

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



Progress in Oceanography

IF 4.1 SCIE JCI 1.2 Q1 地球科学1区 Top EI

Volume 122, March 2014, Pages 77-91



Estimating extremes from global ocean and climate models: A Bayesian hierarchical model approach

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(6)



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.

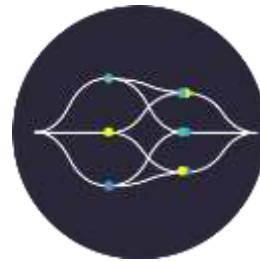
Task



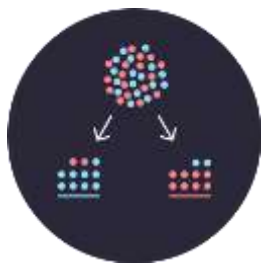
Key steps



Parameter estimation



Hierarchical model



Key steps



Parameter estimation

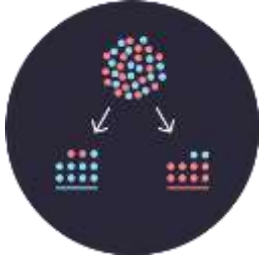


Hierarchical model

Construction

☐ RBF ☐ Periodic ☒ Linear

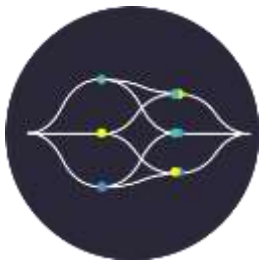




Key steps



Parameter estimation



Hierarchical model

Estimation

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + \varepsilon$$

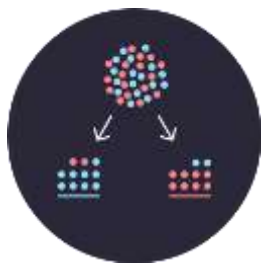
$$g(E(Y)) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n$$

