Using weather radars to monitor continent-wide aerial patterns of animal movement

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Fact:
Billions of insects, birds and bats use the aerosphere for migration, dispersive movements or foraging.

Problem:
How to simultaneously monitor & track multiple organisms with different size, movement patterns and ecology?

Ambition:
Use the current network of weather radars continuously operating all over Europe to record animal movement.

Solution:
1 - Attain weather radar reflectivity & radial velocity data.
2 - Develop and implement bird detection algorithm and convert bird data into “moving targets”.
3 - Composing bird information of multiple radars to obtain large scale movement information.

Result
Tracking bird migration over Belgium and the Netherlands

(see on-line: http://enram.github.io/bird-migration-flow-visualization/viz/)

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Fig 1. Distribution of 201 European weather radars (blue dots) and the 19 countries currently participating in ENRAM (green). Additional countries might join this action (orange).

Fig 2. Weather radar processed bird density, during nocturnal migration. Top: number of birds/km² with wind barbs indicating the birds’ ground speed and direction; Bottom: height-integrated bird density (birds/km²), with grey areas indicating periods between dusk and dawn.

Fig 3. Bird migration measured by operational weather radars in the Netherlands (a. Den Helder and b. De Bilt) and Belgium (c. Jabbeke, d. Zaventem and e. Wideumont) on 7 and 8 April 2013.

Fig 4. Bird movement (black points/streaks) visualized by interpolating mean ground speed and direction of bird flight measured simultaneously at 5 weather radars in Belgium and the Netherlands (blue points). Left: slow moving birds recorded at 8:40 am on the 6th of April 2013; flight trajectories moving birds on active migration recorded 16 hours later, at 00:40 am on the 7th of April 2013.