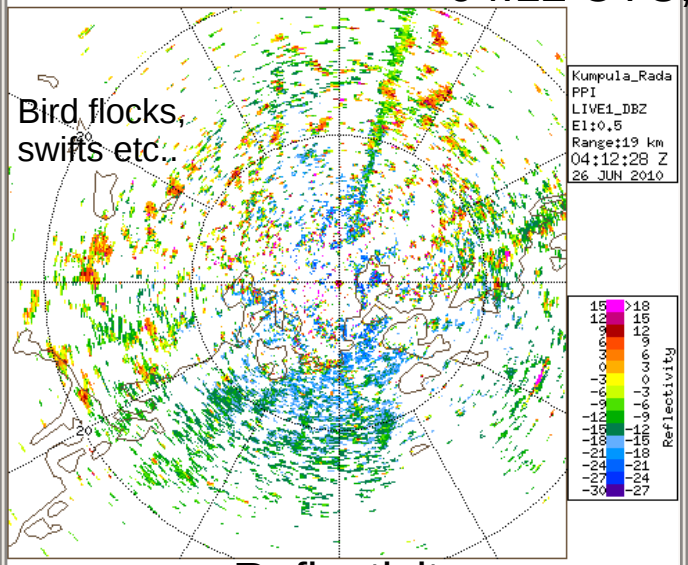
Recognition of insect migrations in polarimetric weather radar measurements

Matti Leskinen, University of Helsinki

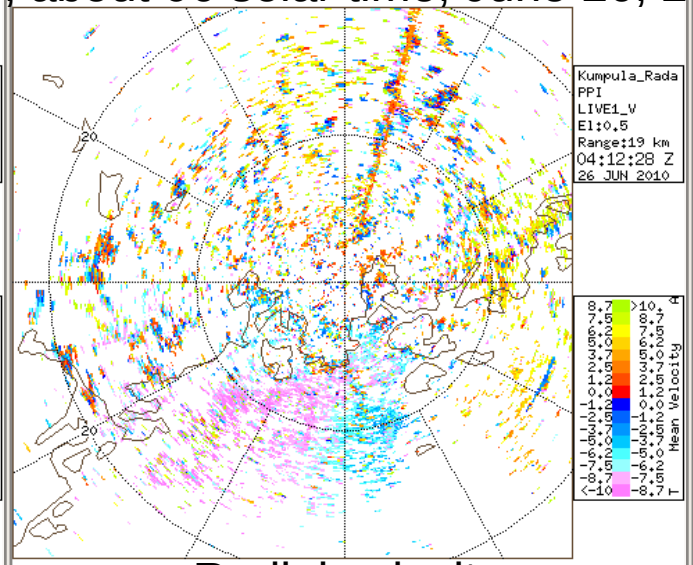


Migration northwards, especially from the islands of the Gulf of Finland, June 26, 2010.
Curved plumes over the sea as the insects get higher and the wind direction changes.
Kumpula radar is a Vaisala WRK-200 dual-polarimetric Doppler weather radar (STAR mode)

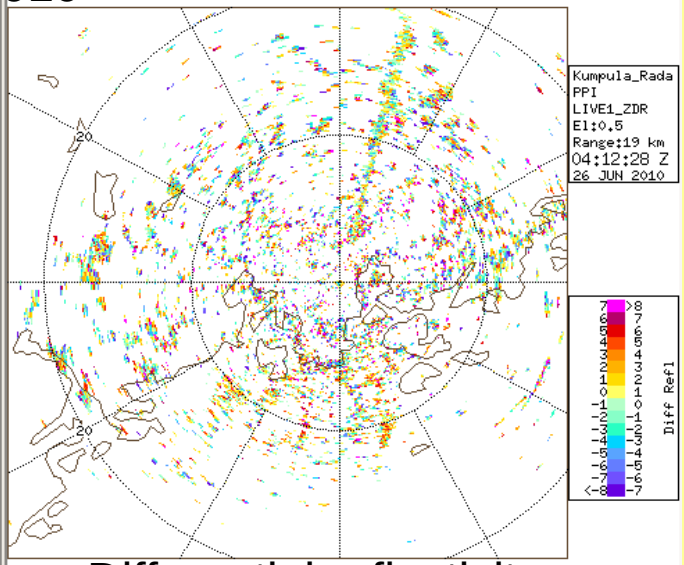
04:12 UTC, about 06 solar time, June 26, 2010



