Supplementary Information

Supplement A (Tables)

Table 1 Mathematical equations and Parameter values

Article	Equatioins	Parameters	Symbols	Range
Zheng et al., (2014)	$$K_t = K_0 \cdot \frac{n^3}{(1-n)^2} \cdot \frac{(1-n_0)^2}{n_0^3}$$	Initial saturated permeability coefficient before recharge during recharge [m/d]	K_0	2.2e-4, 1e-3
	$$K = \frac{n^3}{c(1-n)^2 S^2}$$	*porosity of the sand media [-]*	n	0.5, 0.99
	$$k = K_t / K_0$$	*initial porosity of aquifer media [-]*	n_0	-3, 0.99
		Korenzy constant based on solid volume	c	3.52, 402
		Specific surface area based on solid volume	S	1, 10
Schulz (2020)	K= $c_0/ \sigma_0^2 * \theta^3/(1- \theta)^2$	*Korenzy constant*	c_0	3.52, 402
		Specific surface with respect to the unit volume of the solid matrix	σ_0	1, 10
		Porosity	θ	-3, 0.99
Seytoux et al., (2017)	$Q = (K_u/e_u)*LW_p(h_S - h_a) = C_{riv} (h_S - h_a)$	*Horizontal hydraulic conductivity*	K_H	0.9144, 457.2
	$K_u/e_u = (2K_H/W_P) * \{ \Gamma_{anis\text{-}stand\text{-}\Delta\text{-}rcl}/[1 - (G/D_{aq}) \Gamma_{anis\text{-}stand\text{-}\Delta\text{-}rcl}]\}$	*Half width of the river*	B	10, 250
	$L = B + H$	*Depth in the river*	H	1.5, 7
		Clogging Layer Correction	$\Gamma_{anis\text{-}stand\text{-}\Delta\text{-}rcl}$	1e-4, 1e-2
		Grid size	G	90, 400
		Aquifer thickness	D_{aq}	0.1, 5145
		Length of the river reach within the river cell	L	90, 400
		Head in river	h_S	1, 10

		Head in aquifer	h_a	130, 270
Doble et al., (2012)	$F^* = I/(\Delta S+Q) = [K_c(h_w + d_c)]/\{d_c d_{gw}[(S_y/t_w) + (2T_{aq}/x_w^2)]\}$	*Saturated hydraulic conductivity of the surface soil or clogging layer [LT^{-1}]*	K_c	0.017, 7.13
		height of the wave above the bankfull elevation	h_w	10, 250
		Thickness of the clogging layer	d_c	1.5, 7
		depth of groundwater, taken at the centre of the flood wave extent	d_{gw}	1e-4, 1e-2
		Aquifer specific yield	S_y	90, 400
		duration of the flood wave	t_w	0.1, 5145
		Aquifer transmissivity	Taq	90, 400
		lateral extent of flooding	x_w	130, 270
Pedretti et al., (2012)	$I(x,t)=I_0\ (x)\ e^{-\lambda p\ (x)t}$	I(x, t=0), Initial infiltration capacity [LT-1]	I0 (x)	1e-5, 0.002
	$\lambda_p=m_p\ \lambda_p{*},$	coefficient of proportionality [-]	mp	1, 100
	$\lambda_p^*=\lambda_z\ v_a$	Filtration coefficient [L-1]	λz	0.044, 0.363
		Average particle attachment velocity to the soil matrix	v_a	1e-5, 1.1e-5
		Time [T]	t	1, 365
Kim et al., (2010)	$K = Q/(\Delta h/L_t{*}A)$	transmissivity of aquifer	T	1860, 2240
		Hydraulic head loss [mm]	Δh	0.001, 4.1
		length of the glass bead layer [mm]	L_t	130, 270
		Cross-sectional area of the glass bead layer [mm^2]	A	90, 400
Delfs et al., (2012)	$q_c = \Lambda_1\ exp[\Lambda_2\ (h - h_g)]$	Λ_1 *and* Λ_2 *are parameters implemented into OGS code.*	Λ_1	1e-1, 1
		Λ_1 *and* Λ_2 *are parameters implemented into OGS code.*	Λ_2	0.005, 0.1
		the water height in the river	h	1, 5

