Sensitivity studies for Shooter et al 2020

This document provides typical diagnostic plots supporting Shooter et al. (2020). Section S.1 provides supporting illustrations for a typical analysis. Section S.2 provides a sensitivity analysis into choice of conditional extremes threshold, and adoption of conditional quantile constraints (CQCs). Section S.3 illustrates the effect of choice of conditioning location.

S.1 "Vanilla" analysis

Normal transect (SWNE), CQCs imposed, threshold non-exceedance probability 0.7. Conditioning location 1. Reported in main article.

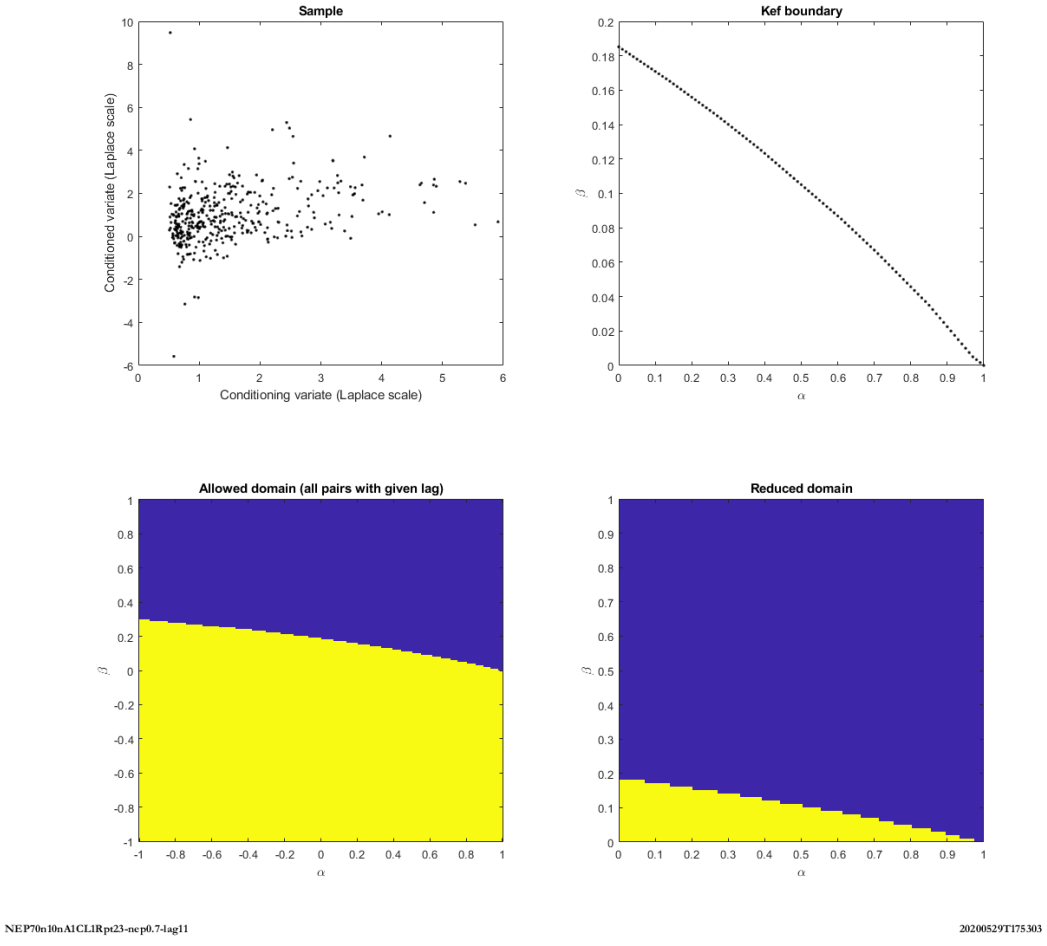

Figure S.1: Illustration of sample and CQC ("Keef") boundary at lag 11 of 19.

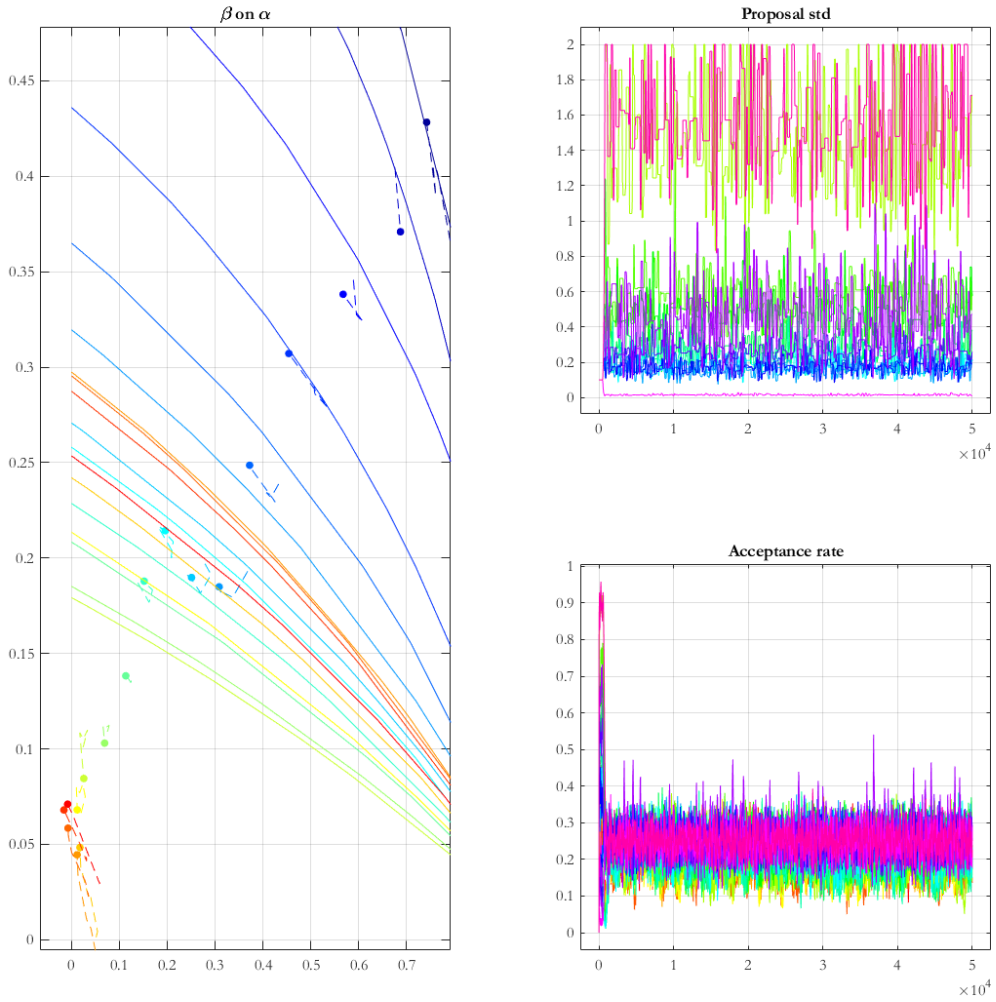

Figure S.2: Left: illustration of CQC boundaries and MCMC trajectories for 10 iterations; α on x-axis, β on y-axis. Top right: proposal standard deviations. Bottom right: acceptance rates.

