

Continental-scale radar monitoring of the aerial movements of animals

Judy Shamoun-Baranes*,

Jason Chapman, Adriaan Dokter, Hans van Gasteren,
Maarten de Graaf, Hidde Leijnse, Felix Liechti

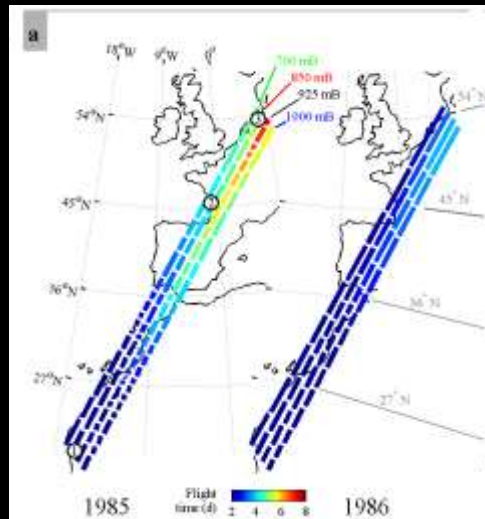
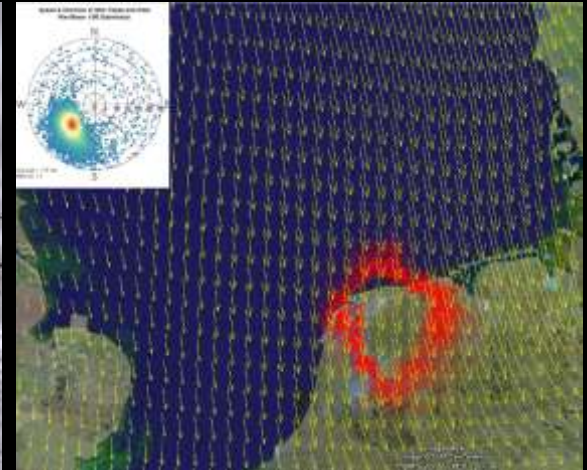
Contributions from: Peter Desmet, Bart Aelterman and Kevin Azijn

*Computational Geo-Ecology, University of Amsterdam
shamoun@uva.nl

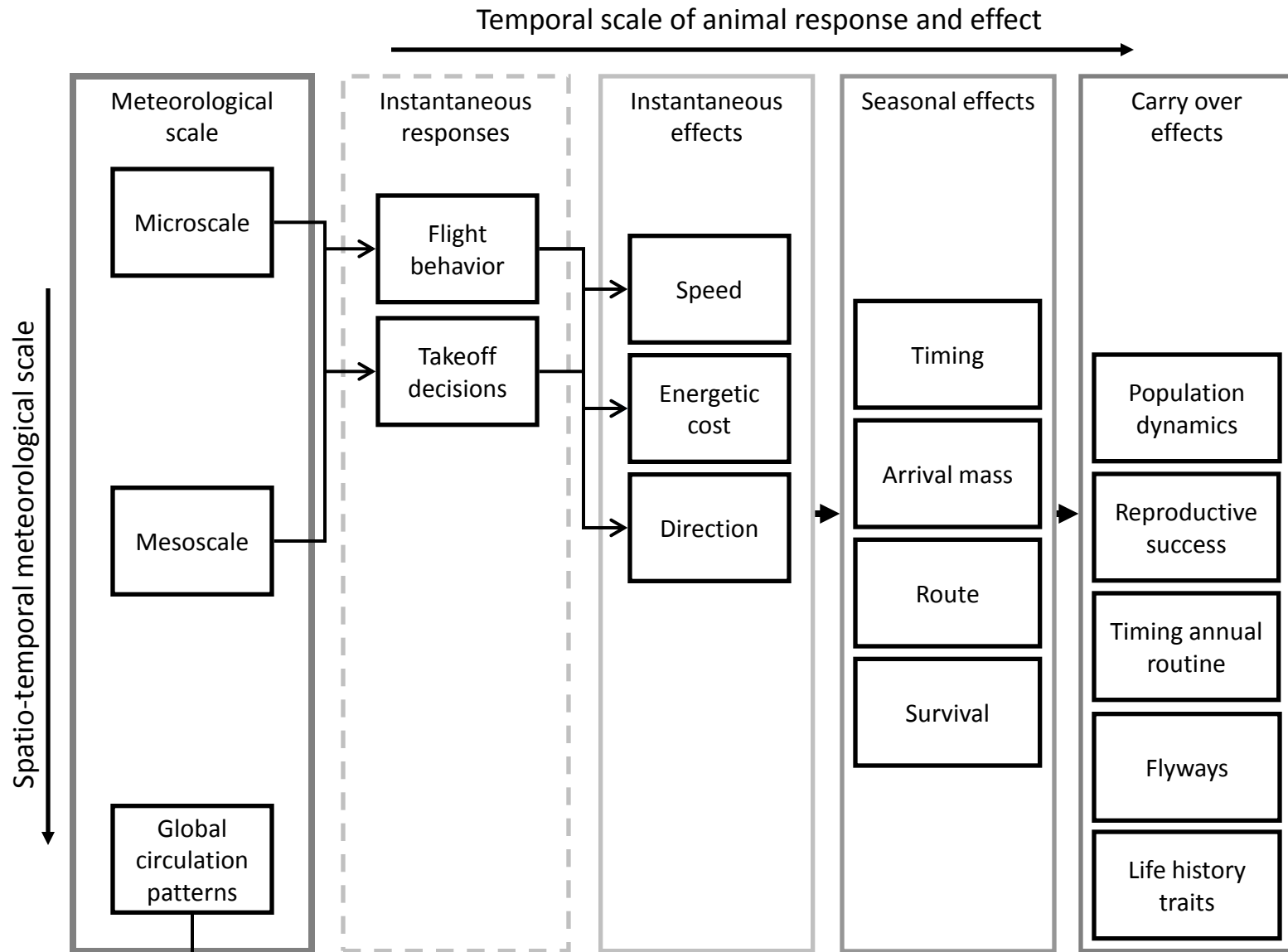
Radar Aeroecology Symposium, 26th IOC, Japan



