

Which radar systems are suitable to study what kind of question? – An overview

J. Aschwanden, V. Martin, H. Stark, E. Bächler, T. Steuri, F. Liechti

Conference on Wind energy and Wildlife impacts

Trondheim, 5th May 2011



vogelwarte.ch



swiss-birdradar.com

Bird Migration: Reasons for bird movements

- daily local movements:

foraging site



roosting site

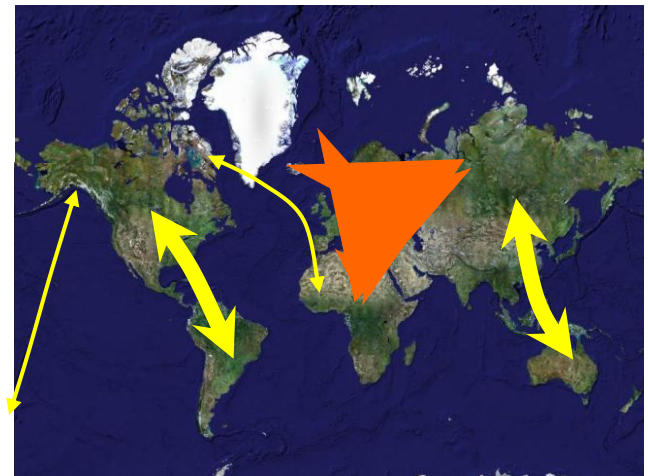


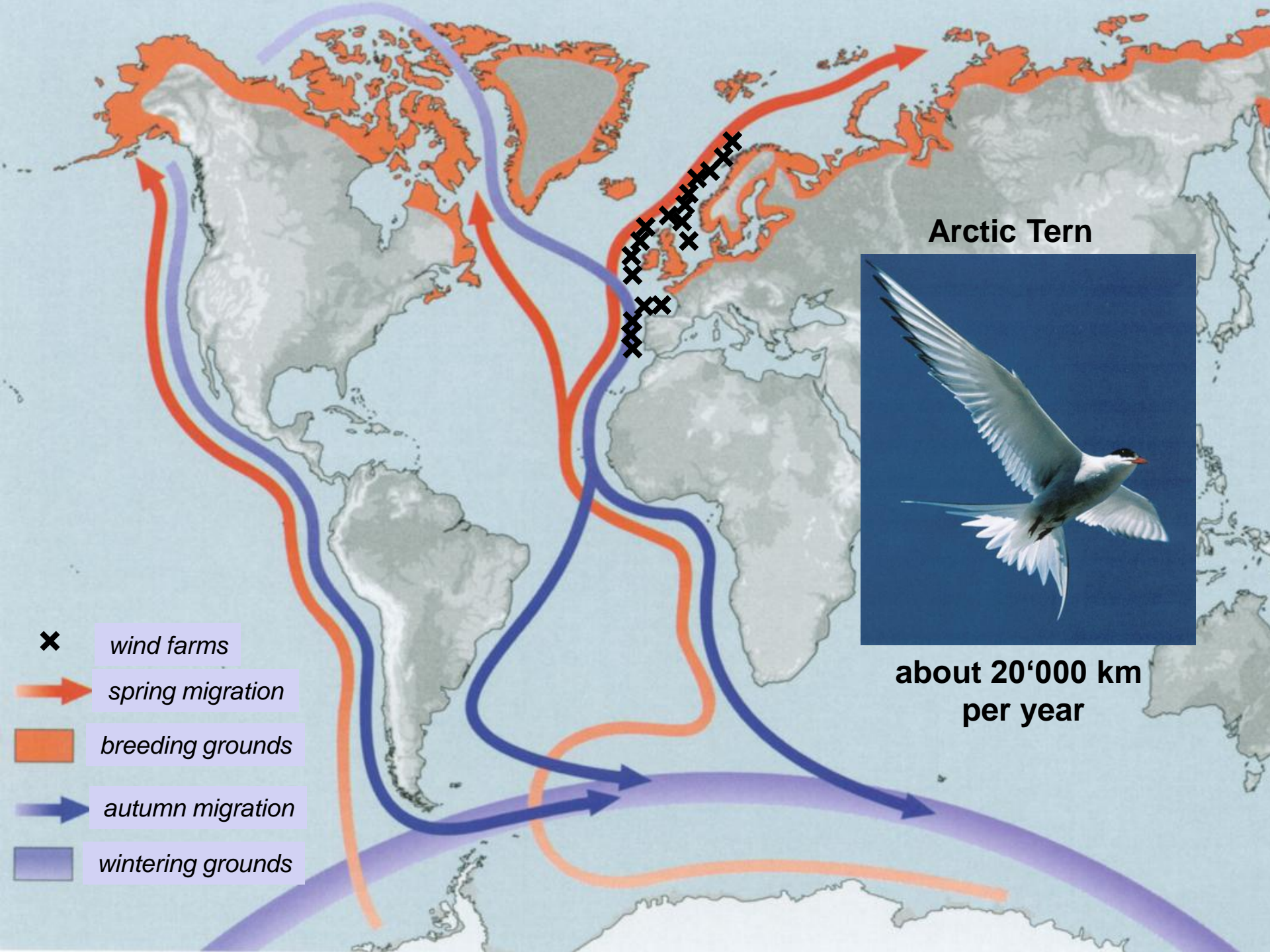
- seasonal global movements:

