Discussion Document

Edward L. Boone
Virginia Pasour
Colin Grudzen
Shirley Han
Lea Jenkins

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Abstract

Discussion on Data Assimilation

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1 Introduction

2 Kot Model

Here is the Kot (1992) Model used in Figure 1.

$$\begin{aligned}
\frac{dS}{dt} &= D\left[S_i\left(1+\epsilon\sin\frac{2\pi}{T}t\right)-S\right]-\frac{\mu_1}{Y_1}\frac{SH}{K_1+S} \\
\frac{dH}{dt} &= \mu_1\frac{SH}{K_1+S}-DH-\frac{\mu_2}{Y_2}\frac{HP}{K_2+H} \\
\frac{dP}{dt} &= \mu_2\frac{HP}{K_2+H}-DP
\end{aligned}$$

3 Competition Model

Here is my stab at putting together a competion model with predators.

$$
\begin{aligned}
\frac{dx_1}{dt} &= r_1 x_1 - r_1 x_1 \left(\frac{x_1 + \alpha_{12} x_2 + \alpha_{13} x_3}{K_1} \right) \\
\frac{dx_2}{dt} &= r_2 x_2 - r_2 x_2 \left(\frac{x_2 + \alpha_{21} x_1 + \alpha_{23} x_3}{K_2} \right) - \beta_{24} x_2 x_4 \\
\frac{dx_3}{dt} &= r_3 x_3 - r_3 x_3 \left(\frac{x_3 + \alpha_{31} x_1 + \alpha_{32} x_2}{K_3} \right) - \beta_{35} x_3 x_5 \\
\frac{dx_4}{dt} &= \beta_{24} x_2 x_4 - c_4 x_4 \\
\frac{dx_5}{dt} &= \beta_{35} x_3 x_5 - c_5 x_5
\end{aligned}
$$

- x_1 is coral, x_2 is tall algae, x_3 is short algae, x_4 is fish that eat tall algae and x_5 is the fist that eat short algae.
- r_1, r_2 and r_3 are the recruitment parameters for coral, tall algae and short algae, respectively.
- K_1, K_2 and K_3 are the carrying capacity parameters for coral, tall algae and short algae, respectively.
- α_{ij} is the competition of x_j on x_i.
- β_{ij} is the predation success of x_j on x_i.
- c_i is the mortality rate for species x_i.

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References

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Kot, M., Sayler, G.S. and Schultz, T.W. (1992) Complex Dynamics in a Model Microbial System, *Bulletin of Mathematical Biology*, **54**, 619–648.

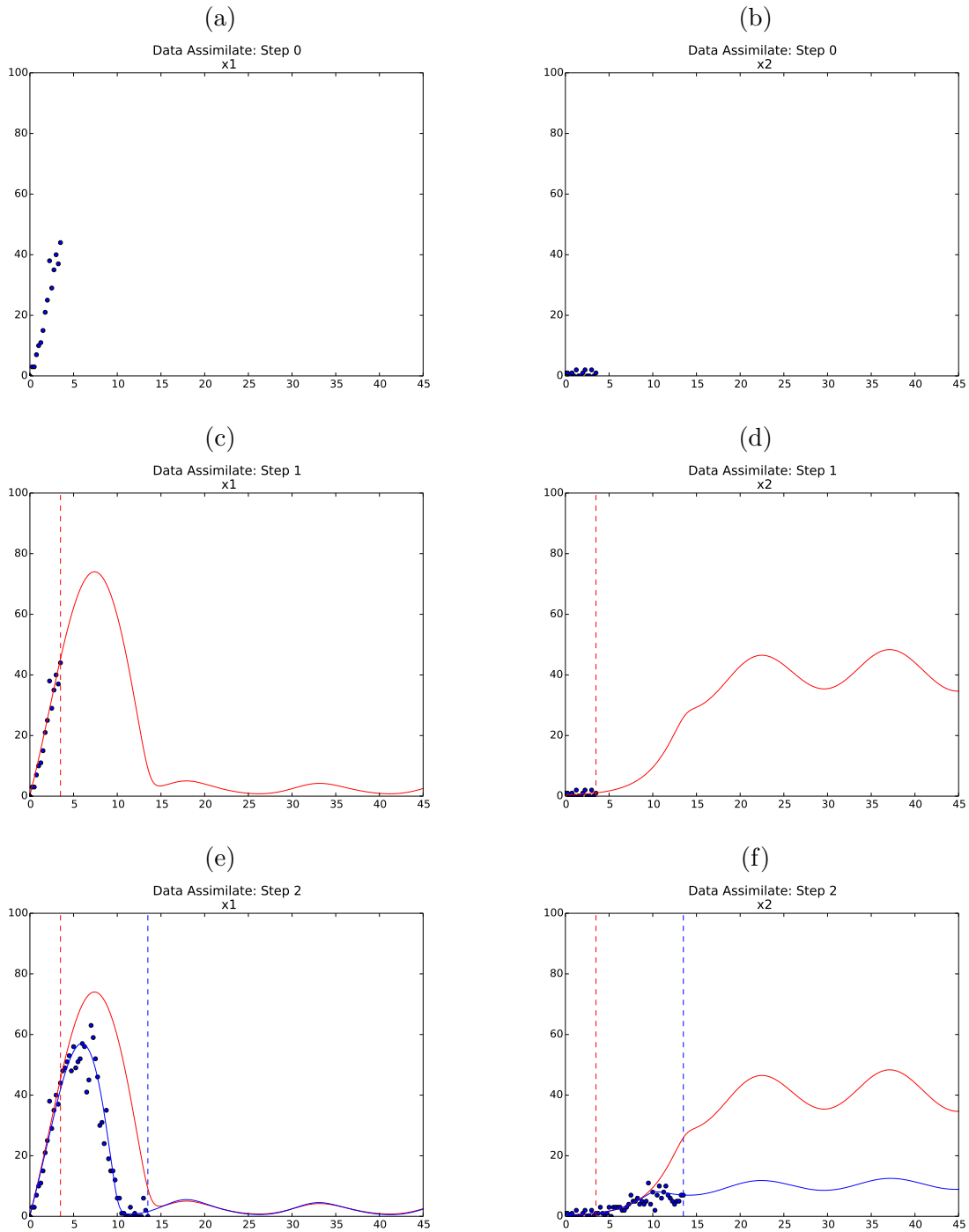

Figure 1: Data for (a) x1, (b) x2 , (c) data with fitted model for x1, (d) data with fitted model for x2, (e) additional data and updated fitted model for x1 and (f) additional data and updated fitted model for x2.