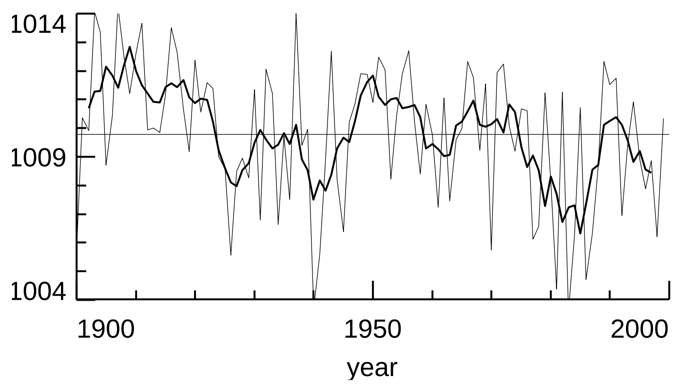

Figure 1: Plot of the NP index (thin curve) and a five year running average of the index (thick). The thin horizontal line depicts the sample mean (1009.8) for the index.

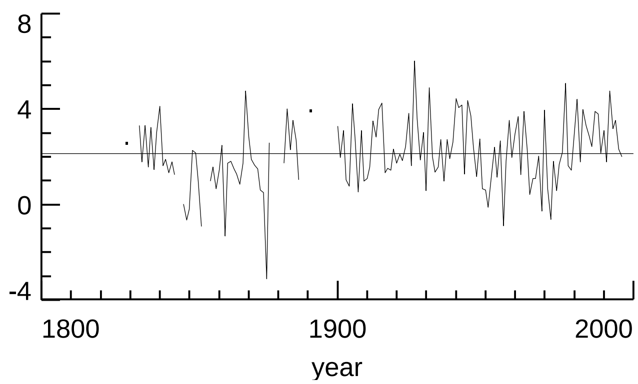

Figure 2: Plot of Sitka winter air temperatures (broken curve). The thin horizontal line depicts the sample mean (2.13) for the series.

	$\hat{\phi}$ (AR)	$\hat{\sigma}_\epsilon$ (AR)	$\hat{\delta}$ (FD)	$\hat{\sigma}_\varepsilon$ (FD)
NP	0.21	2.37	0.17	2.35
95% CI	$[0.02, 0.40]$	$[2.01, 2.67]$	$[0.02, 0.32]$	$[2.00, 2.66]$
Sitka	0.18	1.39	0.18	1.37
95% CI	$[0.02, 0.34]$	$[1.22, 1.54]$	$[0.05, 0.30]$	$[1.20, 1.52]$
Sitka (I)	0.29	1.33	0.24	1.30
95% CI	$[0.14, 0.43]$	$[1.18, 1.47]$	$[0.13, 0.36]$	$[1.15, 1.43]$

Table 1: Autoregressive (AR) and fractionally differenced (FD) process parameter estimates for the NP index, uninterpolated Sitka air temperature and interpolated Sitka air temperature series.

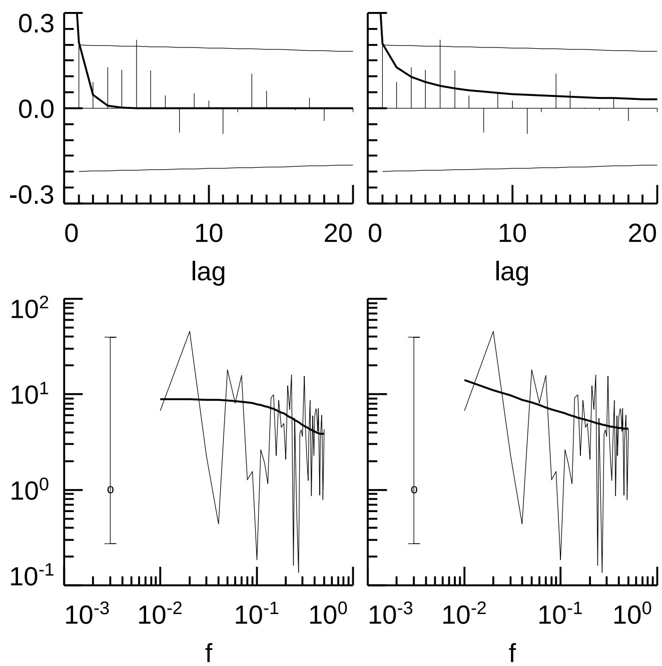

Figure 3: Sample autocorrelation sequence (ACS) and periodogram for the NP index, along with theoretical ACSs and spectral density functions (SDFs) for fitted AR model (left-hand plots) and fitted FD model (right).

