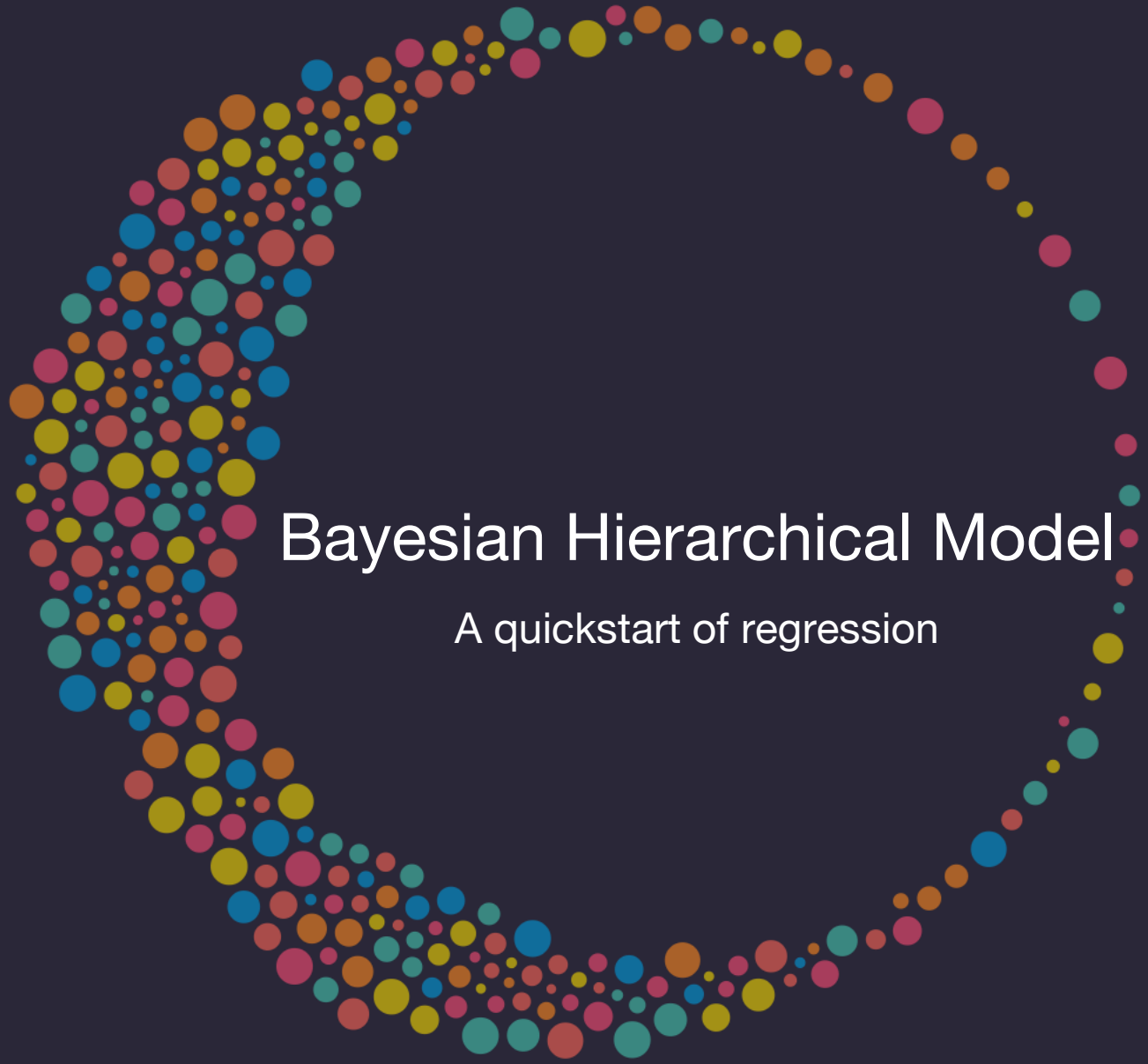
The recommendation article focuses on marine extreme events and serves as an excellent case study for Bayesian Hierarchical Models (BHM).



