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STSM title: Intercalibration of Pencil Beam radar data of birds in Germany and Denmark (Fehmarnbelt) with the Weather Radar stations in Stevns, DK, Rostock and Hamburg (both Germany) – 2009 and 2010

Location: Swiss Ornithological Institute, 6204 Sempach Switzerland

Host: Felix Liechti

**Purpose of the STSM**

In the course of my STSM I spent one month at the Swiss Ornithological Institute to compare two years of existing monitoring pencil beam radar data of night migrating birds at the Danish and German site of the Fehmarnbelt with data from weather radar stations in Denmark an Germany. It is known that bird migration can be observed by means of weather radar. There is a great network of weather radars throughout Europe, which are suitable to detect bird densities. New insights into large distance migration of birds could be gained. Investigating bird densities measured by weather radars could supply information on aspects that influence migration routes of birds.

I wanted to find out, if both radar methods show migration comparable intensity phenologies regarding the periods of low and high migration intensity, flight direction and flight speed. As well as if it is possible to match flight altitude data of both radar methods.

**Description of the work carried out during the STSM**

Günter Haase from the Swedish Meteorological and Hydrological Institute (SHMI) provided the respective weather radar data from the weather radar station at Stevns in Denmark. Due to lack of time and an unsuitable data format it was not possible, during my STSM in Sempach, to get the German weather radar data. Vladislav Kosarev extracted bird data of the weather radar data from Stevns (DK) with an algorithm provided by Adriaan Dokter, so that I was able to use those data for comparison with the pencil beam radar data recorded by the Swiss Ornithological Institute. Felix Liechti provided the pencil beam data as databases at the Swiss Ornithological Institute, Switzerland.

In 2009 on the Danish side and in 2010 on the German side of the Fehmarnbelt the pencil beam data were collected on 100 days, between February and November (about 150000 obs./a). Pencil beam data yield migration intensity by bird type (wing-beat analysis) and altitude bands from 0 to 3000 m.

I compared pencil beam data from the Danish side of the Fehmarnbelt with weather radar data from Stevns (DK) in the year 2009. I tried to find correlations between altitude and migration traffic rate of the spring and autumn migration of those two radar methods.

During my stay in Sempach I received organisational support by the Swiss Ornithological Institute (Felix Liechti) with regard to data acquisition, data analyses, assessment and reporting. As well as Jan Blew from BioConsult SH supported me.

**Description of the main results obtained**

I compared the weighted mean of the altitude per night of both radar methods (fig. 1) in spring 2009, as well as the mean migration traffic rate per night (fig. 2). There were slightly negative correlations between those two methods for both, the MTR per night and the altitude (weighted mean) per night.

Fig. 1: Weighted mean of height [m] per night of weather radar data (red dots) and pencil beam data (black dots) in spring 2009

The main results of this STSM were, that I could not find similarities or correlations between the data of those two radar methods, with the statistically tests I used so far. The both radar methods did not show same periods of low and high migration intensity and up to now it was not possible to match flight altitude data or migration traffic rates.

It was striking, that the weather radar data had some really high echoes (fig. 2), which are maybe not only bird data. It could be, that the algorithm has to be changed or adjusted individually for every weather radar station. In order to test this, further investigations with data from other weather radar stations should be done.

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Fig. 2: Mean migration traffic rate [birds/h/km] per night of weather radar data (light grey) and pencil beam data (dark grey) in spring 2009.

**Description about how the results contribute to the Action aims**

Profound knowledge about airborne movement of animals over large distances, abundance and ecology can be provided with the help of radar observations. To get a better understanding of aero-ecological dynamics it is beneficial to understand individual behavioural responses of birds to changes of the environment.

Because of the large existing weather radar network and since weather radars could supply information on aspects that influence migration routes of birds and could be used to investigate bird movement on continental scales, it is important to improve the use of this radar method. Meteorologists and ornithologists/biologists share the interest to understand clear air echoes. It has been already shown that weather radars can be used for this kind of purpose.

A challenge is now to identify the issues and handle the noise and clutter of the data so that the algorithm can be implemented successfully to other weather radars in near future.

**Future collaboration with the host institution (if applicable)**

When I need again support or access to the pencil beam database maintained by the Swiss Ornithological Institute, it is possible, that I have to go to the Swiss Ornithological Institute this winter once more**.**

**Foreseen publications/articles resulting from the STSM (if applicable)**

Maybe the master thesis, as a result of this project, will be published as an article.

Stuttgart, 21st October 2015

Denise Ade