breeding grounds



wintering ground



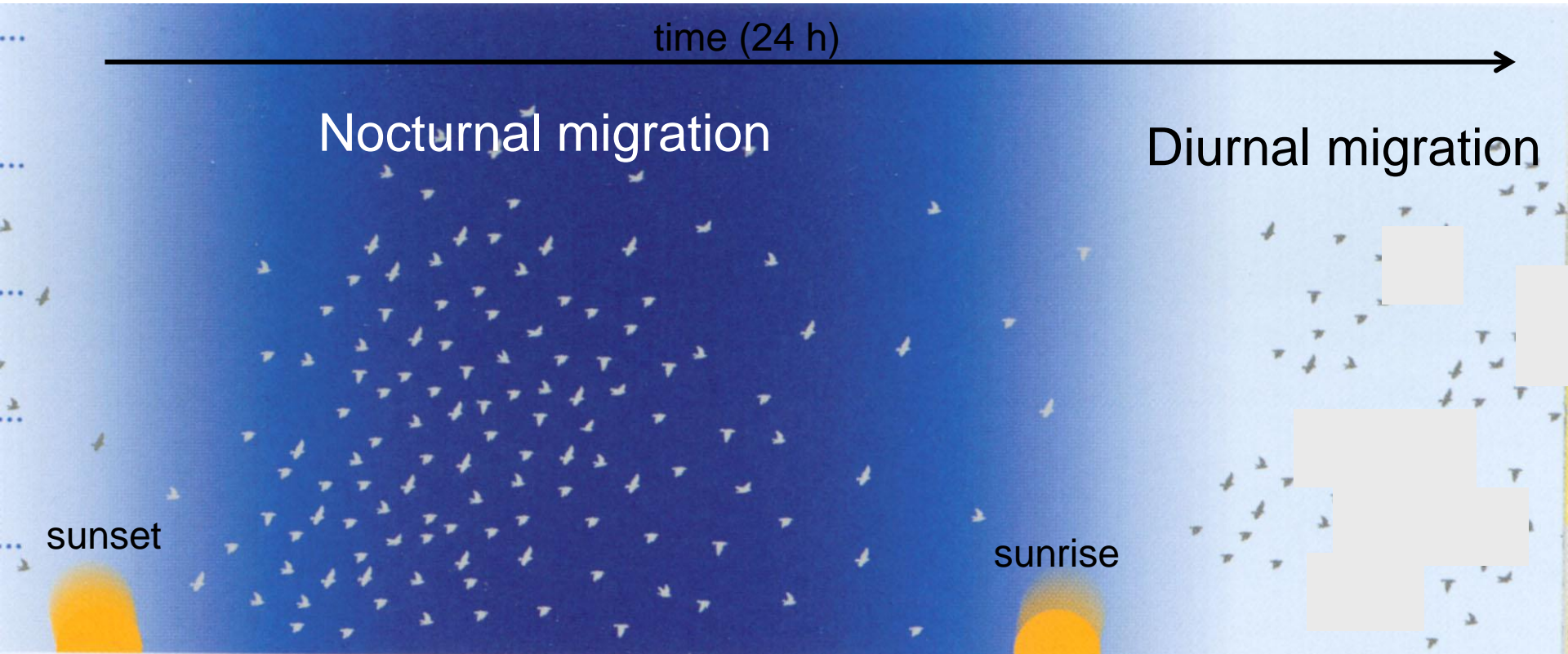


Arctic Tern



**about 20'000 km
per year**

Bird Migration: When do birds migrate?



During night: single birds

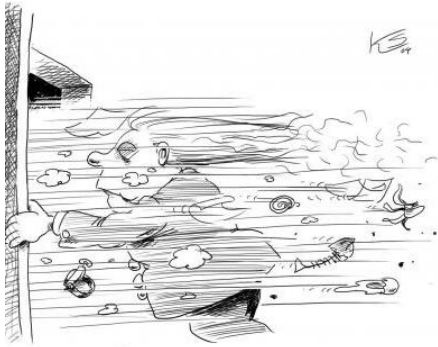
during day: flocks of birds

→ about 2/3 of all birds migrate at night!

Bird Migration: How high do birds migrate?

- altitudes: few meters over water/land up to 8'000 m a.s.l.
- wheather conditions -> altitudes
- conditions for low altitudes:

- Head wind



- Low cloud cover

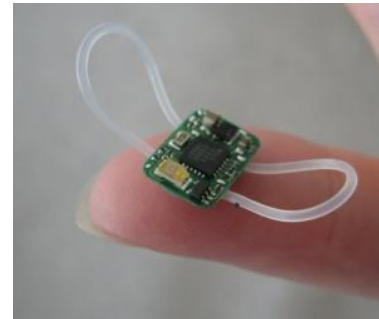
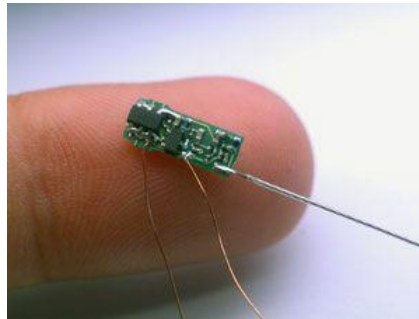


- Limited sight



Bird Migration: Methods to investigate migration?

- Equipping birds with marking or recording devices (e.g. rings, gps-transmitters, geolocators etc.)

