CUSUM residual plots for assessing the fit of occupancy models.

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Introduction

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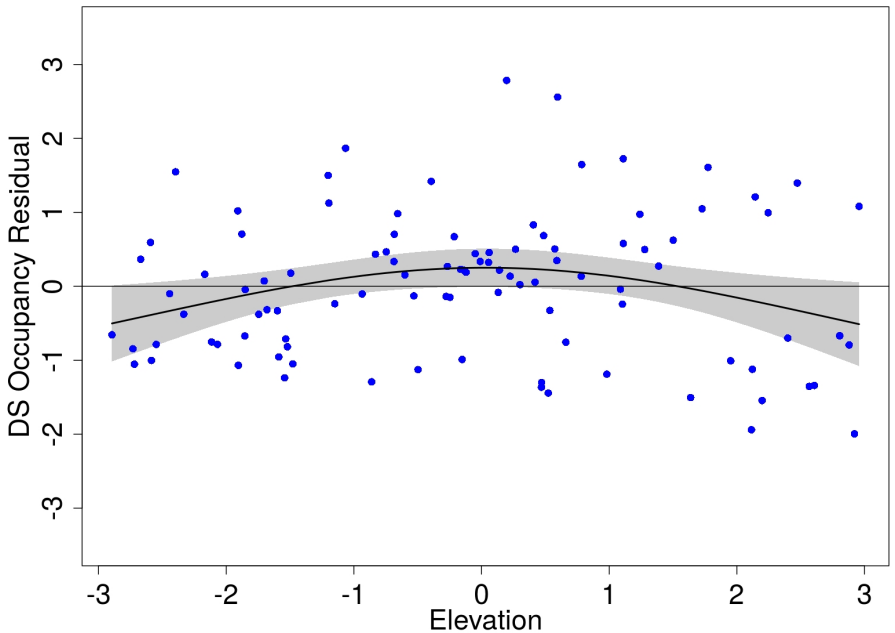
- Warton et al. (2017) suggested plots based on Dunn-Smyth residuals.



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- WARNING: explicit content to follow.

Residual Definition

- For occupancy:

$$E\left[z_i|\mathbf{h}_i,\hat{\theta}\right] = 1, \text{ if at least one detection}$$
$$= \hat{\psi}_i^c, \text{ otherwise.}$$

$$\zeta_i = \frac{E\left[z_i|\mathbf{h}_i,\hat{\theta}\right] - \hat{\psi}_i}{\sqrt{\hat{\psi}_i\left(1-\hat{\psi}_i\right)}}$$

Residual Definition

- For detection:

$$\delta_{ij} = E\left[z_i | \mathbf{h}_i, \hat{\theta}\right] \times \frac{h_{ij} - \hat{p}_{ij}}{\sqrt{\hat{p}_{ij}\left(1 - \hat{p}_{ij}\right)}}.$$

