

# Modelling the effects of environmental heterogeneity within the lung on the tuberculosis life-cycle - Supplementary Material

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## A Sensitivity analysis - PRCC values

	Days after initial infection											
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-110	111-120
$S_V$	-											
$S_Q$	+		+	+	+	+	+	+	+	+	+	+
$\lambda_R$	+	+	+	+	+	+	+	+	+	+	+	+
$\lambda_D$	+	+			-	-	-					+
$\sigma_\lambda$												
$\phi$	-											
$\xi$	+	+										
$\theta_\xi$												
$\sigma_\xi$	-		-								-	-
$\tau_{BY}$		+	+							+		
$\alpha_D$	-	-	-					-	-		-	-
$\beta_D$	+							+	+	+	+	
$\theta_{\beta_D}$	-											
$\mu_{DI}$	+	+										
$\tau_D$	+	+										
$\alpha_{MY}$	+	+										
$\beta_{MY}$												
$\omega$					+	+	-	-	-	-	-	-
$\theta_{eMB}$		-	-	-								
$\theta_{eMT}$	+	+	+	+	+	+	+	+	+	+	+	+
$\mu_{MR}$	+	+										
$\mu_{MA}$				+	+							
$\kappa_M$		-	-	-	-	-	-	-	-	-	-	-
$\theta_{\kappa_M}$	+	+	+	+	+	+	+	+	+	+	+	+
$\psi_{\kappa_M}$	+											
$\gamma_R$	+	+						+				
$\theta_{\gamma_R}$	+											
$\eta$	+	+	+									
$\gamma_A$		-	-	-								
$\theta_{\gamma_A}$					+							
$\tau_M$	-	-	-	-	-	-	-	-	-	-	-	-
$\beta_T$		+	+	+	+	+	+	+	+	+	+	+
$\theta_{\beta_T}$												
$\epsilon_T$	-	-	-	-	-	-	-	-	-	-	-	-
$\epsilon_T$	+	+	+	+	+	+	+	+	+	+	+	+
$\tau_T$	-	-	-	-	-	-	-	-	-	-	-	-
$\lambda_T$	+	+	+	+	+	+	+	+	+	+	+	+
$\mu_{TN}$	+	+	+									
$\mu_{TA}$	+	+	+	+							+	+

Table A1: Parameter effects on average lesion size ( $\Omega_S$ ) over the course of infection. + denotes the parameter has a significant, positive PRCC value for the lesion size in the 10 day period, whilst - denotes the parameter has a significant, negative PRCC value for the lesion size. Where no symbol is present, the PRCC value is non-significant.

	Days after initial infection											
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-110	111-120
$S_Q$					+	+	+	+				
$S_G$	+/-	-	-	+	+	+	+	+	+	+	+	+
$\lambda_R$			+	+	+	+	+	+	+	+	+	+
$\lambda_I$			-	-								
$\sigma_\lambda$			-	-								
$\phi$		+	+	+	+	+	+	+	+			
$\xi$												
$\theta_\xi$	+	+										
$\theta_\xi$		-										
$\lambda_D$	-		+	+	+							
$\theta_{\tau BY}$	+		-	-								
$\alpha_D$	-	-	-	-					-	-	-	-
$\beta_D$										+	+	
$\theta_{\beta D}$					+	+						
$\mu_{DI}$	-	+	+									
$\mu_{DM}$	+	+										
$\gamma_D$	+											
$\theta_{\gamma D}$	-											
$\tau_D$	+											
$\beta_{ML}$	+	+	+									
$\beta_{MY}$						-	-	-				
$\theta_{\beta MY}$		-										
$\theta_{\epsilon MB}$	+											
$\epsilon_{MT}$			-	-								
$\theta_{\epsilon MT}$			+	+	+	+	+	+	+	+	+	+
$\mu_{MR}$			+	+	+	+	+	+	+	+	+	+
$\zeta$	-											
$\kappa_M$												
$\theta_{\kappa M}$	-		+	+	+	+	+	+	+	+	+	+
$\psi_{\kappa M}$												
$\theta_{\gamma R}$	+	+	+	+	+	+	+	+	-			
$\eta$	+											
$\gamma_A$	+		-	-	-	-	-	-	-	-	-	-
$\theta_{\gamma A}$	-											
$\tau_M$	+	-	-	-	-	-	-	-	-	-	-	-
$\alpha_T$	+	+										
$\beta_T$	-	-										
$\theta_{\beta T}$	-											
$\epsilon_T$												
$\theta_{\epsilon T}$	+	+	+	+	+	+	+	+	+	+	+	+
$\tau_T$												
$\sigma_T$				+	+	+	+	+	+	+	+	+
$\lambda_T$			-	-	-	-	-	-	-	-	-	-
$\mu_{TN}$			+	+	+	+	+					
$\mu_{TA}$	-											+