Reflectivity

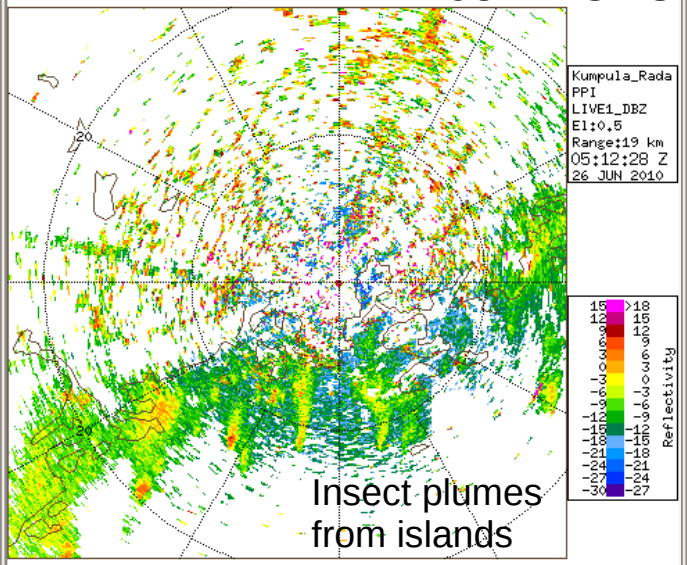


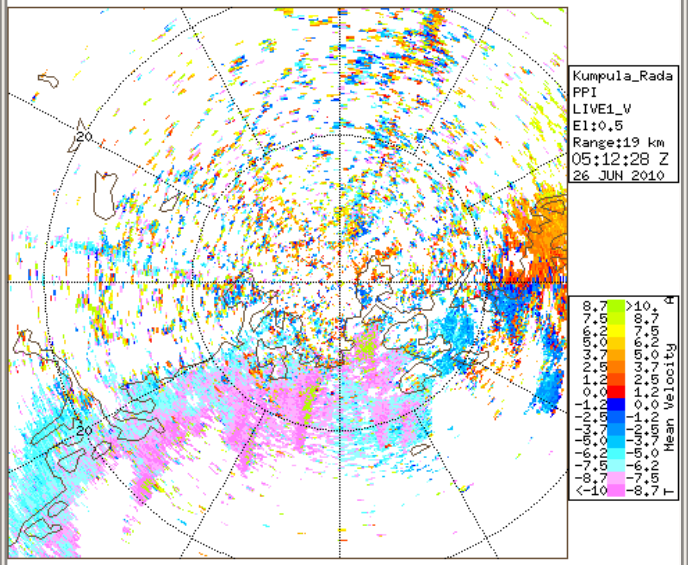
Radial velocity

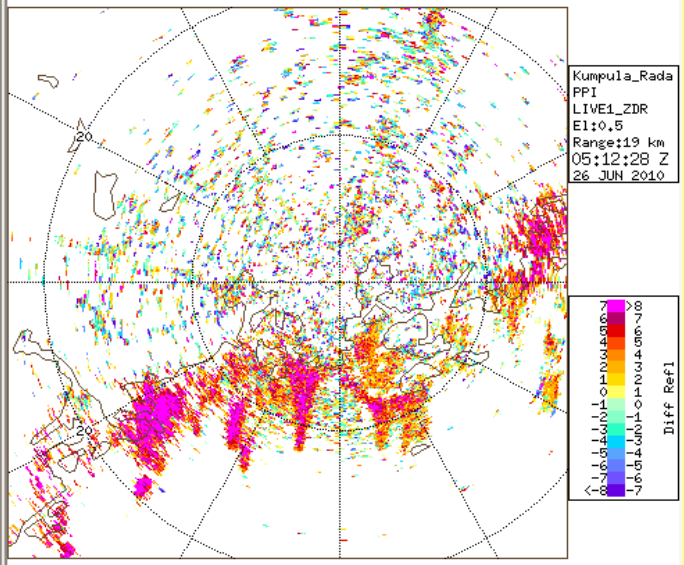


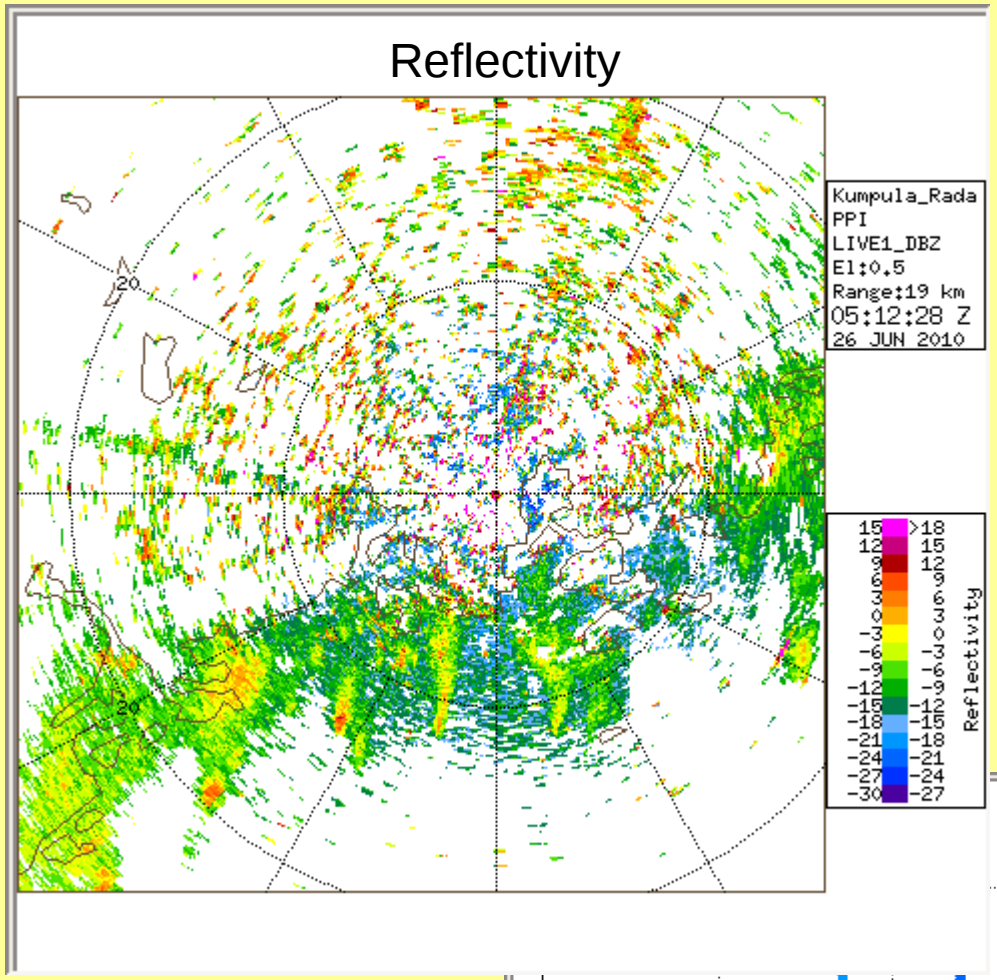
Differential reflectivity

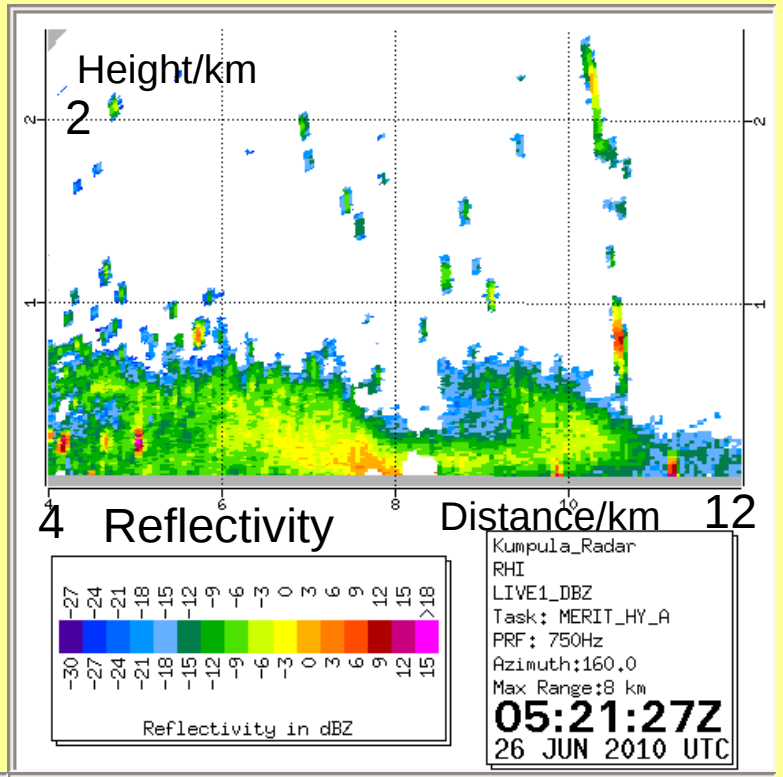
05:12 UTC



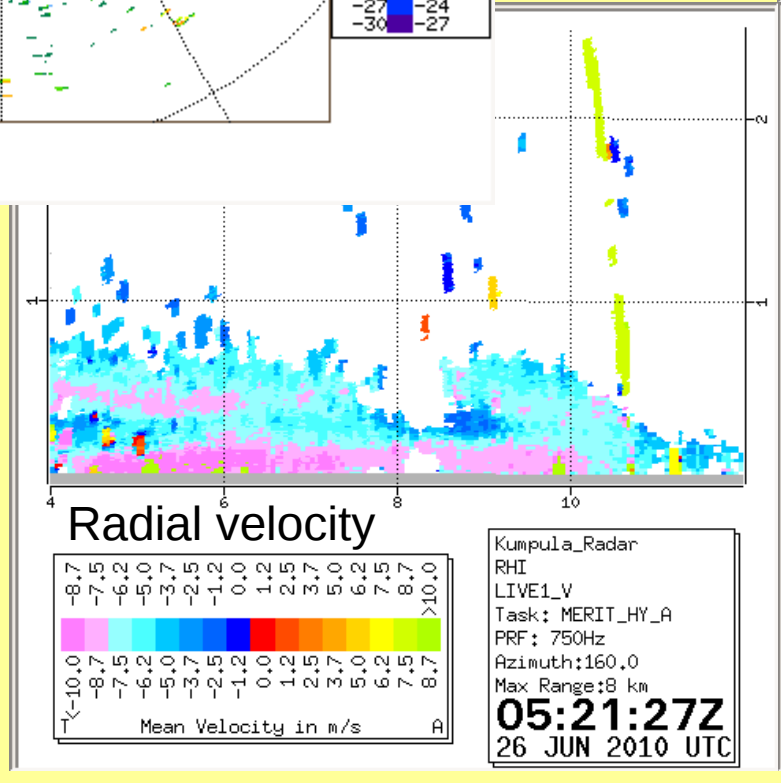


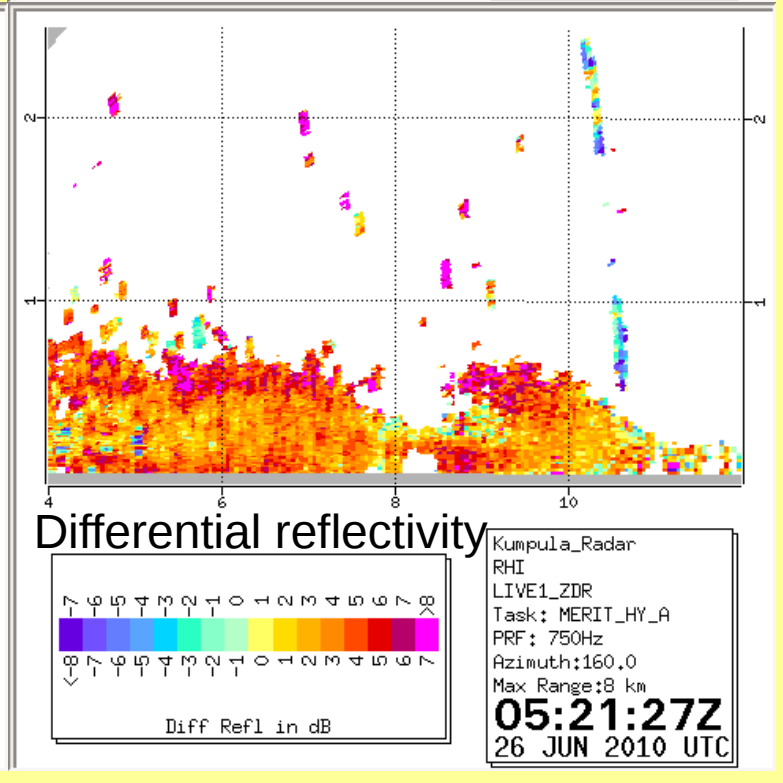




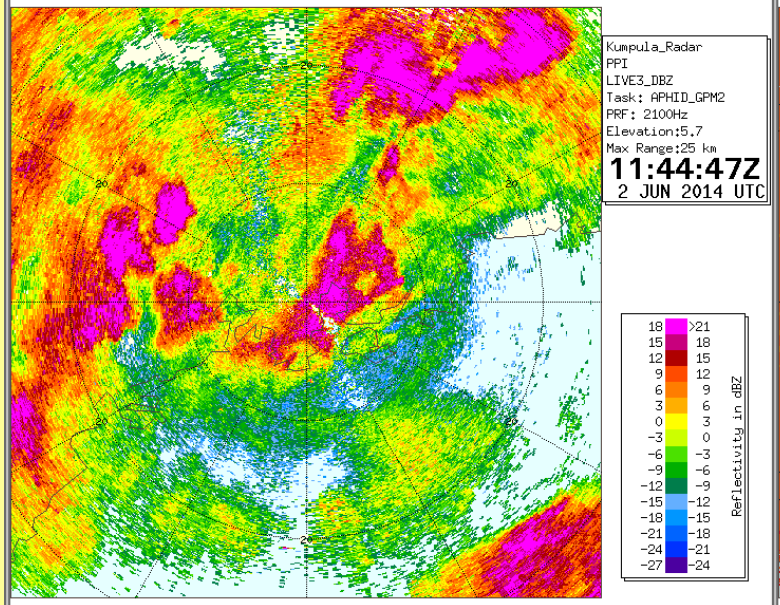


Insect plumes in vertical cross-section towards 160 degrees, SSE, June 26, 2010

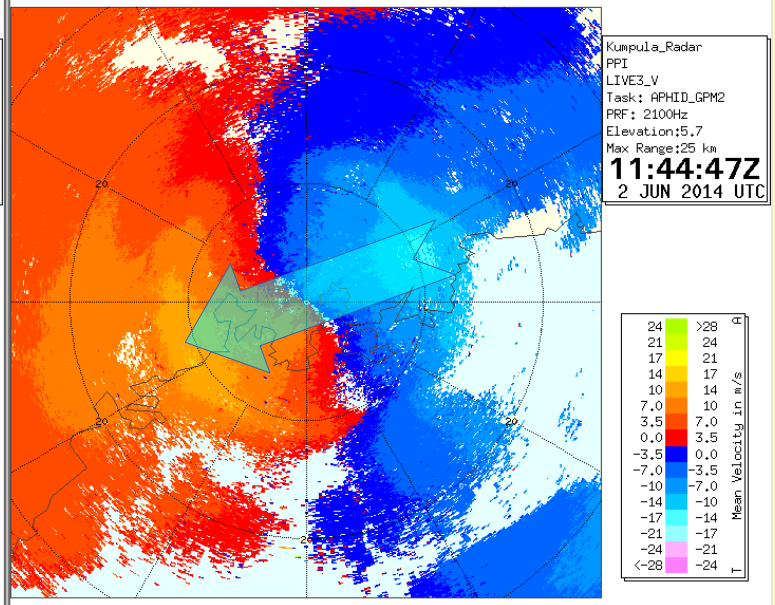




