
ANIMOVE
P1.y=diag(c(0, 0.001, 0.001))
splayPar(mov.model=~1, err.model=list(x=~errX, y=~errY),
data=nfsNew, fixPar=c(NA, 1, NA, 1, NA, NA, NA, NA)
t <- crwMLE(mov.model=~1, err.model=list(x=~errX, y=~errY),
data=nfsNew, coord=c("longitude", "latitude"),
Time.name="Time", initial.state=initial.drift,
fixPar=c(NA, 1, NA, 1, NA, NA, NA, NA),
control=list(maxit=2000,trace=1, REPORT=10),

June 2024

Movement data in R

Introduction into movement data collection

Movement data types

Two fundamental types of movement data

- **Eulerian methods**
  - Camera traps
  - Rings and bands
  - RFID tags
  - Microphon arrays

- **Lagragian methods**
  - Radio tracking
  - Satellite tracking
  - GPS
  - Geo-locators

A nice comparison of these two methods is offered by *Phillips et al., 2019*
https://doi.org/10.1002/ece3.5083

Data structure: Eularian

Eulerian methods pose great challenges. Most methods and analysis assume unbiased sampling (more to follow). But here the **device is fixed and it observes a certain space**, hence eulerian methods are violating the assumption of unbiased spatial sampling.
However, the data they provide in specific systems allow quite a reliable reconstruction of paths, especially in movements along grids (fish in rivers).
(*Perony et al.* have a nice example: https://doi.org/10.1371/journal.pcbi.1002786)

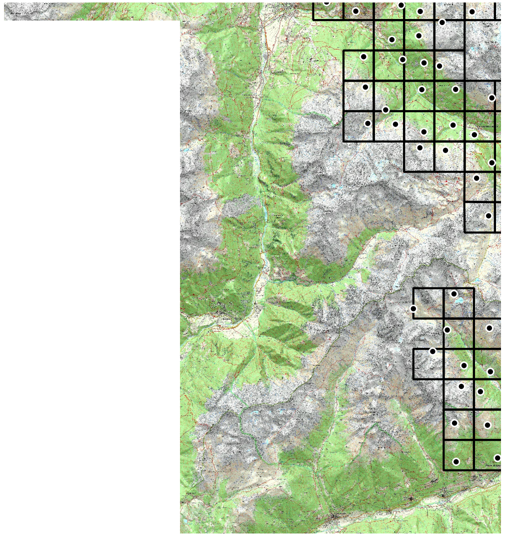


Figure: Grid of camera traps in Stelvio National Park (Italy). Courtesy of Valerio Donini.

Data structure: Lagragian

If the **device ”moves” with the animal** and records its position in time, it in principle allows knowing where the animal is at any time: **Lagragian data**.
The different methods differ mainly in their precision. The error in location estimation needs to be accounted for and we have to be aware of it, when we analyse data.

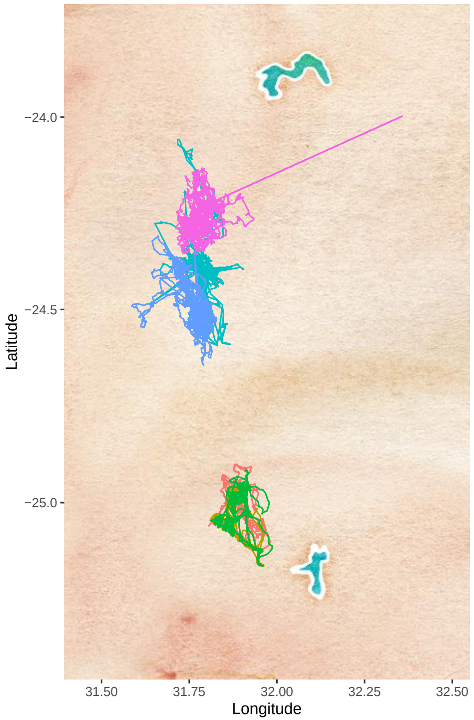


Figure: Trajectories of buffaloes in Kruger National Park. Courtesy of Getz et al. 2007.

Data structure: Lagragian

Ironically, most methods of analysis did/do not explicitly take into account **location error.** New methods take error into account (we'll deal with that later).