Table A2: Parameter effects on number of lesions ( $\Omega_N$ ) over the course of infection. + denotes the parameter has a significant, positive PRCC value for the number of lesions in the 10 day period, - denotes the parameter has a significant, negative PRCC value for the number of lesions, and +/- denotes both positive and negative PRCC values exist. Where no symbol is present, the PRCC value is non-significant.

	Days after initial infection											
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-110	111-120
$S_V$	-											
$S_Q$	+		+	+	+	+	+	+	+	+	+	+
$S_G$				+								
$\lambda_R$	+	+		+	+	+	+	+	+	+	+	+
$\lambda_D$	+				+	+	+	+	+	+	+	+
$\lambda_I$	+	+			-	-	-	-	-	-	-	-
$\sigma_\lambda$												
$\phi$	-		+	+	+	+						
$\xi$	+	+	+									
$\theta_\xi$			-									-
$\sigma_\xi$	-		-									
$\tau_{BY}$		+	+	+					+	+	+	
$\theta_{\tau_{BY}}$	-	-	-									
$\alpha_D$	+								-	-	-	-
$\beta_D$	+		+					+	+	+	+	+
$\theta_{\beta_D}$	-	-										
$\mu_{DI}$	+	+	+									
$\mu_{DM}$								-	-	-	-	-
$\tau_D$	+		-	-	-	-	-	-	-	-	-	-
$\alpha_{MY}$	+	+										
$\beta_{MY}$												
$\theta_{\epsilon_{MB}}$	-	-	-									
$\theta_{\epsilon_{MT}}$	+	+	+	+	+	+	+	+	+	+	+	+
$\mu_{MR}$	+	+	+	+	+	+	+	+	+	+	+	+
$\mu_{MA}$				+	+	+						
$\kappa_M$	-	-	-	-	-	-	-	-	-	-	-	-
$\theta_{\kappa_M}$	+	+	+	+	+	+	+	+	+	+	+	+
$\psi_{\kappa_M}$	+											
$\gamma_R$	+	+										
$\theta_{\gamma_R}$	+			+				+				+
$\eta$	+	+	+									
$\gamma_A$	-	-	-	-	-	-	-	-	-	-	-	-
$\tau_M$	-	-	-	-	-	-	-	-	-	-	-	-
$\beta_T$			+	+	+	+	+	+	+	+	+	+
$\theta_{\beta_T}$												
$\epsilon_T$	-	-	-	-	-	-	-	-	-	-	-	-
$\theta_{\epsilon_T}$	+	+	+	+	+	+	+	+	+	+	+	+
$\tau_T$	-	-	-	-	-	-	-	-	-	-	-	-
$\lambda_T$												
$\mu_{TN}$	+	+	+	+	+							
$\mu_{TA}$	+	+	+								+	+

Table A3: Parameter effects on total number of bacteria ( $\Omega_T$ ) over the course of infection. + denotes the parameter has a significant, positive PRCC value for the total bacteria numbers in the 10 day period, whilst - denotes the parameter has a significant, negative PRCC value for the total bacteria numbers. Where no symbol is present, the PRCC value is non-significant.