Bayesian Hierarchical Model

A quickstart of regression

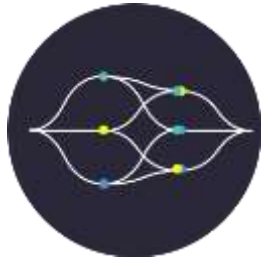
Regression

This is not a rigorous statistics tutorial. I just explain some important statistical concepts in a simple manner.

Task

Key steps

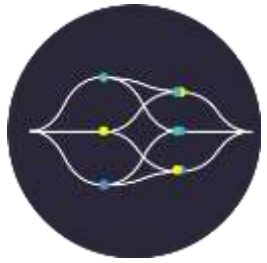
Parameter estimation



Hierarchical model

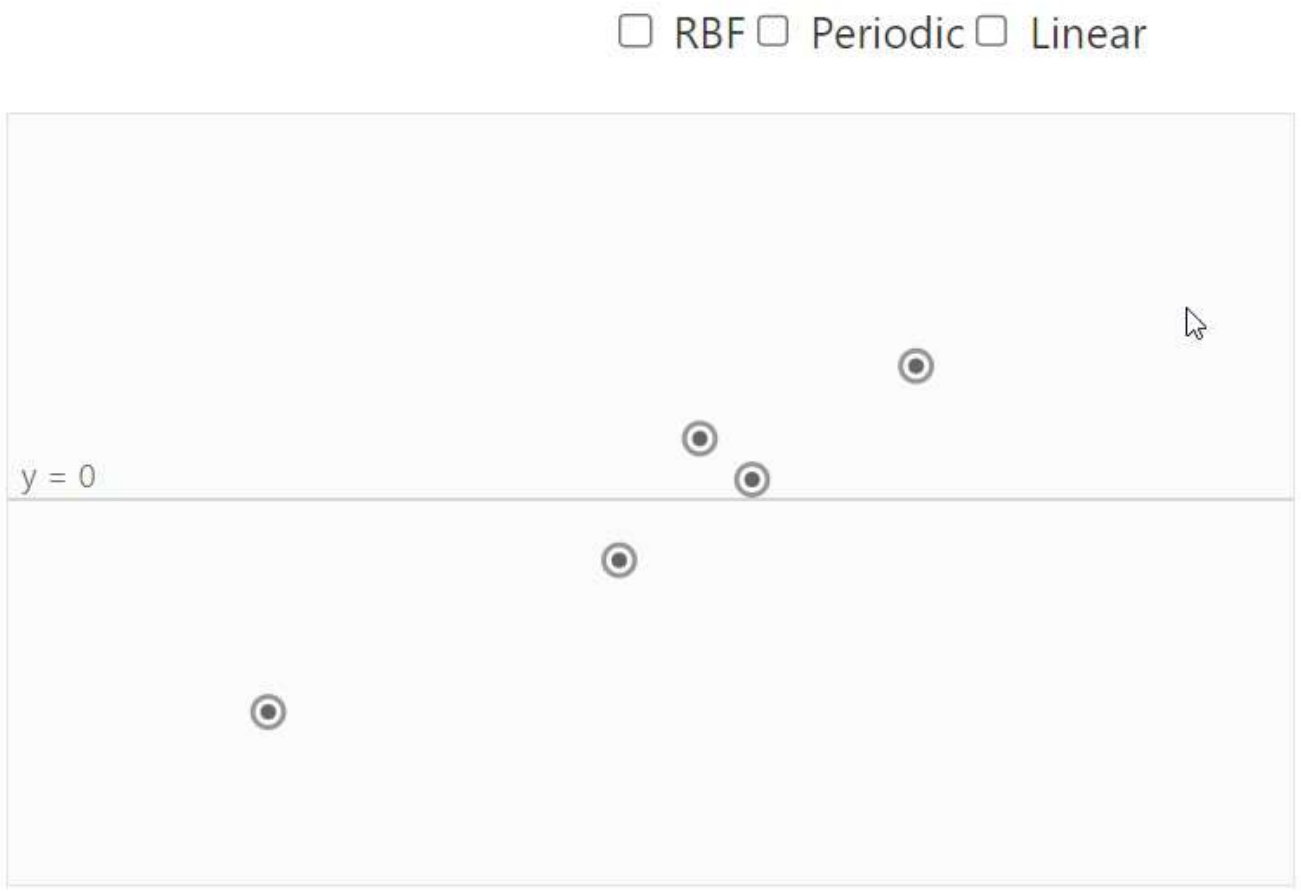
Key steps

Parameter estimation



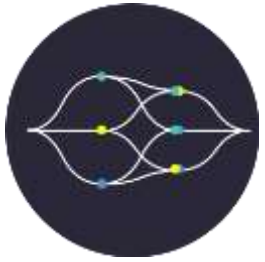
Hierarchical model

Construction



Key steps

Parameter estimation



Hierarchical model

Estimation

$$Y = \beta 0 + \beta 1 X1 + \beta 2 X2 + \ldots + \beta n * Xn + \varepsilon$$

$$g(E(Y)) = \beta 0 + \beta 1 X1 + \beta 2 X2 + \ldots + \beta n * Xn$$

$$g(E(Y)) = \beta 0 + f1(X1) + f2(X2) + \ldots + fn(Xn)$$

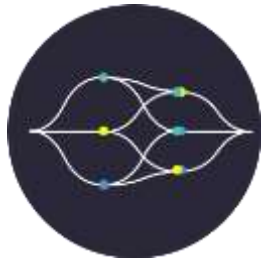
$$f(x) = (1 / (\sigma * \sqrt{(2\pi)})) * \exp(-((x-\mu)^2) / (2 * \sigma^2))$$

