



Royal Netherlands
Meteorological Institute
*Ministry of Infrastructure and the
Environment*

The European Network for the Radar Surveillance of Animal Movement





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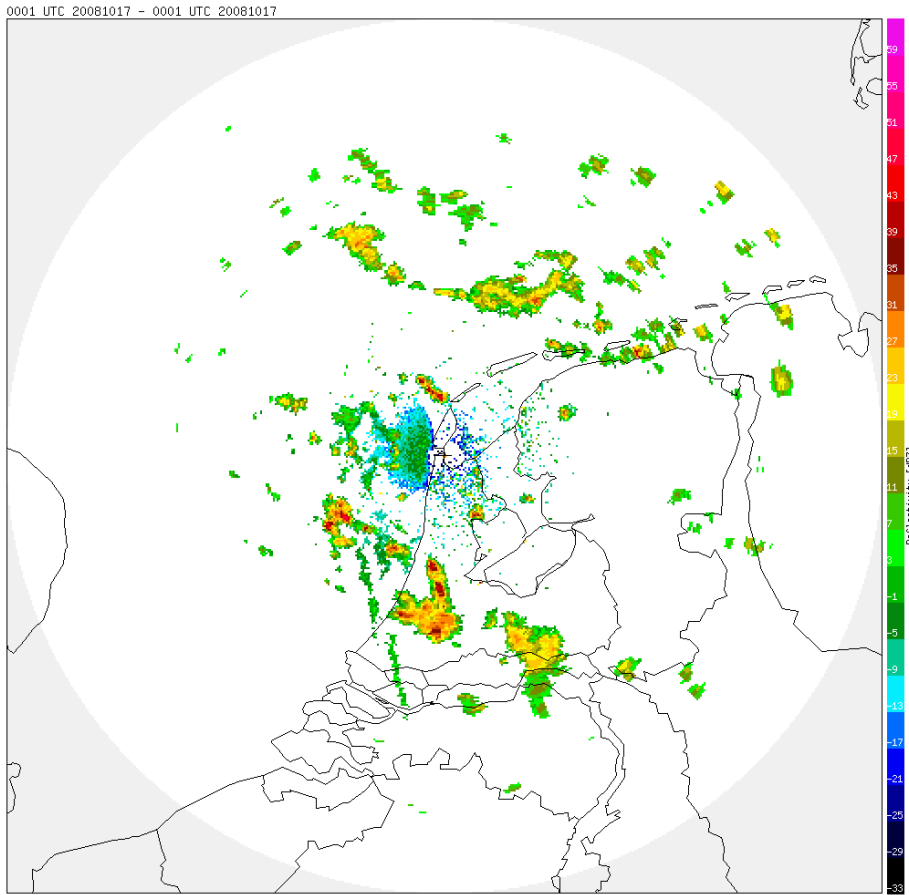
ENRAM: overview

- October 2013 – October 2017
- 24 countries participated
- 15 meetings
- 32 short-term scientific missions
- Training school and conference
- 4 working groups
 - Classification and Retrieval of Biological Data from European Weather Radars
 - Improvement of Weather Radar Data Quality and Validation of Biological-classification Algorithms
 - Visualizing Spatio-temporal Patterns of Animal Movement
 - Significance and potential of Animal Movement Research
- www.enram.eu