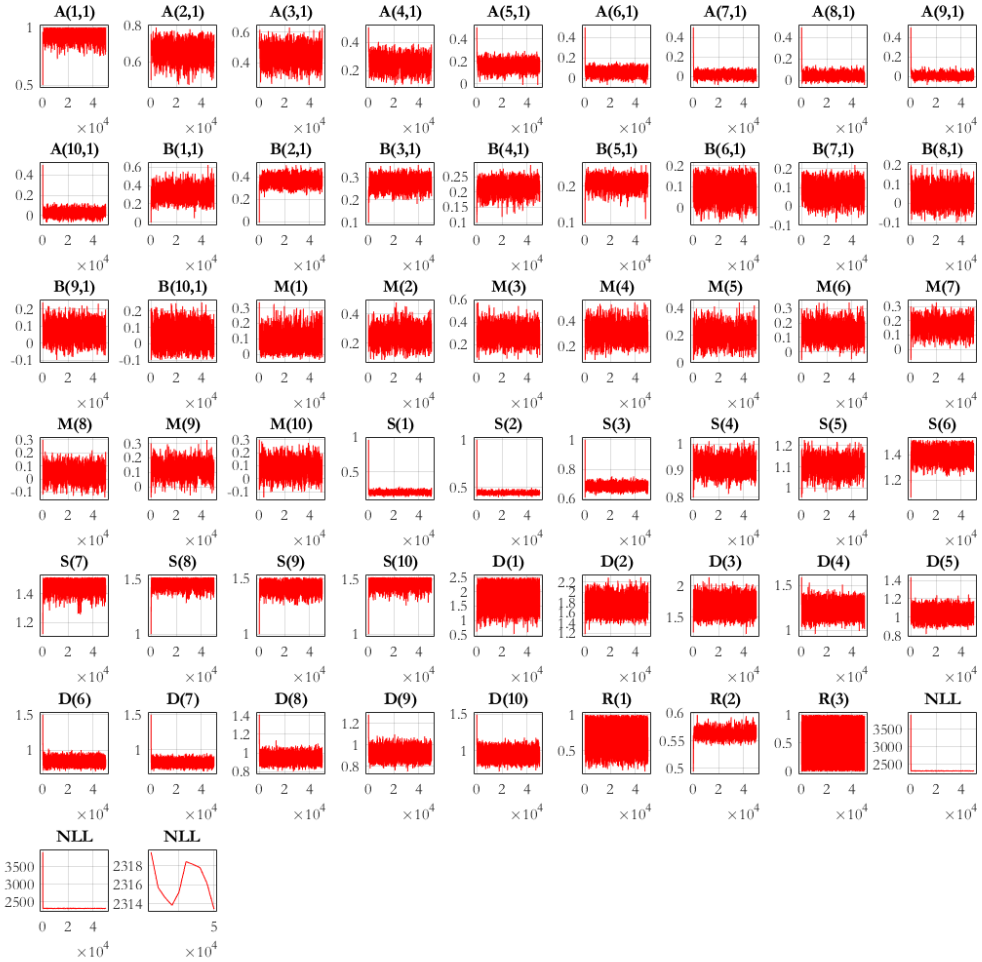

Figure S.3: MCMC trace plots for all model parameters, and negative log posterior likelihood. 50k iterations.

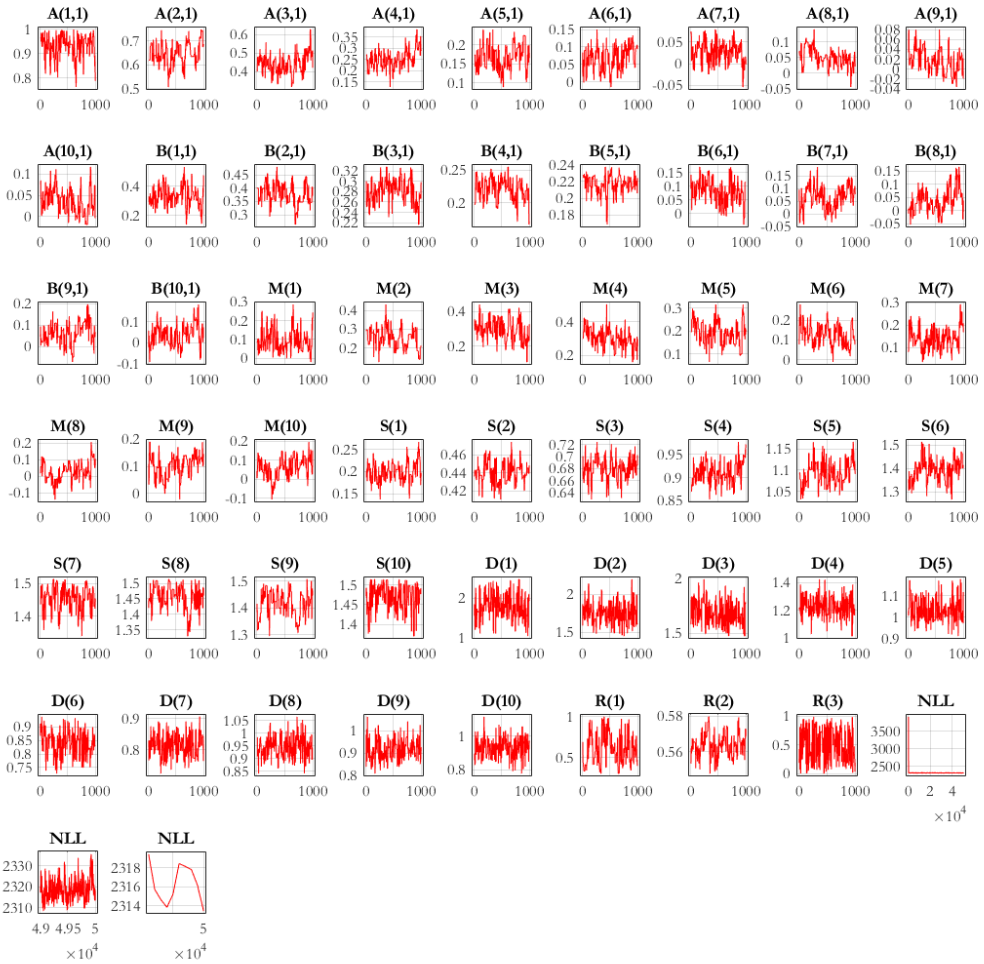

Figure S.4: MCMC trace plots for all model parameters, and negative log posterior likelihood. Last 1000 of 50k iterations.

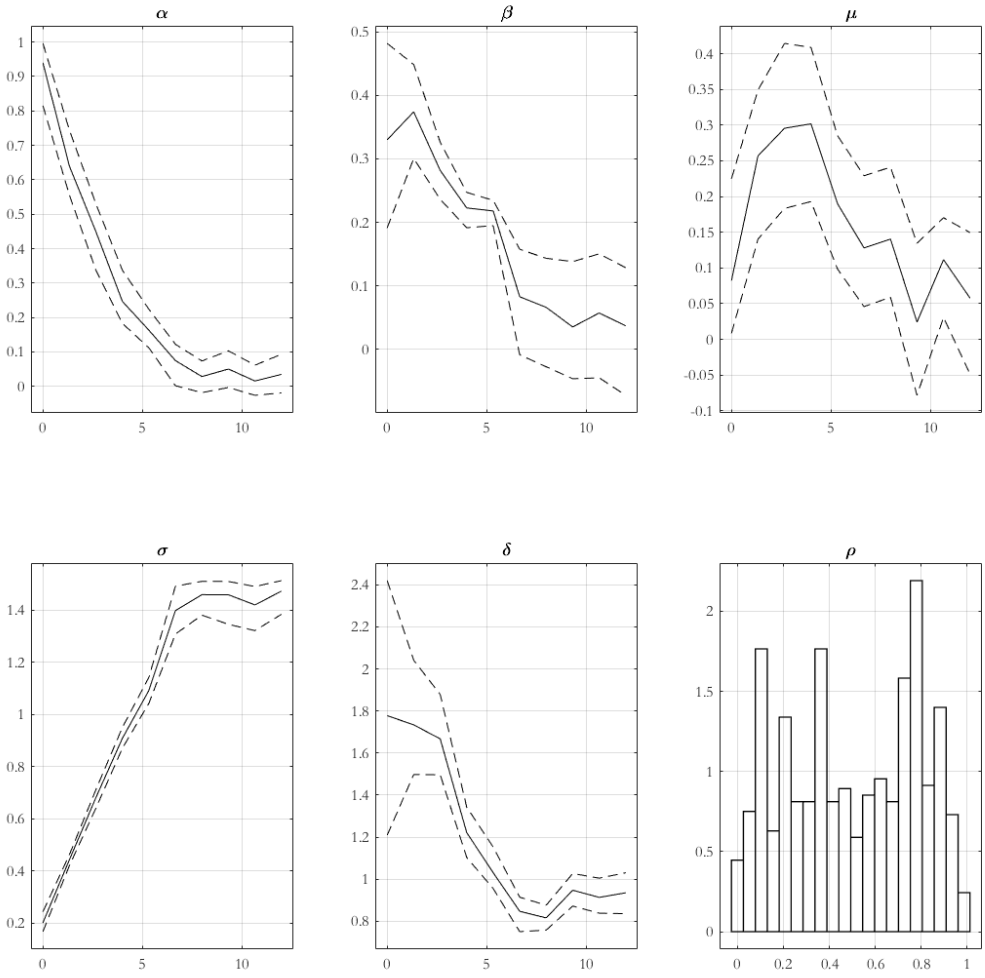

Figure S.5: Parameter estimates with distance. For all but ρ, posterior median and 95% credible intervals. For ρ, posterior density. One distance unit is approximately 111.2km, actually $(\pi/180)R$, where R is the radius of the Earth.