		Water table height	h_g	1, 10
Zhang et al., (2020)	$CC = E_{t0} – E_t/E_{t0}$	*Initial water absorbing capacity*	E_{t0}	0.143, 1.194
		Water absorbing capacity at time t	E_t	6.056, 6.282
Du et al., (2014)	$K = Ql/\pi r^2 \Delta h$	*flow rate [$m^3 d^{-1}$]*	Q	0.004992, 840
		distance between any two piezometric tubes along the column [m]	l	1, 10
		Inner diameter of the column [m]	r	1, 5
		hydraulic head difference at a difference l [m]	Δh	0.001, 4.1
Rehg et al., (2005)	$C(t)/C_0 = d'/m(t)\theta + d'$	*Effective stream depth (total volume of stream water per unit bed area)*	d'	1.5, 10.87
		Average depth of solute penetration into the bed	m	0, 0.18
		Bulk porosity	θ	-3, 0.99
Hoehn et al., (2006)	$q = xn_e/ \tau_w$	*path length from the infiltration point in the river to a nearby monitoring well*	x	1, 10
		flow-effective porosity of the riverbed and aquifer materials	n_e	-3, 0.99
		mean residence time of freshly infiltrated water	τ_w	1, 365
Moutsopoulos (2013)	$\lambda = (Kb)/\kappa$	*hydraulic conductivity of the aquifer*	K	1e-12, 1e0
		length of the base of semipervious layer of rectangular shape	b	1, 10
		Hydraulic conductivity of the clogging layer	κ	0.1, 50
Rudnick et al., (2015)	$c_f = 1/[G * (1/(1 + e^{(-k * G * Grad\text{-}norm)} * [(G/k_0) – 1)])) * clogg_{max}]$	*Soil heat flux density*	G	0.9, 1
		Hydraulic gradients	k	1, 12

		Vertical hydraulic gradient of the cell normalized by the steepest negative gradient of −0.25 m/m	*Grad-norm*	-0.26, -0.25
		hydraulic gradient	k_0	0.01, 0.02
		Maximum assumed clogging factor of 100 (–)	$clogg_{max}$	1, 100
Kaleris 1998)	$Q_{i,j} = (a - \Psi_{i,j})A/RL_{i,j}$	*water depth in the stream [m]*	a	1.5, 7
		P*ressure head below the clogging layer [m]*	$\Psi_{i,j}$	1, 2
		Stream bed area corresponding to the node (i j) [m²]	A	90, 400
		Hydraulic resistance of the clogging layer at the node (i, j) [s⁻¹]	$RL_{i,j}$	1e-12, 1e0
Dimkic et al., (2011)	$q_L(t) = [K_L/d](t) * \Delta S(t) * 2\pi * r * L$	*Conductivity of the well-lateral colmated layer [L T⁻¹]*	K_L	0.1, 50
		Thickness of the colmated layer [L]	d	0.1, 0.11
		Piezometric head drop at the colmated layer, the local drawdown	ΔS	0.001, 4.1
		Radius of the well lateral [L]	r	1, 5
		Length of the well lateral [L]	L	1, 10
Nguyen et al., (2021)	$Q_{ex} = h * (k_c/B) * (W_p * L * \%_{leak})$	*Wastewater in pipe (L)*	h	0, 0.1
		Hydraulic conductivity of colmation layer (L T⁻¹)	k_c	0.1, 50
		Thickness of the colmation layer (L)	B	0.1, 0.11
		Wetted perimeter generated with the water level in the sewer (L)	W_p	99.9, 99.999
		Length of the sewer segment of interest (L)	L	1, 10
		Percentage of leaking surfaces from the total area under the wetted perimeter.	$\%_{leak}$	0.005, 0.1