$$g(E(Y)) = \beta_0 + f_1(X_1) + f_2(X_2) + \dots + f_n(X_n)$$

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

$$f(x) = (a * x_{\min}^a) / (x^{(a+1)})$$

⋮



Key steps

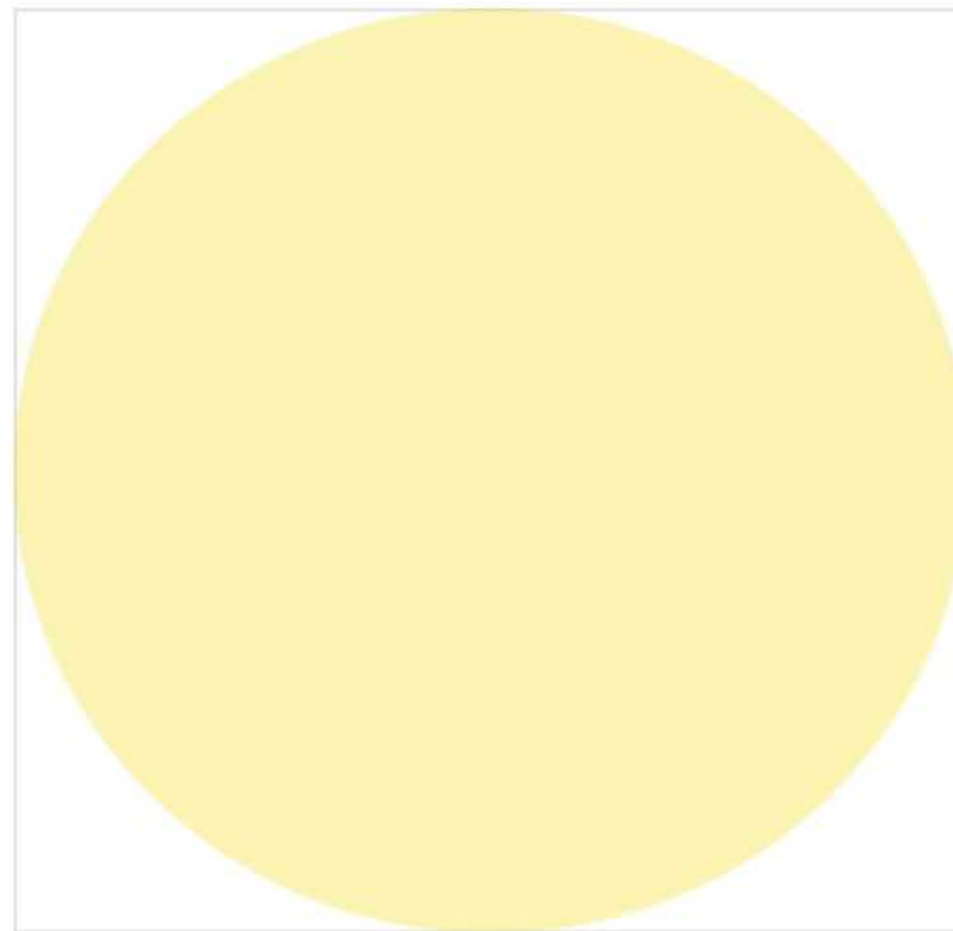


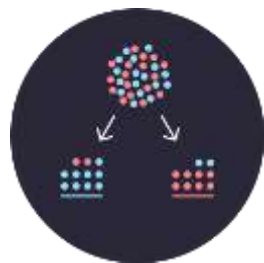