S.2 Effect of threshold and conditional quantile constraints

S.2.1 Normal (SWNE) transect

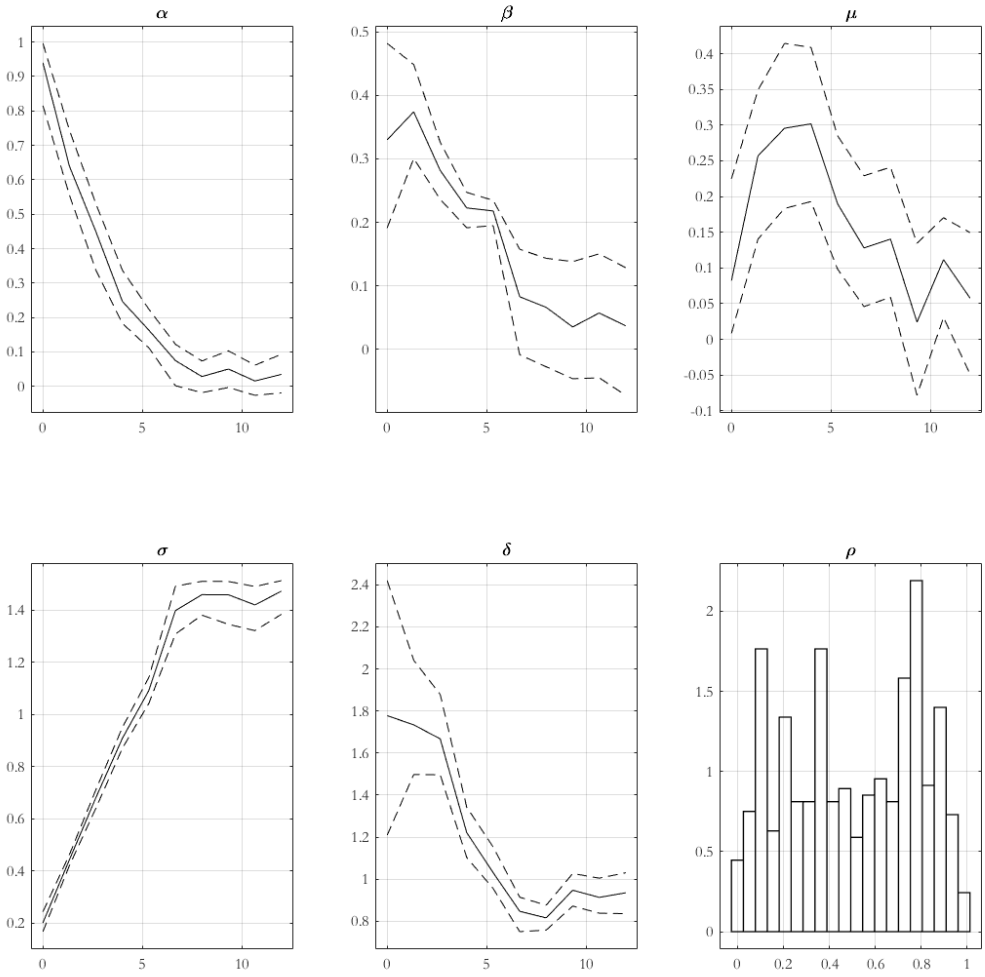

Figure S.6: Parameter estimates with distance (see Figure S.5). CQCs imposed. Threshold non-exceedance probability 0.7.

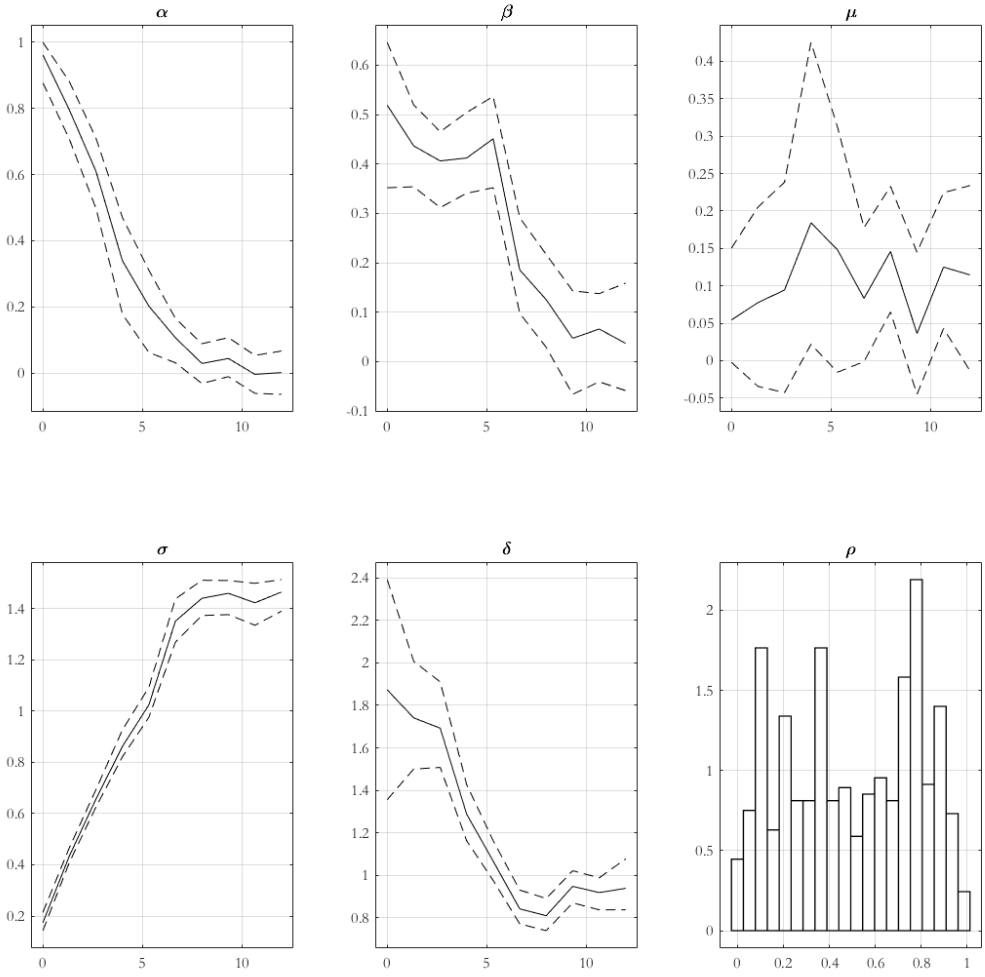

Figure S.7: Parameter estimates with distance (see Figure S.5). No CQCs. Threshold non-exceedance probability 0.7.