j	model	T_j	$Q_j(0.90)$	$Q_j(0.95)$	$Q_j(0.99)$	$\alpha = 0.05$ test result	$\hat{\alpha}$
1	AR	0.30	0.38	0.39	0.42	fail to reject	0.67
	FD	0.28	"	"	"	fail to reject	0.78
	WN	0.39	"	"	"	reject	0.05
2	AR	0.10	0.17	0.19	0.23	fail to reject	$\gg 0.1$
	FD	0.07	"	"	"	fail to reject	$\gg 0.1$
	WN	0.21	"	"	"	reject	≈ 0.03
3	AR	4.65	7.74	9.45	13.31	fail to reject	0.32
	FD	3.12	"	"	"	fail to reject	0.54
	WN	12.63	"	"	"	reject	0.01
4	AR	4.97	7.74	9.45	13.31	fail to reject	0.29
	FD	3.34	"	"	"	fail to reject	0.50
	WN	13.31	"	"	"	reject	0.01

Table 2: Model goodness of fit tests for the NP index.

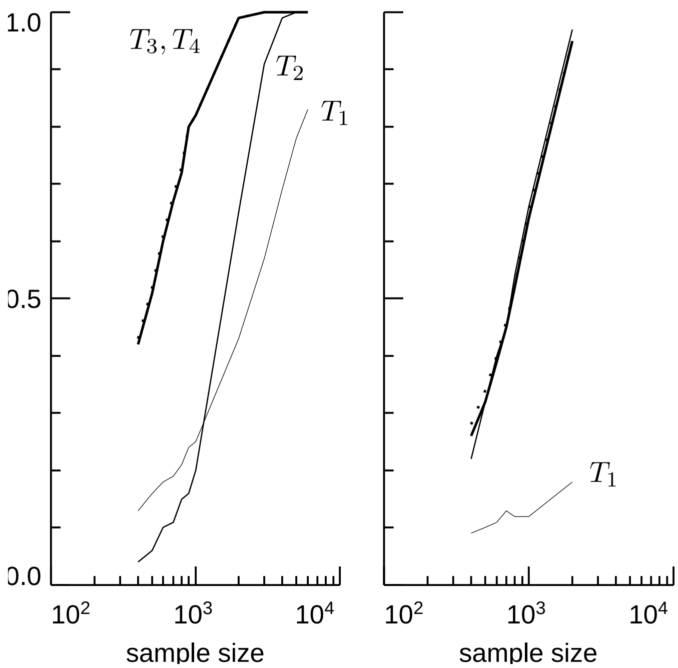

Figure 4: Probability (as a function of sample size) of rejecting the null hypothesis that a fitted model A is adequate for a realization of a process B when using the test statistics $T_1, \ldots, T_4$. In the left-hand plot, model A and process B are, respectively, an AR(1) model and an FD process with parameters δ and σ_ε^2 set to the values estimated for the NP index; in the right-hand plot, A and B are an FD model and an AR(1) process with ϕ and σ_ϵ^2 again set to the values estimated for the NP index. In both cases the best statistics for identifying that a particular model is not correct are the two portmanteau test statistics T_3 and T_4 (however, the cumulative periodogram test statistic T_2 is competitive with T_3 and T_4 when fitting an FD model to realizations of an AR(1) process).

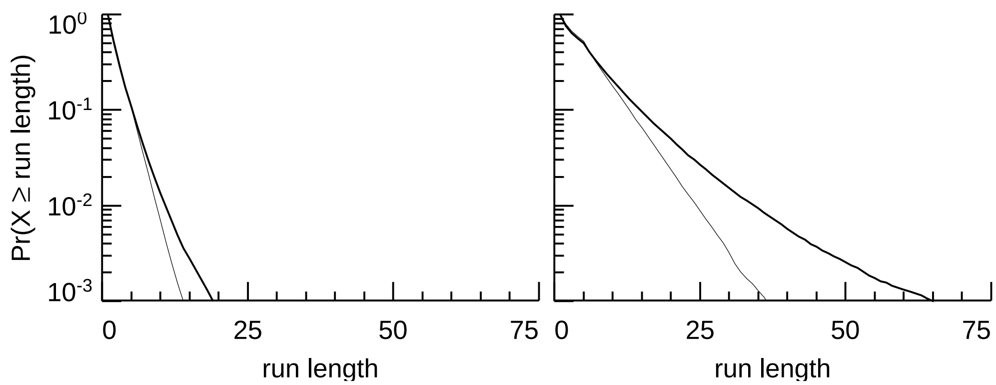

Figure 5: Probability of observing a run that is greater than or equal to a specified run length. The thin (thick) curves denote the AR (FD) process. The left-hand plot is for processes without smoothing, whereas the right-hand plot is for processes subjected to a five year running average.