$$f(x) = (\alpha * x\_min^\alpha) / (x^{(\alpha+1)})$$

⋮

Key steps

Parameter estimation

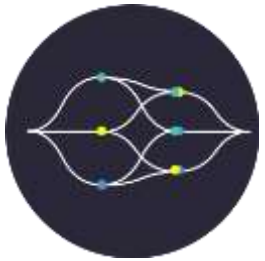


Hierarchical model

Frequentist

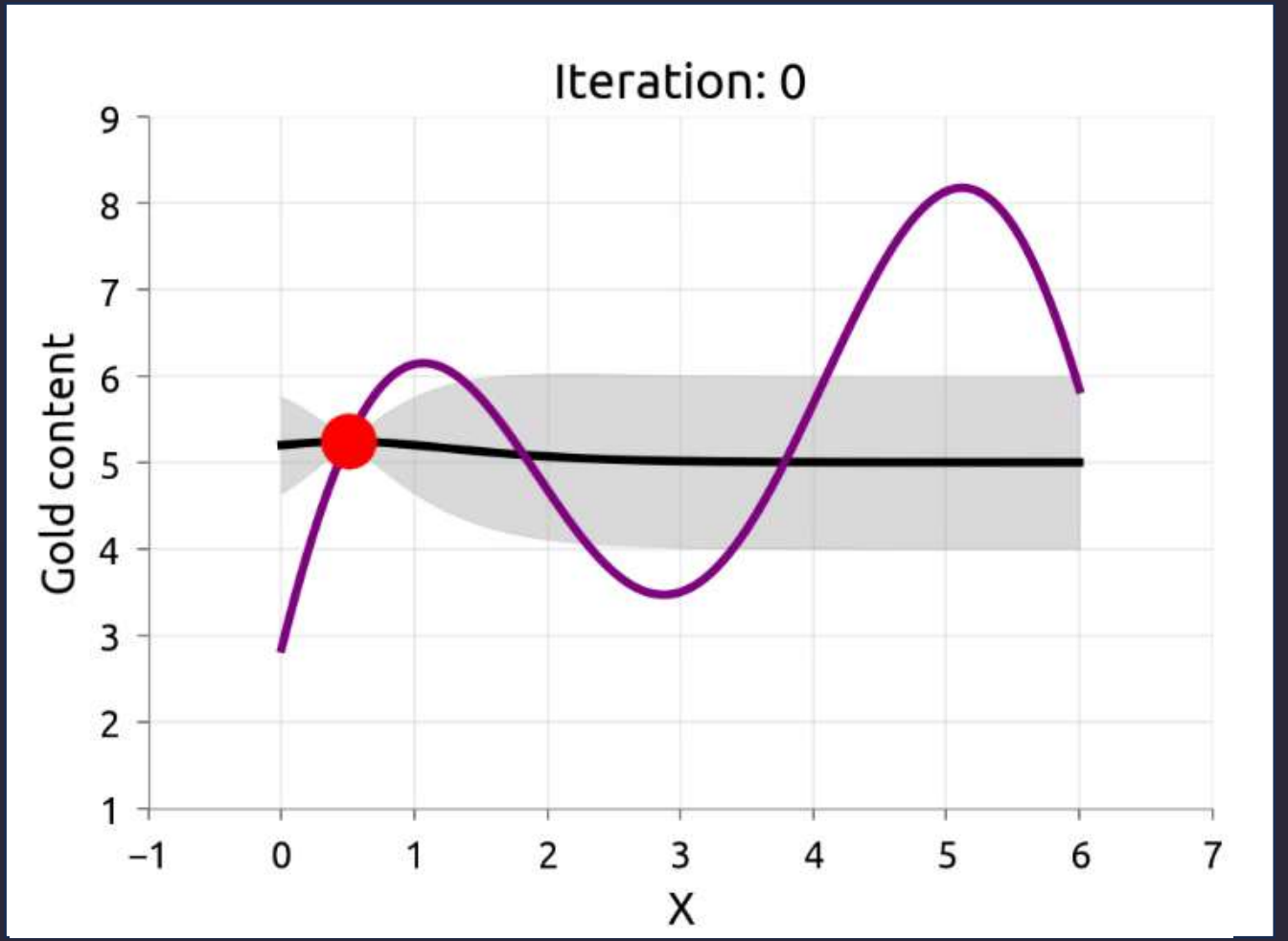
Key steps

Parameter estimation