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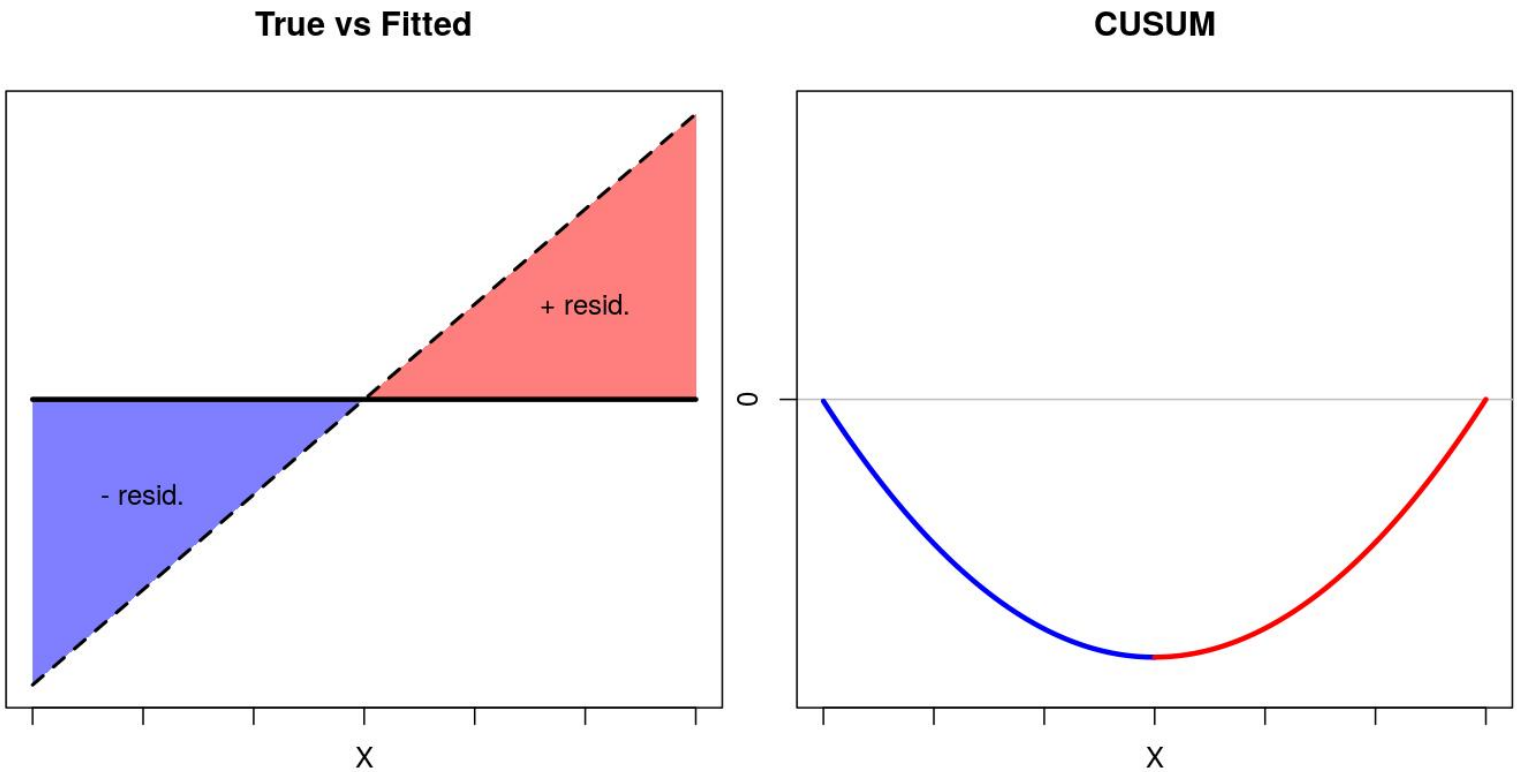
- Calculate cumulative sum (CUSUM) of ordered residuals.

CUSUM Residual Plot

- Assess covariate relationships:



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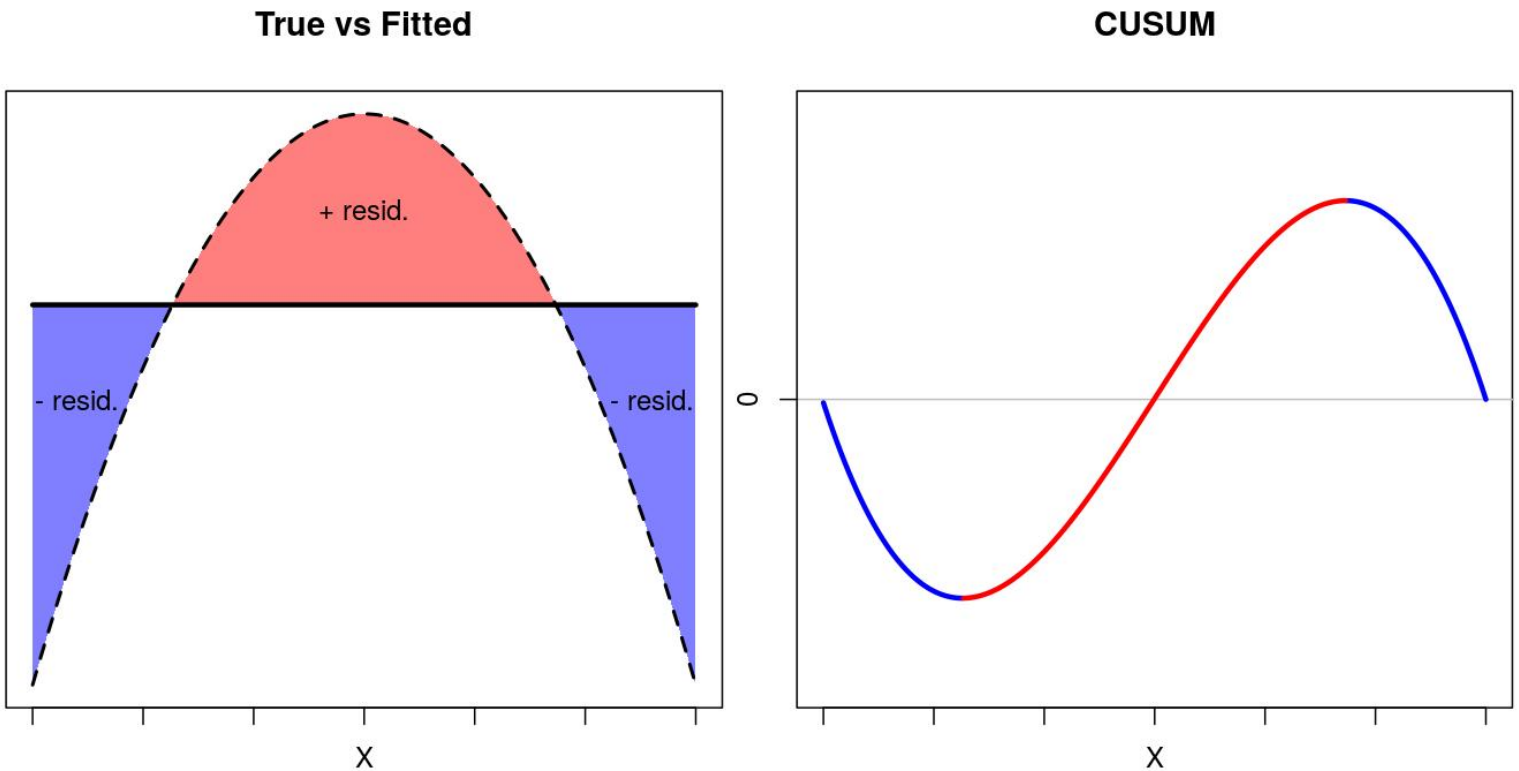