## B Sensitivity analysis - PRCC plots

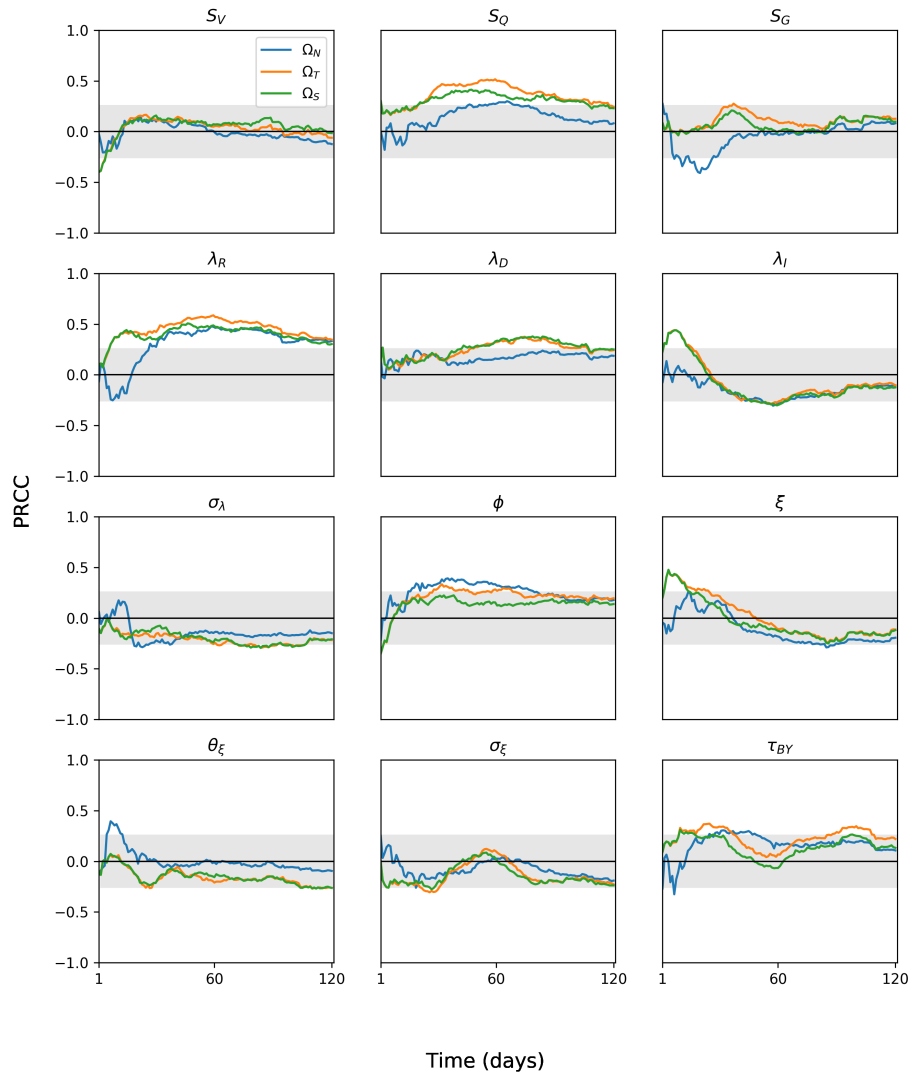


Figure B1: Sensitivity plots for various parameters within *TBMetaPopPy*, plotting the PRCC value of the parameter against the three outputs over time. Grey shaded area shows non-significance ( $p < 0.01$ ).