Parameter estimation



Hierarchical model

Frequentist





Key steps

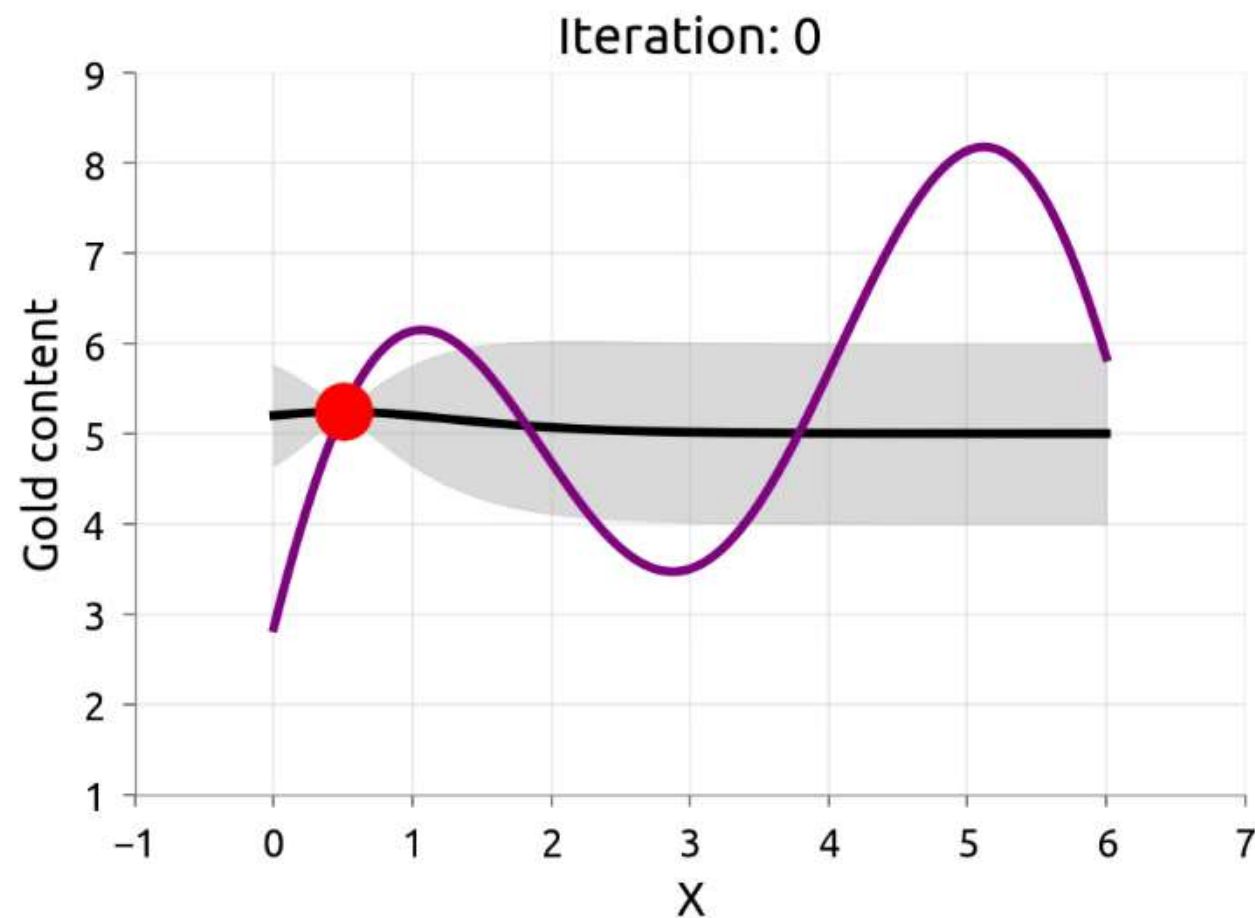


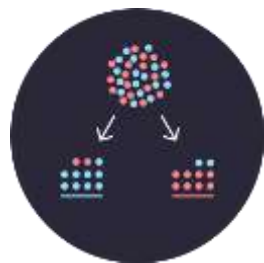
Parameter estimation



Hierarchical model

Bayesian





Key steps

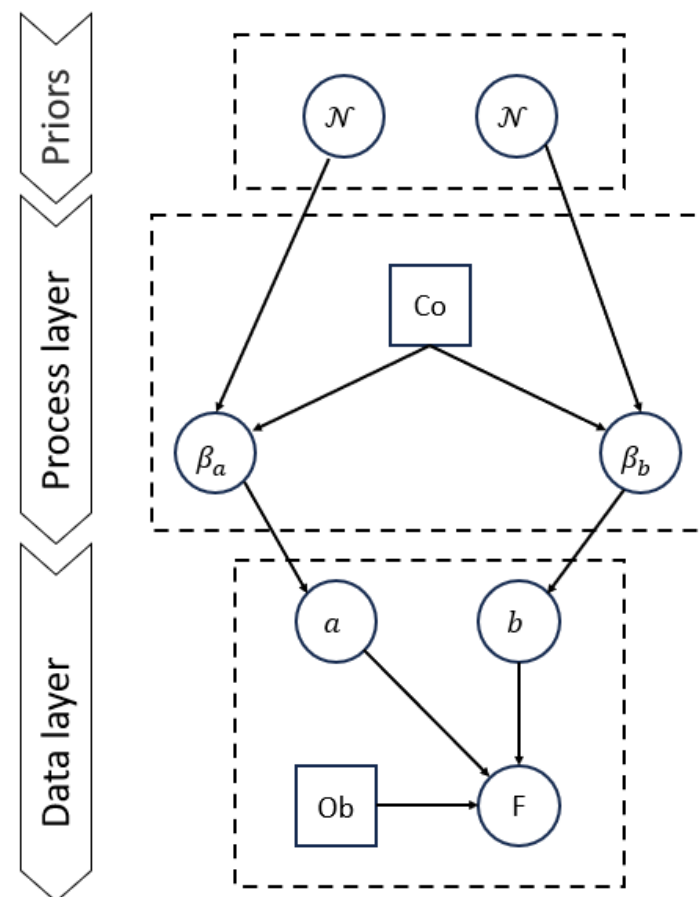


