Dose Response Curves

A new option for modeling winter hardiness

What is a dose response curve?

Based on a logistic regression

Used for estimating the response of something to the amount of dose it is given. So lots of use with pharmaceuticals and toxicity

I dont think it is the same as a growth model, but still getting my head around this

What is a dose response curve?

$$f(x,(b,c,d,e)) = c + \frac{d-c}{1+e^{b(log(x)-\tilde{e})}}$$

Where:

x is the concentration of the dose (amount of winter cold)

b is the response rate (slope)

d is the upper asymptote of the response (maximum hardiness)

b is the lower asymptote of the response (minimum hardiness)

e is the effective dose ED50 (winter temperature where cold hardiness is half way between min and max)

$\tilde{e}$ is the log of the effective dose ED50

Constraints

The dose response must be positive

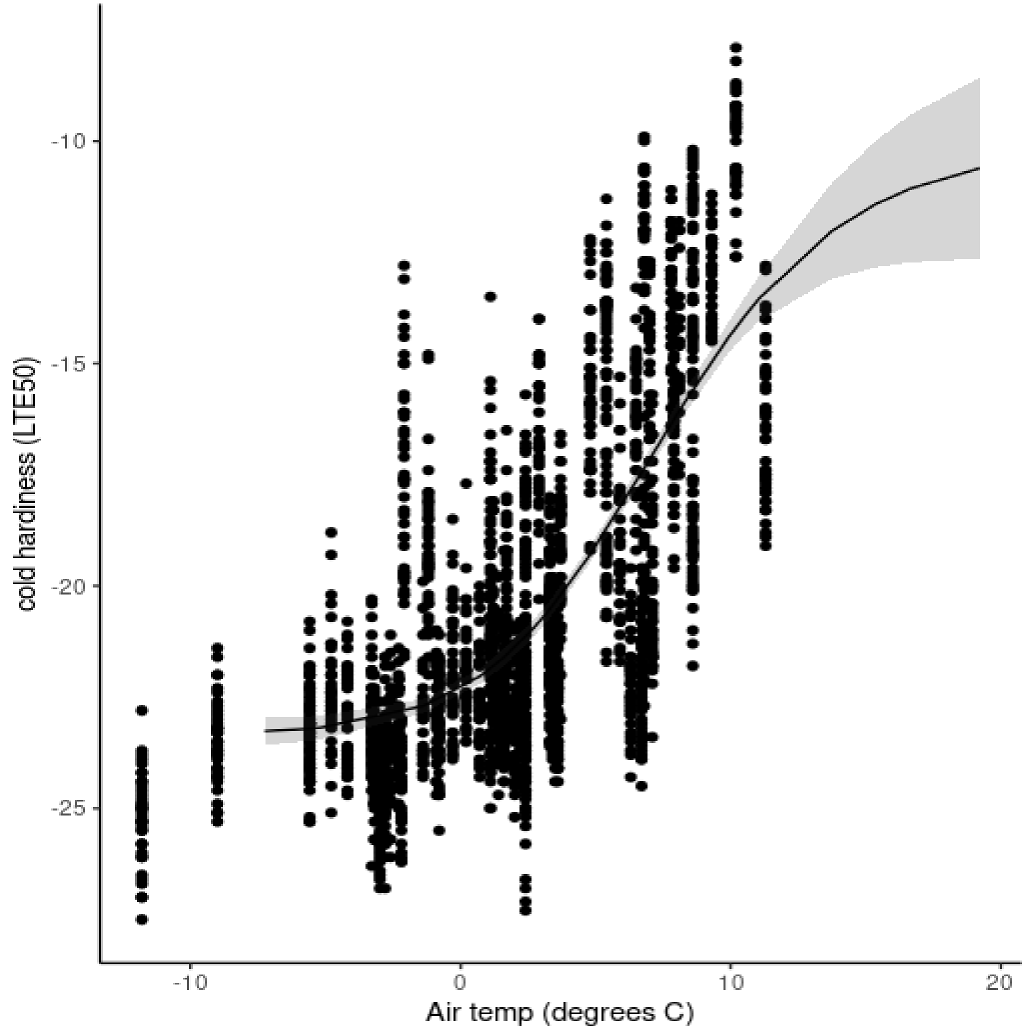
I added 30 to all my temperature values for the modeling so there are no minus temperatures

I think it helps if the response variable is also positive?

I multiplied winter hardiness values with -1 so more dose means higher values

What does it look like?