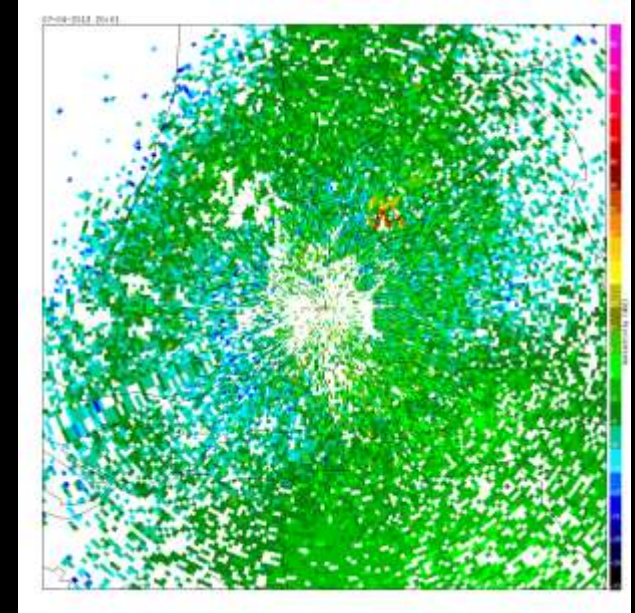
Bird movement in relation to their environment



The influence of atmospheric dynamics on flight



Bio-logging and radar to study movement at different scales and levels of biological organization