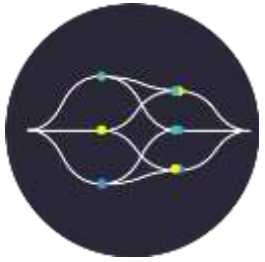
Hierarchical model

Bayesian



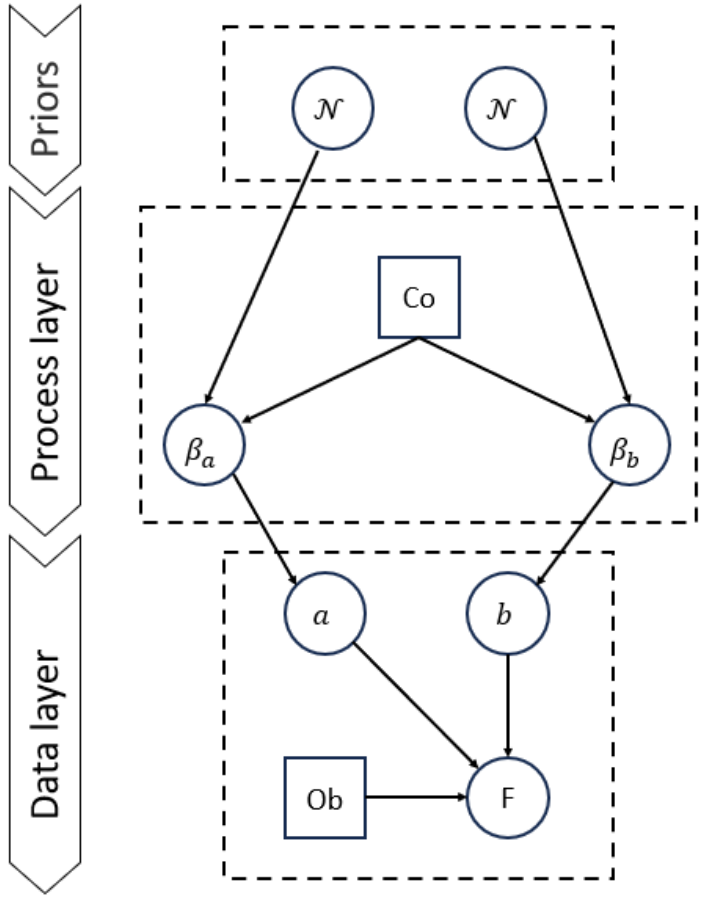
Key steps

Parameter estimation



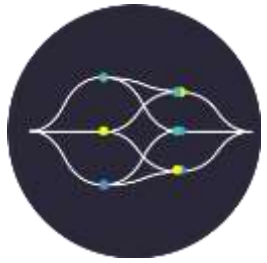
Hierarchical model

Illustration



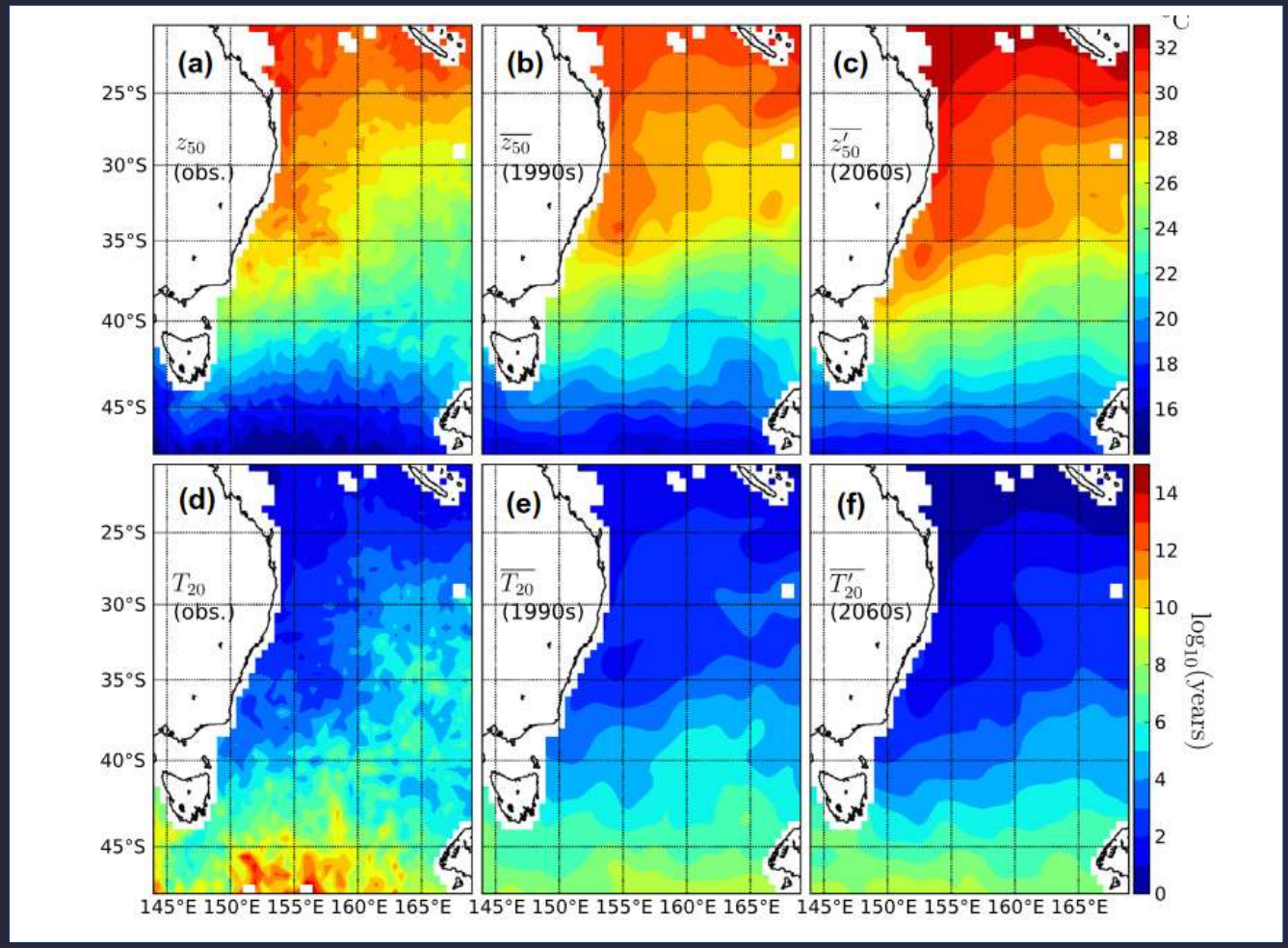
Key steps

Parameter estimation



Hierarchical model

Case



THANKS !

Source:
https://seeing-theory.brown.edu/index.html#4thPage
https://distill.pub/2020/bayesian-optimization/
https://www.sciencedirect.com/science/article/pii/S0029801816303122