I was not sure where to start with this model so I fit a parametric one using the DRC package in R



Simulating the data

I used the parameters suggested by the DRC R package model to simulate the data

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$$f(x,(b,c,d,e)) = c + \frac{d-c}{1+e^{b(log(x)-\tilde{e})}}$$

x = winter air temp + 30

y = winter hardiness * -1

b = 11

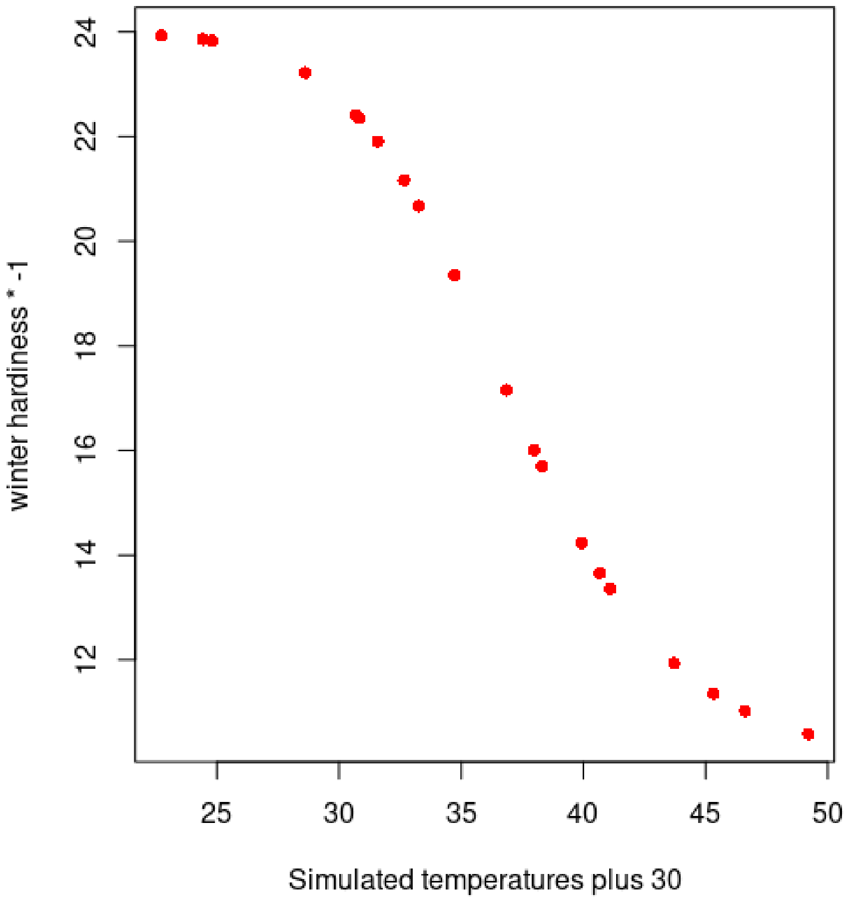
d = 24

c = 10

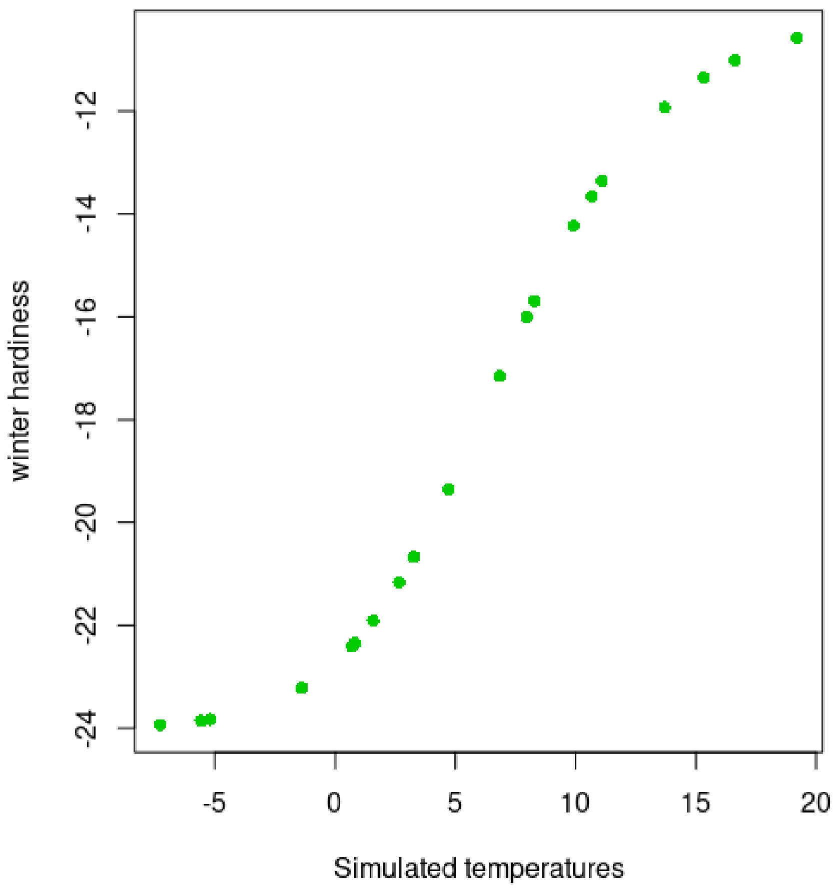
e = 37

Simulating the data

Transformed data



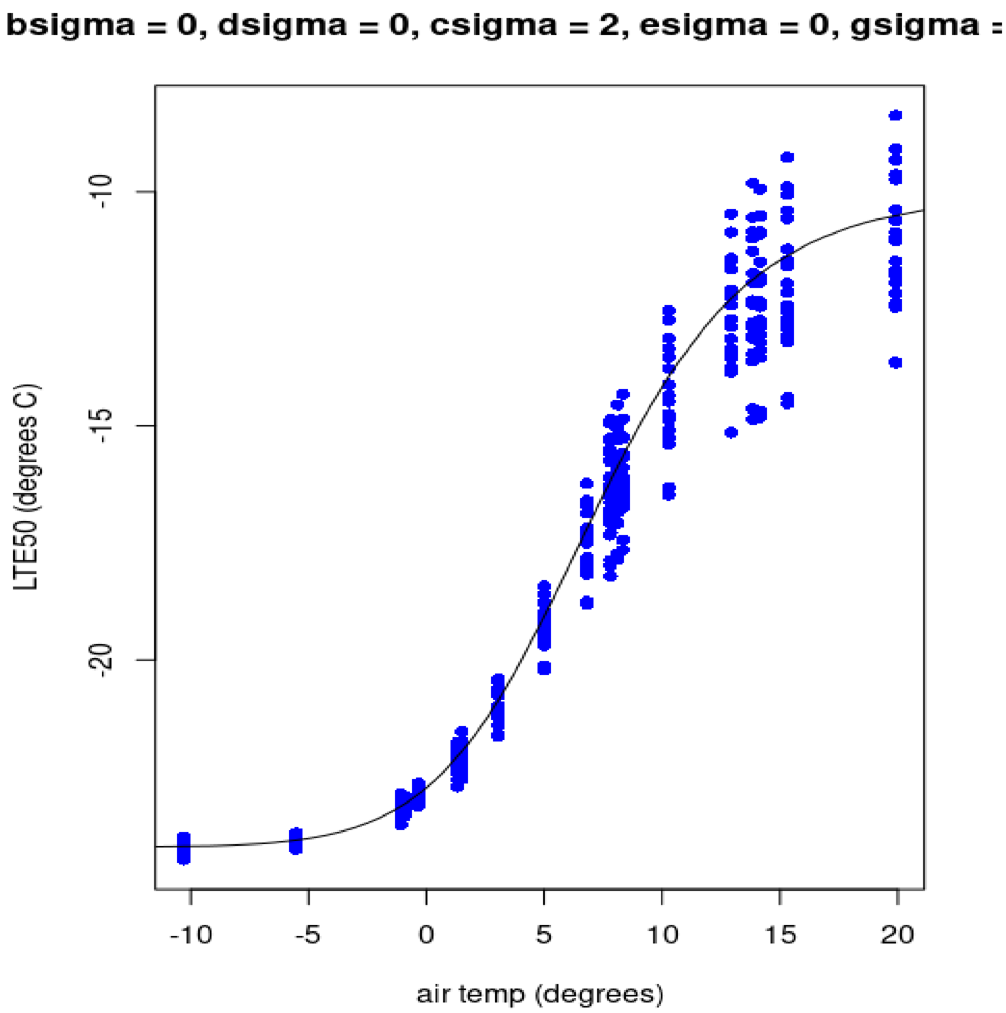