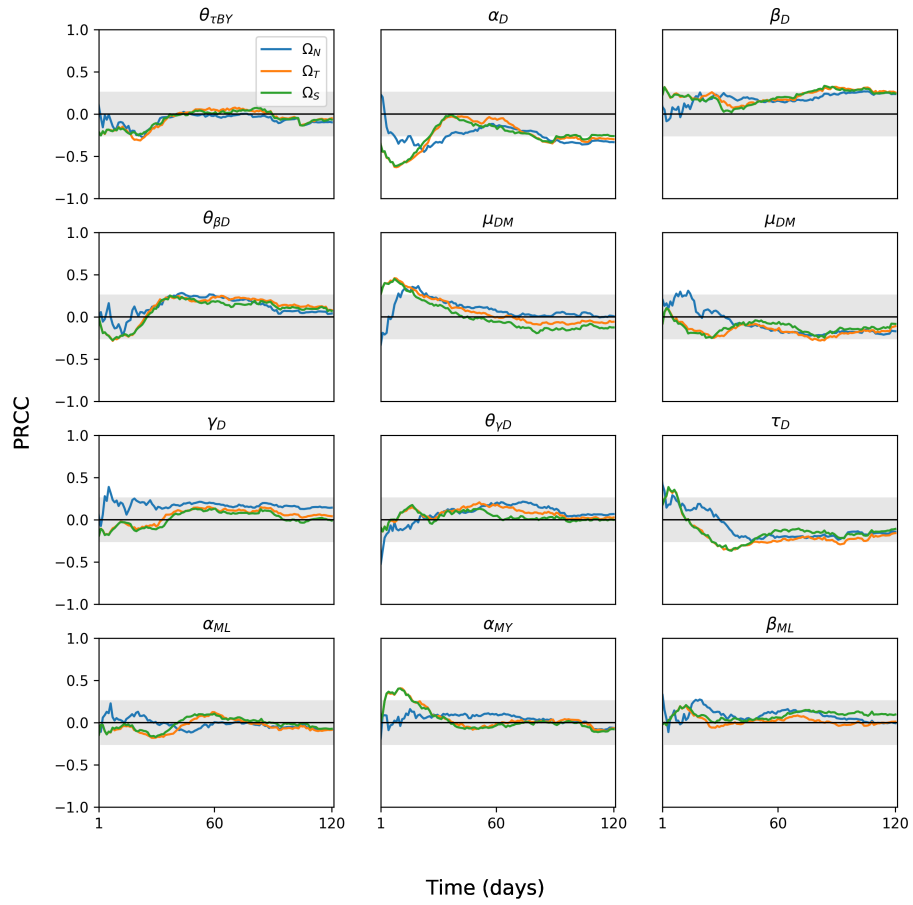


Figure B2: Sensitivity plots for various parameters within *TBMetaPopPy*, plotting the PRCC value of the parameter against the three outputs over time. Grey shaded area shows non-significance ( $p < 0.01$ ).