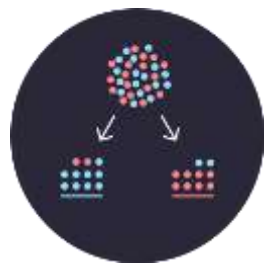
Parameter estimation



Hierarchical model

Illustration





Key steps

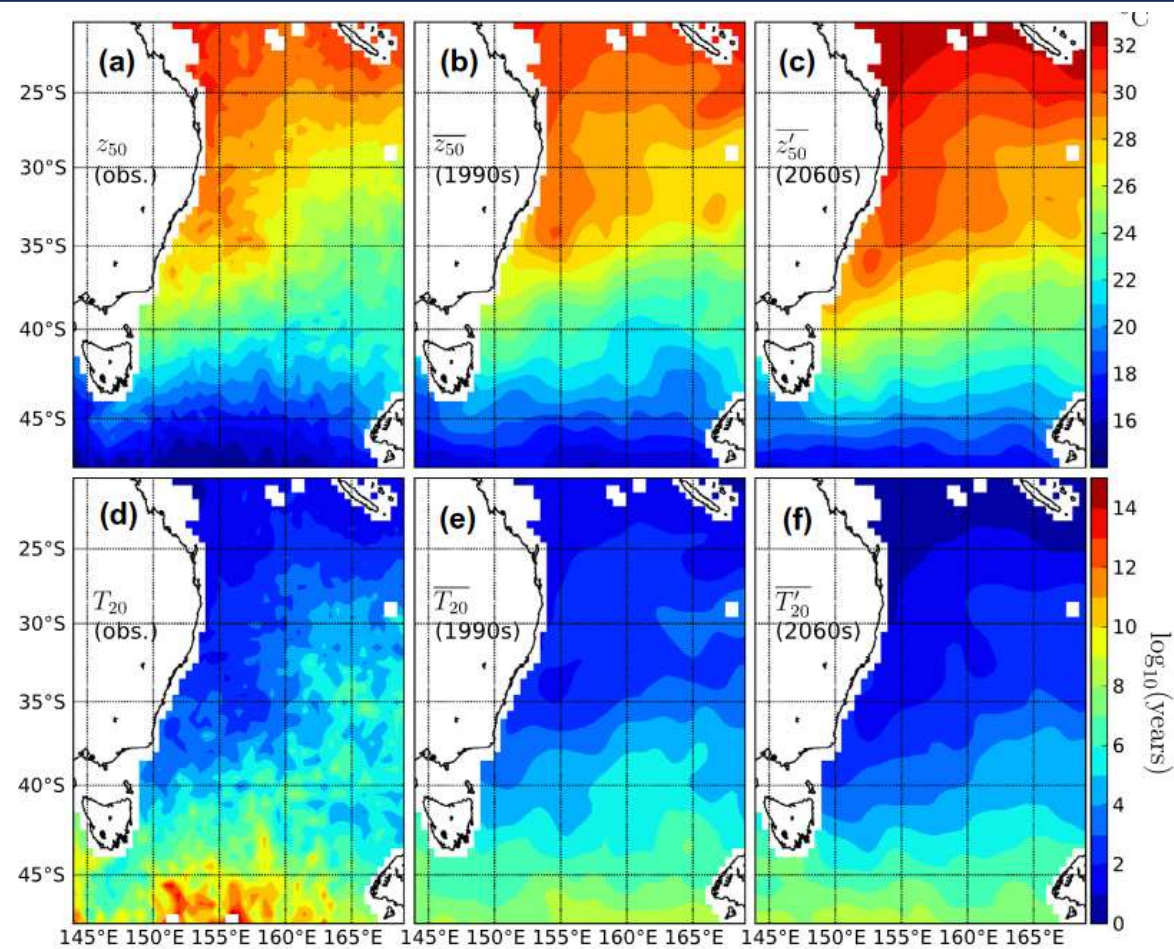


Parameter estimation



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>