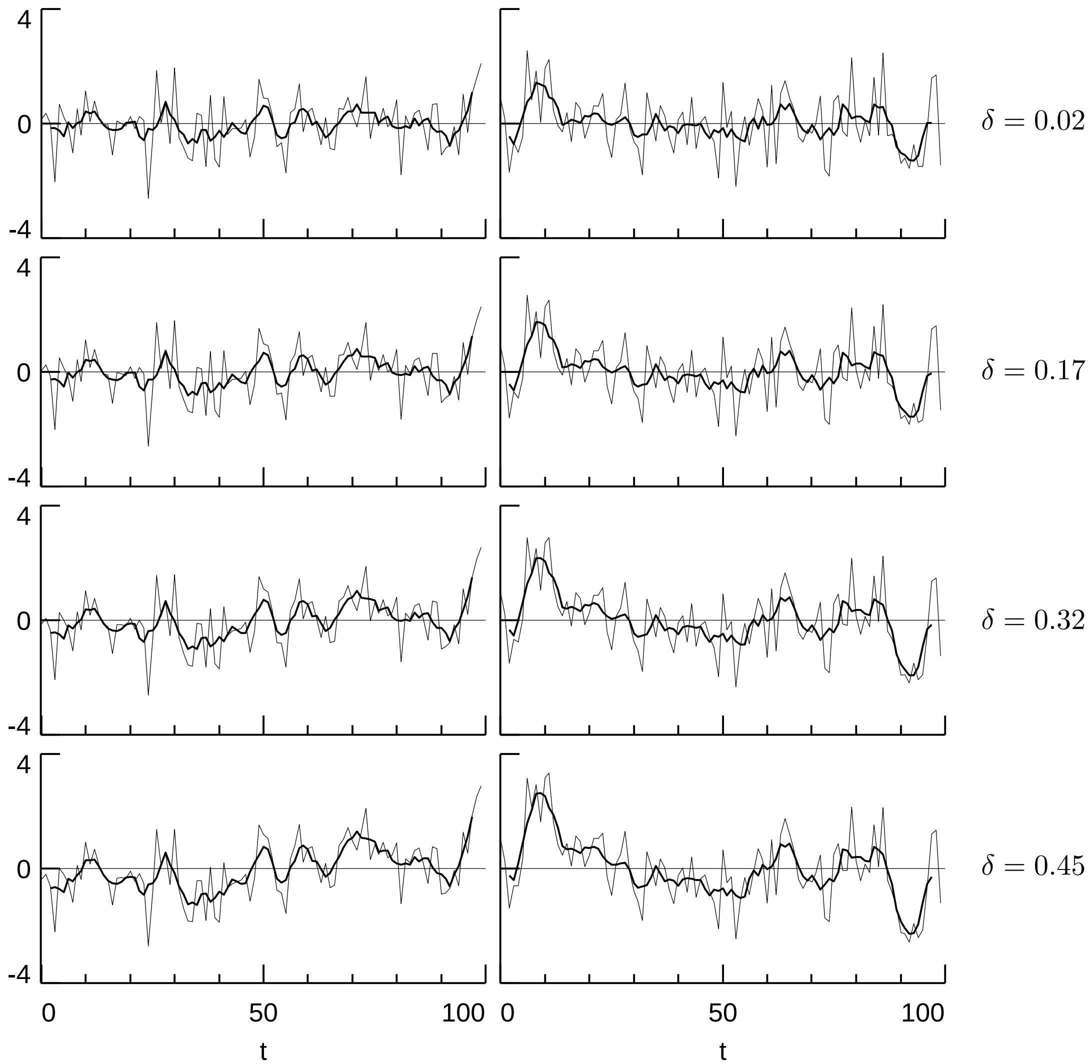

Figure 6: Simulated realizations of FD processes with different parameters δ (thin curves) along with five point running averages (thick).