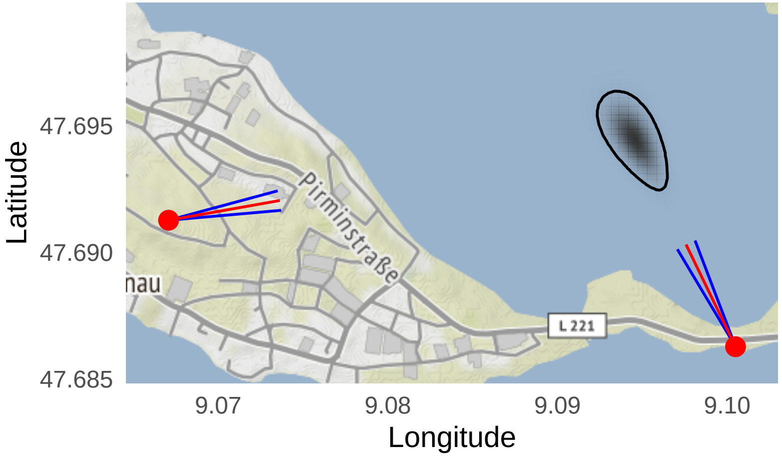


Figure: Estimating the error of triangulation using standard functions in geosphere assuming 95% of the locations fall within 5 degree of the true direction of the signal. The black line contains 95% of the randomized locations, this area is 8.14 hectares, the black shading shows the density of points.

Data standardisation: Movebank

Data standardisation and stratification is fundamental, and Movebank hugely helps with this

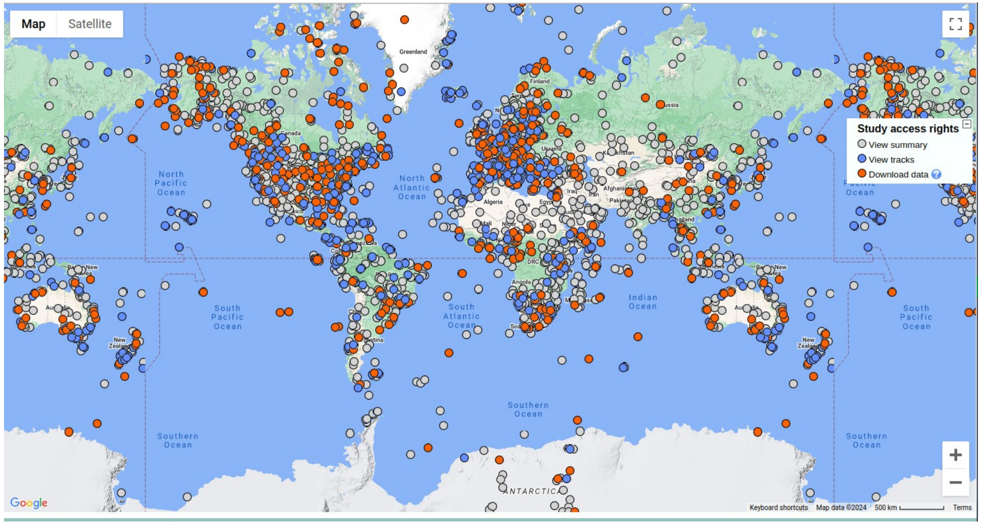
www.movebank.org

February 2024

Taxa: > 1400	Live feeds: 22000 tags
Locations: 6.1 bil	Studies: > 8000
NonLoc: > 7 bil	Data owners: 4180

ADVANTAGES

- Data are safe
- Data are standardized
- User defines privacy settings
- Easy visualization
- Makes data sharing easy
- Environmental annotation (EnvData)
- Access directly through R
- Repository with DOI



Data sets

We will be working, depending on the context and suitability, with a few different **sample data sets**, kindly offered by their owners for educational purpose:

- Bats (radio telemetry)
- African buffalo (GPS)
- ”Leroy” and ”Ricky” two fishers from Albany (GPS)
- ”Leo” the vulture (GPS)
- ”Sierit” the stork (GPS)
- “Habiba” from the African Elephant Dataset (GPS)

These data sets can be all found on Movebank, or as data associated with the R packages *move* and *move2*.