

Bird flock tracking by weather radars

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(Dated: 18 July 2014)

1 Introduction

ENRAM, European Network for Radar surveillance of Animal Movements, has discussed if flocks of big birds could be tracked using the available network of weather radars (OPERA in particular). We take a look on this issue utilizing the three dual-polarization C-band weather radar systems close to each other in southern Finland. Kumpula radar (KUM) is operated by the University of Helsinki, Vantaa radar (VAN) by the Finnish Meteorological Institute, and Kerava radar (KER) by Vaisala Ltd. KUM is a Vaisala WRK200, VAN and KER Vaisala WRM200 systems. The distances between the radars are 22, 19 and 9 km.

If we only think about the detection of the targets, tracking birds is not a problem by radars having the basic characteristic of weather radars. Operational radars map precipitation areas, and as a standard provide a three-dimensional view of echoes from precipitation. Unwanted echoes, including the birds and other single volume targets, may be filtered out in the data processing. In any case the use of many elevation angles means lower frequency scanning of any particular elevation angle. This makes tracking of individual targets challenging if not impossible.

More accurate analysis of surface precipitation and hazardous weather phenomena may already cause changes to the manner weather radars are operated, because of the need to have rapid updates of the situation close to the ground. This development should also help bird tracking using the weather radar data.

We shall present case studies of well documented episodes of large flocks observed by bird watchers at the surface. We comment the observations and results found in the simultaneous use of three dual-polarization weather radar systems, very close to each other but differing in measurement practices.

2 Examples of cases

Arctic birds are migrating along or close the Gulf of Finland especially during spring. Figure (2) shows photographs taken in the evening of May 21, after some light precipitation. The flock of geese was flying between the site and Helsinki-Vantaa airport. The distance is 3 km from the northern end of the runway 15 of Helsinki-Vantaa airport, directly at the runway line, and only 2 km from the crossing lines of runways 22R and 15. The large flock is well spotted in the radar images as well, and its track can be drawn.

Swifts (*Apus apus*) were observed locally on July 1 close to lake about 20 km WNW from Kumpula radar, total number of the birds amounted to 1900 (Veikko Solantie, personal communication). Figure (3) shows Kumpula radar PPI-images of reflectivity and radial velocity in two scans having 2.5 minutes time separation. The birds are obviously catching insects in the air, and the line shaped structures are probably related to zones that have more insects aloft. The reasons for insects' behaviour are in the air currents, not only low level convergence but also changes in solar radiation and other meteorological variables are present. These cases may have huge amount of birds in a very narrow lines, and the position and shapes of these lines are probably much more slowly changing than the positions of individual birds.