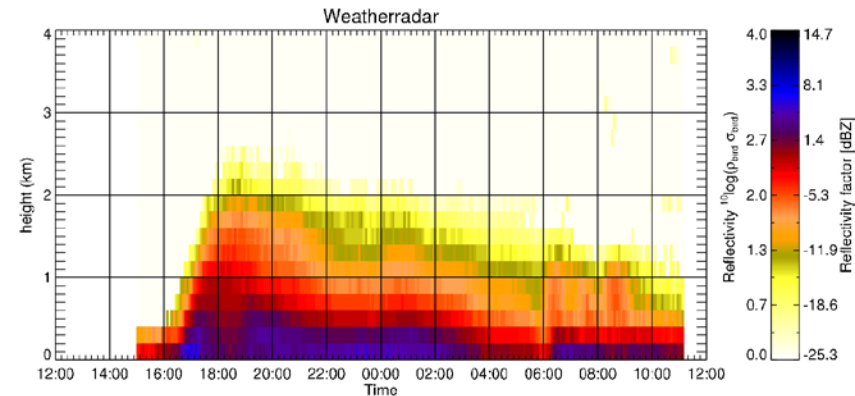
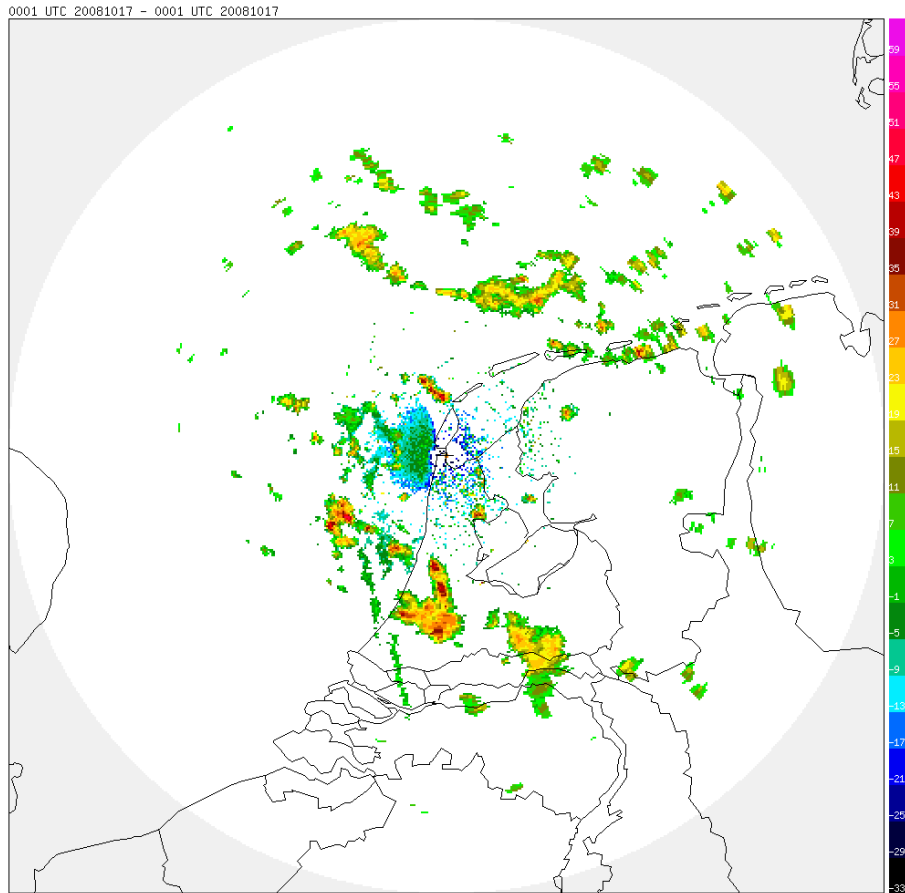
Background