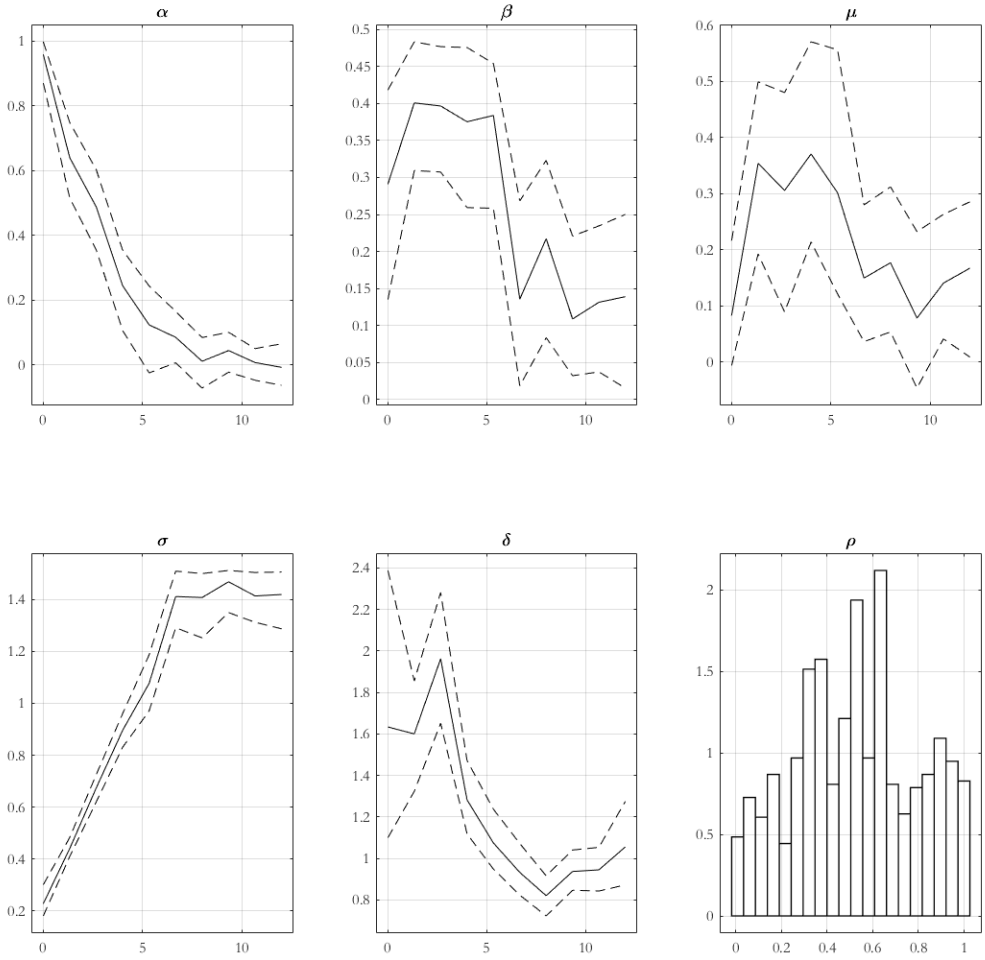

Figure S.8: Parameter estimates with distance (see Figure S.5). CQCs imposed. Threshold non-exceedance probability 0.8.

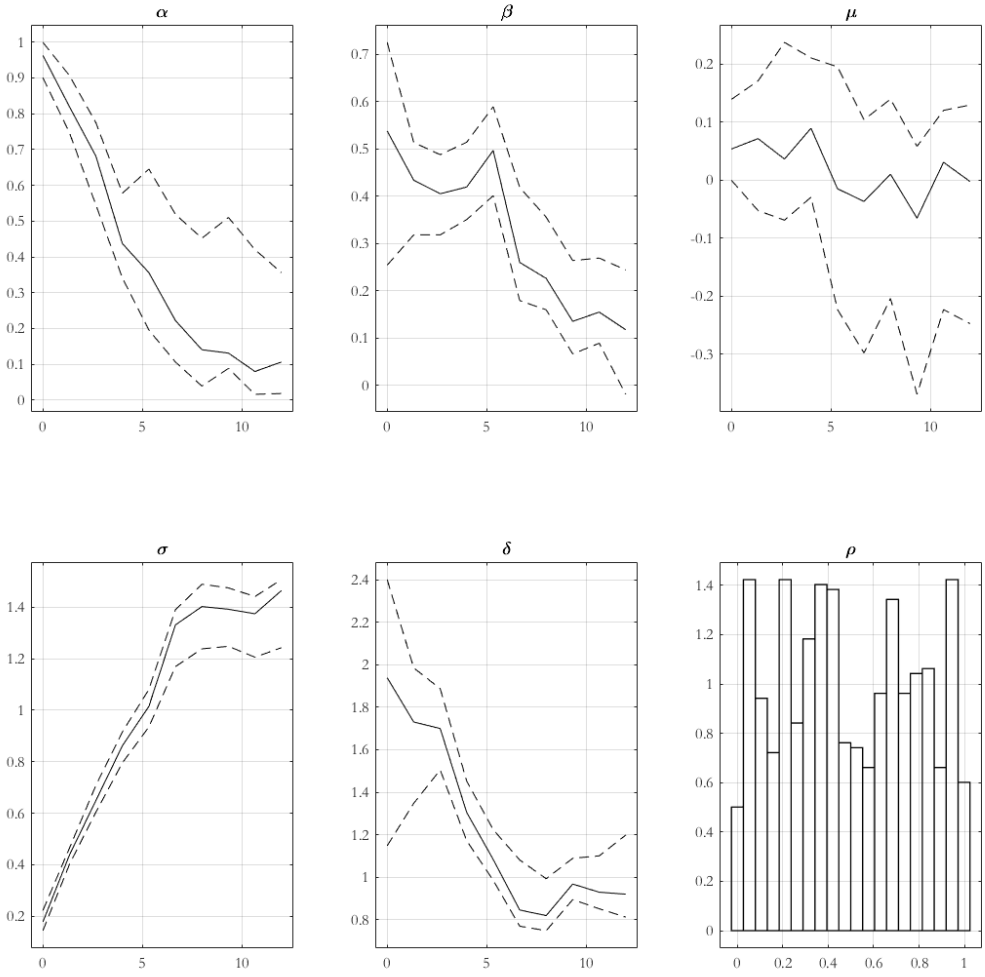

Figure S.9: Parameter estimates with distance (see Figure S.5). No CQCs. Threshold non-exceedance probability 0.8.