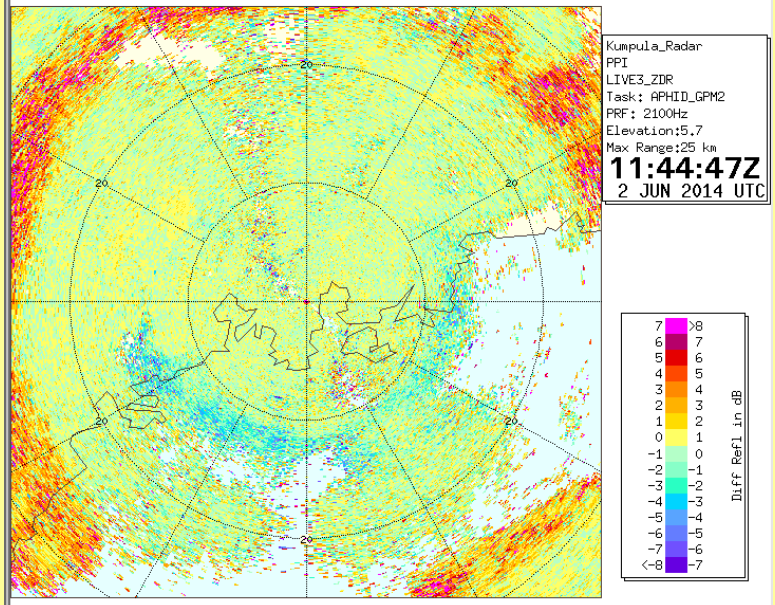
Reflectivity



Radial velocity



Differential reflectivity, ZDR

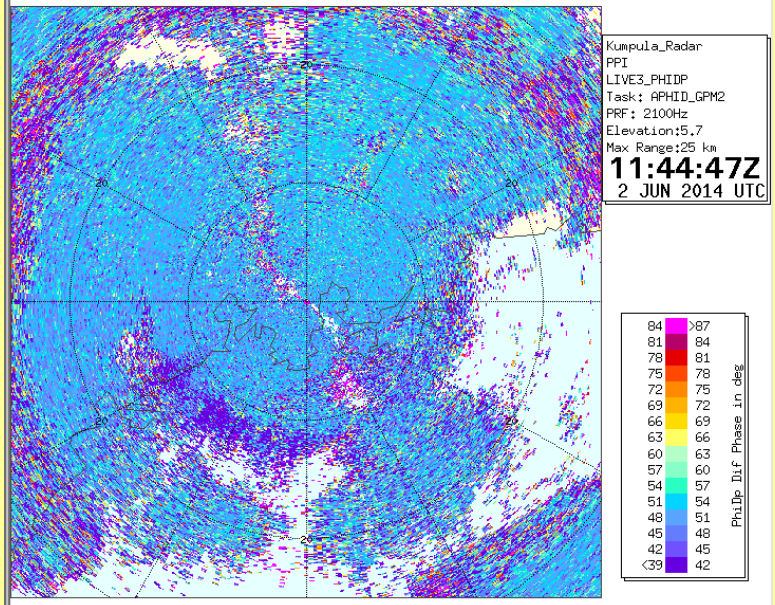


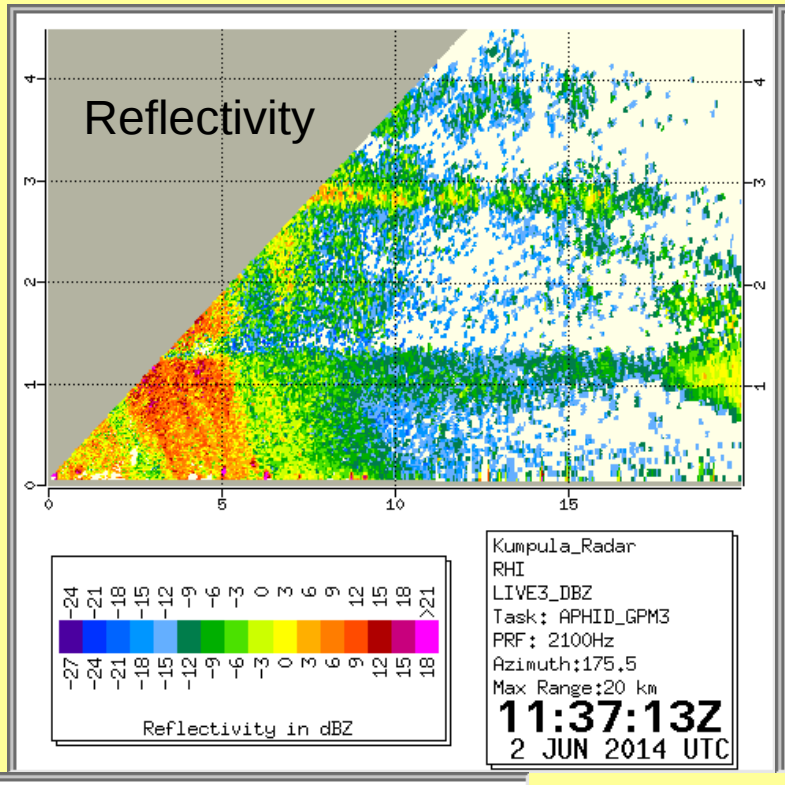
Insects at the edge of large scale precipitation June 2, 2014.

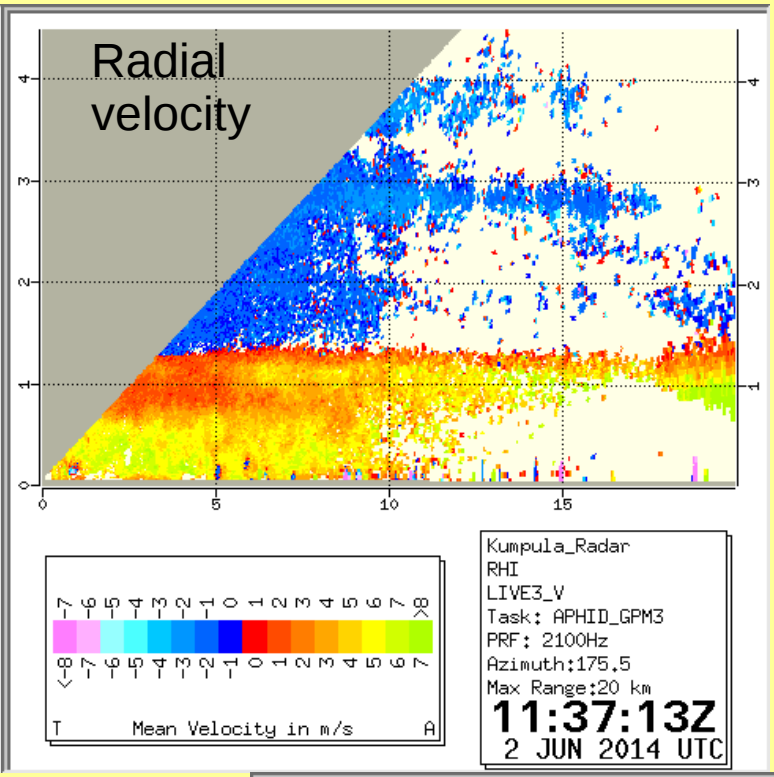
Conical scan at 5.7 degrees elevation angle. Melting layer in precipitation at 25-30 km distance, 2.5 to 3 km height, showed by high values of ZDR. Insect layer at about 1 to 1.5 km altitude with below 0 dB ZDR, from ENE 15 m/s.