Bird migration retrieval from weather radars



Bird migration retrieval from weather radars

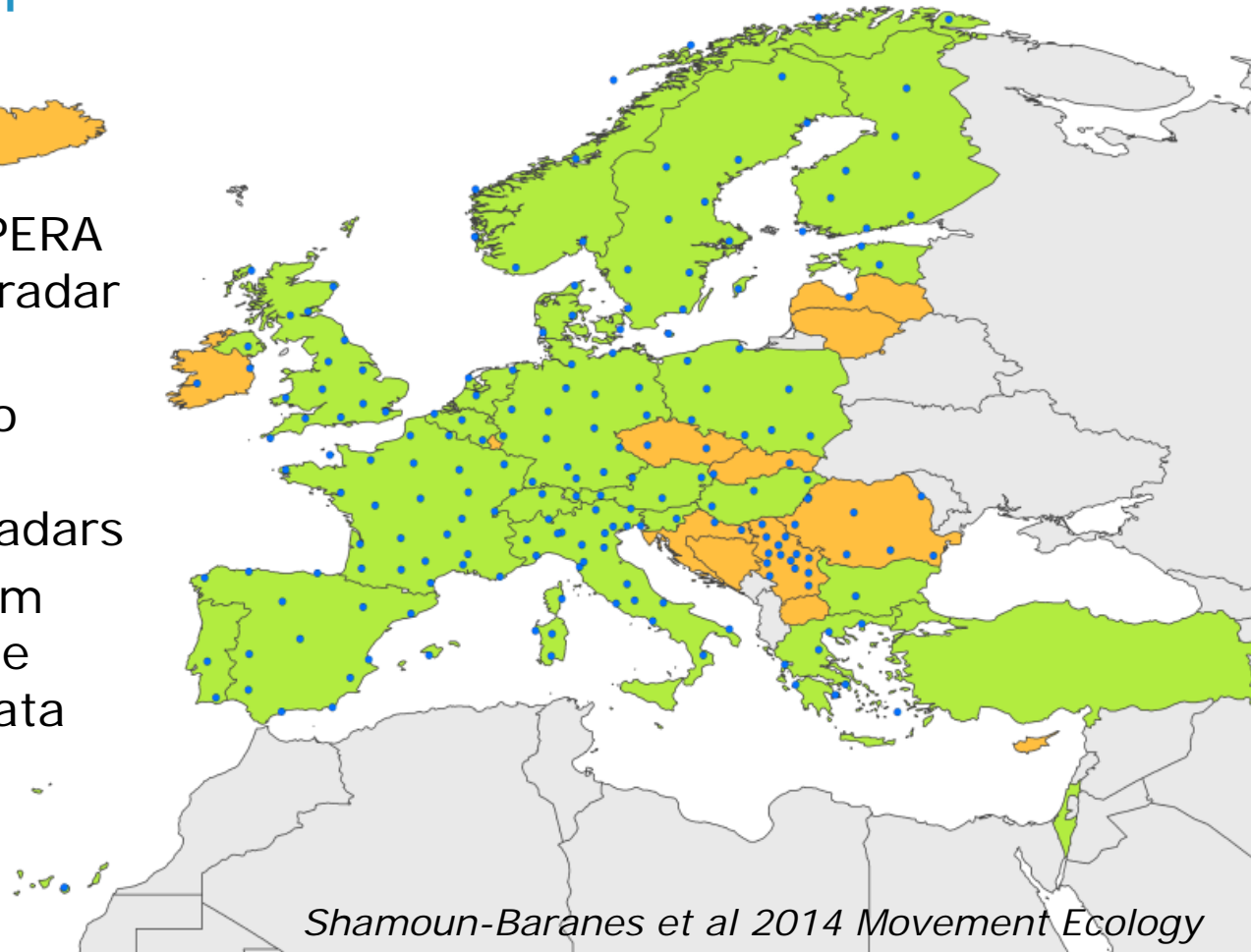


*Dokter et al 2011 Interface;
Dokter et al 2018 Ecography*

- Open-source software package bioRad
- Written in R and C
- Includes radar analysis and visualization tools
- [Github.com/adokter/bioRad](https://github.com/adokter/bioRad)

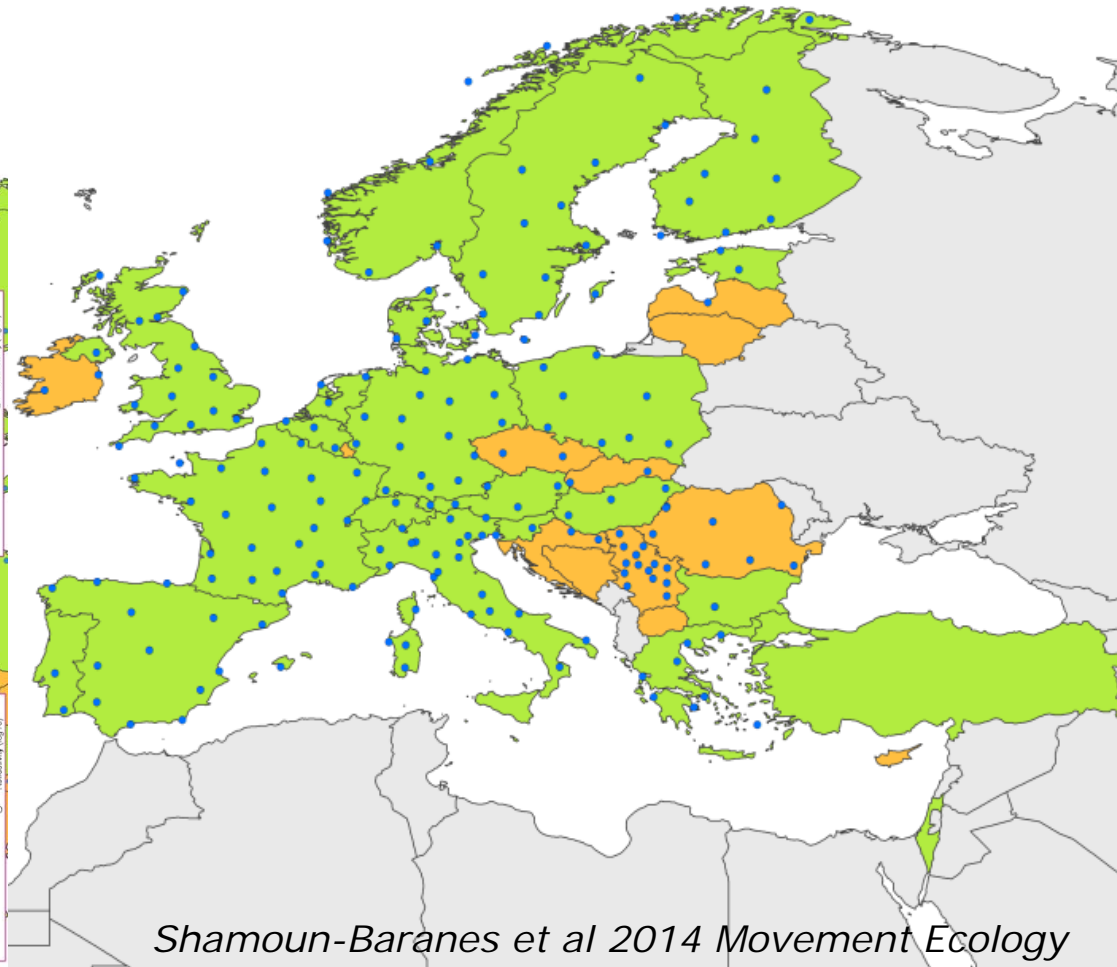
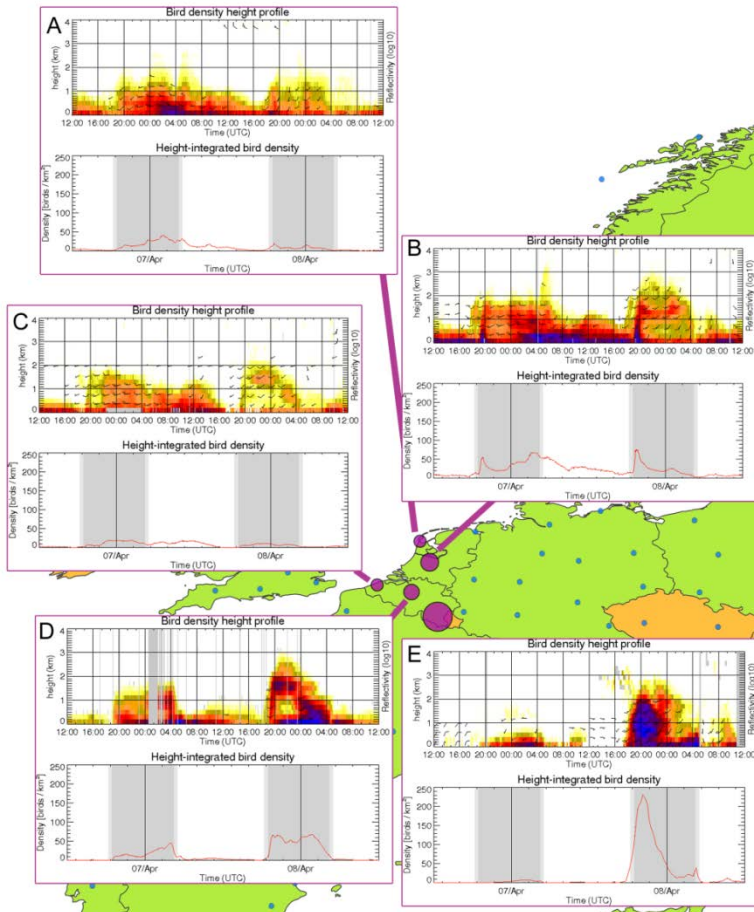
Potential in Europe