Boukhemacha et al., (2015)	$Q_{exf} = K * (\Delta H/B) * (W_p * L) * \%_{leaks}$	*Hydraulic conductivity of the clogging layer [m/day], 0.15 – 33.09 (literature), 7.34 – 29.37 (NEIMO calibration)*	*K*	0.1, 50
		Hydraulic head difference between the water level in the sewer and the hydraulic head of the surrounding groundwater (taken to be null) [m]	ΔH	0, 0.1
		Thickness of the clogging layer [m] = 0.1	*B*	0.1, 0.11
		Wetted parameter [m]	W_p	99.9, 99.999
		Sewer segment length [m]	*L*	1, 10
		Percentage of the leaky area from the total area generated by the wetted perimeter	$\%_{leaks}$	0.005, 0.1
Descloux et al., (2010)	$Porosity=[(Mt-\Sigma Mw)xp/Vt]*100$	*Total mass of sample core [kg] 9.17*	*Mt*	1, 10
		Mass of wet sediments	*Mw*	1, 5
		Water density [kg/m^3], 1000	*P*	999.9, 1000
		Total volume of sample core 12	*Vt*	1, 10
Pholkern et al., (2015)	$Kv = QL/(A \times \Delta h)$	*Outflow / Infiltration discharge [m^3/s]*	*Q*	0.004992, 840
		Thickness of sediment layer [m] 0.1	*L*	0.003, 0.006
		Area of flow [m^2]	*A*	5.65, 237.56
		Head difference [m]	Δh	0.001, 4.1
Pfeiffer et al., (2000)	$K = Q * \Delta x/\pi r^2 * \Delta dh$	*Flow rate (m^3 /day)*	*Q*	0.004992, 840
		Length (m) of the column between any two pressure sensors	Δx	1, 10
		Radius	*r*	1, 5
		Difference in hydraulic head between the same two points along the column.	Δh	0.001, 4.1

Cabalar et al., (2016)	$k = 6 \times 10^{-4} \times \frac{g}{v} \times [1 + 10(n - 0.26)] \times (d_{10})^2$	*Acceleration due to gravity*	*g*	9.8, 9.81
			v	1.16, 4.39
			n	0.34, 0.47
		grain size	d_10	0.09, 2.20
Cabalar et al., (2016)	$k = 8.3 \times 10^{-3} \times \frac{g}{v} \times \left[\frac{n^3}{(1-n)^2}\right] \times (d_{10})^2$	*Acceleration due to gravity*	*g*	9.8, 9.81
			v	1.16, 4.39
			n	0.34, 0.47
		grain size	d_10	0.09, 2.20
Schälchli (1992)	$K = K_0\, t^{-\alpha}$	*Initial (maximum) hydraulic conductivity*	K_0	9.7e-5, 4.9e-3
		Time [T]	t	1, 365
		Clogging exponent	α	0.328, 0.935
Grischek et al., (2016)	$\lambda=\sqrt{kMw}$	*Aquifer hydraulic conductivity (m/s)*	*k*	1e-12, 1e0
	$L = kc/dc = vi/\Delta h = 1/w$	*Saturated thickness of aquifer below the river (m)*	*M*	0.1, 5145
		Infiltration resistance (s)	*w*	1e-5, 0.002
Ghani et al., (2017)	$K=QL/Ath$	*Volume of discharge (cm3)*	*Q*	0.004992, 840
		Length of specimen (cm)	*L*	1, 10
		Cross sectional area of permeameter(cm2)	*A*	1, 10
		Time for discharge (s)	*t*	1, 365
		Hydraulic head difference (H1-H2)	*h*	0.001, 4.1
Tao et al., (2019)	$S=(0.05U^5)/(\sqrt{g}\, C^3\, \Delta^2\, D_{50})$	*Magnitude of depth-average flow velocity (m/s)*	*U*	40, 115
		Acceleration due to gravity (m/s2)	*g*	9.8, 9.81