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- Use parametric bootstrap to assess 'typical' CUSUM curve for fitted model.
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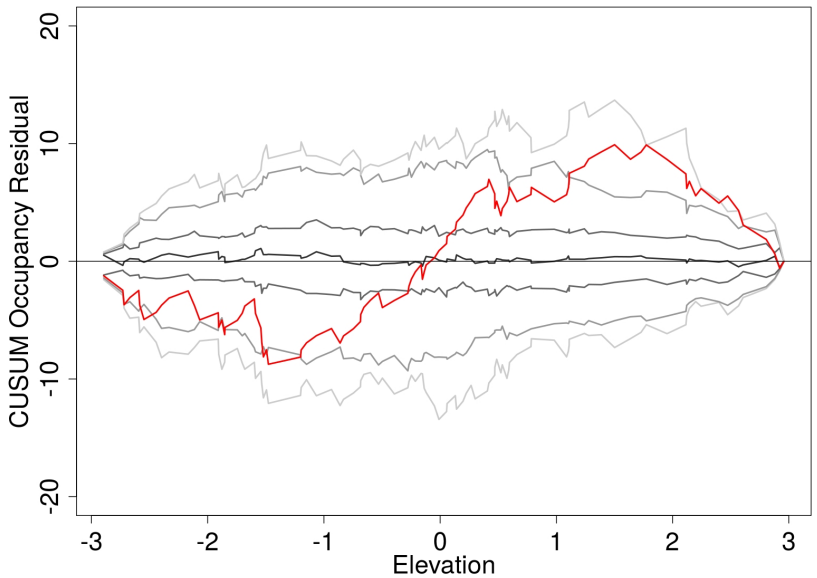
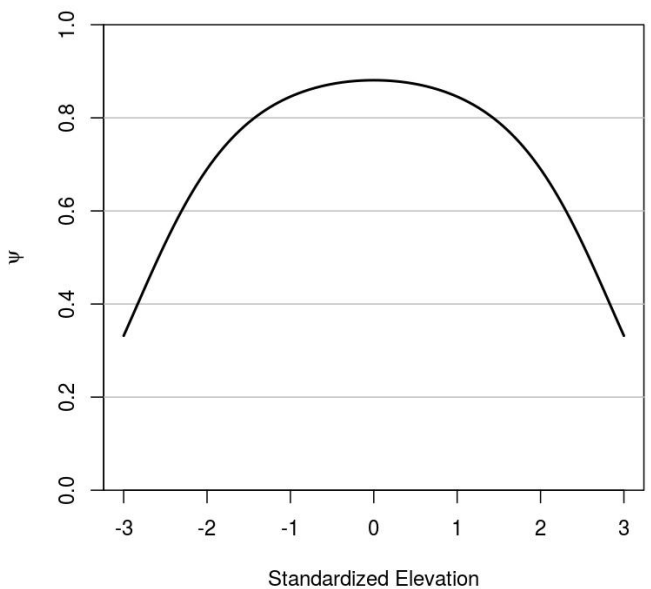
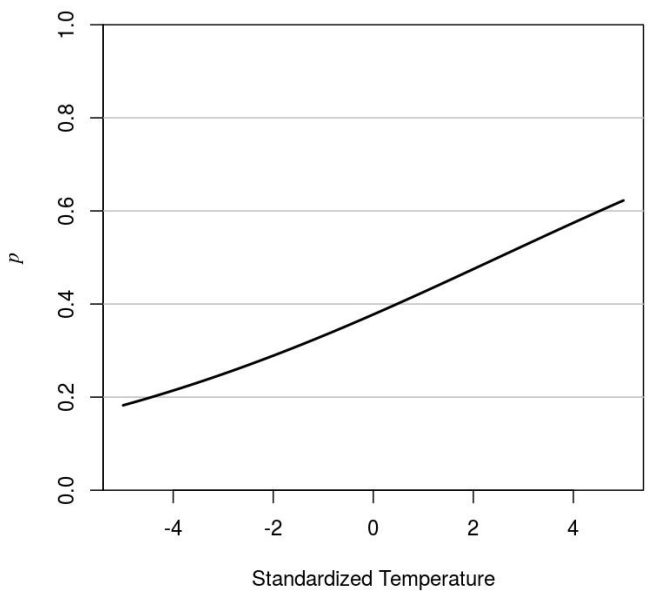
- Plot a percentile 'envelope' with respect to covariate values.