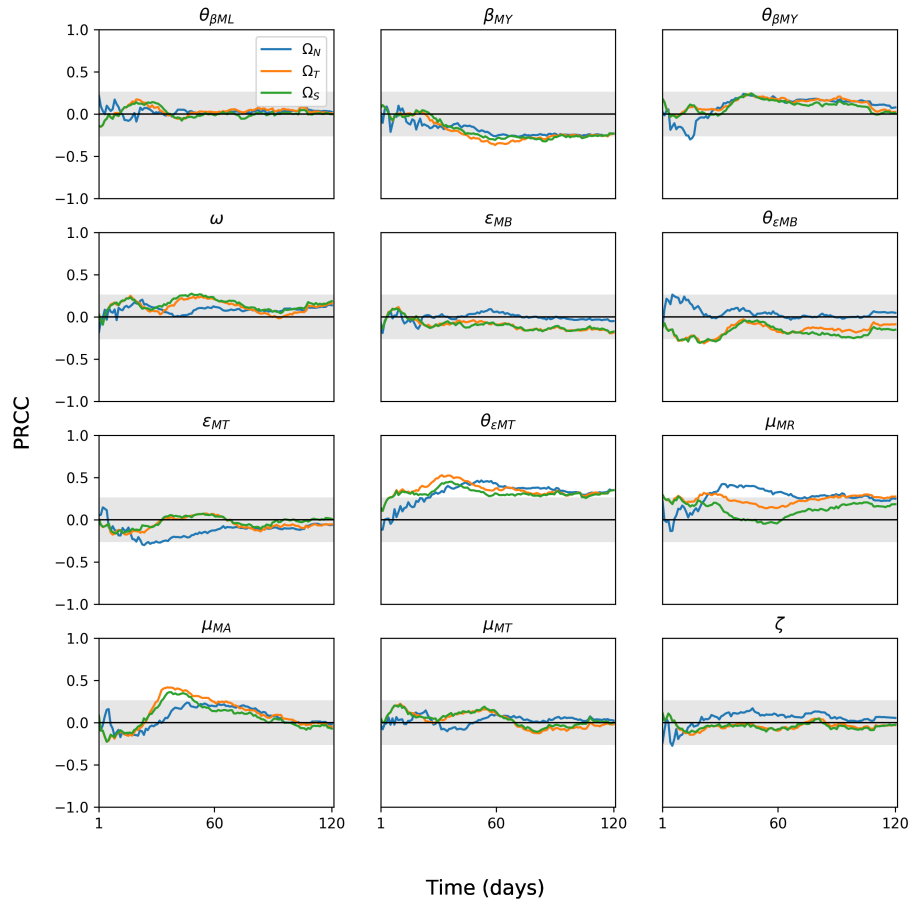


Figure B3: Sensitivity plots for various parameters within *TBMetaPopPy*, plotting the PRCC value of the parameter against the three outputs over time. Grey shaded area shows non-significance ( $p < 0.01$ ).