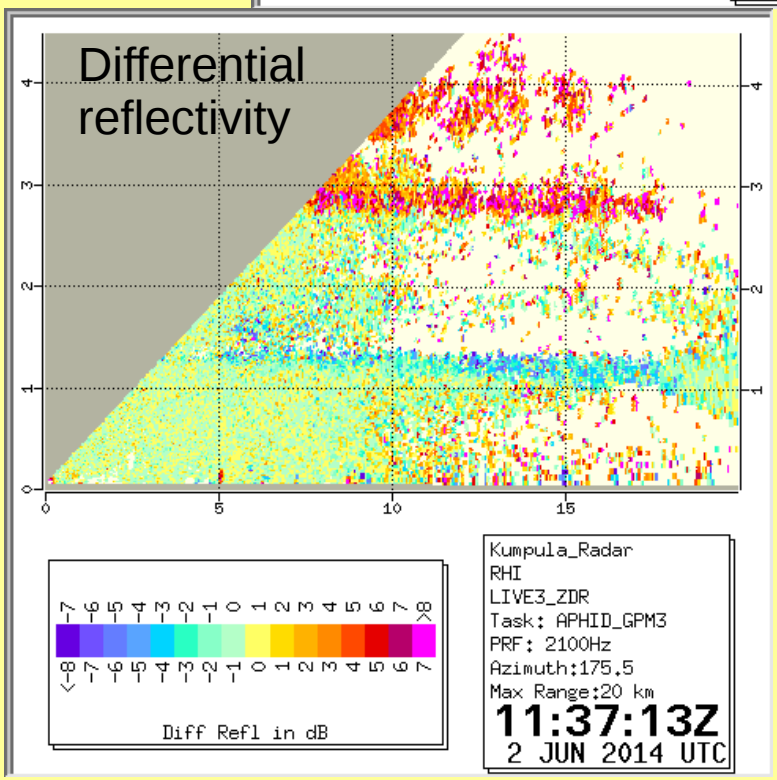
ENRAM Workshop 2014-07-08

Differential phase





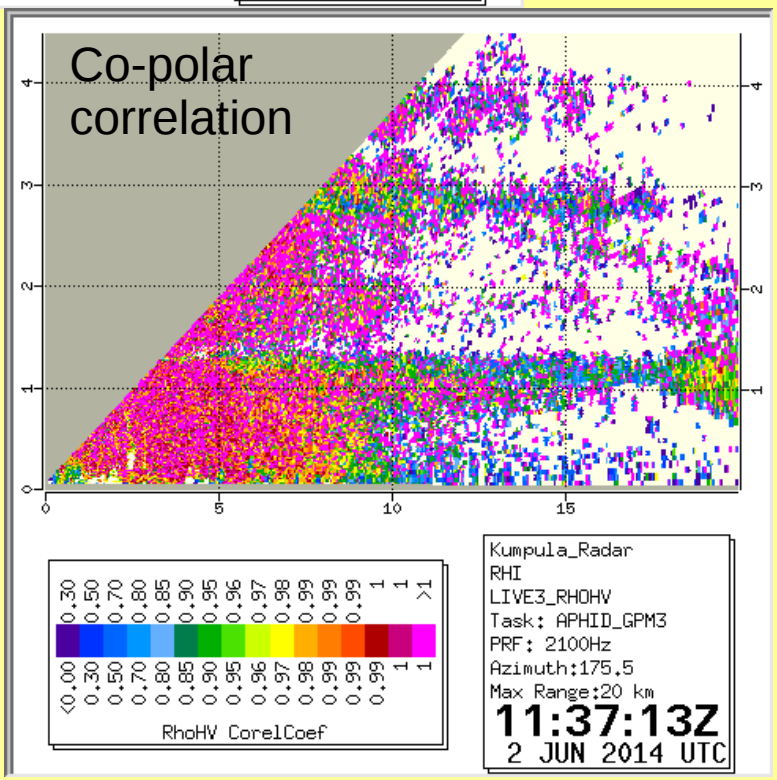




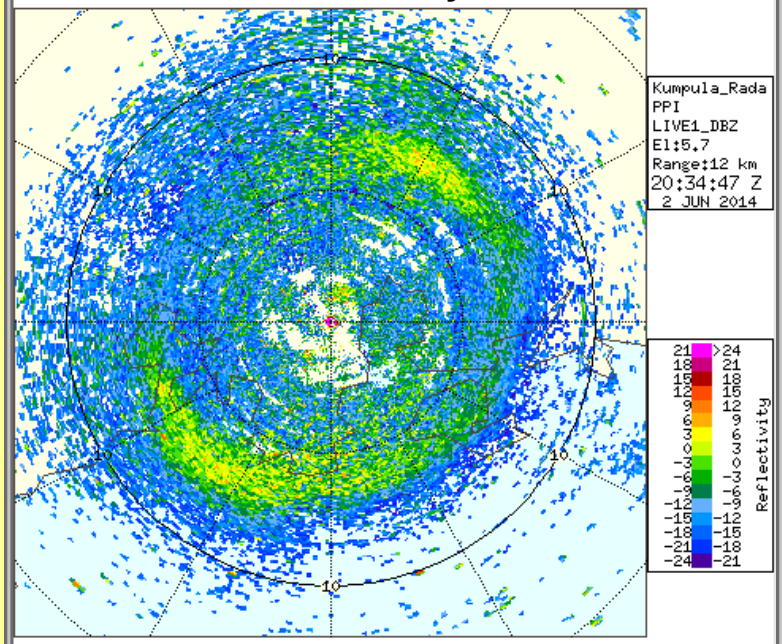
Insect migration and precipitation June 2, 2014

Vertical cross-section towards south, max. Distance 20 km and max. Height 4.5 km. Melting layer just below 3 km height, special insect layer just above 1 km.

