BRAIN-be
Belgian Research Action through Interdisciplinary Networks

RAVEN

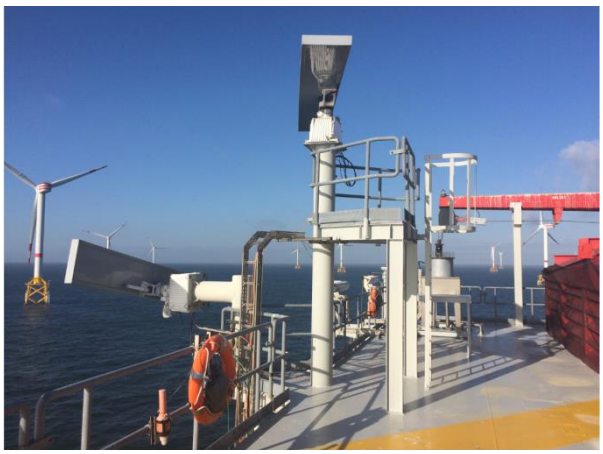
RAdar registrations of bird migration Validation through an interdisciplinary approach

DURATION
15/12/2015 - 15/09/2018

BUDGET
136 025 €

PROJECT DESCRIPTION

Bird migration is one of the world's most conspicuous ecological phenomena. Twice a year, during autumn and spring, hundreds of millions of birds fly over Europe during their migration towards and from their wintering grounds. It is known to be impacted by climate change and migrating birds suffer from ever increasing human pressures (e.g. increased mortality due to desertification, loss of stop-over places or collision with man-made structures). Both from a purely scientific and a conservational point of view, it is crucial to understand and monitor this unique phenomenon. Radar observations greatly contribute to the understanding of bird migration because of the ability to register birds continuously at a large spatial scale and at high altitudes.



The Merlin bird radar installed on an offshore platform in a wind farm in the Belgian part of the North Sea. The bird radar is owned and operated by the RBINS.

Belgium is part of one of the main European migration flyways, which makes it an ideal area to study bird migration. The Belgian part of the North Sea is part of a very important seabird migration route through the Southern North Sea. Because of its shape, this part of the North sea acts as a migration bottleneck, concentrating birds during migration.

Additional to its location, Belgium also holds a unique combination of weather radars and a specialized bird-radar system. The Royal Meteorological Institute of Belgium (RMI) uses three weather radars for meteorological observations. Weather radars are used primarily to detect precipitation, but they are also particularly sensitive to the presence of birds in the atmosphere. Several of these registrations of birds were already extensively reported in the press (e.g. massive thrush migration, frightened birds during New Year's fireworks). The Royal Belgian Institute of Natural Sciences (RBINS) has installed a Merlin bird radar (DeTect Inc., Florida, USA) to study the impact of offshore wind farms on an offshore platform at the Thorntonbank. This radar system is especially designed to register birds. The Merlin radar system consists of two identical radar antennas, one scanning in the horizontal pane and one in the vertical. The vertical radar is generally operated at 1.8 km range, the horizontal radar at 7.4 km, thus providing high resolution data. The bird radar is located within the measurement volume of the weather radar in Jabbeke, offering a unique situation to cross-validate the data of both types of radar and to extrapolate the high resolution data of the bird radar to the wider spatial scale of the weather radar.

The objectives of this study are:

1. To validate bird registrations of both weather and bird radars in order to assess their accuracy in the detection of migrating birds.
2. To couple small scale bird radar registrations and large scale weather radar observations to investigate migration events at a wider spatial scale.
3. To process data of two entire migration seasons with the validated and refined bird-detection algorithm in order to estimate the total flux of birds during a migration season in the detection volume of the weather radar and compare this with the currently accepted flux estimates as taken from literature.

The project consists of four work packages. In a first work package the data of the bird radar will be validated by visual observations at the radar location and by telemetry data of tagged seabirds. The second work package focuses on the quality of the weather radar registrations of birds. This quality assessment will be performed through cross-validation of the weather radar data with the bird radar data. In the third work package we will couple the high resolution bird radar and large scale weather radar data and extrapolate the measured fluxes to a large spatial scale. In a last work package, the refined bird detection algorithm will be used to process the data of two entire migration seasons (spring and autumn), in order to calculate the total flux of birds.

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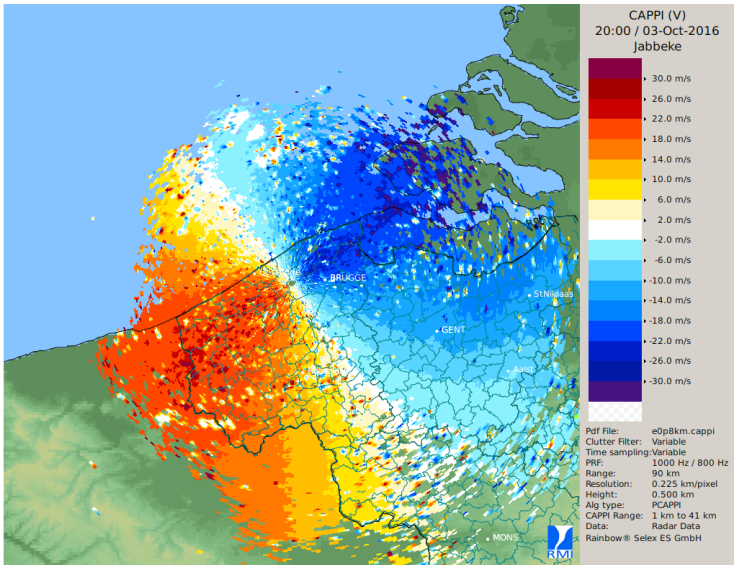

An example of intense bird migration observed by the weather radar of Jabbeke on 03/10/2016 at 20:00 UTC. All signal on this image is caused by migrating birds. The figure shows the radial velocity of the birds with respect to the radar: blue means towards the radar, red away from the radar. Birds are moving in Southwest direction towards their wintering grounds

These objectives will be achieved through an interdisciplinary collaboration between RBINS, RMI and the Research Institute for Nature and Forest (INBO), bringing together a unique combination of expertise, equipment and data sources. Each type of data has value in its own, but especially the combined use adds an extra value dimension to the project.

Validating weather radar registrations of birds with a bird radar has been done in the past by Dokter et al. (2011). It is, to our knowledge, however the first time this will be done in an offshore environment where concentrated migration of seabirds occurs.

The outcome of RAVen will offer an assessed and improved radar tool to continuously study bird migration, which will be applicable in aviation safety, in cumulative impact assessment of human activities (e.g. wind farms in North Sea) and offer a tool to gain increased knowledge in bird migration ecology, e.g. phenology and intensity of bird migration in relation to climatic and meteorological conditions.

RAVen runs in parallel with the COST Enram networking project (European Network for the Radar Surveillance of Animal Movement). The Enram project aims at creating a continent-wide remote sensing network to monitor bird migration by means of weather radars. The outcome of RAVen will hence directly feed into the objectives of the COST Enram project.

The final results will be presented in two peer reviewed papers: one on the assessment and improvements of the bird detection tool, the second one about the application of the tool to estimate the total flux of birds in an entire migration season.

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