Re-transformed to original data

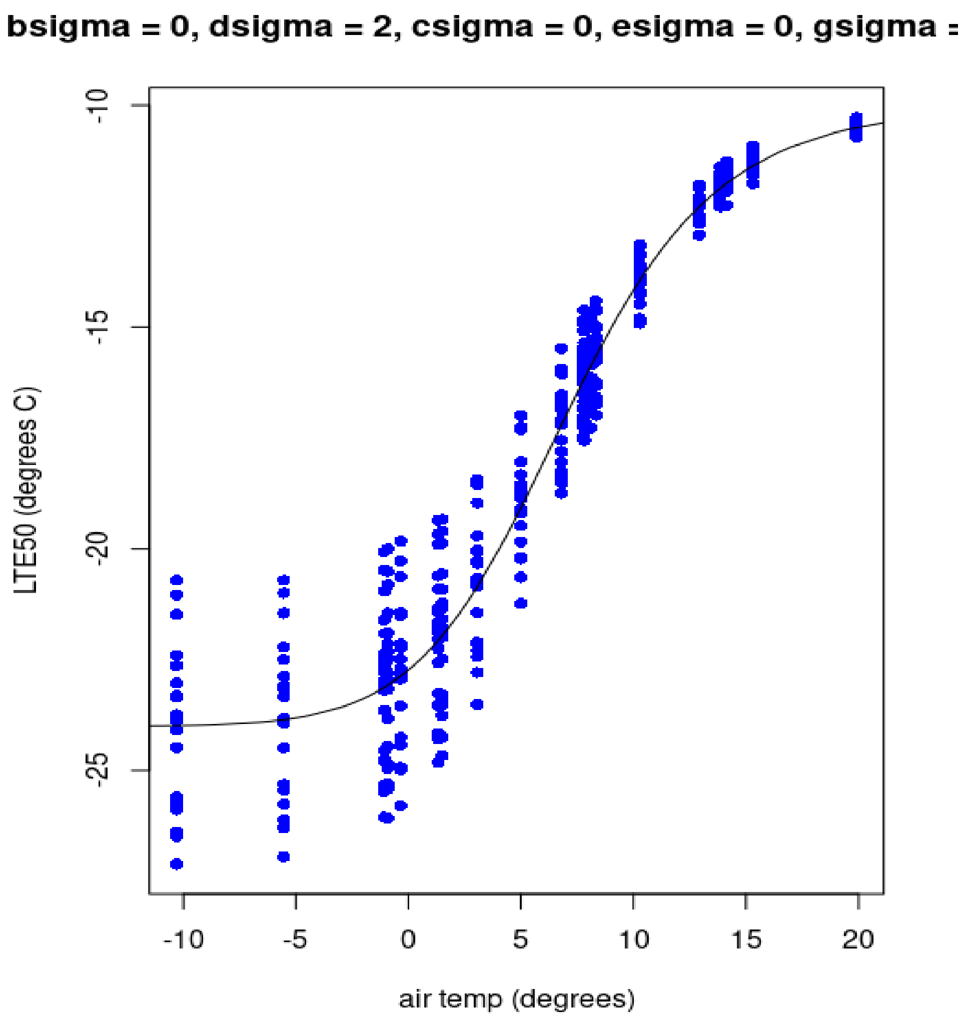


Playing with varience

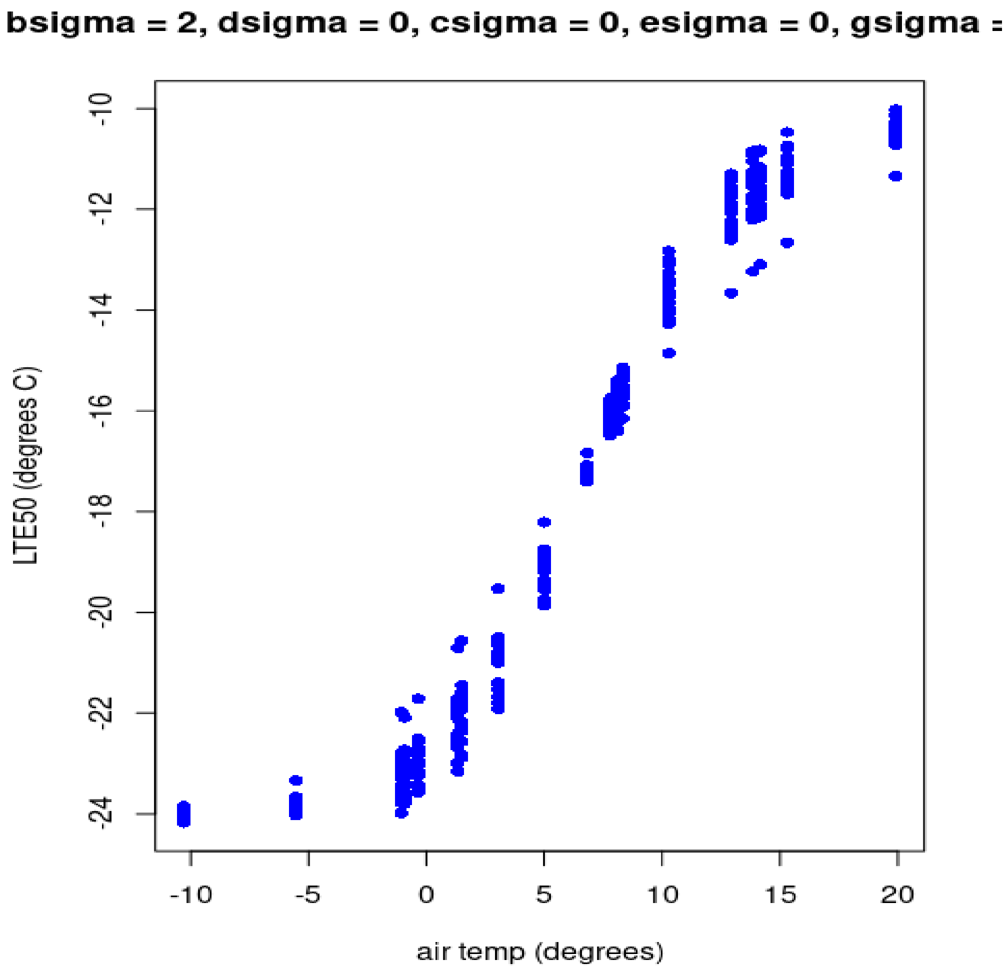
I also tried changing the amounts of variation on the sifferent parameters to see how thsi affects the shape of the data.