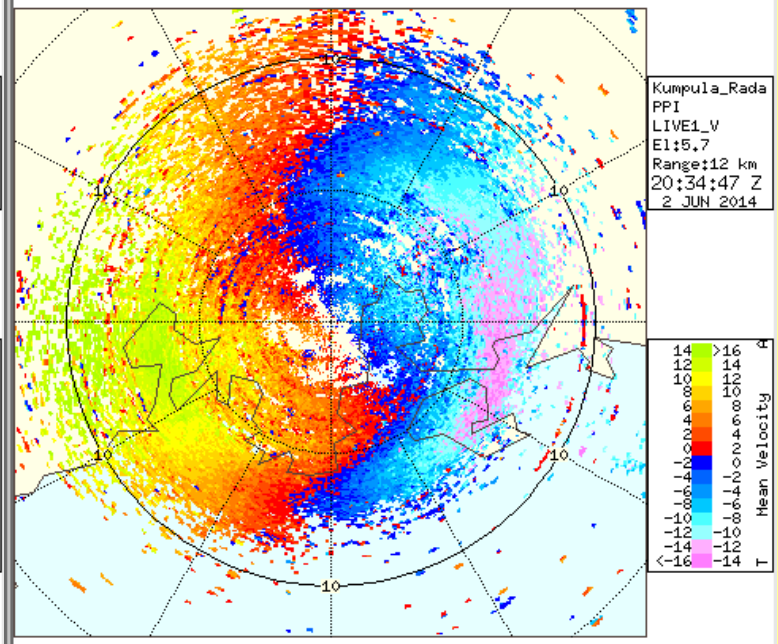
ENRAM Workshop 2014-07-08



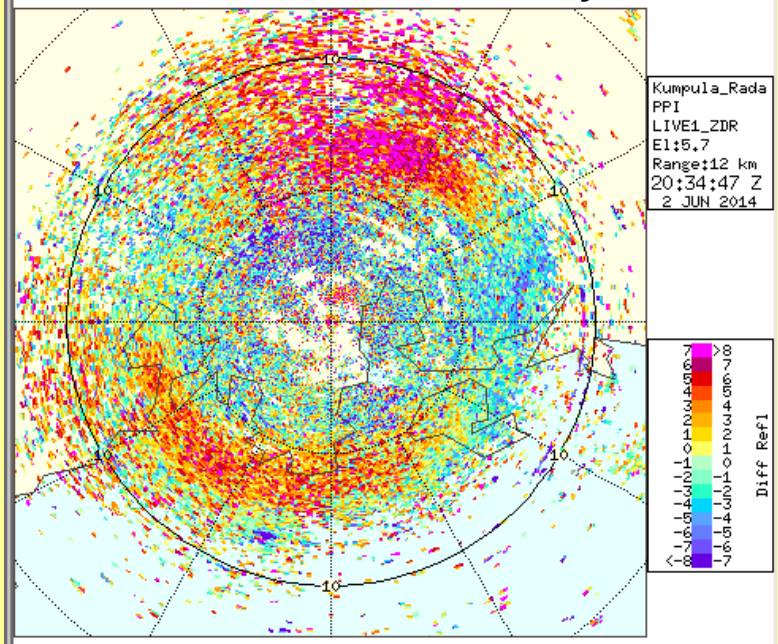
Reflectivity



Radial velocity



Differential reflectivity

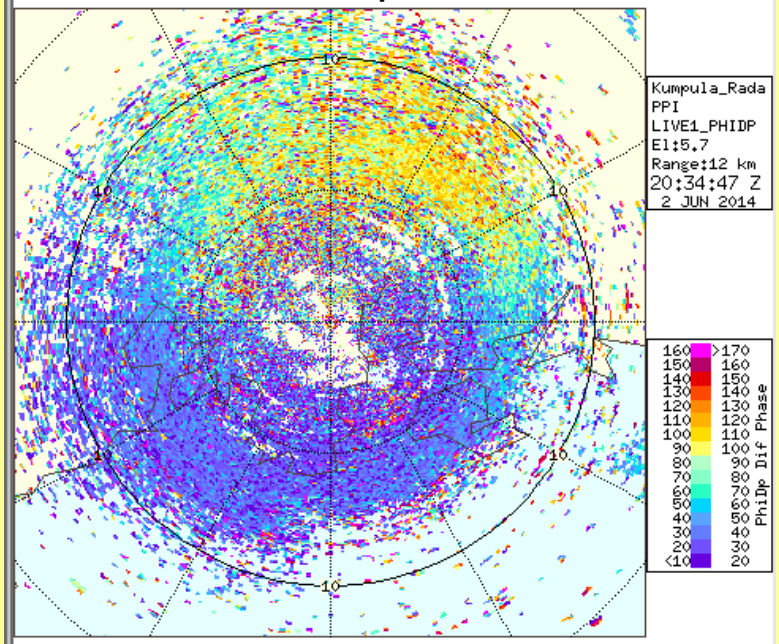


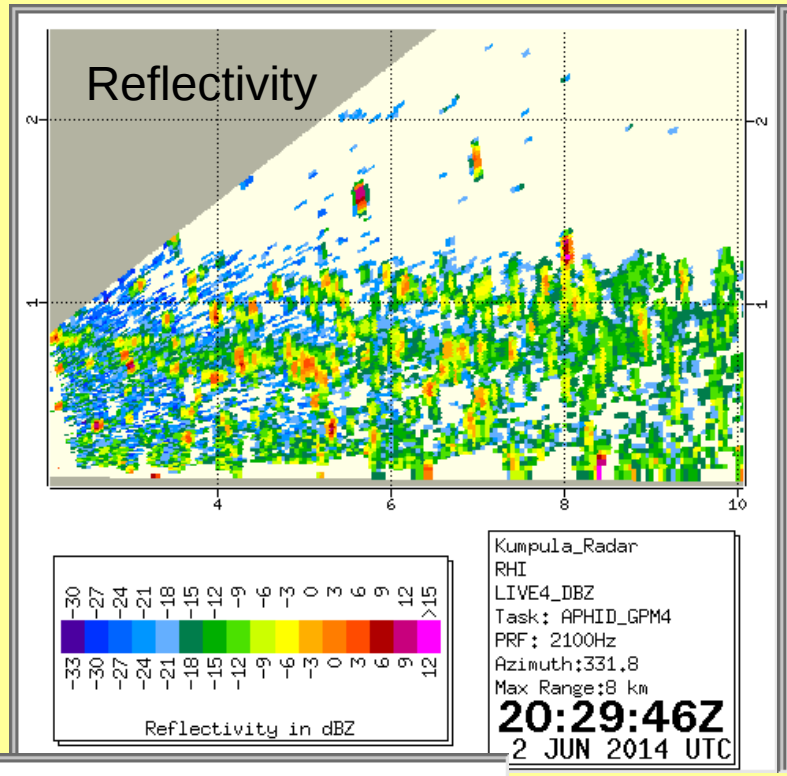
Insect migration after precipitation from ENE-E June 2, 2014

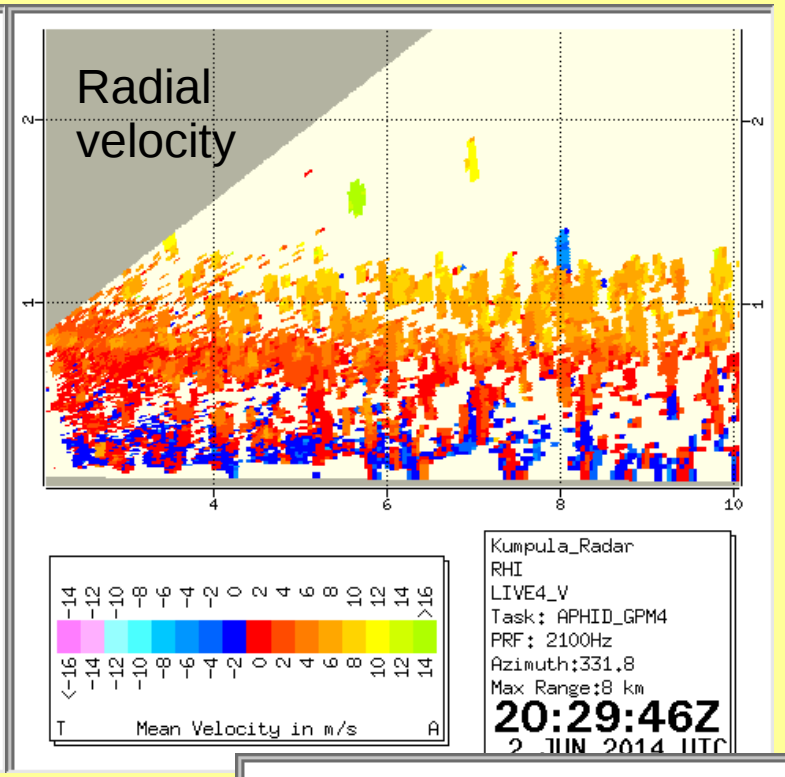
Conical scan at 5.7 degrees elevation angle. Distance 10 km is about 1 km above ground. Symmetrical maxima in reflectivity and ZDR indicate body orientation along ESE-NNW axis.