- Strong links with OPERA (European weather radar network)
- License for access to data from most European weather radars
- Feedback to and from OPERA about the use and quality of the data



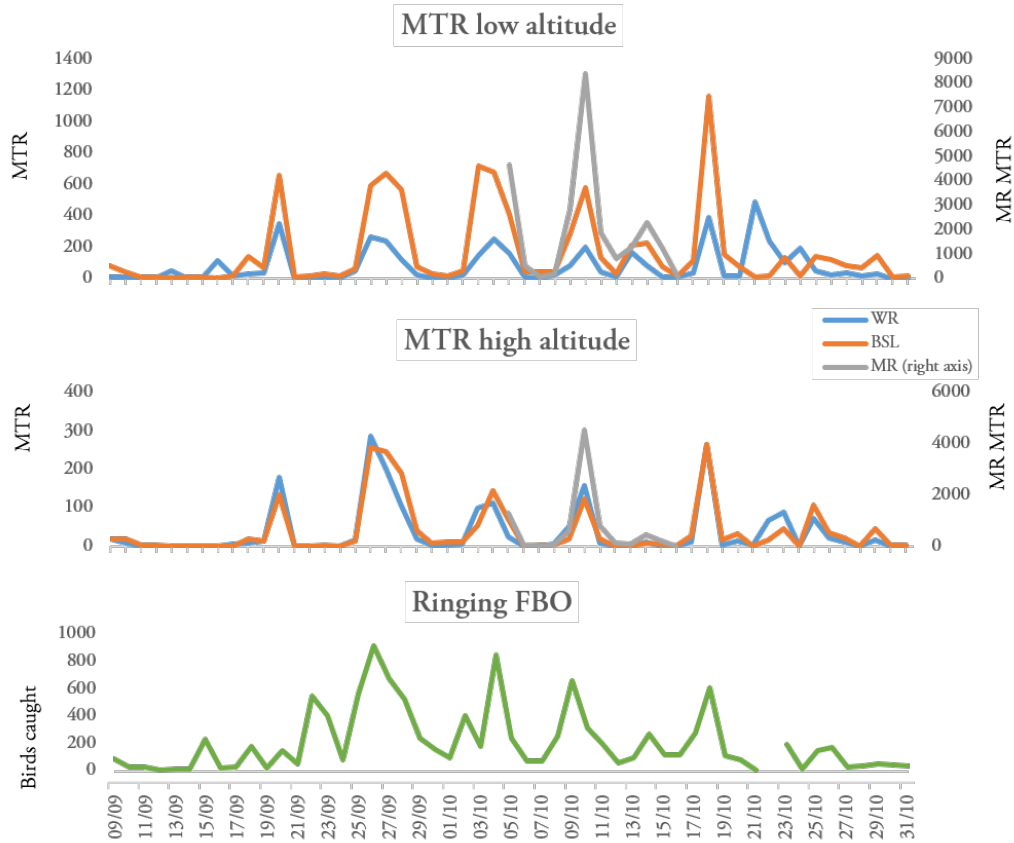
Shamoun-Baranes et al 2014 Movement Ecology