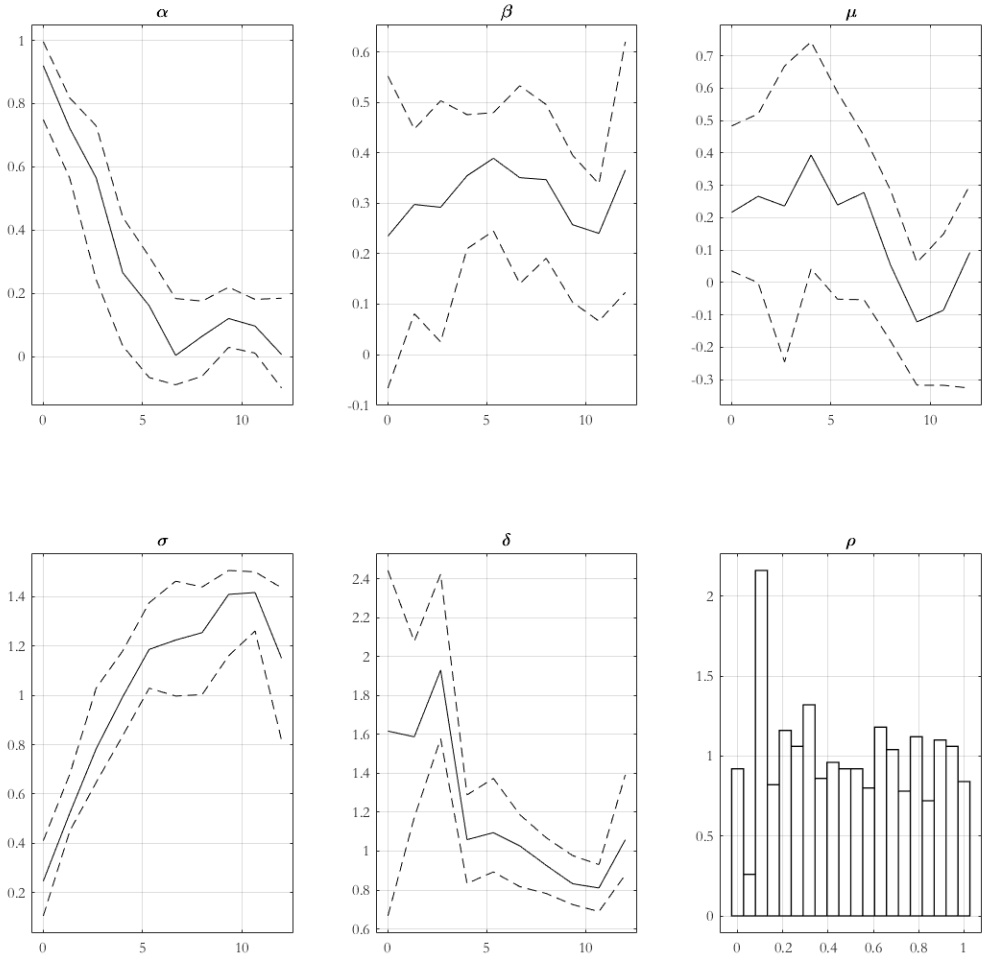

Figure S.10: Parameter estimates with distance (see Figure S.5). CQCs imposed. Threshold non-exceedance probability 0.9.

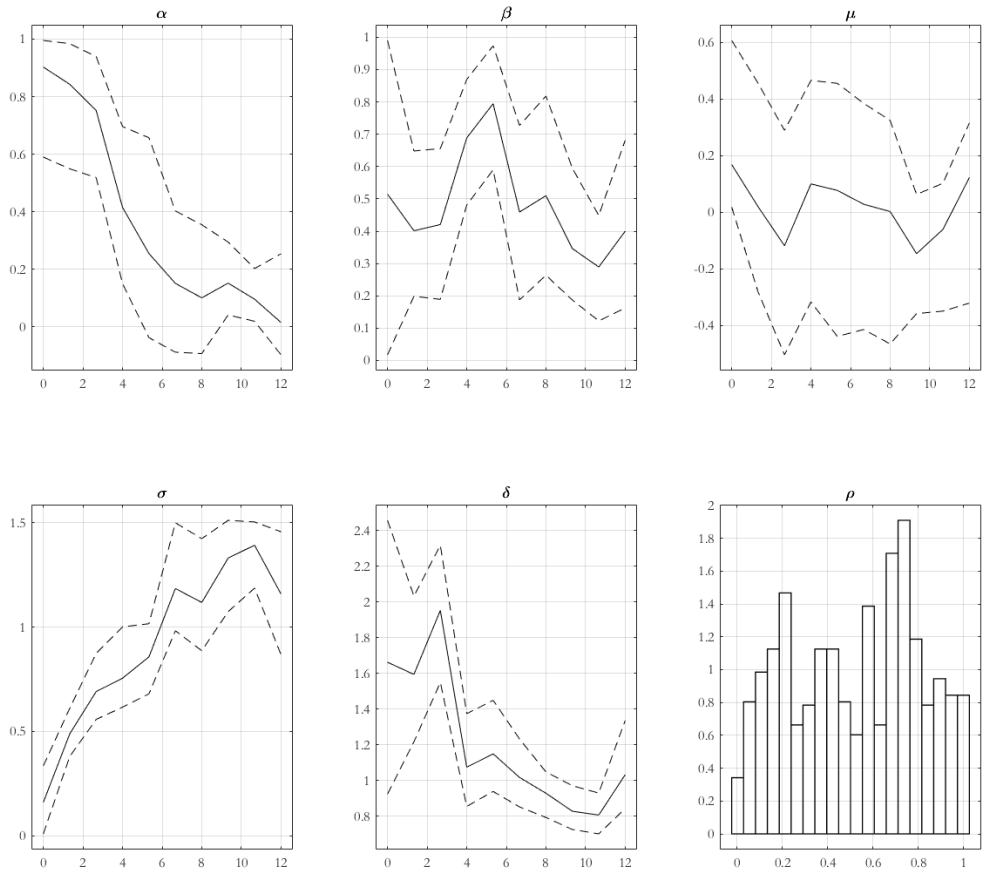

Figure S.11: Parameter estimates with distance (see Figure S.5). No CQCs. Threshold non-exceedance probability 0.9.

S.2.2 Opposite (NWSE) transect

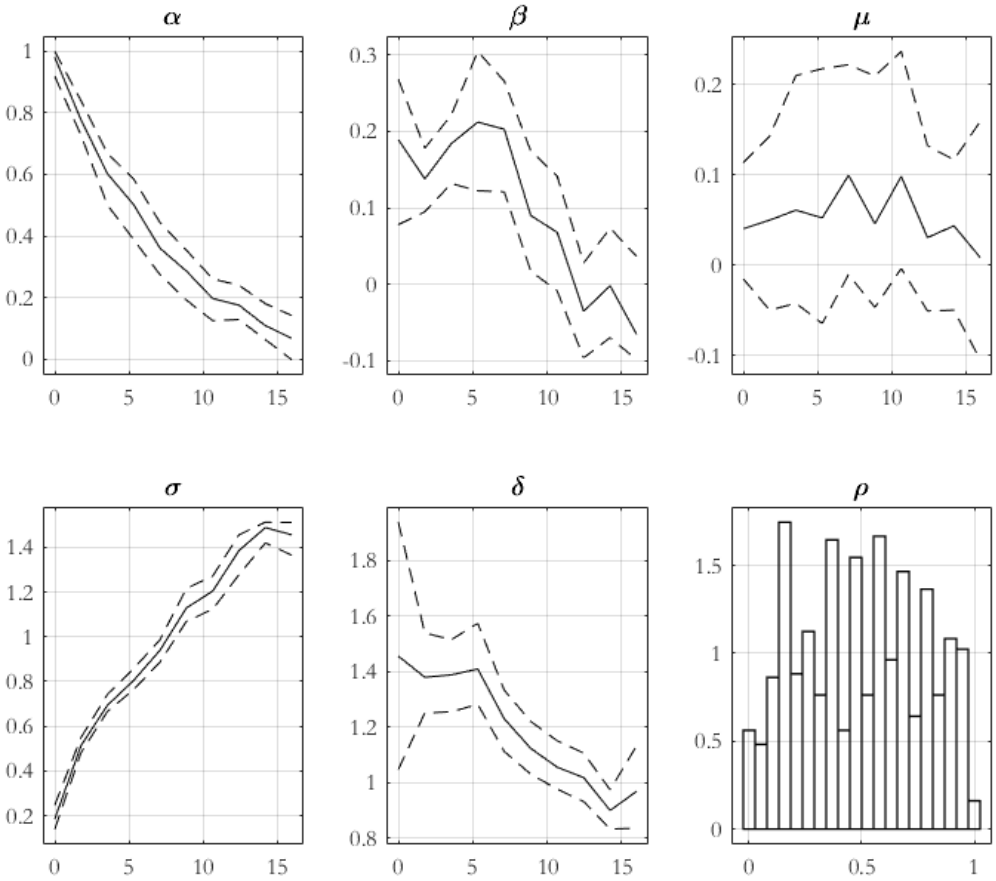

Figure S.12: Parameter estimates with distance (see Figure S.5). CQCs imposed. Threshold non-exceedance probability 0.7.

