Title

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Contents

1 Introduction

Write the introduction in here.

Second paragraph of the introduction ...

In Section 2 we see how to do various useful things. In Section 2.1 we import pdf files. In Section 2.2 we create a table. In Section 2.3 we produce some mathematics. In Section 2.4 we produce lists. In Section 2.5 we consider citing books, papers etc..

2 Name of section 2

How to do important things like importing graphs, create tables and produce beautiful mathematics.

2.1 Including a pdf file as a figure

Figure 1 shows that, even for pairs of sites situated at opposite points of the network, there is strong spatial association in the storm peak values.

Figure 1: Scatter plots of contemporaneous H_s^{sp} values at pairs of sites. Left: contiguous sites (site 30: latitude=3, longitude=6 and site 31: latitude=3 and longitude=7). Right: distant sites (site 1: latitude=1, longitude=1 and site 72: latitude=6, longitude=12)

2.2 Tables

Table 1 is an example of a fairly simple table.

model	neg. log-lik	d.f.	ALRS	p-value
constant	22763.20			
linear	22742.59	2	34.23	3.7×10^{-8}
quadratic	22737.09	3	20.50	1.3×10^{-4}
cubic	22737.02	4	2.09	0.72

Table 1: Summary of point process modelling in which the location parameter μ is modelled as a polynomial function of longitude and latitude and σ and ξ are constant. The likelihood ratio tests compare the model with the model in the row above. neg. log-lik = negated maximised log-likelihood; d.f. = degrees of freedom; ALRS = adjusted likelihood ratio statistic.

Table 2 is an example of the use of the `\multicolumn` command to produce column headings that span more than one column.

	wave height (m)		windpseed (m/s)	
return period	estimate	95% CI	estimate	95% CI
10 years	8.7	(8.0, 10.7)	10.2	(5.7, 14.4)
100 years	22.1	(20.6, 25.6)	34.9	(30.1, 42.4)
1,000 years	35.5	(32.4, 42.5)	63.5	(67.3, 76.9)
10,000 years	40.3	(35.2, 52.8)	78.6	(70.9, 98.0)

Table 2: Estimates and 95% confidence intervals of return levels of H_s.

2.3 Mathematics

Maths in text

Maths in text needs to be enclosed between dollar signs, e.g. `$x$` gives x (rather than x) and `$f$` gives maths font f (rather than f).

We get Greek symbols like this: $\lambda, \alpha, \beta, \gamma, \delta, \phi, \theta, \ldots$. …and mathematical operators like this: $1/x, x^{-1}, x_2, xy, \log x, 1+x, -2, x^2, \exp(x), \sin x$.

Displayed equations

Using the `equation` environment: `\begin{equation}` …`\end{equation}`. An exponential distribution, with mean $1/\lambda$, has probability density function (p.d.f.)

$$f_X(x) = \lambda\,\mathrm{e}^{-\lambda x}, \quad x > 0. \tag{2.1}$$

This comment refers to equation (2.1).

An alternative way to produce this displayed equation is to enclose it between `\[` and `\]` …

$$f_X(x) = \lambda\,\mathrm{e}^{-\lambda x}, \quad x > 0.$$

…but no equation number is produced.

Multi-line displayed equations

Using the `align` environment (produces equation numbers) …

Suppose that we have a random sample $X_1, \ldots, X_n$ from an exponential distribution with mean $1/\lambda$. The likelihood function for λ is given by

$$\begin{aligned} L(\lambda) &= \prod_{i=1}^{n} \lambda \mathrm{e}^{-\lambda x_i} \\ &= \lambda^n\,\mathrm{e}^{-\lambda \sum_{i=1}^{n} x_i} \qquad (2.2) \\ &= \lambda^n \mathrm{e}^{-\lambda \displaystyle\sum_{i=1}^{n} x_i} \qquad (2.3) \\ &= \lambda^n \exp\left\{-\lambda \sum_{i=1}^{n} x_i\right\}. \qquad (2.4) \end{aligned}$$

Which of the above expressions do you think looks best? Equation (2.3) is rather ugly...

Using the `align*` environment (produces no equation numbers) ...

$$\begin{aligned} P(M_n \leqslant z) &= P(X_1 \leqslant z, X_2 \leqslant z, ..., X_n \leqslant z) \\ &= P(X_1 \leqslant z) \times P(X_2 \leqslant z) \times \cdots \times P(X_n \leqslant z) \\ &= F(z)^n. \end{aligned}$$

Some more examples ... The cumulative distribution function (c.d.f.) of a Generalized Extreme Value (GEV) distribution is given by

$$P(X \leq x) = \exp\left\{ -\left[1 + \xi\left(\frac{x-\mu}{\sigma}\right)\right]^{-1/\xi}\right\}, \quad \text{for } 1 + \xi\left(\frac{x-\mu}{\sigma}\right) > 0.$$

We estimate θ using the estimator

$$\widehat{\theta} = \frac{1}{n}\frac{\frac{1}{M}\sum_{i=1}^{M}\widehat{H}(Y_i)}{\frac{1}{N}\sum_{j=1}^{N}\widehat{G}(Z_j)},$$

where

$$\widehat{G}(y) = \frac{1}{M}\sum_{i=1}^{M} I(Y_i \leqslant y) \quad \text{and} \quad \widehat{H}(z) = \frac{1}{N}\sum_{j=1}^{N} I(Z_j \leqslant z).$$

Two examples of defining a quantity conditional on the value of another quantity. First using the cases environment ...

$$|x| = \begin{cases} x & \text{if } x \geqslant 0, \\ -x & \text{if } x \leqslant 0. \end{cases}$$

... and now using the array environment ...

$$|x| = \left\{ \begin{array}{rl} x & \text{if } x \geqslant 0, \\ -x & \text{if } x \leqslant 0. \end{array}\right.$$

Note: Mathematics should read just like sentences of text, with punctuation, i.e. commas, full stops etc.

2.4 Lists

Some useful symbols presented as bullet/numbered/lettered points using the `itemize` environment ...

- $\overset{\text{i.i.d.}}{\sim}$; as in $X_1, \ldots, X_n \overset{\text{i.i.d.}}{\sim} N(\mu, \sigma^2)$.

2. $\overset{\text{indep}}{\sim}$; as in $X_i \overset{\text{indep}}{\sim} N(\mu_i, \sigma^2)$, for $i = 1, \ldots, n$.

(d) $\overset{\text{d}}{=\!=}$; as in $X_1 \overset{\text{d}}{=\!=} X_2$, i.e. X_1 has the same distribution as X_2.

(i) $W \dot{\sim} \chi^2_p$, i.e. W is approximately chi-squared with p degrees of freedom.

- $X_1 \perp\!\!\!\perp X_2$, i.e. X_1 is independent of X_2.

The `enumerate` environment can be used to number items automatically using 1., 2., etc.

2.5 Citing books, papers etc.

Remember to read the guidelines on the STATG099 Moodle page.

? is a good introduction to extreme value theory.

Many papers (**?**) have also been written about exteme value theory.

3 Conclusion