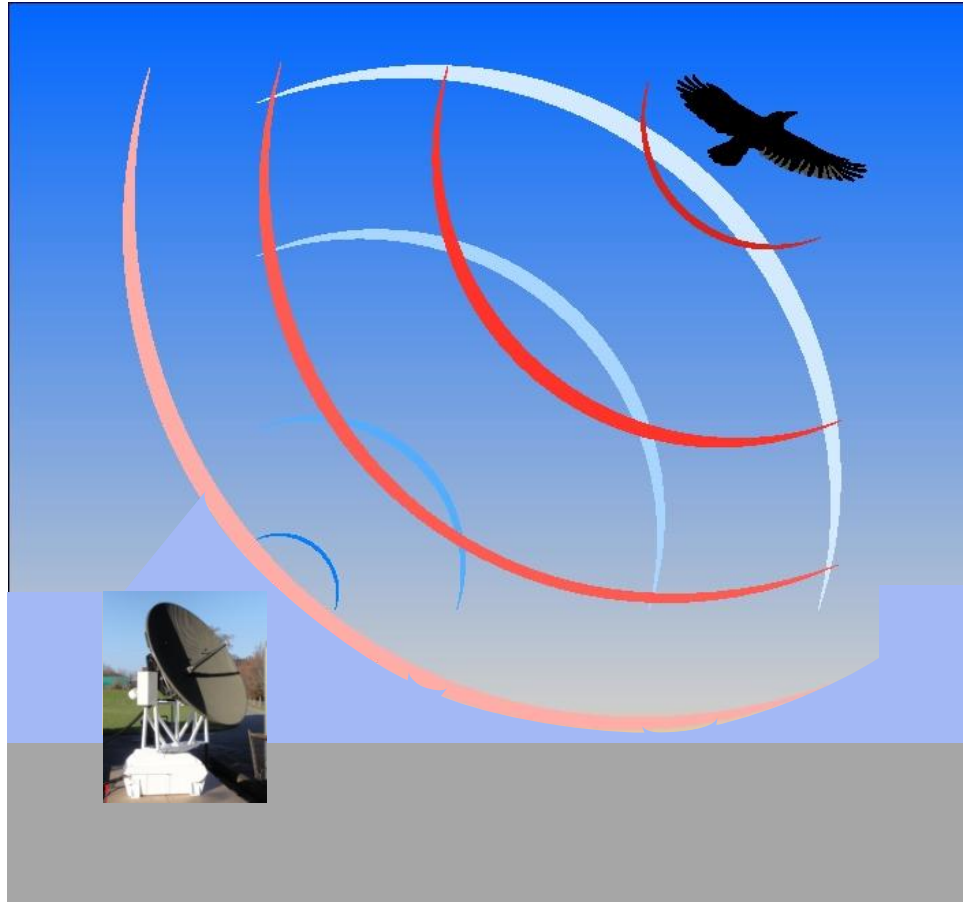


- «Stay-and-wait-at-one-location»



Radar Method: Principle of radar technology

- Microwaves -> reflected by objects in the air -> echoes



Radar Method: Difficulties with bird detection?

- Microwaves are not only reflected by birds!

Birds



Clouds



Clutter



Air turbulences



It's just a little air pocket, dear!

Bats



Insects



UFOs



→ Determination of echoes to differentiate between echoes of birds and non-birds is essential!

Radar Method & Impact Studies: Required information

- What is the potential collision risk within the area of a planned wind farm?

- How many birds are passing by?
- Temporal and spatial distribution?

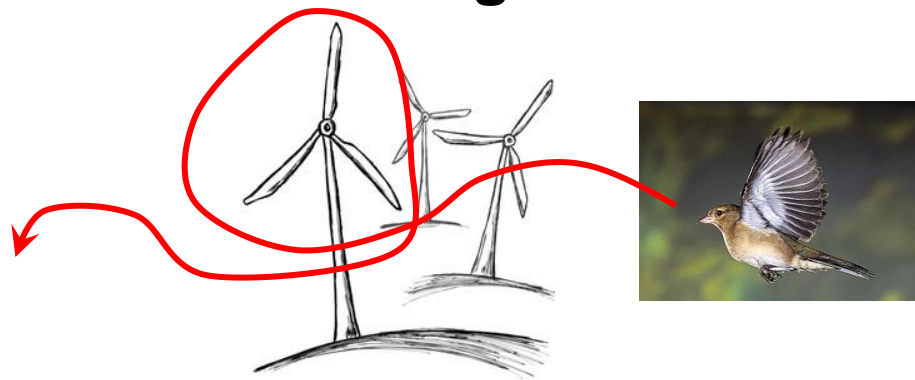
-> Quantification



- How is the airspace used by flying birds within the area of a planned wind farm?

- Single trajectories?