Potential in Europe



Shamoun-Baranes et al 2014 Movement Ecology

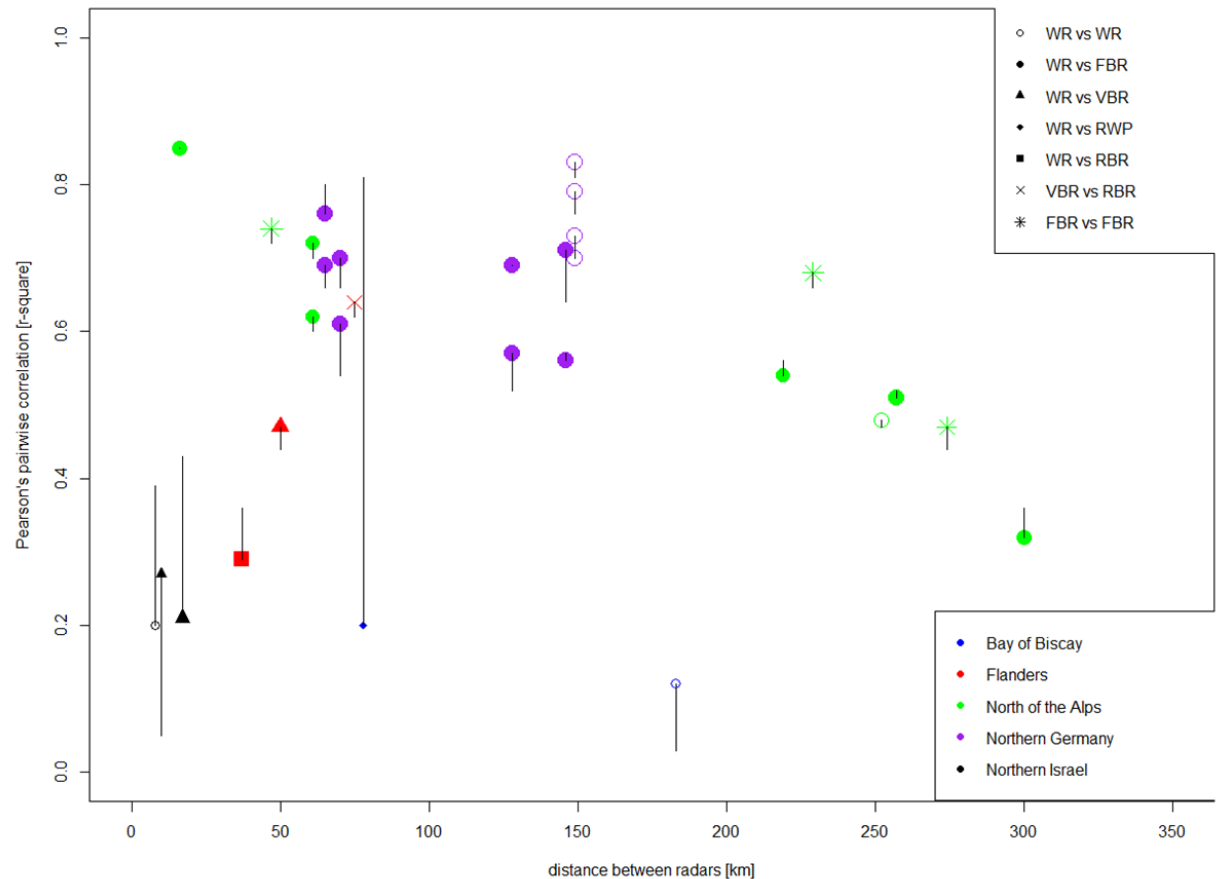
Campaigns for calibration and validation



Campaigns for calibration and validation

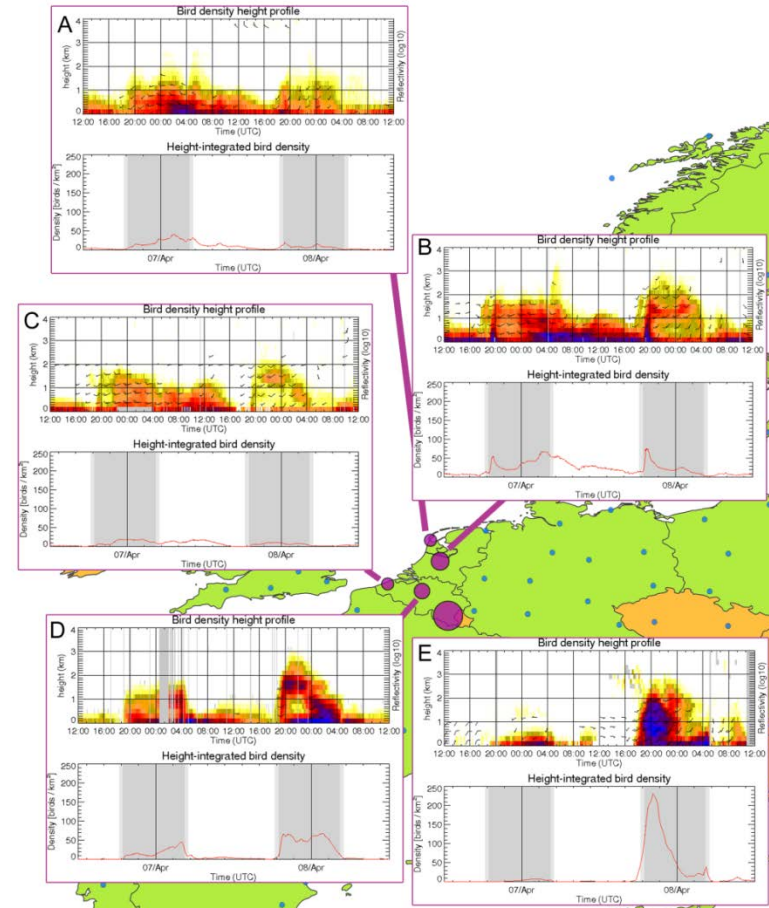
- Several calibration campaigns
- Clearer idea of differences between radar types
- We have confidence in weather radars