		H1/6/n is the Chézy friction coefficient (m1/2/s)	*C*	0.015, 0.0156
		Relative density(ρs − ρw)/ρw	*Δ*	0.328, 0.935
		Median grainsize (m/s)	*D50*	0.02, 64
Koren et al., (2021)				
		Coefficient of aquifer elastic storativity	*S*	0.1, 50
		Transmissivity of aquifer	*T*	1860, 2240
Brunke (1999)	$\tau = pgRS$	*density of water*	*p*	999.8, 1000
	$\Theta = \tau/(p_s - p)gD$	*acceleration due to gravity*	*g*	9.8, 9.81
		hydraulic radius	*R*	1, 5
		slope	*S*	0.328, 0.935
		density of the sediment	*Ps*	0.328, 0.935
		grain size	*D*	0.02, 64
Wang et al., (2015)	$\chi_0 = k_0/m_0$	*Hydraulic conductivity [L/T]*	*k0*	0.017, 7.13
		Thickness[L]of the semi pervious layer of the riverbed	*m0*	1, 10
Cui et al., (2021)	$K = g/v \times 8.3 \times 10^{-3} \times (n^3/(1-n)^2) \times d_{10}^2$	gravitational acceleration	g	9.7e-5, 4.9e-3
		kinematic viscosity	v	0.328, 0.935
		porosity,	n	0.328, 0.935
		grain diameter (mm)	d10	1, 365

Table 2 Discription related to Mathematical Model. Time, Dimensions, and Processes

No.	References	Dimensions	Time	Maths	Processes
1	Grischek et al., (2016)	1-D	Transient	Analytical	Hydraulic Conductivity, GW-SW Interaction, Infiltration, Leakance, Clogging Depth
2	Ghani et al., (2017)	2-D	Steady	Analytical	GW-SW Interaction, Infiltration, Sediment Distribution, Sediment Size, Sediment Transport, Bed-load, Sediment Analysis, Hydraulic Conductivity, Shear Stress Calculations, Shear Velocity Calculations, Sieve Analysis, Flow Calculations, Water Turbidity
3	Pholkern et al., (2015)	2-D	Steady	Analytical	Leakance, Infiltration, Sediment Distribution, Sediment Size, Sediment Transport, Bed-load, Sediment Analysis, Hydraulic Conductivity, Shear Stress Calculations, Shear Velocity Calculations, Flow Calculations, Water Turbidity
4	Tao et al., (2019)	2-D	Steady	Numerical	Sediment Distribution, Sediment Size, Sediment Transport, Bed-load, Sediment Analysis
5	Koren et al., (2021)	1-D	Transient	Empirical	GW-SW Interaction, Sinusoidal Cyclic Disturbances, River-level Oscillations, Porosity, Pressure Propagation, Storativity, Transmissivity
6	Brunke (1999)	Dimensionless	Transient	Analytical	Infiltration, Sediment Distribution, Sediment Size, Sediment Transport, Bed-load, Sediment Analysis, Shear Stress Calculations, Shear Velocity Calculations, Porosity, Filtration

No.	References	Dimensions	Time	Maths	Processes
7	Wang et al., (2015)	2-D	Transient	Analytical	GW-SW Interaction, Leakance, Transmissivity
8	Harvey et al., (2015)	Dimensionless	Steady	Empirical	GW-SW Interaction, Sediment Distribution, Sediment Size, Sediment Transport, Bed-load, Sediment Analysis
9	Cui et al., (2021)	1-D	Steady	Numerical	Infiltration, Hydraulic Conductivity, Heat Tracing
10	Pedretti et al., (2012)	1-D	Steady	Hybrid	Infiltration, Sediment Distribution, Sediment Size, Sediment Transport, Bed-load, Sediment Analysis, Hydraulic Conductivity, Porosity, Mass Balance, Filtration, Heterogeneity, Darcy's Law, Temporal Variability
11	Kim et al., (2010)	2-D	Steady	Hybrid	GW-SW Interaction, Hydraulic Conductivity, Porosity, Flow Calculations, Density, Darcy's Law, Temporal Variability, Biofilm
12	Seytoux et al., (2017)	1-D, 2-D, 3-D, Dimensionless	Steady	Hybrid, Numerical, Empirical	GW-SW Interaction, Leakance, Hydraulic Conductivity, Flow Calculations, MODFLOW, Seepage, Wetted Parameter
13	Doble et al., (2012)	Dimensionless	Steady	Hybrid	GW-SW Interaction, Infiltration, Hydraulic Conductivity, Transmissivity, Temporal Variability, Storage
14	Delfs et al., (2012)	1-D, 2-D	Steady, Transient	Hybrid	GW-SW Interaction, , Leakance, Infiltration, Hydraulic Conductivity, Spatial Variability, Coupling Flux
15	Zhang et al., (2020)	Dimensionless	Transient	Hybrid, Empirical	GW-SW Interaction, Flow Calculations, Recharge Capacity, Kozeny-Carman Equation