-> Flight Behaviour

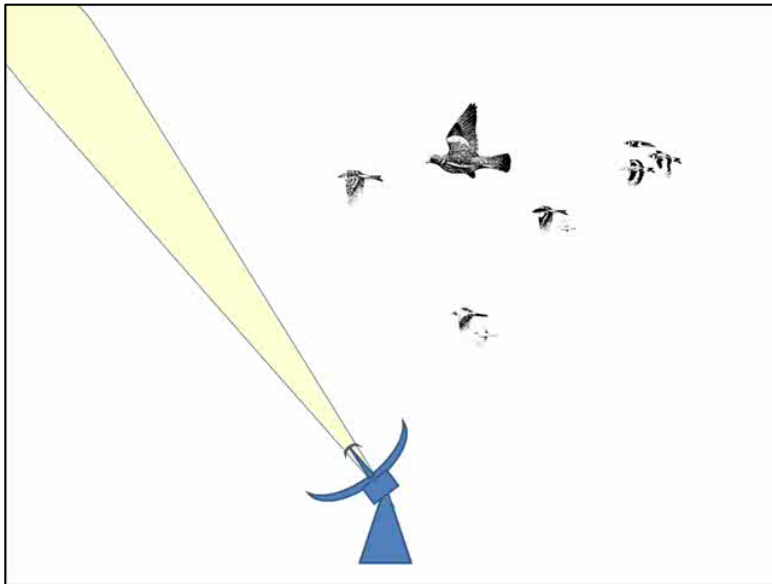


Radar Methods & Impact Studies: Measurement methods

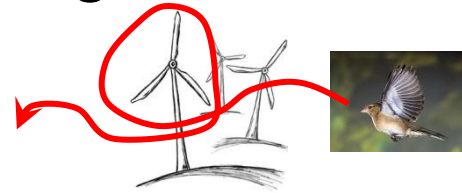
- Quantification



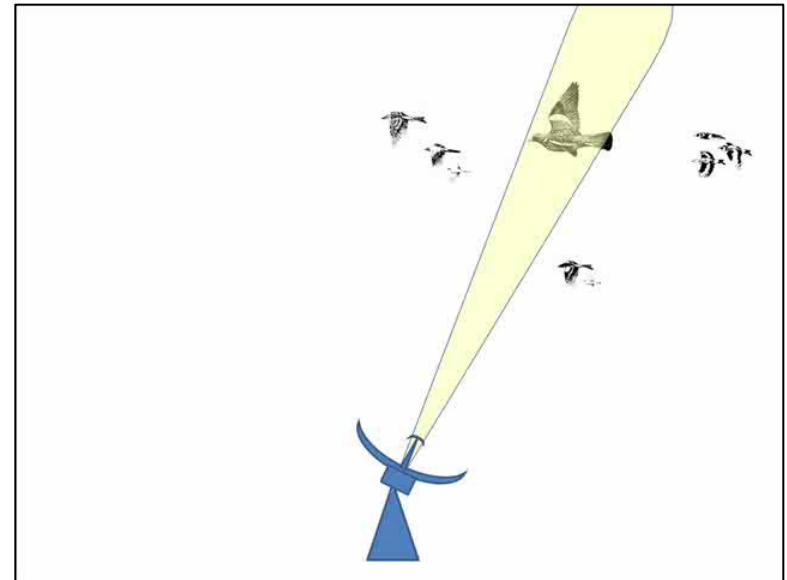
fixbeam method



- Flight Behaviour

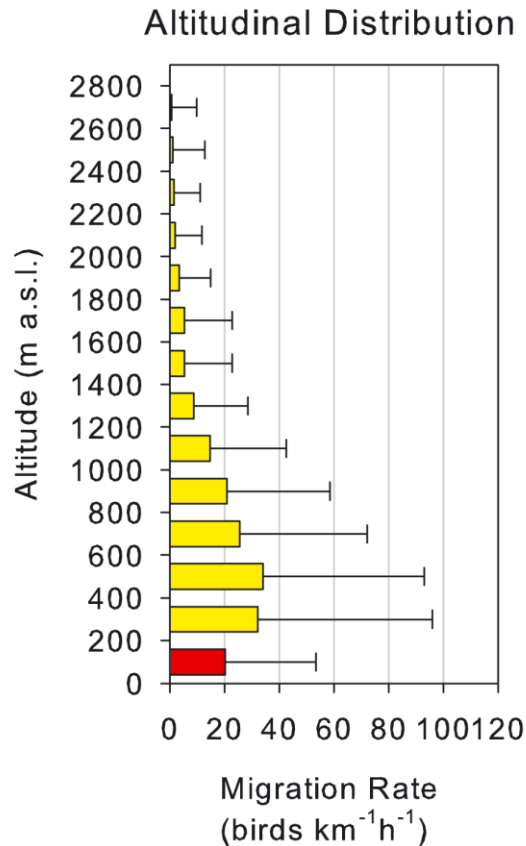


tracking method



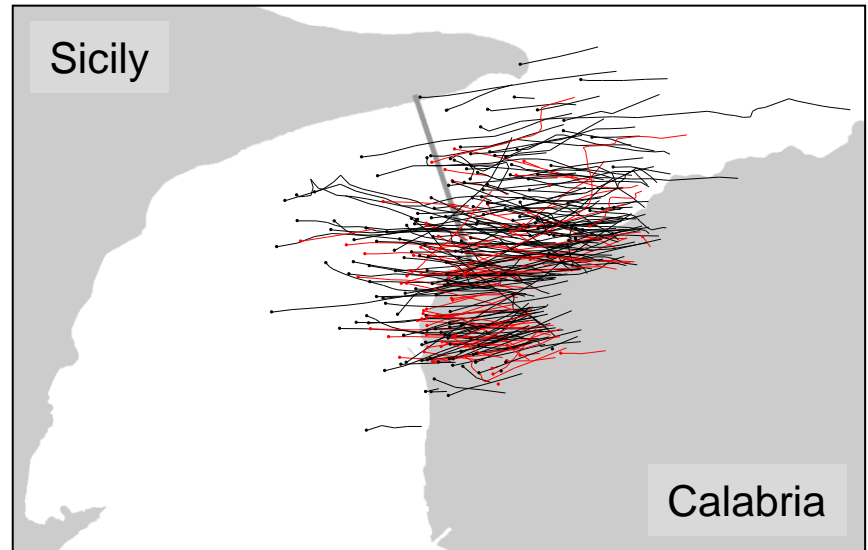