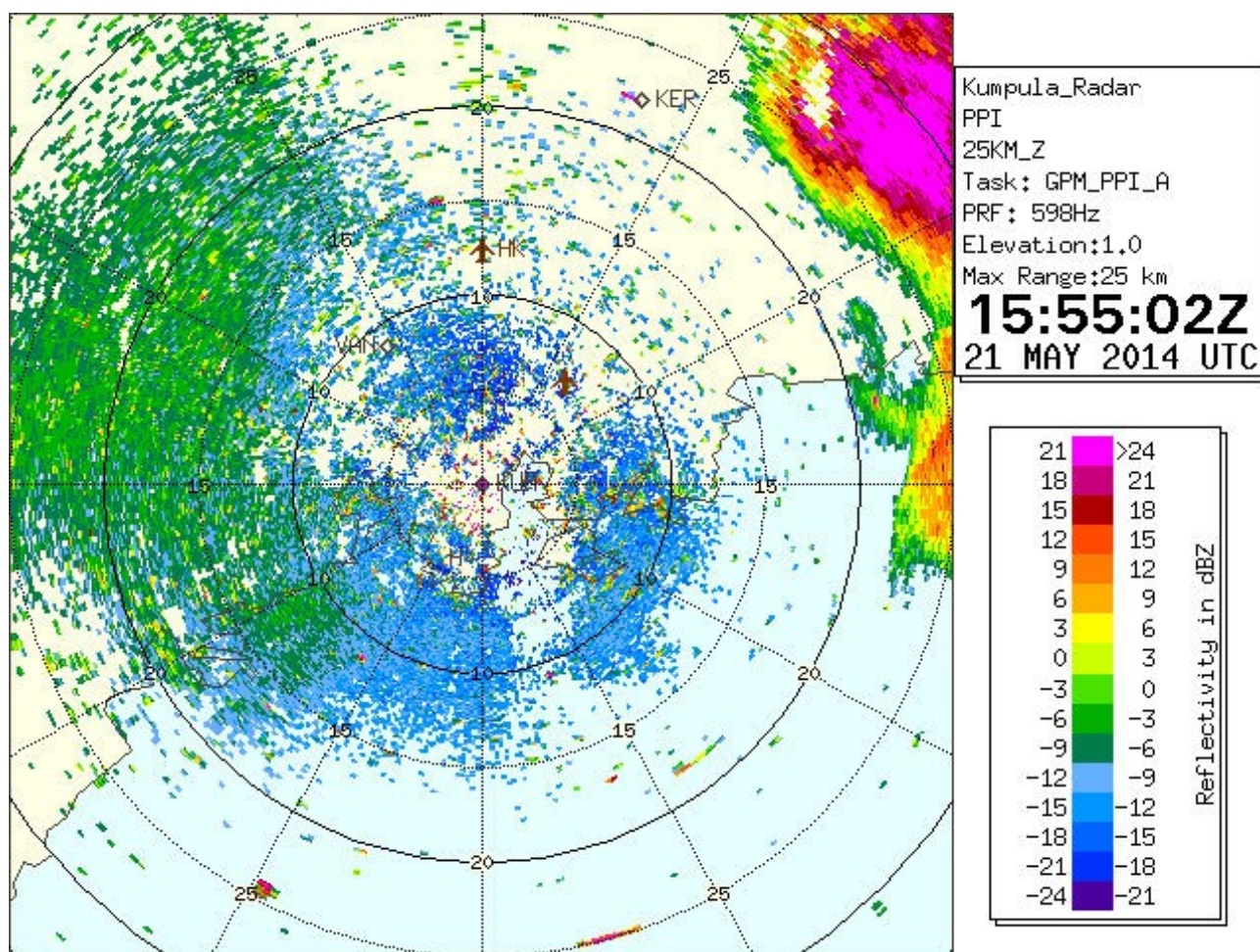


Figure 1: Kumpula radar PPI image showing echoes but also the location of weather radars, VAN = Vantaa and KER = Kerava. The echoes show the precipitation in the east and clear air echoes, mostly from insects taking off after rainfall, but also from birds. The locations of Helsinki-Vantaa and Helsinki-Malmi airports are shown by the map overlay as well.