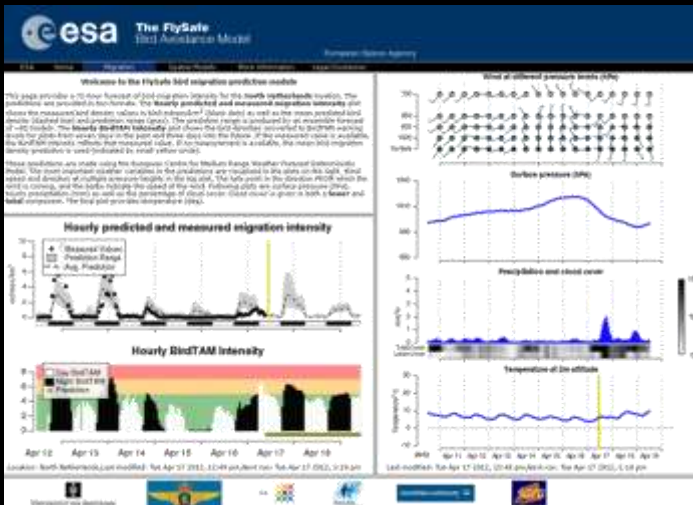
Radar aeroecology and flight safety



1.2 billion USD per year



US Airways landed in Hudson River, New York



<http://www.flysafe-birdtam.eu/>



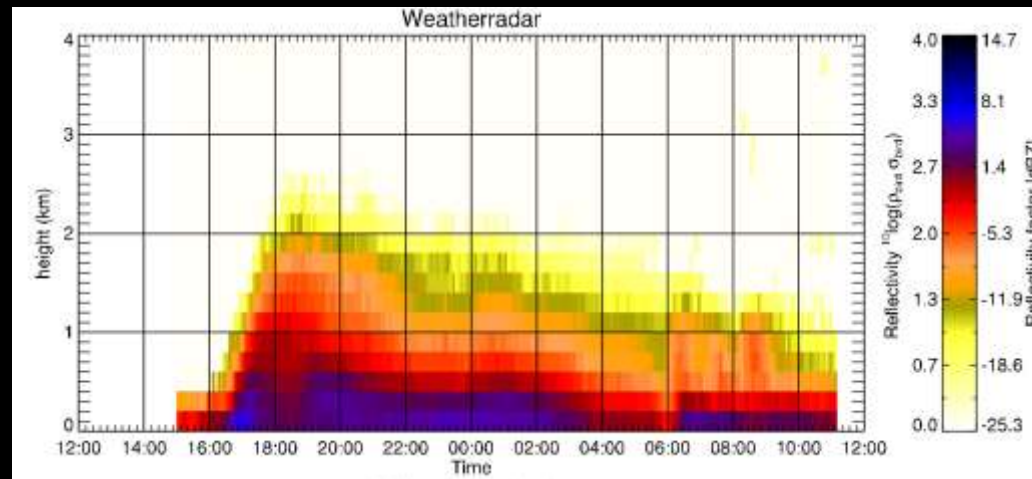
Shamoun-Baranes et al. 2008 *Ecol. & Soc.*; Ginati et al. 2010 *ESA Bulletin*;
 PhD Thesis Michael Kemp, 2012

Radar aeroecology and flight safety



Flysafe: An ESA Integrated Application promotion program

- Calibration with bird detection radar at 3 locations
- NL & BE: C-Doppler, FR - Dual polarization
- Density, speed and direction
- Altitude profiles every 15 minutes
- Development of bird detection algorithm
- **FlySwift**: real time monitoring of bird movements 24/7, BE (3 radar), NL (2 radar) <http://www.flysafe-birdtam.eu/>



Entomological studies

- Pest insect migration monitoring and forecasting (*Leskinen et al 2011 J Appl Entomol*)
 - Measure speed and direction of migration
 - Polarimetric radar products to separate insects
 - Flow trajectory models to predict movement
- Long distance migration of the painted lady butterfly (*Stefanescu et al 2013 Ecography*)
 - Combination of methods
 - Intensity, timing, altitude, spatial patterns
 - Flow trajectory models to predict movement