Example

- Simulated data:





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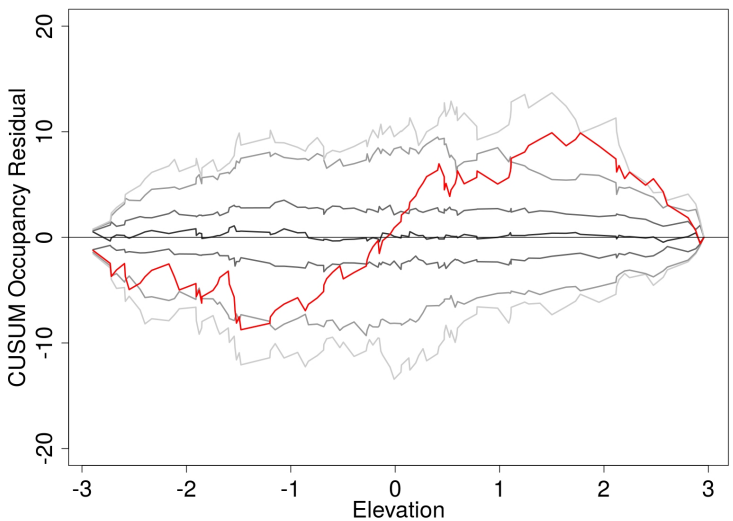
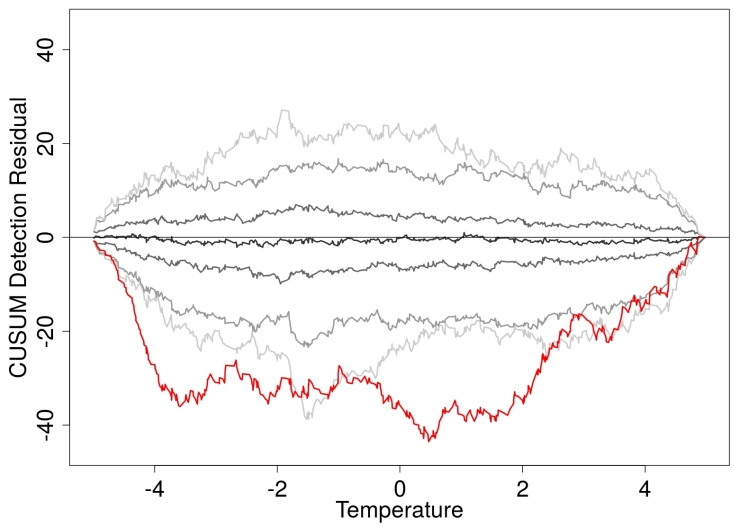
- Fitted model: $\psi(\cdot)p(\cdot)$