Radar Methods & Impact Studies: Practical examples

- Quantification



- Flight Behaviour

Tracks of Honey Buzzards, < 400 m a.s.l.



Radar Methods & Impact Studies: Our radar systems


- Quantification



- Flight Behaviour

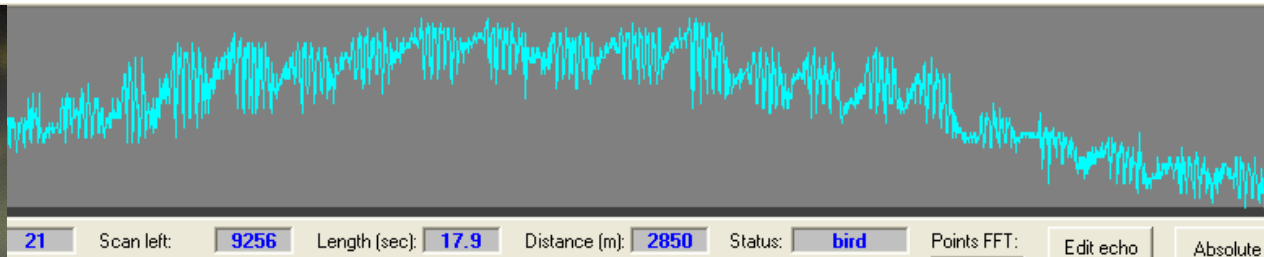
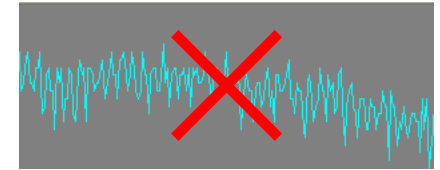
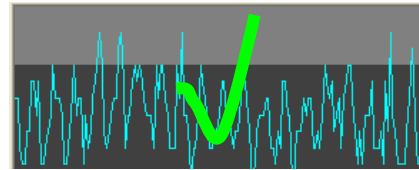