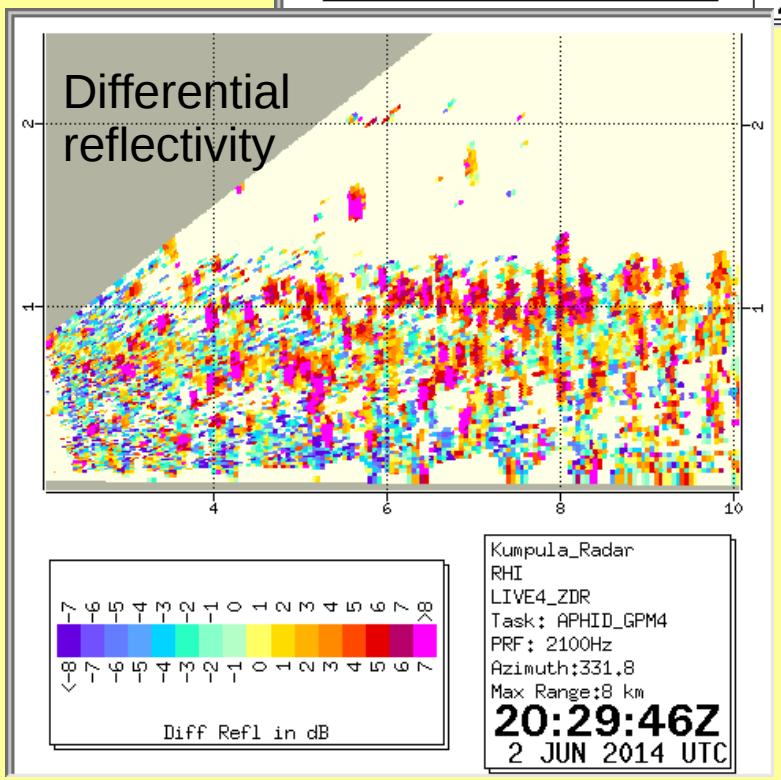
ENRAM Workshop 2014-07-08

Differential phase









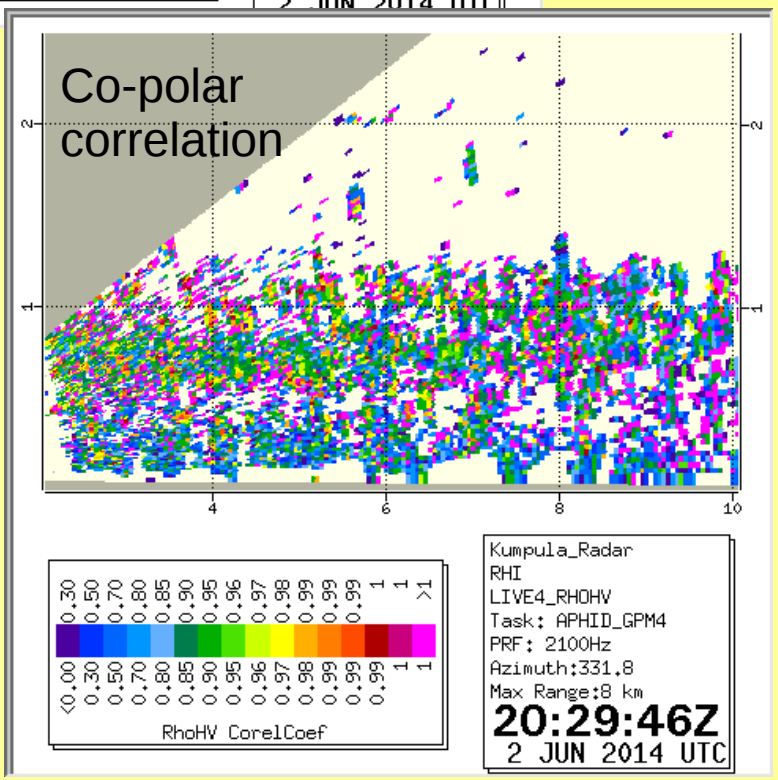
Insect migration after precipitation from ESE-E June 2, 2014

20:29 UTC, about 22 solar time.

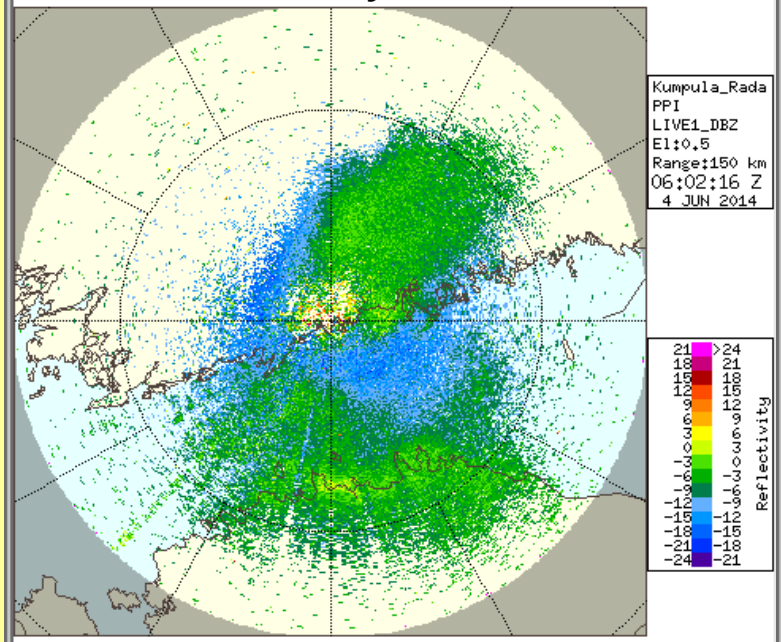
Vertical cross-section towards NNW.

Large insects can be spotted as individual targets, and their velocity differs a bit from the smaller ones.

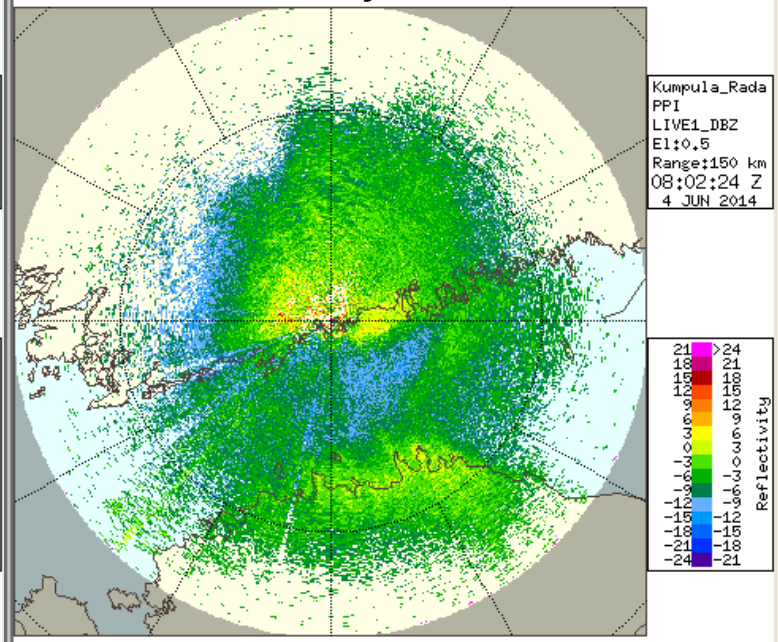
ENRAM Workshop 2014-07-08



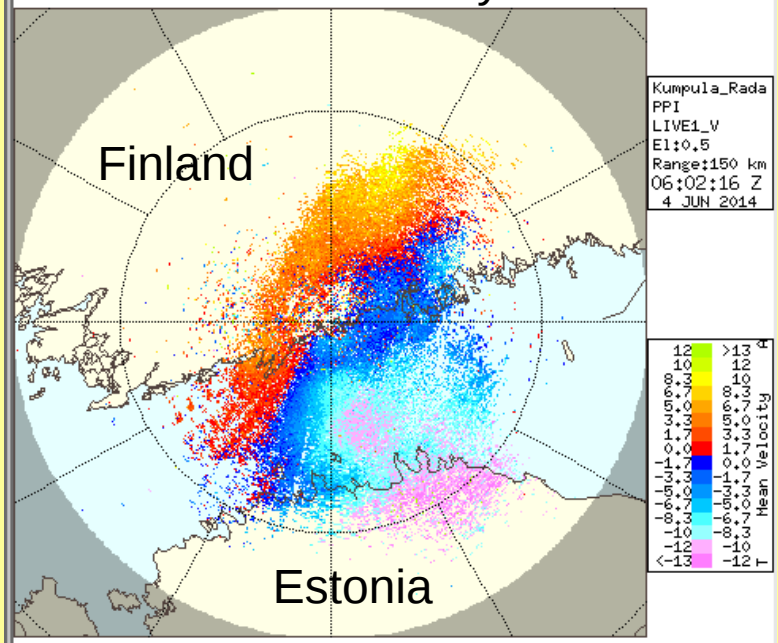
Reflectivity 06 UTC



Reflectivity 08 UTC



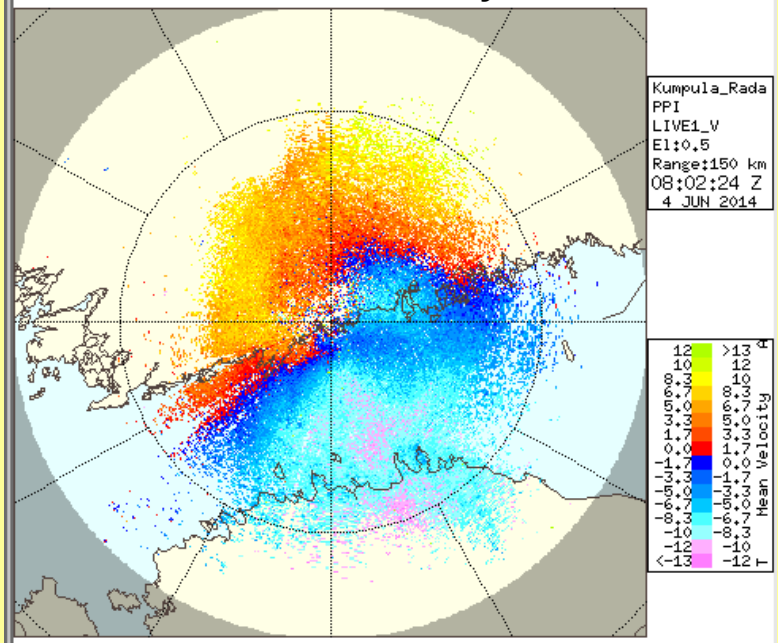
Radial velocity



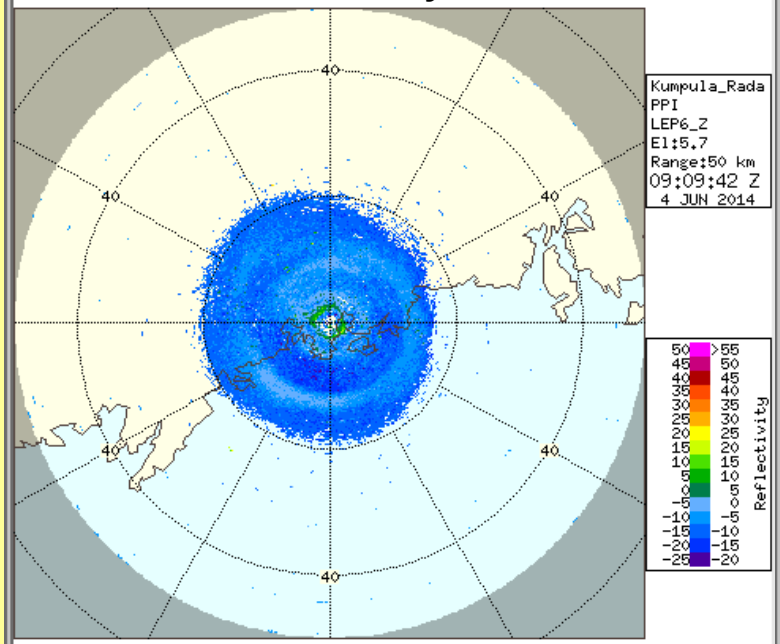
Insect migration in warm clear air from SE-S June 4, 2014

More insects over the land areas in Finland and Estonia, but migration over the Gulf of Finland from Estonia to NW-N.