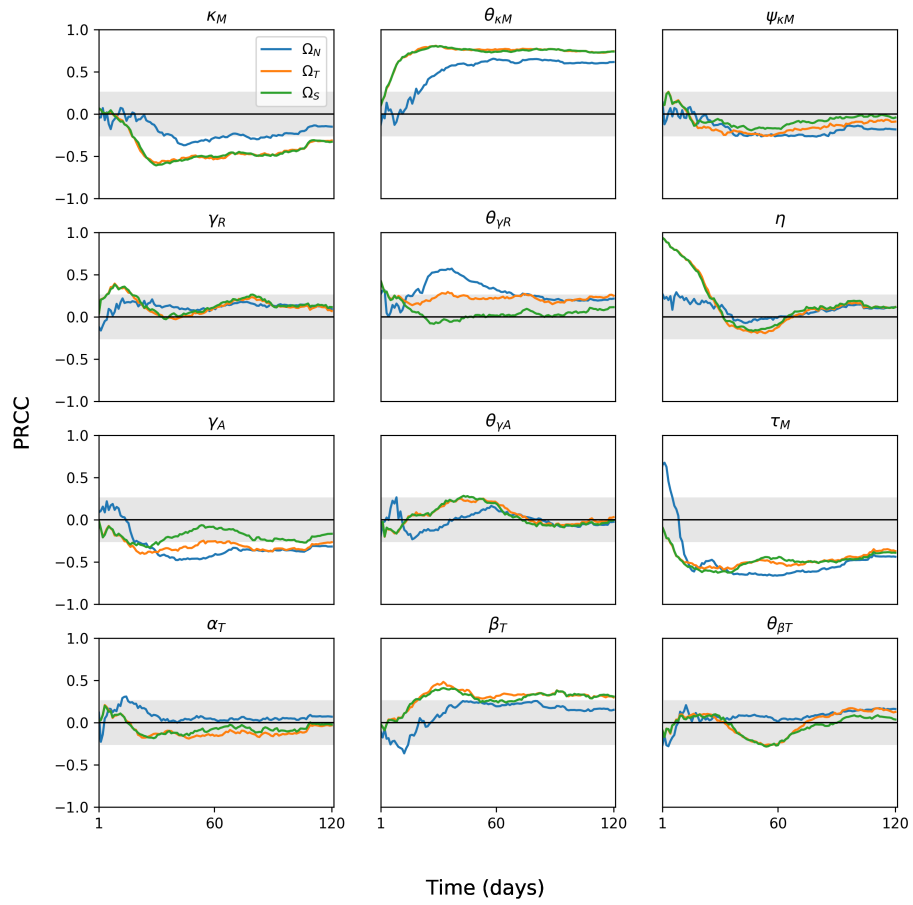


Figure B4: Sensitivity plots for various parameters within *TBMetaPopPy*, plotting the PRCC value of the parameter against the three outputs over time. Grey shaded area shows non-significance ( $p < 0.01$ ).

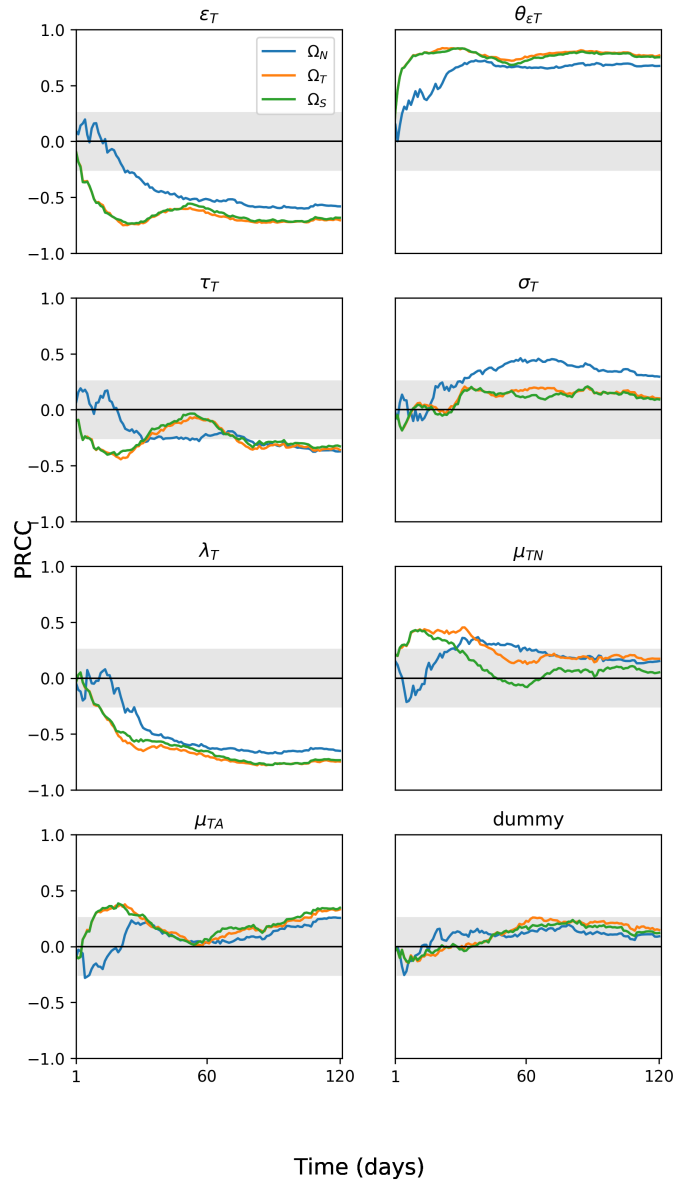


Figure B5: Sensitivity plots for various parameters within *TBMetapopPy*, plotting the PRCC value of the parameter against the three outputs over time. Grey shaded area shows non-significance ( $p < 0.01$ ).