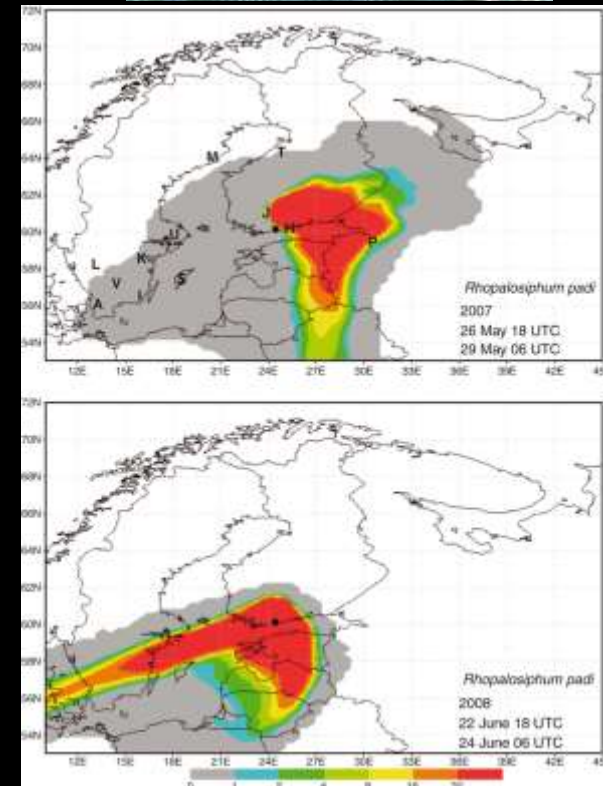
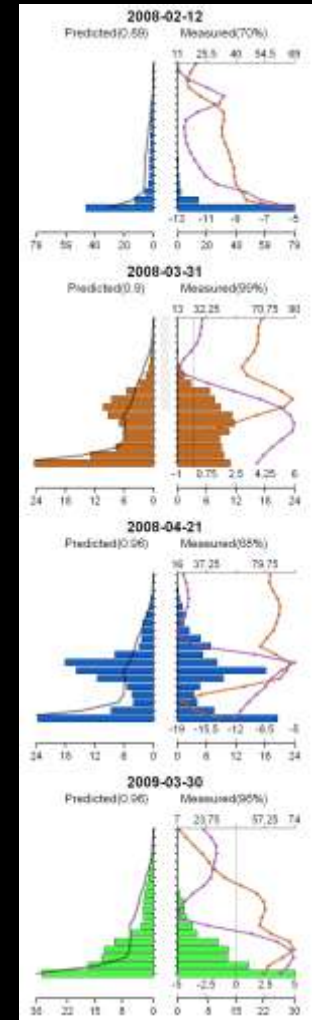
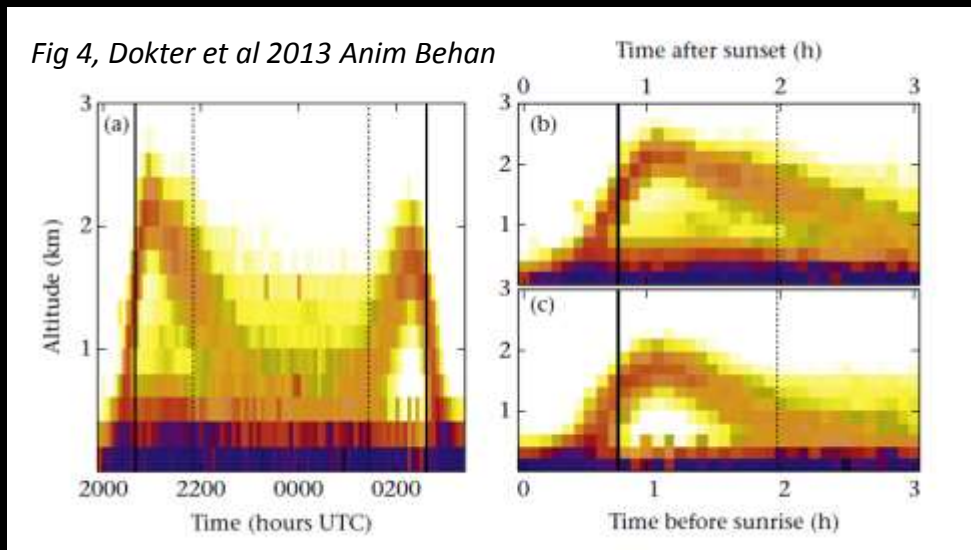


Fig 7, Leskinen et al 2011 J Appl Entomol

Avian studies: Flight altitudes

- Influence of weather on flight altitudes during migration (*Dokter et al 2013 PLoS ONE, Kemp et al 2013 Ibis*)
- Twilight ascents by common swifts (*Apus apus*) during the breeding season (*Dokter et al 2013 Anim Behav*)