Liechti et al 2018 Ecography



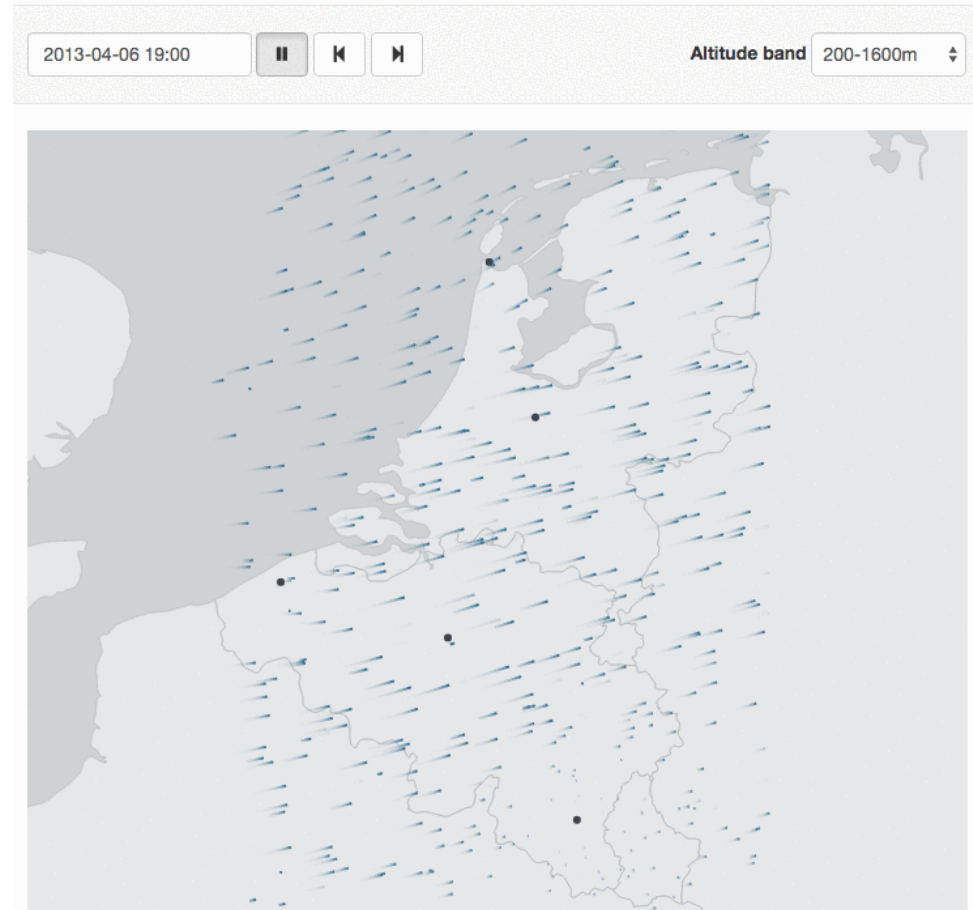
Visualizing migration data from radars

- Helps interpretation
- Summarizes complex data
- Scalable and transferable
- Open-source software
- enram.github.io/bird-migration-flow-visualization/viz