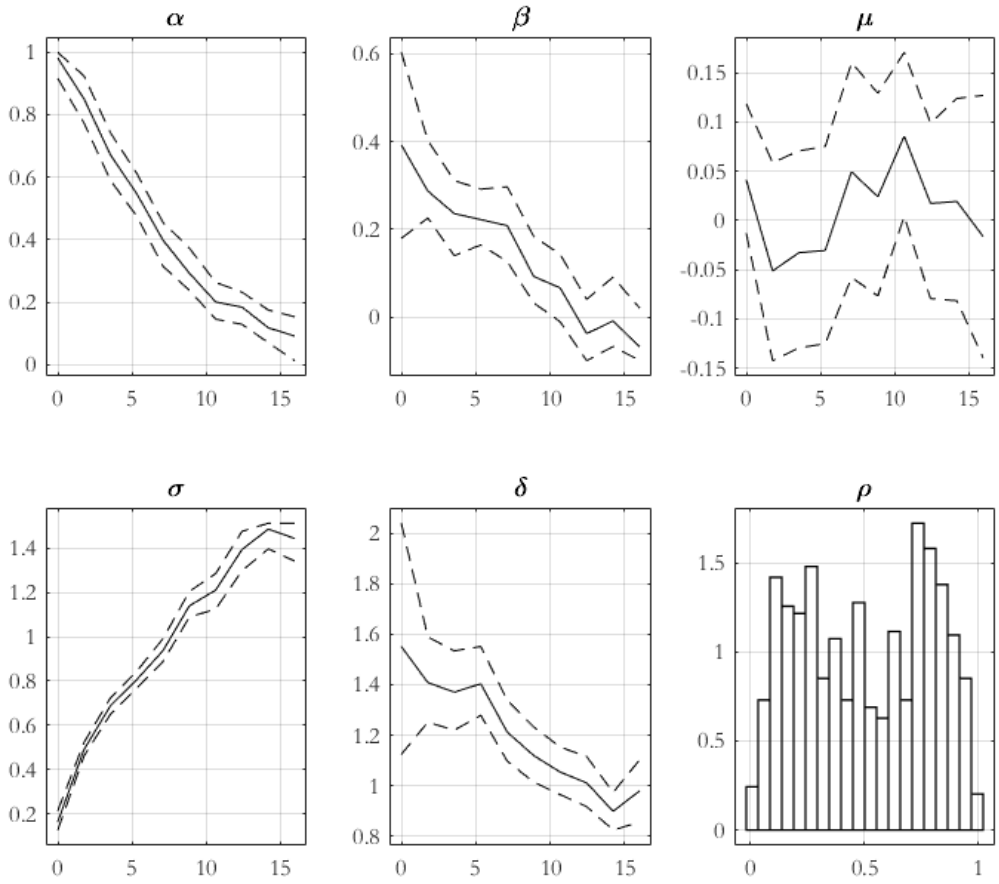

Figure S.13: Parameter estimates with distance (see Figure S.5). No CQCs. Threshold non-exceedance probability 0.7.

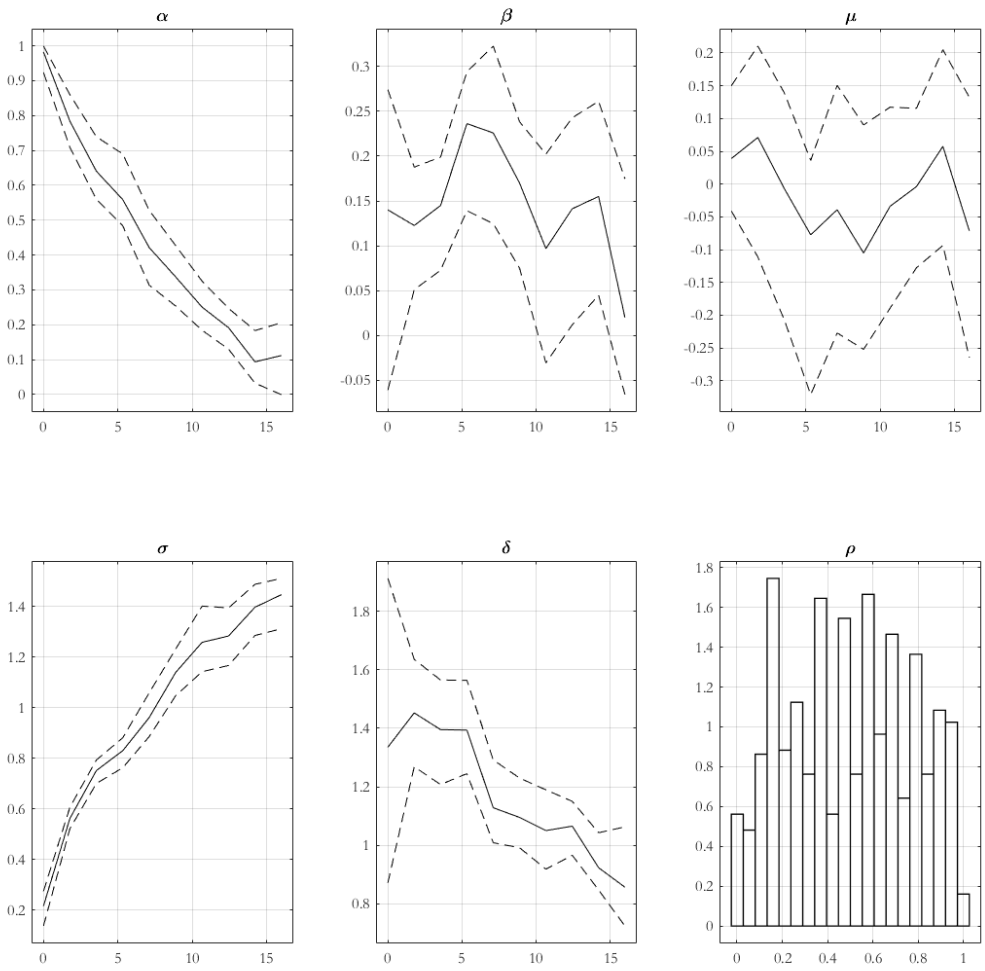

Figure S.14: Parameter estimates with distance (see Figure S.5). CQCs imposed. Threshold non-exceedance probability 0.8.

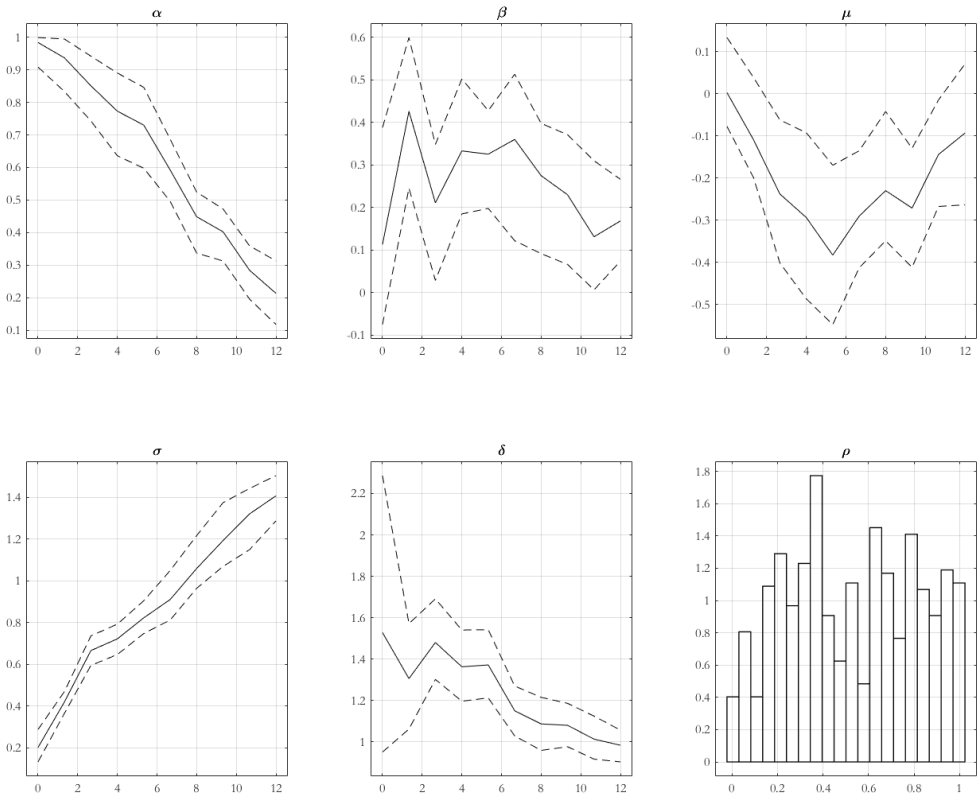

Figure S.15: Parameter estimates with distance (see Figure S.5). No CQCs. Threshold non-exceedance probability 0.8.