No.	References	Dimensions	Time	Maths	Processes
16	Zheng et al., (2014)	1-D	Transient	Hybrid	GW-SW Interaction, Infiltration, Sediment Distribution, Sediment Size, Sediment Transport, Bed-load, Sediment Analysis, Porosity, Density, Darcy's Law, Recharge Capacity, Permeability, Kozeny-Carman Equation
17	Du et al., (2014)	Dimensionless	Transient	Analytical	Infiltration, Sediment Distribution, Sediment Size, Sediment Transport, Bed-load, Sediment Analysis, Hydraulic Conductivity, Porosity
18	Rehg et al., (2005)	1-D	Steady	Analytical, Hybrid, Numerical	GW-SW Interaction, Pumping, Sinusoidal Cyclic Disturbances, Sediment Distribution, Sediment Size, Sediment Transport, Bed-load, Sediment Analysis, Hydraulic Conductivity, Clogging Depth, Porosity, Flow Calculations, Pressure Propagation, Spatial Variability, Darcy's Law, Temporal Variability, Coupling Flux, Hyporheic Exchange, Tracers
19	Hoehn et al., (2006)	1-D	Steady	Hybrid	Infiltration, Sediment Distribution, Sediment Size, Sediment Transport, Bed-load, Sediment Analysis, Hydraulic Conductivity, Flow Calculations, Heat Tracing, Density, Tracers, Travel Times, Advection-dispersion Equation, Solute Transport, Seepage Velocity, Sinusoidal Temperature Fluctuation
20	Moutsopoulos (2013)	1-D, 2-D, Dimensionless	Transient	Hybrid	Leakance, Hydraulic Conductivity, Permeability, Boussinesq Equation, Adomian Decomposition Method, MODFLOW, Discharge, Dupuit Discharge Formula

No.	References	Dimensions	Time	Maths	Processes
21	Rudnick et al., (2015)	1-D	Steady	Analytical	GW-SW Interaction, Infiltration, Hydraulic Conductivity, Flow Calculations, Heat Tracing, Mass Balance, Spatial Variability, Discharge, Evapotranspiration
22	Schulz (2020)	1-D	Steady	Analytical	GW-SW Interaction, Porosity, Flow Calculations, Mass Balance, Permeability, Diffusivity, Muckenhoupt Class Weights, Degenerate Parameters
23	Kaleris 1998)	3-D, Dimensionless	Steady	Analytical, Hybrid, Numerical	GW-SW Interaction, Infiltration, Sediment Distribution, Sediment Size, Sediment Transport, Bed-load, Sediment Analysis, Hydraulic Conductivity, Flow Calculations, Discharge, Seepage, Water Balance, Hydraulic Resistance
24	Dimkic et al., (2011)	1-D, 3-D	Transient	Numerical	Infiltration, Hydraulic Conductivity, Porosity, Flow Calculations, Spatial Variability, Darcy's Law, Coupling Flux, Storage, Heat Tracing, Discharge, Hydraulic Resistance, Well Aging, Finite Element Method, Specific Drawdown, Clogging Layer Thickness
25	Levy et al., (2011)	2-D	Steady	Analytical	Infiltration, Sediment Distribution, Sediment Size, Sediment Transport, Bed-load, Sediment Analysis, Hydraulic Conductivity, Filtration, Spatial Variability, Temporal Variability, Tracers, Heat Tracing, Seepage, Clogging Layer Thickness
26	Nguyen et al., (2021)	1-D, 3-D	Steady	Analytical	Leakance, Hydraulic Conductivity, Permeability, Clogging Layer Thickness, Sewer Exfiltration, Soil Matrix, Wetted Parameter, Urban-GW Interaction