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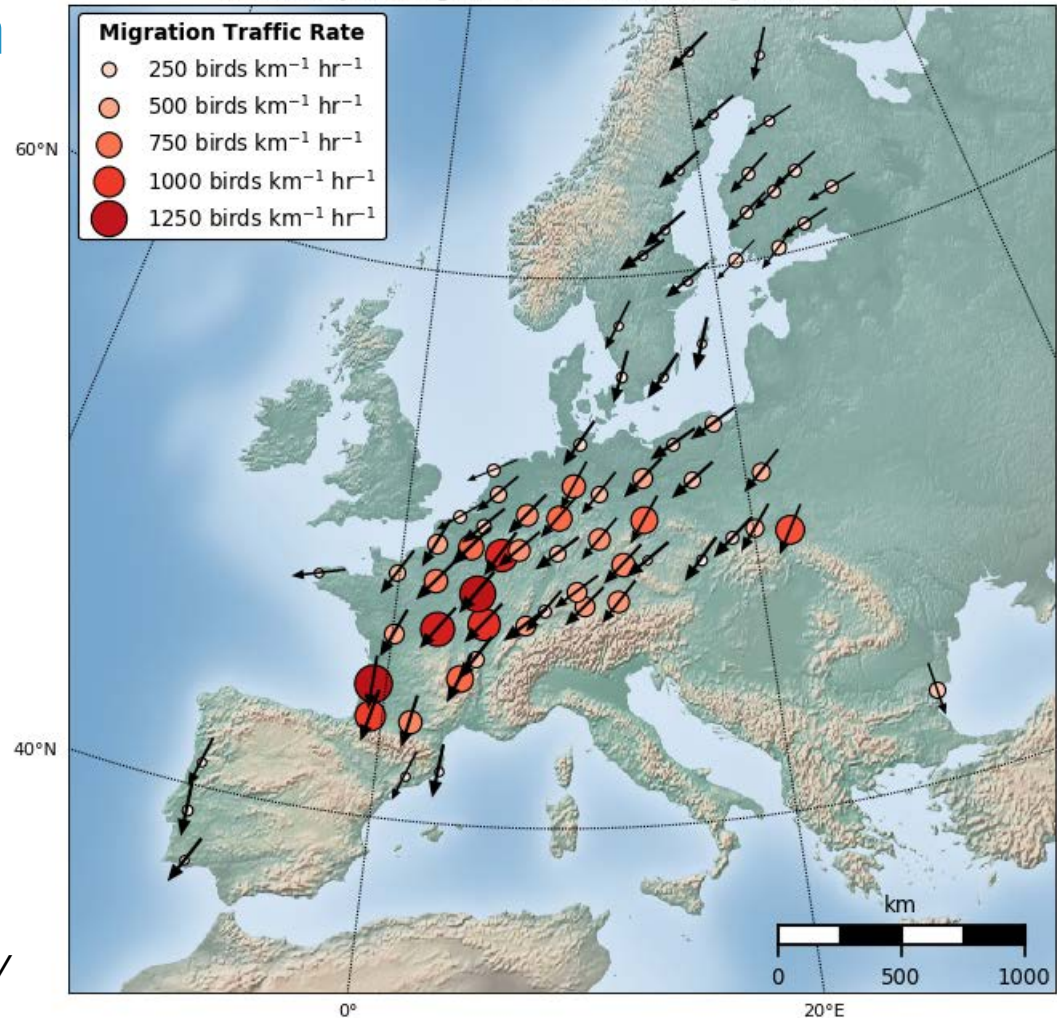


Shamoun-Baranes et al 2016 PLOS ONE

Large-scale migration

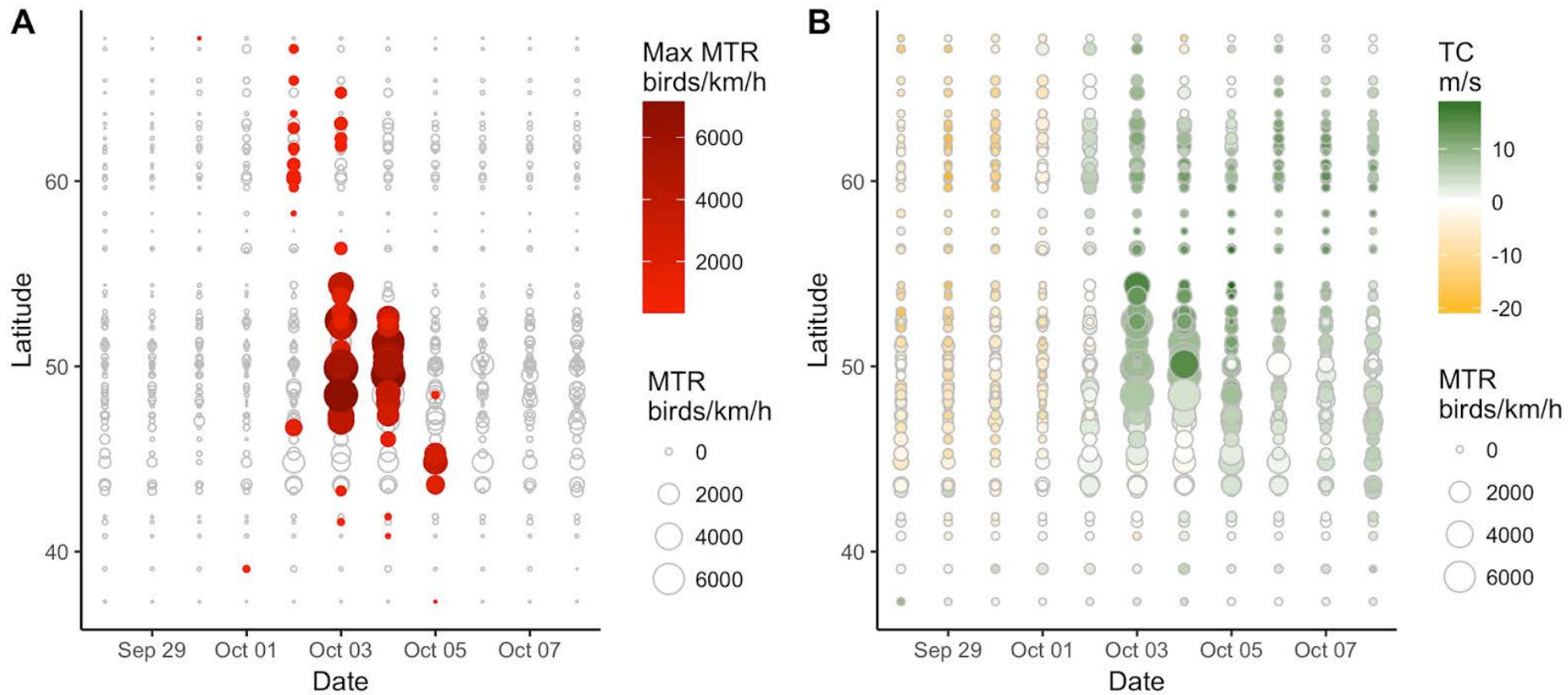
- We can now map continental-scale bird migration
- More than 70 weather radars are used, and this number is growing
- Many unresolved questions can be answered