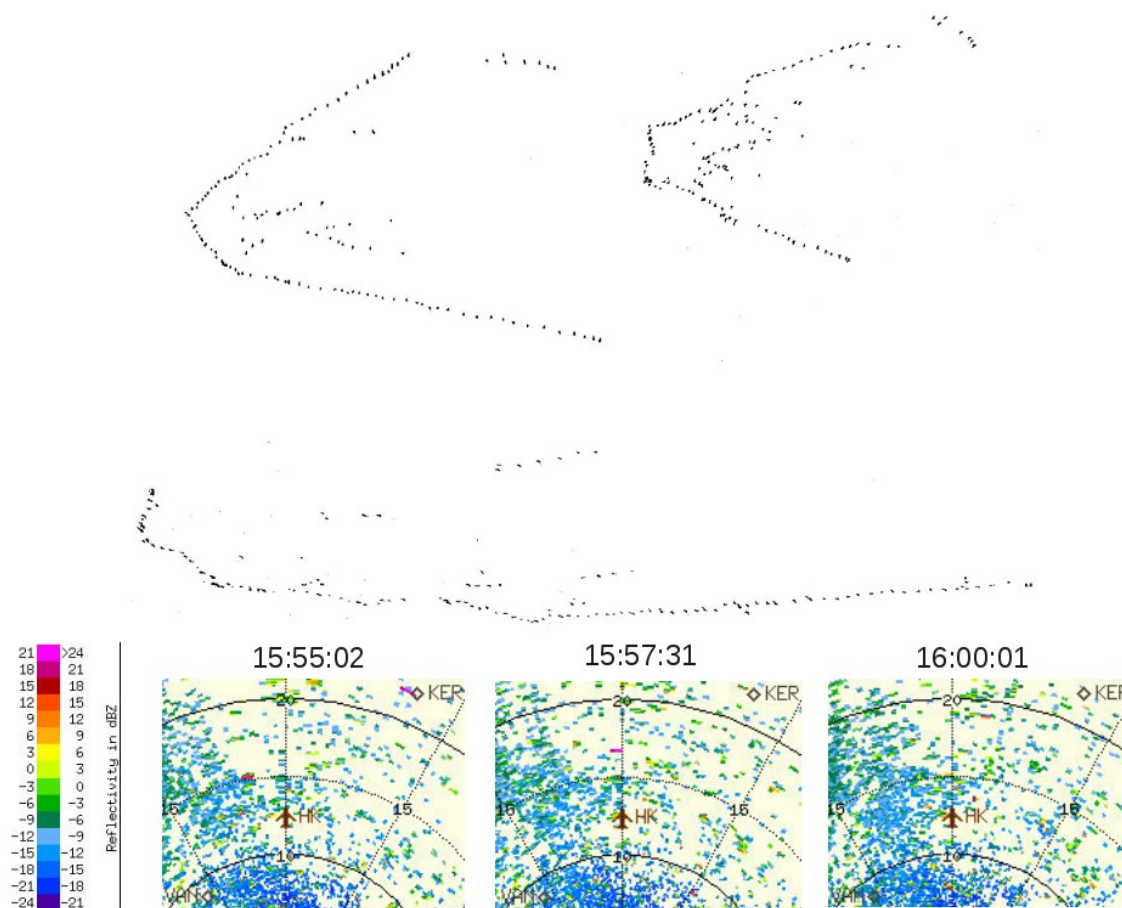


Figure 2: A flock of birds 5 km north of the Helsinki-Vantaa airport in the evening of 21 May, 2014 on their way to ENE. Three photographs of the same flock; towards, side view and away. The flock is visible in the radar images, about 17 km distance in the north at 15:57:31 scan. The north end of runway 15 azimuth is 0 degrees and distance 14.0 km, the photographers site azimuth is 357 degrees and distance 16.7 km.

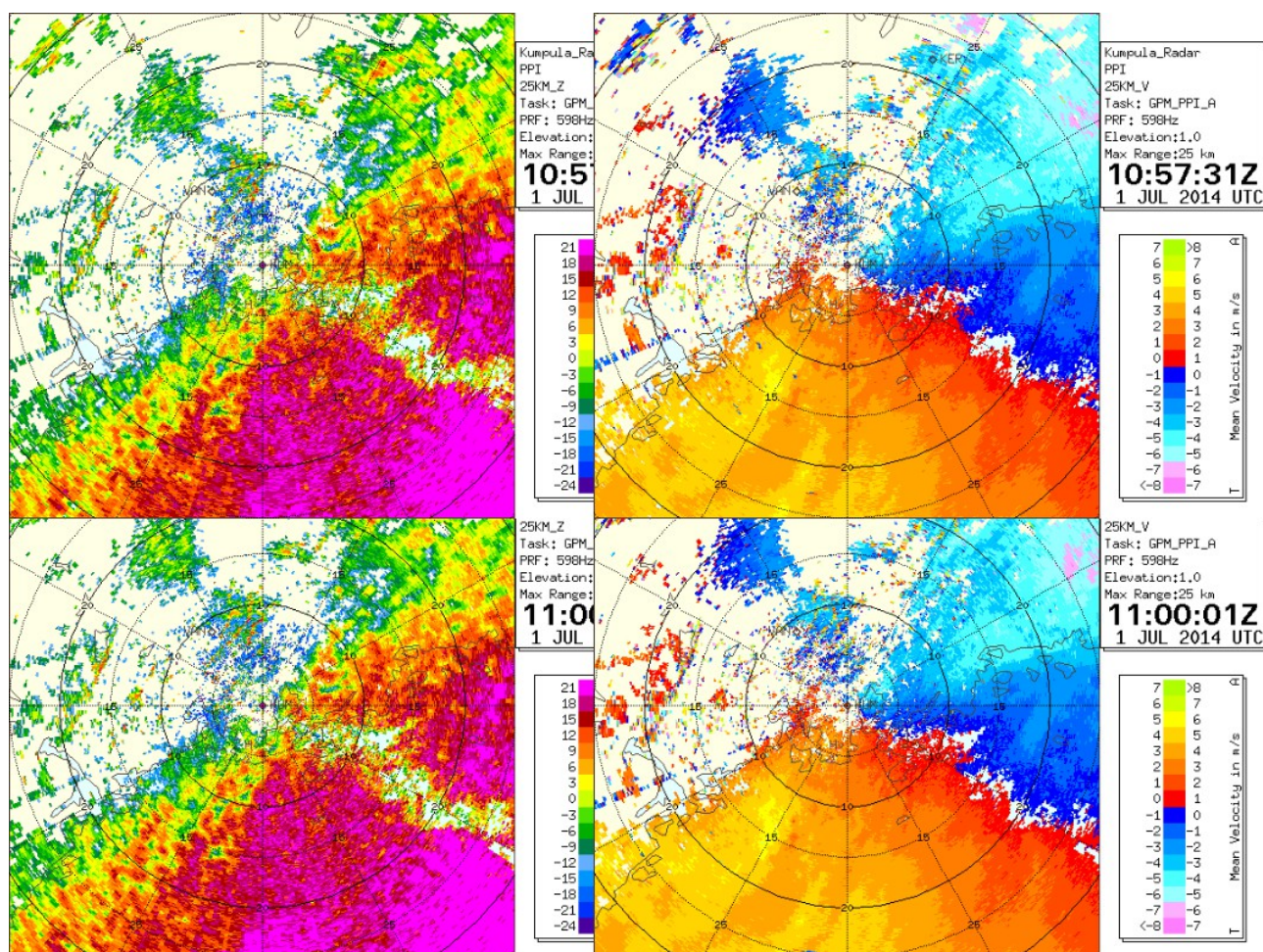


Figure 3: A huge flock of swifts in a generally cool weather with weak rainfall nearby, and obviously with convective and other mesometeorological features. Kumpula radar PPI images of reflectivity and radial velocity in 10:57:31 and 11:00:01 UTC scans.