Avian studies: Fleeing from fireworks

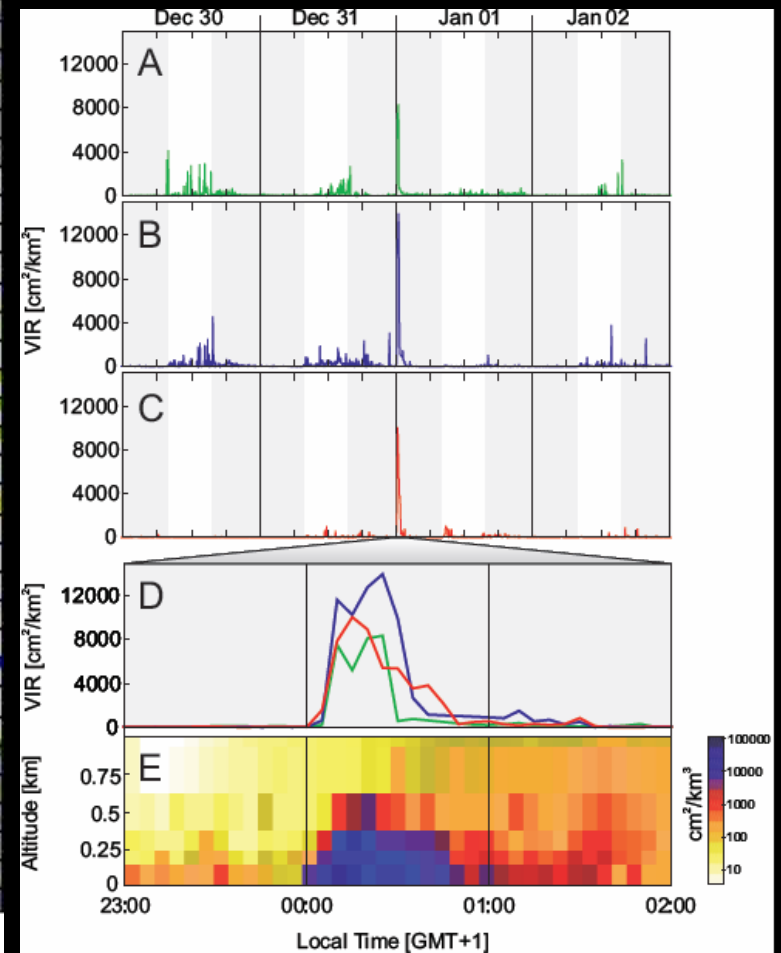
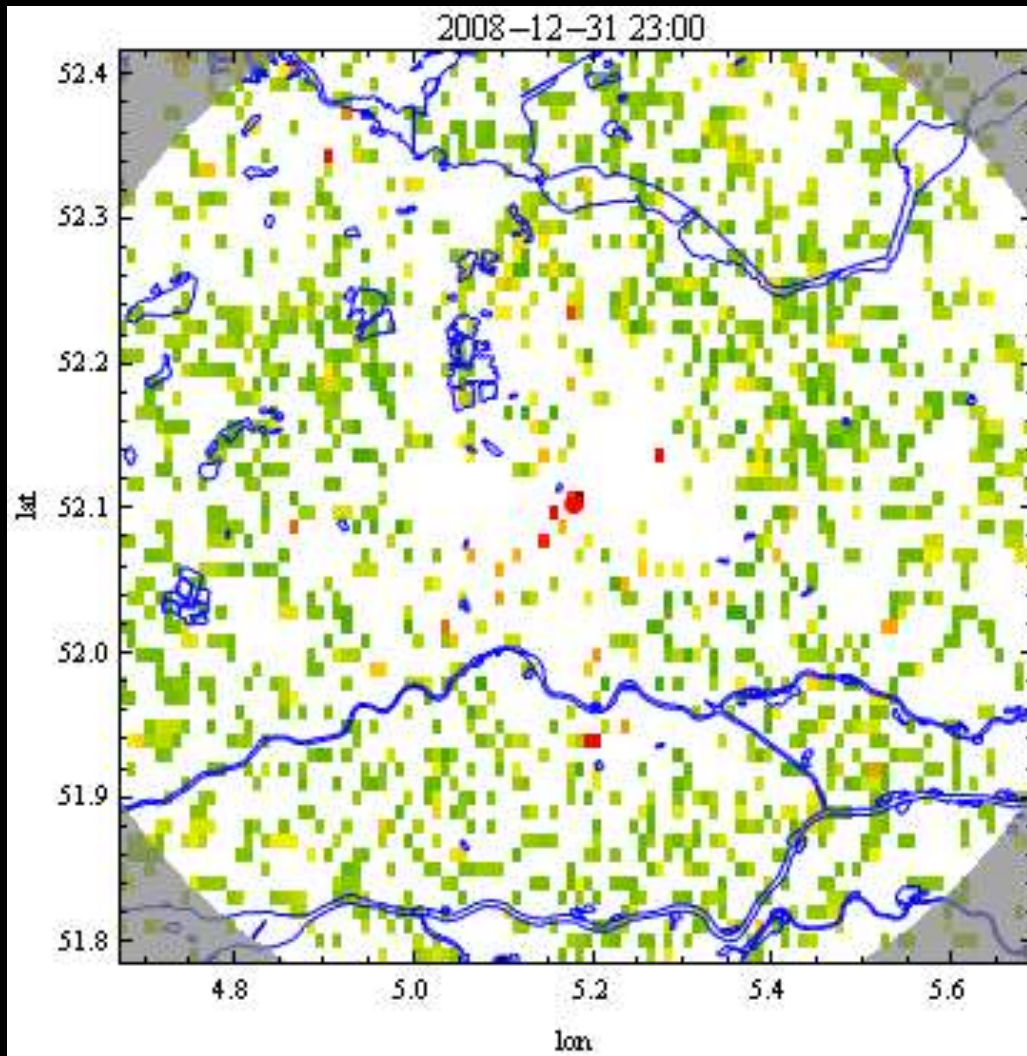