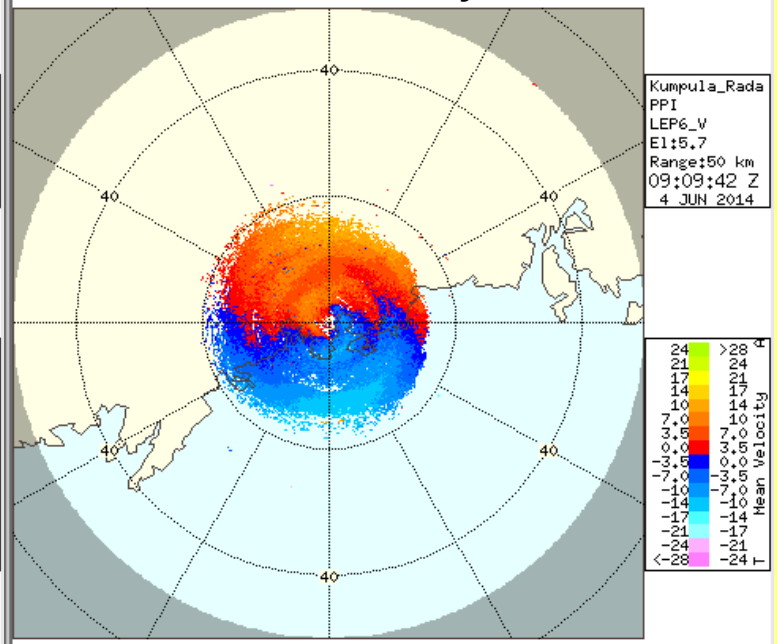
Radial velocity



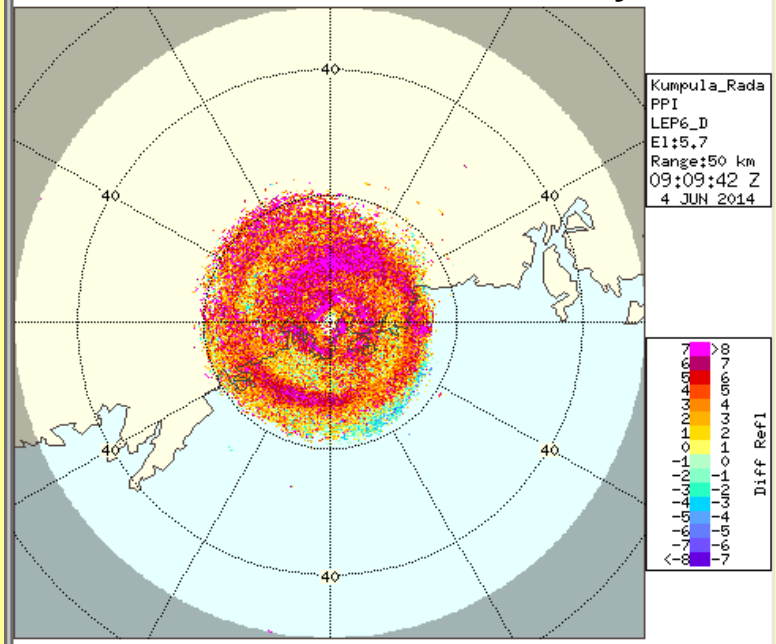
Reflectivity



Radial velocity



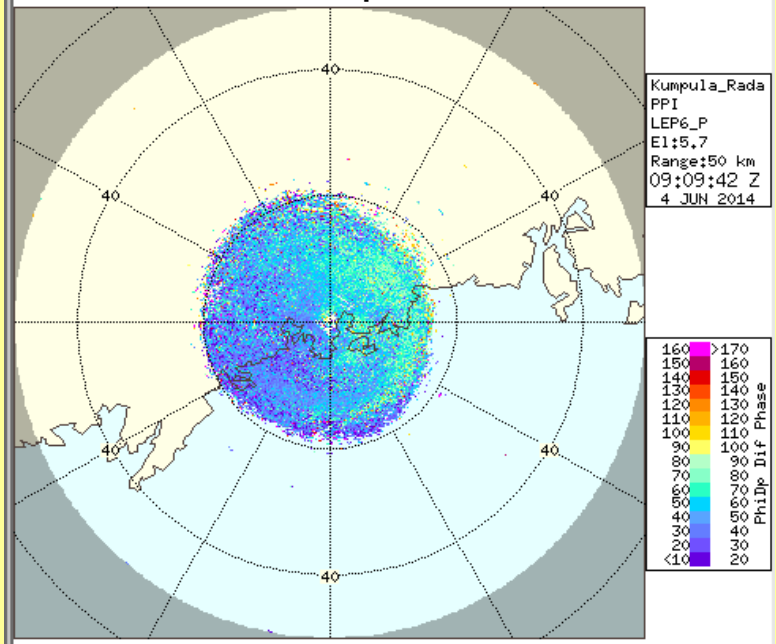
Differential reflectivity



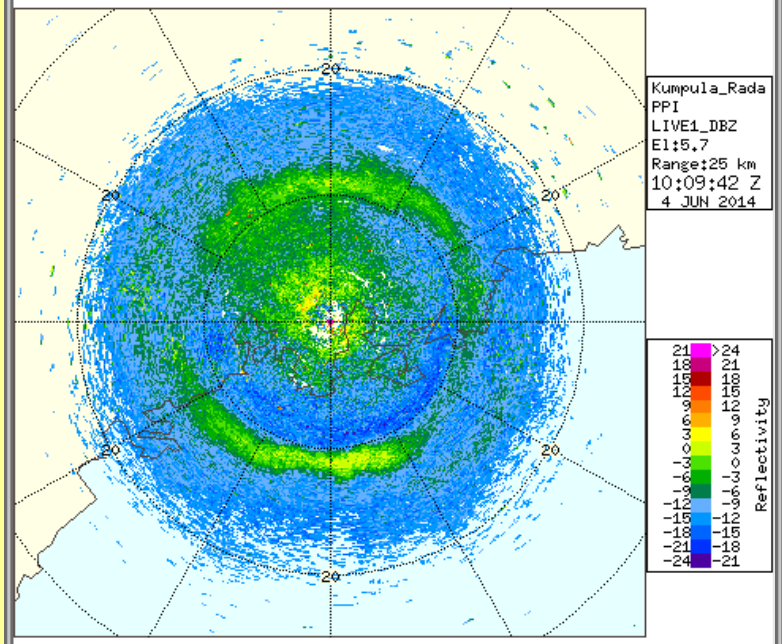
Insect migration in warm clear air from SE-S June 4, 2014
09 UTC.
Conical scan at 5.7 degrees elevation angle, at 20 km distance the radar beam at 2 km height. Layering of insects, and perhaps vertical orientation differences.