Radar Methods & Impact Studies: Our radar systems and abilities

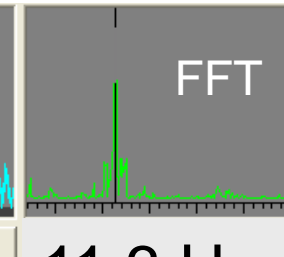
Radar systems and measurement method						
	Day	Night	Day	Night	Day	Night
Quantification	Yes	Yes	No	No	No	No
Flight Behaviour -> direction -> speed -> altitude	No -> Rough -> Rough -> Yes	No -> Rough -> Rough -> Yes	Yes (projection) -> Yes -> Rough -> No	Yes (projection) -> Yes -> Rough -> No	Yes -> Yes -> Yes -> Yes	Yes -> Yes -> Yes -> Yes
Echo determination («wing-beat») -> bird <-> non-bird -> bird species	Yes automatically automatically (bird types)	Yes automatically automatically (bird types)	No automatically manually (direct observations)	No automatically not possible	Yes manually manually (bird types, direct observations)	Yes manually manually (bird types, IR observation)
Remote operation (offshore)	Yes	Yes	Yes	Yes	No	No

Radar Methods & Impact Studies: Echo determination by wing-beat

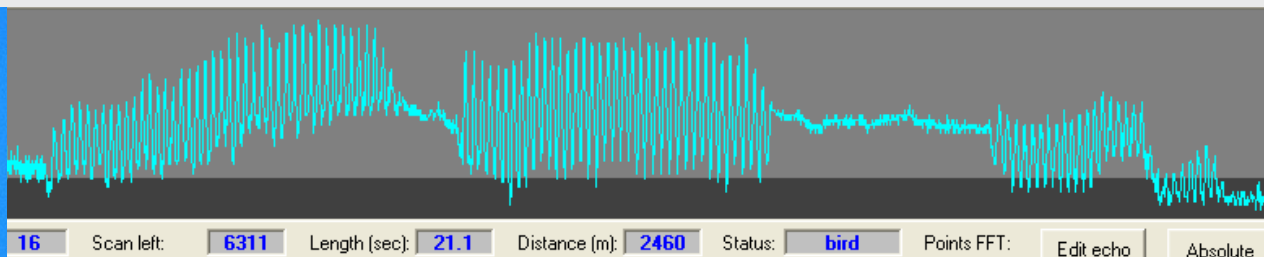
1. Differentiation birds <-> non birds
2. Identification of bird classes