Photo: Peter Eekelder



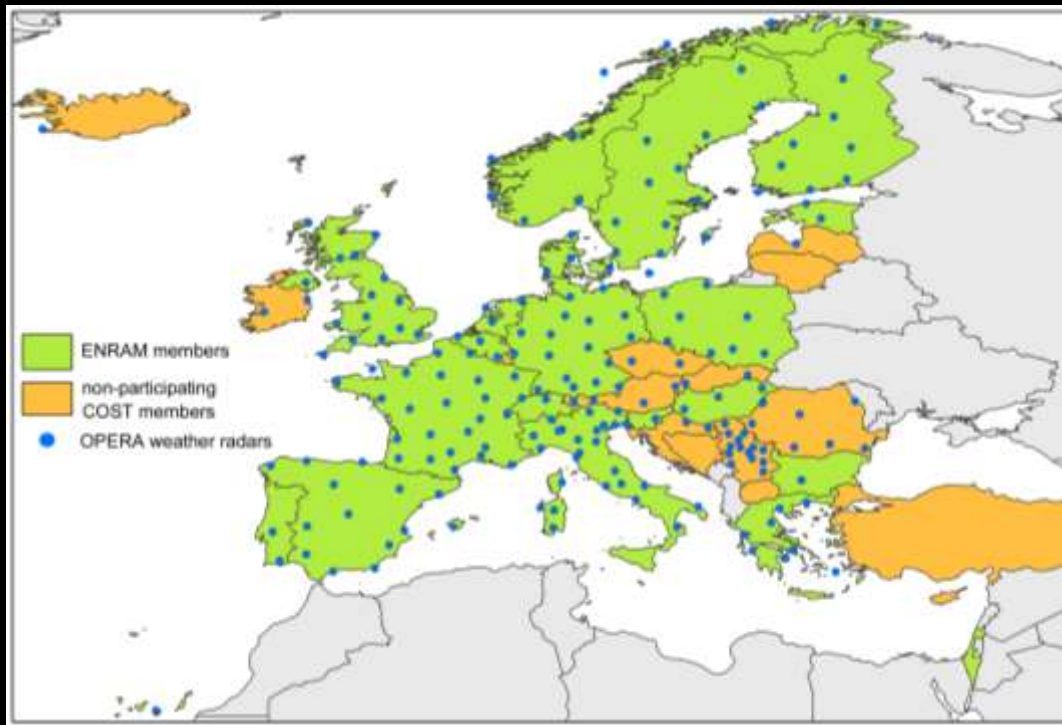
Photo: Peter Eekelder

Avian studies: Fleeing from fireworks



European Network for the Radar surveillance of Animal Movement

Foster international and multidisciplinary collaboration to monitor and study animal movement at a continental scale



Shamoun-Baranes et al 2014 Movement Ecology

- e-COST Action
- Research networking
- 21 countries
- Management committee
- 4 working groups
- STSM (Short term scientific mission)
- www.enram.eu





ENRAM working groups

- WG 1: Classification & retrieval of biological data
- WG 2: Improve data quality & validation of biological targets
- WG 3: Visualization of spatio-temporal patterns
- WG 4: Significance and potential of animal movement research