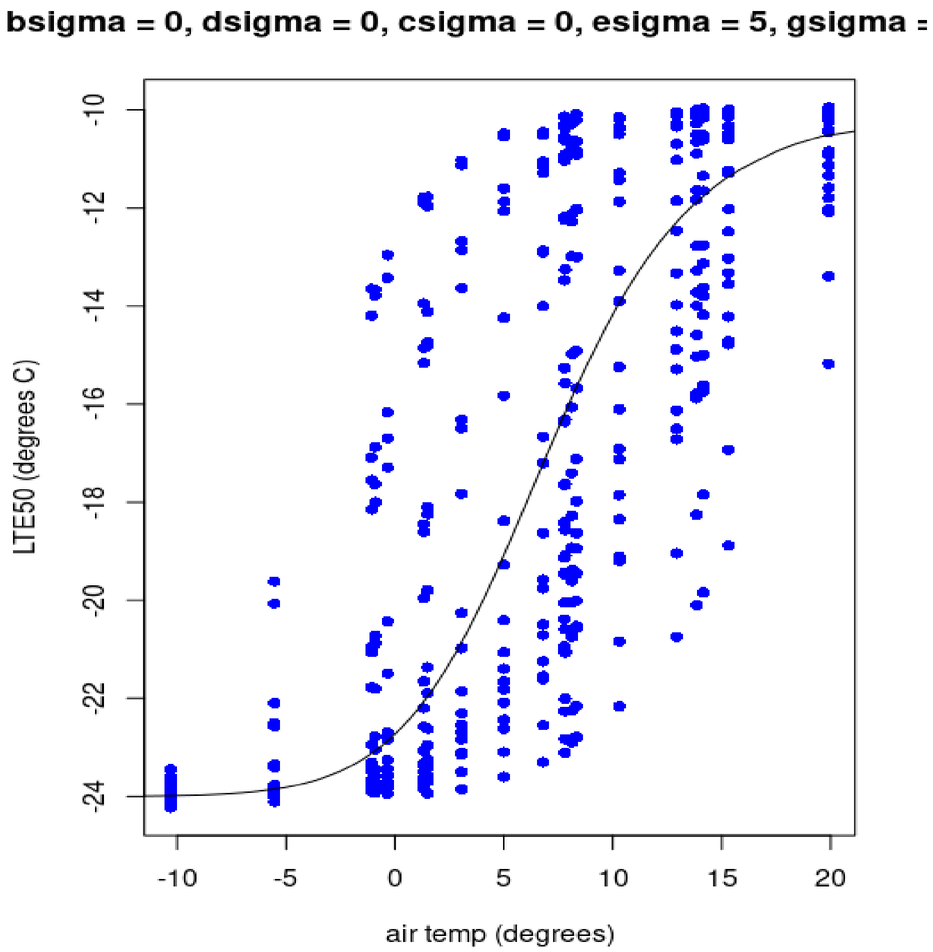
Playing with varience





Playing with varience





Next Steps

Try and build a Stan model

Probably start with no hierarchical levels. Then try one on either b or e. Mayeb both is all goes well?