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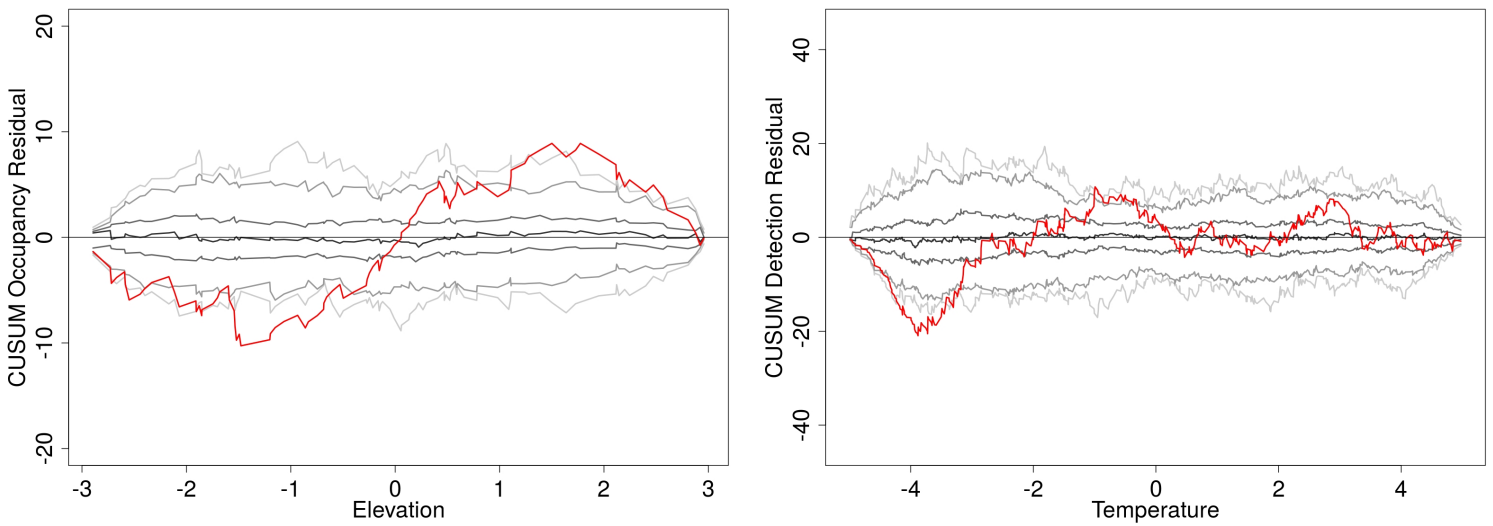

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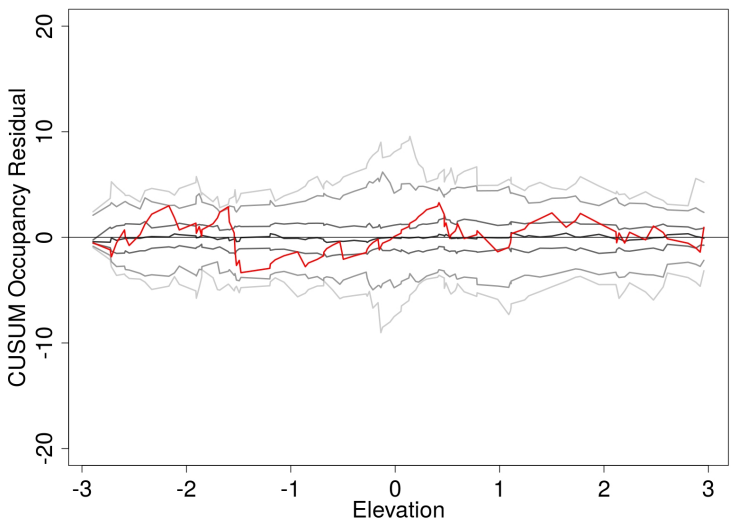
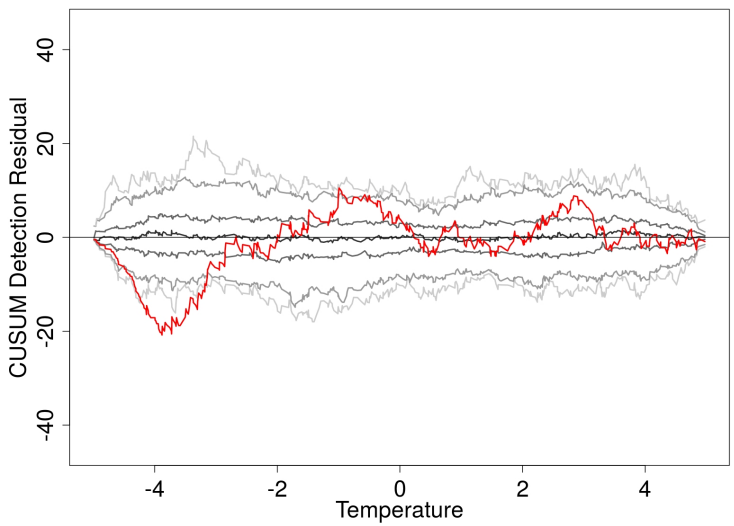
- Fitted model: $\psi(Elev. + Elev.^2)p(Temp.)$





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- THANKS FOR LISTENING!