Mass migration case study

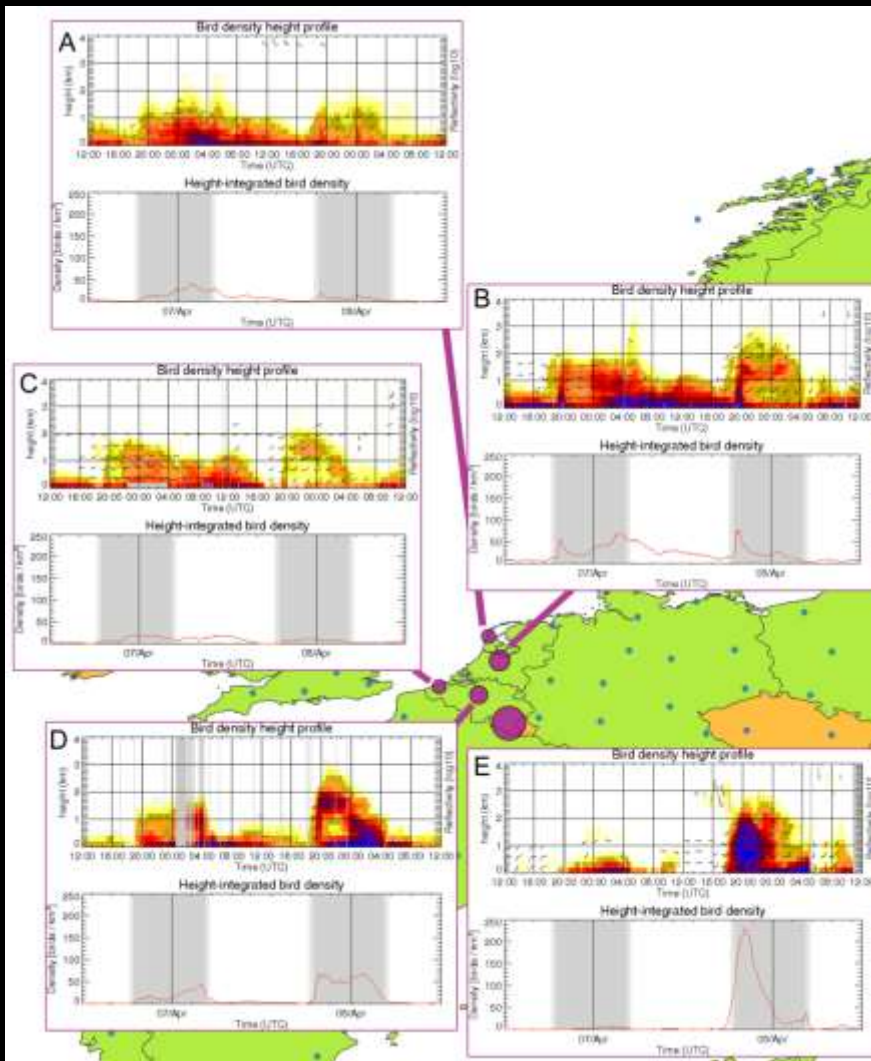
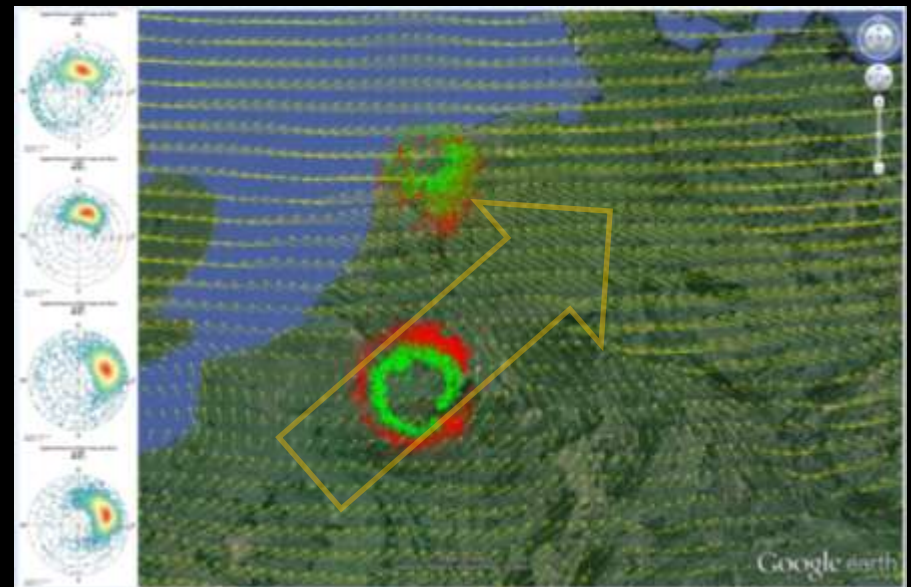


