

## Detecting behavioural responses from movement data using stochastic differential equations

Large amounts of data are collected on animal movement, typically from animal-borne telemetry tags (e.g., GPS, accelerometer), and various statistical models have been developed to extract ecological information. One problem of general interest is to describe the time-varying behaviour of an animal based on its movement patterns, for example to understand how behaviour is affected by environmental or individual-specific conditions. We recently developed a framework to model the parameters of stochastic differential equations as nonparametric functions of covariates. In the context of animal movement, this method can be used to investigate the drivers of animal behaviour (e.g., how is speed of movement affected by covariates?). We applied this approach to investigate the effects of human disturbance, in particular ship sonars, on beaked whales. Multiple animals were tagged and exposed to sounds in controlled experiments, and we contrasted movement parameters before and after exposure events to estimate behavioural responses. The analysis was based on two data sets with different sets of analytical challenges: a coarse time series of noisy longitude-latitude locations, and a high-resolution record of depth and acceleration. We will present initial results suggesting that sound exposure can elicit multiple types of responses, including horizontal and vertical avoidance.