ENRAM Workshop 2014-07-08

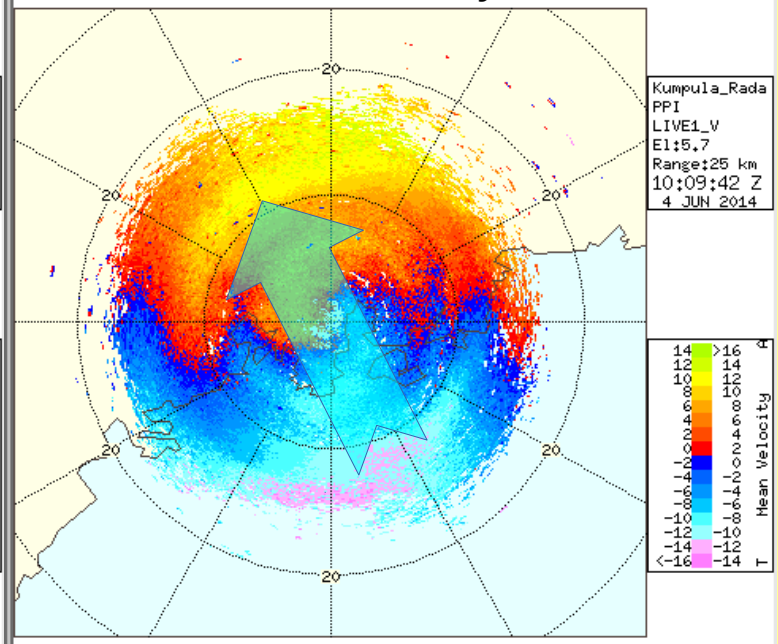
Differential phase



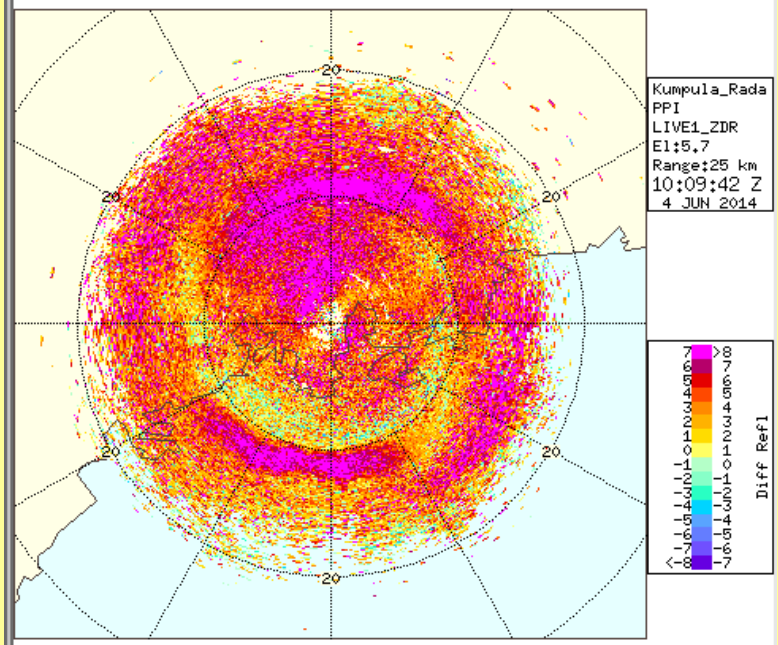
Reflectivity



Radial velocity



Differential reflectivity



Insect migration in warm clear air from SE-S June 4, 2014

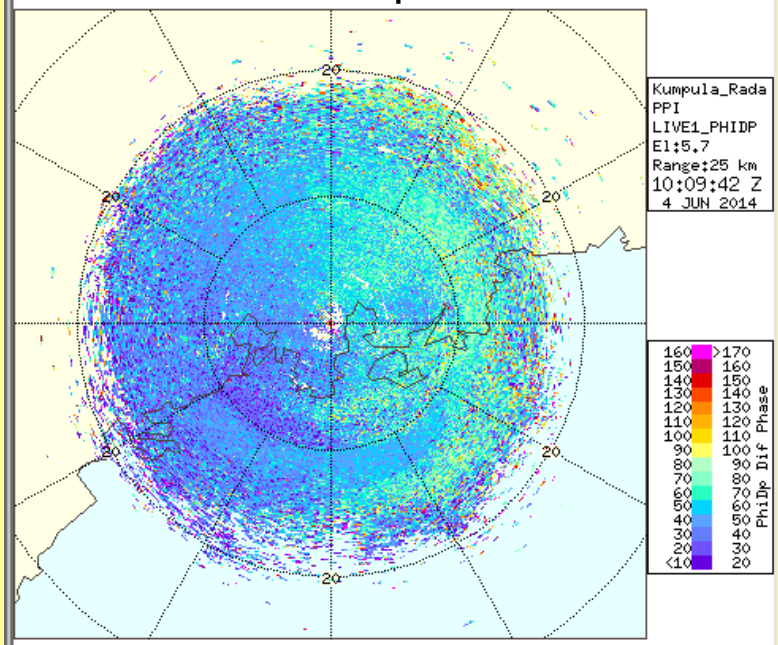
10 UTC.

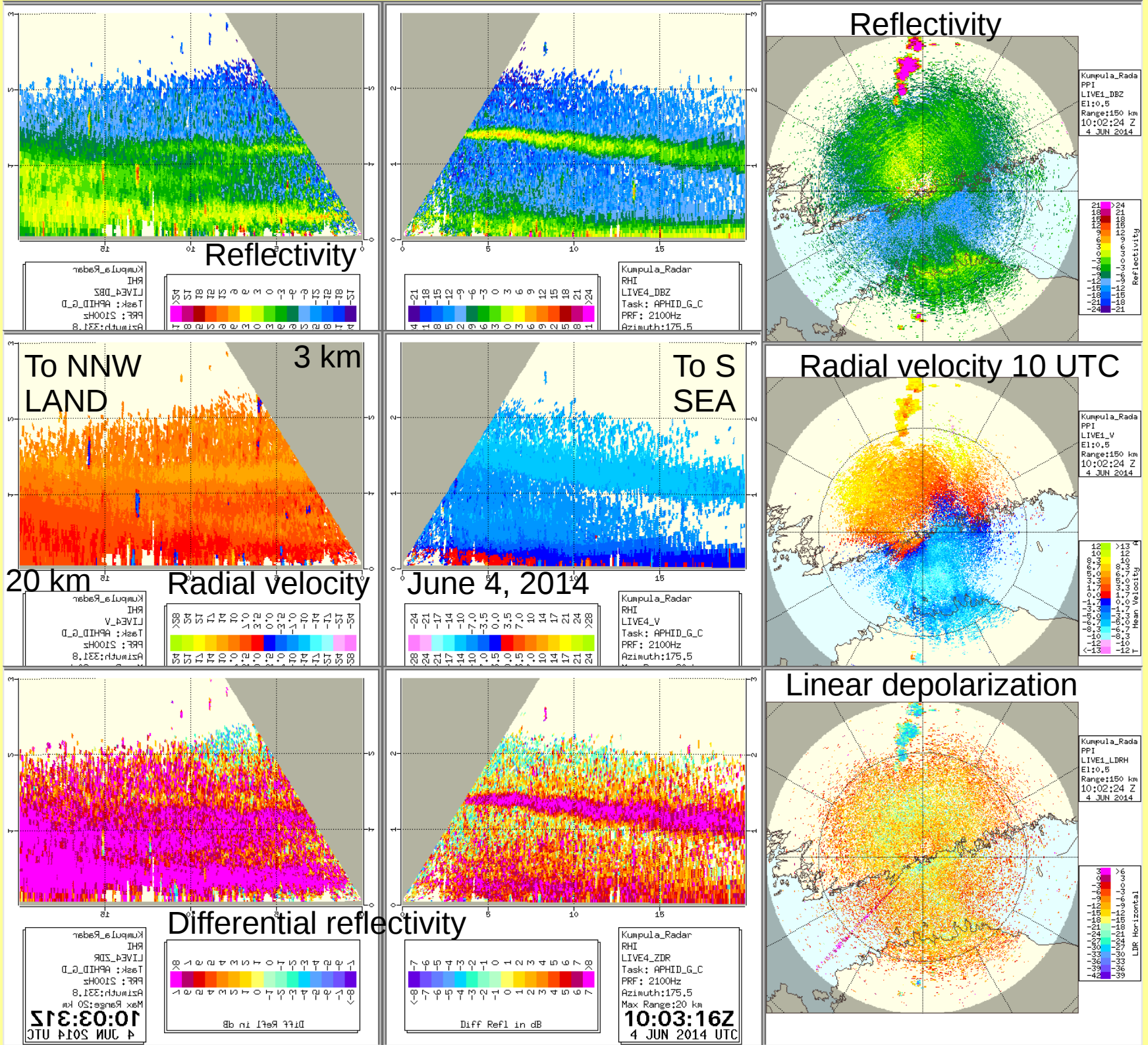
Conical scan at 5.7 degrees elevation angle, at 20 km distance the radar beam at 2 km height.

Intensified layer at 1 km altitude, showing body orientation along E-W axis, 12 m/s from SSE.

ENRAM Workshop 2014-07-08

Differential phase




Reflectivity
Kumpula_Radar
RHI
LIVE4_DBZ
Task: APHID_G_C
PRF: 2100Hz
Azimuth:175.5
Reflectivity
Kumpula_Rada
PPI
LIVE1_DBZ
El:0.5
Range:150 km
10:02:24 Z
4 JUN 2014
To NNW
LAND
3 km
20 km
Radial velocity
To S
SEA
June 4, 2014
Kumpula_Radar
RHI
LIVE4_V
Task: APHID_G_C
PRF: 2100Hz
Azimuth:175.5
Radial velocity 10 UTC
Kumpula_Rada
PPI
LIVE1_V
El:0.5
Range:150 km
10:02:24 Z
4 JUN 2014
Mean Velocity
Differential reflectivity
Kumpula_Radar
RHI
LIVE4_ZDR
Task: APHID_G_C
PRF: 2100Hz
Azimuth:331.8
Max Range:20 km
10:03:12Z
4 JUN 2014 UTC
Diff Refl in dB
Kumpula_Radar
RHI
LIVE4_ZDR
Task: APHID_G_C
PRF: 2100Hz
Azimuth:175.5
Max Range:20 km
10:03:16Z
4 JUN 2014 UTC
Linear depolarization
Kumpula_Rada
PPI
LIVE1_LDRH
El:0.5
Range:150 km
10:02:24 Z
4 JUN 2014
LDR Horizontal