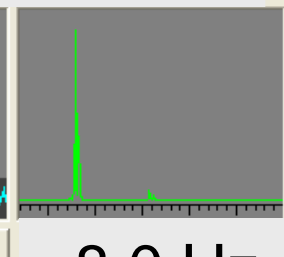
Song bird - type



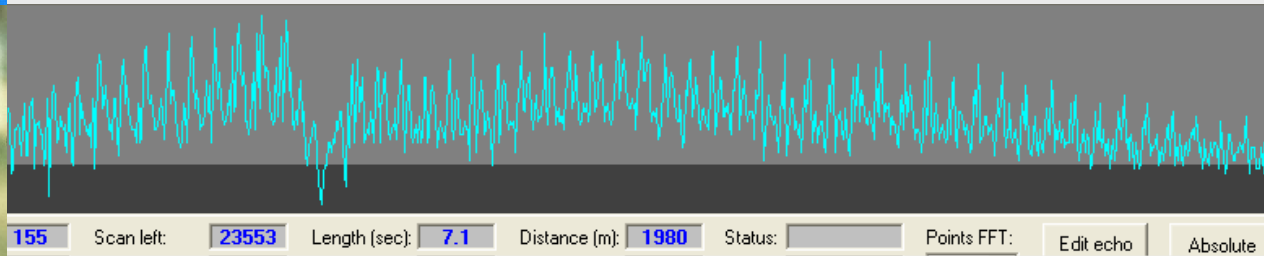
11.3 Hz



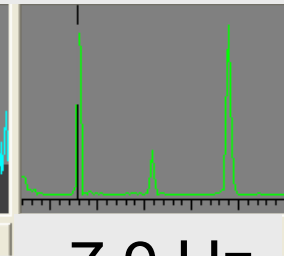
Swift - type



8.0 Hz



Wader - type



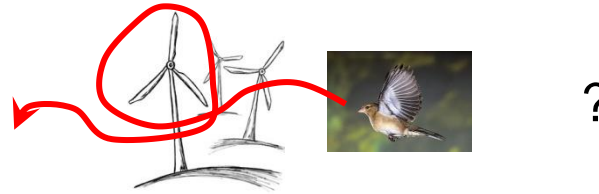
7.9 Hz

Impact Studies: How to choose the suitable method?

- What kind of information do you need?
 - Quantification or an investigation of flight behaviour?



or



- Do you need information on species composition and how precise does the information have to be?
 - The more precise, the less automatic and therefore the more expensive



Song bird type

or

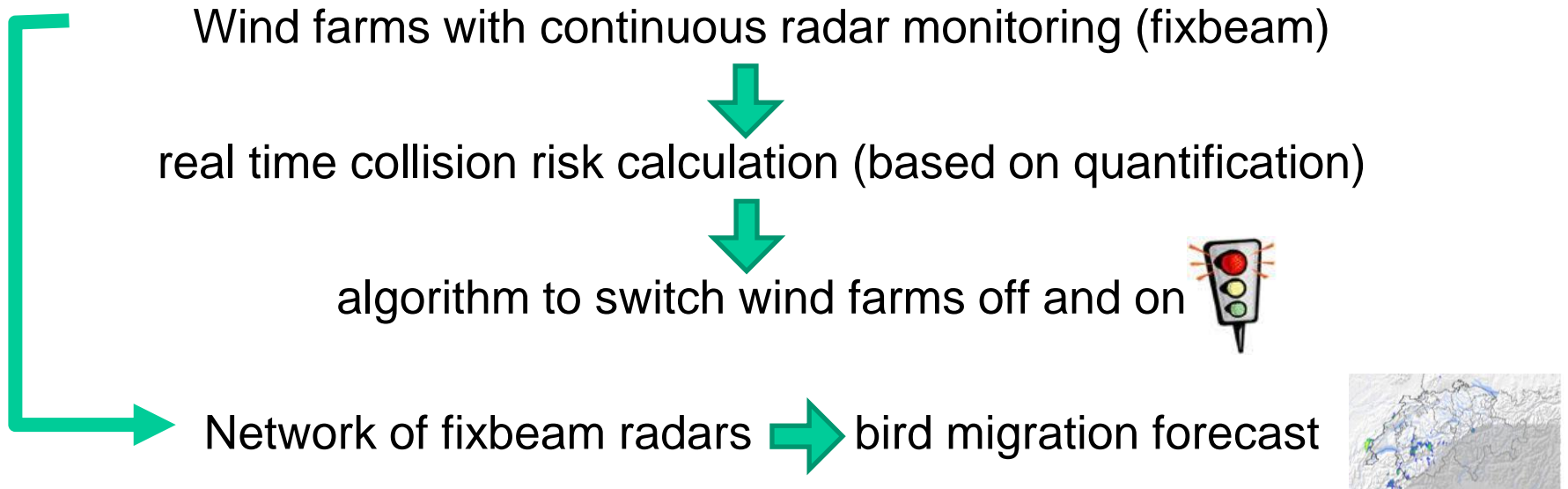


?

Robin (*Erithacus rubecula*)



Situation in Switzerland:



3 locations in CH -> pre- and post construction studies

➔ Relationship between migration rate (quantification) and number of fatalities



Thank you for your attention!