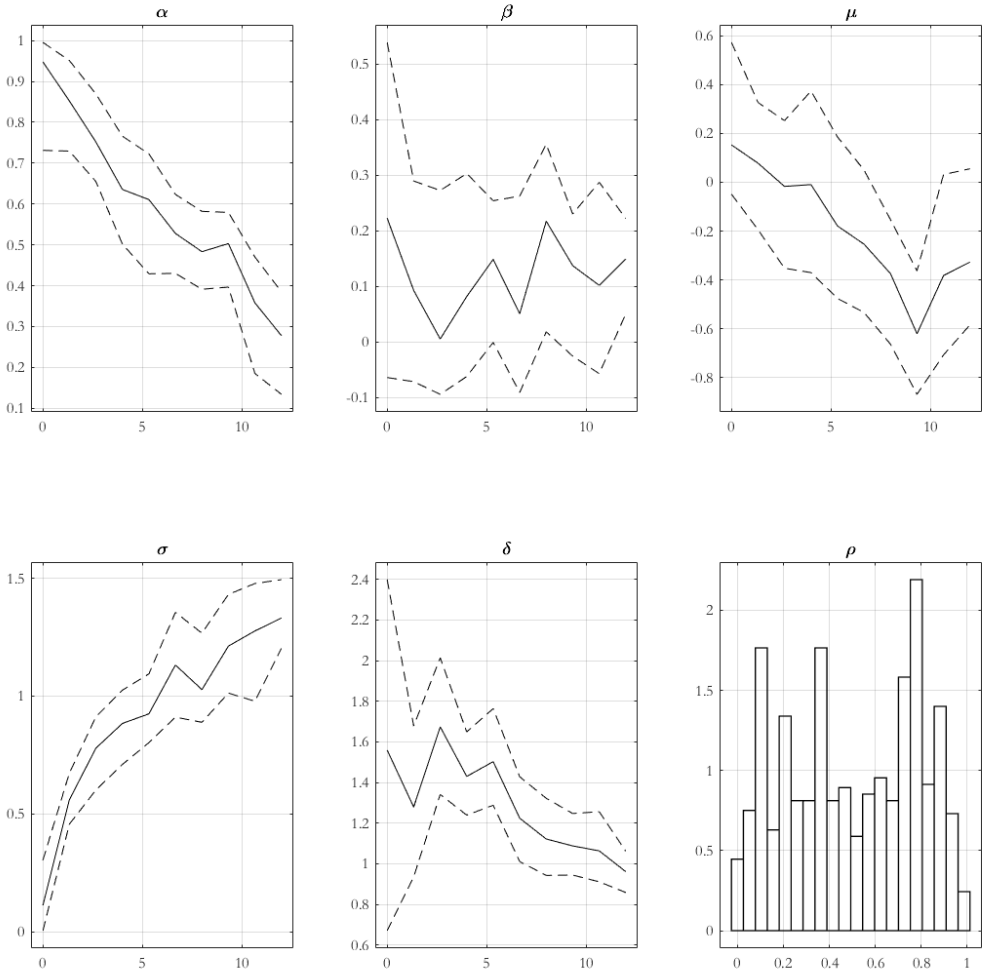

Figure S.16: Parameter estimates with distance (see Figure S.5). CQCs imposed. Threshold non-exceedance probability 0.9.

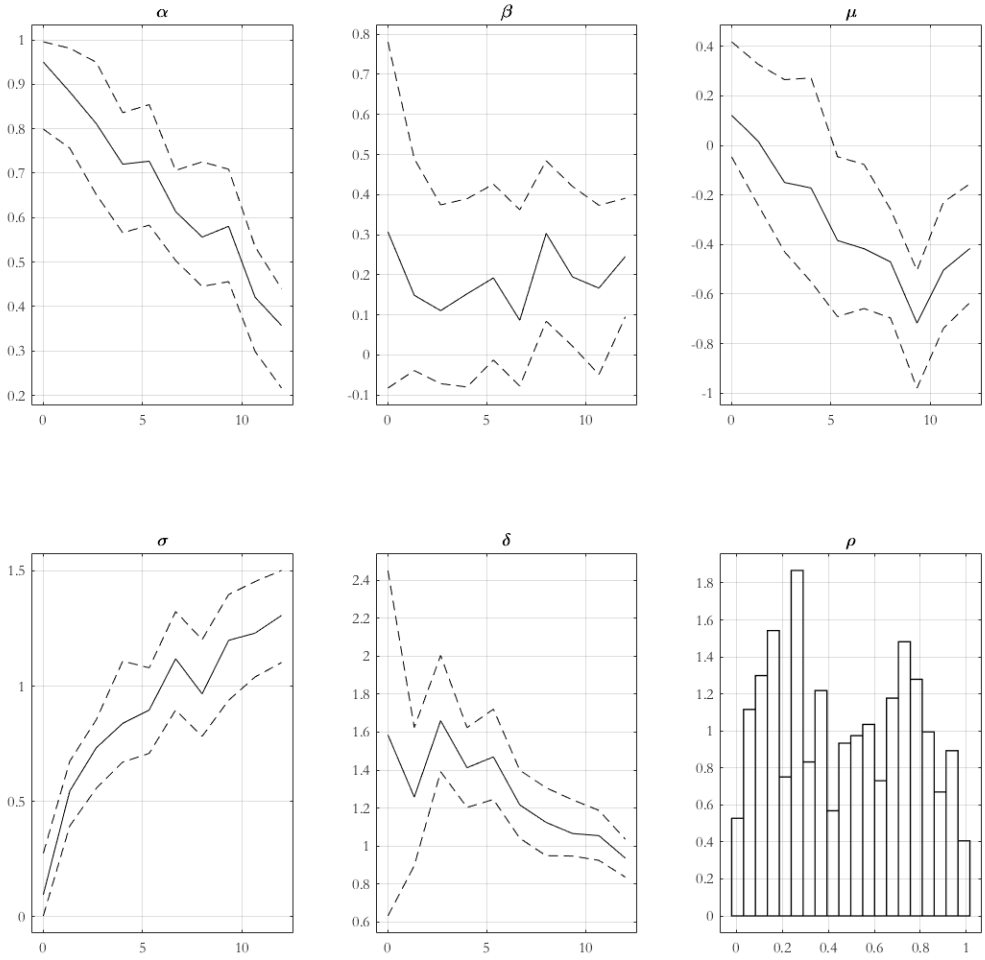

Figure S.17: Parameter estimates with distance (see Figure S.5). No CQCs. Threshold non-exceedance probability 0.9.

S.3 Effect of choice of conditioning location

Figure 7 of the main text illustrate parameter estimates with distance for conditioning location 0 (western end of transect). In this section, we provide supporting information for Figure 8 of the main text, comparing estimates obtained for conditioning location 0, with those for conditioning location 9 (centre of transect) and conditioning location 18 (eastern end). Threshold non-exceedance probability 0.7, and CQC constraints active throughout.