Seasonally-Averaged Nocturnal Avian Migration Traffic



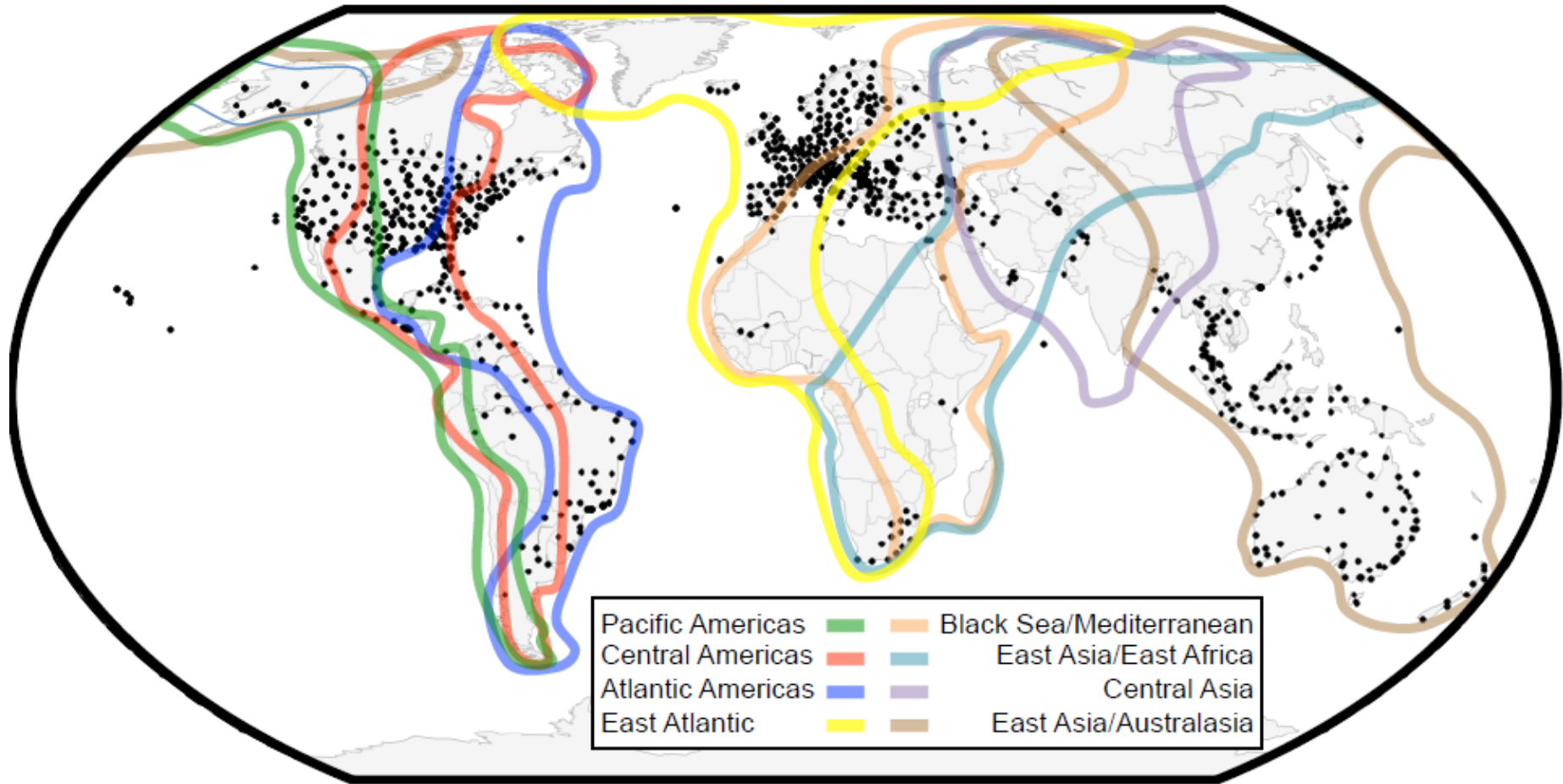
Nilsson et al 2018 Ecography

Migration wave through Europe



Nilsson et al 2018 Ecography

Even larger-scale...



Thank you!