Fig 2, Shamoun-Baranes et al 2014 *Movement Ecology*

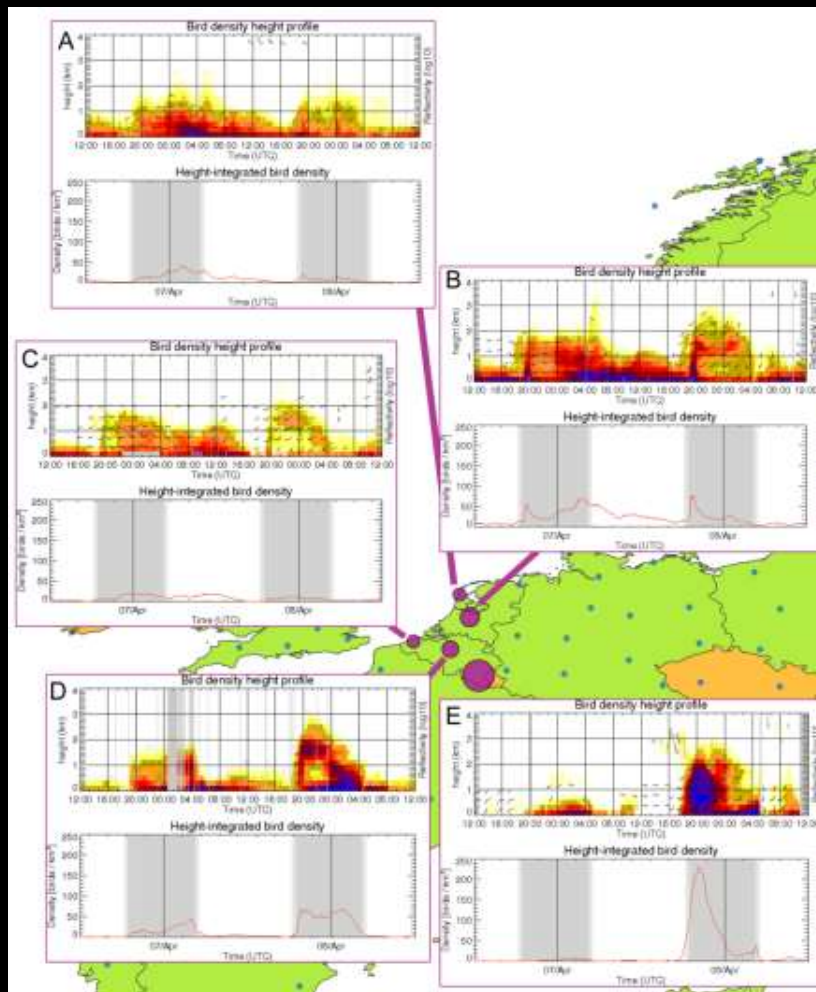
- Mass migration April 7-8 2013
- Layering at several locations
- Coldest spring in 40 years
- Complex wind conditions
- Challenge: how do we visualize movement dynamically with minimal amount of information?

2014-04-08 20:00 UTC, wind 925 mb



Mass migration case study

Data visualization hackaton



Peter Desmet, Bart Aelterman, Kevin Azijn
(INBO Belgium)

- ENRAM STSM hosted at UvA, NL
- Assume passerine migration
- Height integrated bird density (threshold)
- Use mean ground speed & direction
- Inverse weighted distance interpolation
- Re-engineer earth.nullschool.net

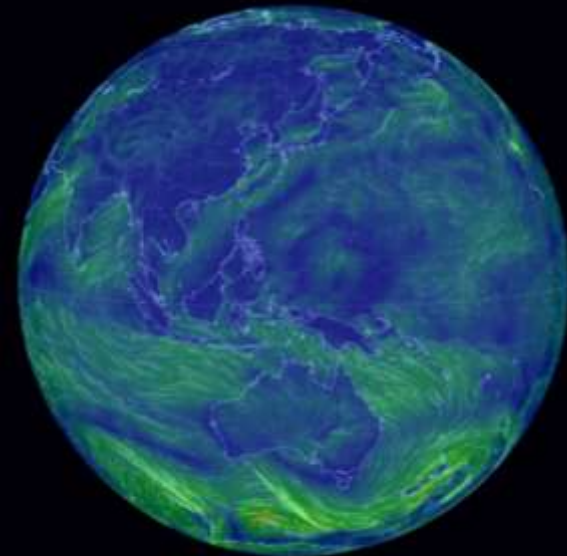


Fig 2, Shamoun-Baranes et al 2014 *Movement Ecology*



Mass migration case study

Data visualization hackaton



Peter Desmet, Bart Aelterman, Kevin Azijn (INBO Belgium)
<http://enram.github.io/bird-migration-flow-visualization/viz/>



Summary

- International and interdisciplinary network
- Improve existing algorithms
- New ways of exploring and visualizing movement data
- Integrating techniques
- Continental-scale monitoring
- Map flyways, aerial biomass, anthropogenic impact
- Cross-taxa analysis
- Join our network www.enram.eu

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