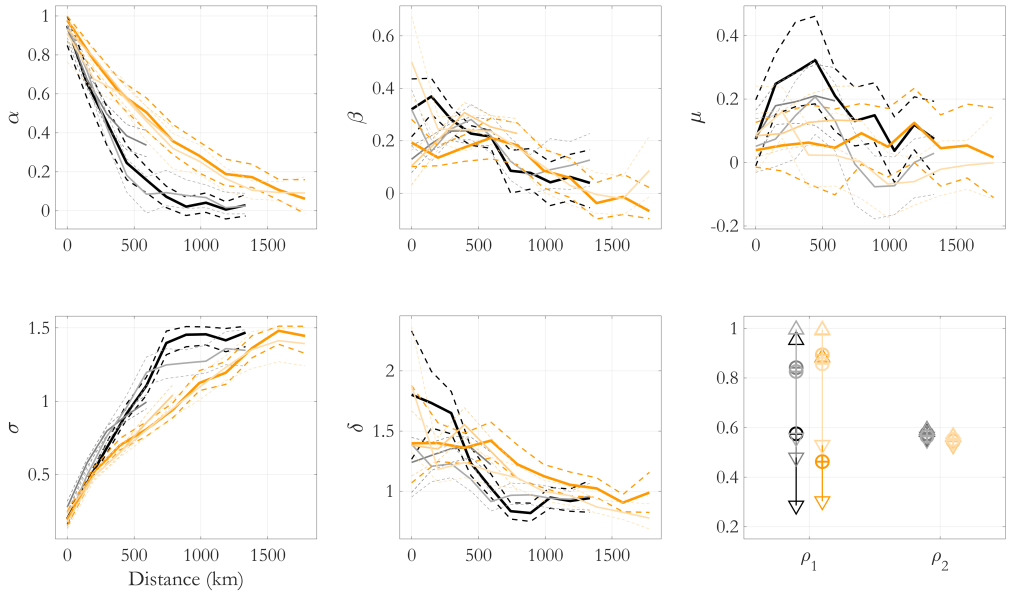

Figure S.18: Extension of Figure 7 of main text. Colour intensity (of orange or black) used to indicate different conditioning locations: conditioning locations 0, 9 and 18 shown as increasingly lighter shades. Other plot details as for Figure 7. Plots suggest that characteristics of $\alpha(d|\text{SWNE})$, $\alpha(d|\text{NWSE})$, $\sigma(d|\text{SWNE})$ and $\sigma(d|\text{NWSE})$ in particular do not depend on conditioning location. Yet differences between SWNE and NWSE in terms of α and σ are relatively clear.

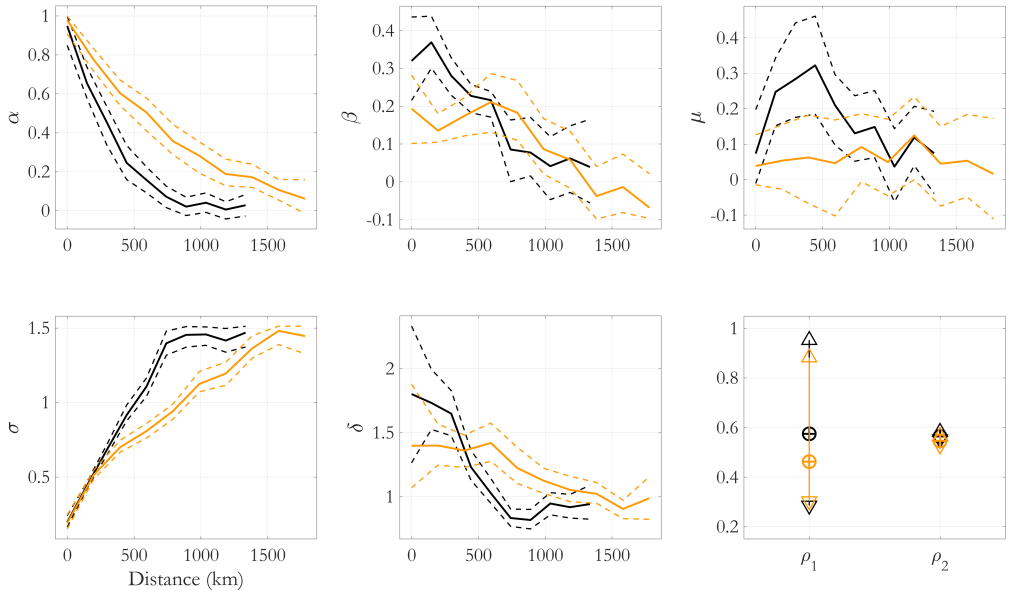

Figure S.19: Break-out of Figure S.18 for conditioning location 0.

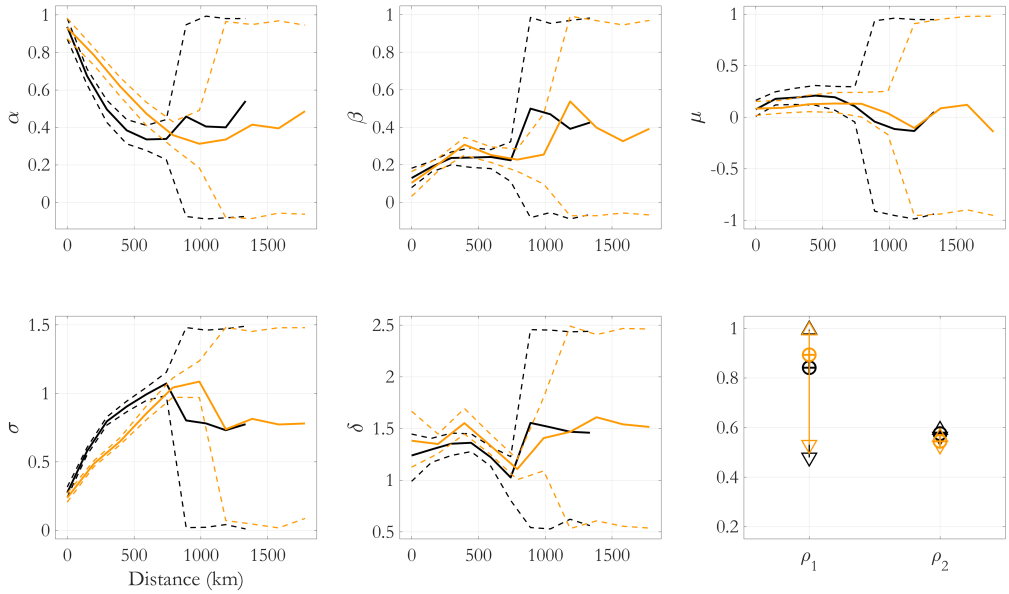

Figure S.20: Break-out of Figure S.18 for conditioning location 9. Since location 9 is central to the transect, we cannot examine behaviour at large distances.

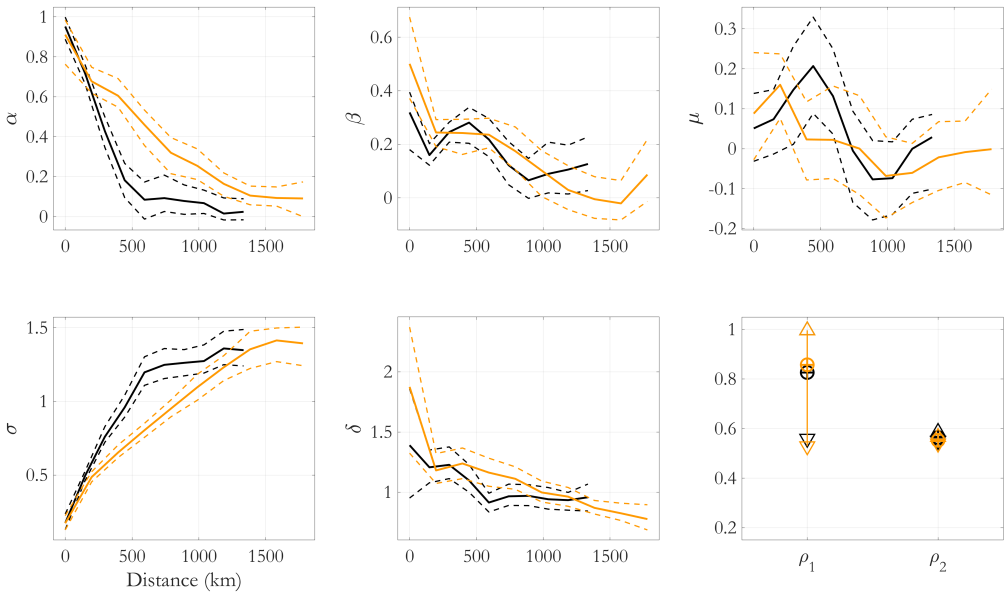

Figure S.21: Break-out of Figure S.18 for conditioning location 18.

References

Shooter, R., Ross, E., Ribal, A., Young, I.R., Jonathan, P., 2020. Spatial conditional extremes for significant wave height from satellite altimetry. Submitted to Environmetrics (Draft at www.lancs.ac.uk/∼jonathan) .