No.	References	Dimensions	Time	Maths	Processes
27	Boukhemacha et al., (2015)	2-D, 3-D	Steady	Analytical	Leakance, Infiltration, Hydraulic Conductivity, MODFLOW, Discharge, Clogging Layer Thickness, Sewer Exfiltration, Wetted Parameter, Urban-GW Interaction
28	Schälchli (1992)	Dimensionless	Steady	Analytical	GW-SW Interaction, Sediment Distribution, Sediment Size, Sediment Transport, Bed-load, Sediment Analysis, Hydraulic Conductivity, Shear Stress Calculations, Shear Velocity Calculations, Porosity, Flow Calculations, Darcy's Law, Discharge, Seepage
29	Descloux et al., (2010)	1-D	Steady	Analytical	GW-SW Interaction, Infiltration, Sediment Distribution, Sediment Size, Sediment Transport, Bed-load, Sediment Analysis, Hydraulic Conductivity, Porosity, Density, Discharge
30	Czuba et al., (2022)	Dimensionless	Steady	Empirical	GW-SW Interaction, Manning's Equation, Infiltration, Sediment Distribution, Sediment Size, Sediment Transport, Bed-load, Sediment Analysis, Shear Stress Calculations, Shear Velocity Calculations, Porosity, Flow Calculations, Discharge, Wetted Parameter
31	Welch et al., (2014)	2-D	Transient	Numerical	GW-SW Interaction, Hydraulic Conductivity, Pressure Propagation, Temporal Variability, Coupling Flux
32	Pfeiffer et al., (2000)	2-D	Steady	Analytical	Sediment Distribution, Sediment Size, Sediment Transport, Bed-load, Sediment Analysis, Hydraulic Conductivity, Porosity, Flow Calculations, Filtration, Spatial Variability, Temporal Variability, Tracers

No.	References	Dimensions	Time	Maths	Processes
33	Cabalar et al., (2016)	2-D	Steady	Empirical	Sediment Distribution, Sediment Size, Sediment Transport, Bed-load, Sediment Analysis, Hydraulic Conductivity, Flow Calculations, Density, Kozeny-Carman Equation, Bedform

Table 3 Processes

Author	Hydraulic Conductivity	GW-SW Interaction	Infiltration	Leakance	Clogging Depth	Sediment Distribution	Sediment Size
Grischek et al., (2016)	+	+	+	+	+	-	-
Ghani et al., (2017)	+	+	+	-	-	+	+
Pholkern et al., (2015)	+	-	+	+	-	+	+
Tao et al., (2019)	-	-	-	-	-	+	+
Koren et al., (2021)	-	+	-	-	-	-	-
Brunke (1999)	-	-	+	-	-	+	+
Wang et al., (2015)	-	+	-	+	-	-	-
Harvey et al., (2015)	-	+	-	-	-	+	+
Cui et al., (2021)	+	-	+	-	-	-	-
Pedretti et al., (2012)	+	-	+	-	-	+	+
Kim et al., (2010)	+	+	-	-	-	-	-
Seytoux et al., (2017)	+	+	-	+	-	-	-
Doble et al., (2012)	+	+	+	-	-	-	-
Delfs et al., (2012)	+	+	+	+	-	-	-
Zhang et al., (2020)	-	+	-	-	-	-	-
Zheng et al., (2014)	-	+	+	-	-	+	+
Du et al., (2014)	+	-	+	-	-	+	+
Rehg et al., (2005)	+	+	-	-	+	+	+
Hoehn et al., (2006)	+	-	+	-	-	+	+
Moutsopoulos (2013)	+	-	-	+	-	-	-
Rudnick et al., (2015)	+	+	+	-	-	-	-
Schulz (2020)	-	+	-	-	-	-	-
Kaleris 1998)	+	+	+	-	-	+	-

Author	Hydraulic Conductivity	GW-SW Interaction	Infiltration	Leakance	Clogging Depth	Sediment Distribution	Sediment Size
Dimkic et al., (2011)	+	-	+	-	-	-	-
Levy et al., (2011)	+	-	+	-	-	+	+
Nguyen et al., (2021)	+	-	-	+	-	-	-
Boukhemacha et al., (2015)	+	-	+	+	-	-	-
Schälchli (1992)	+	+	-	-	-	+	-
Descloux et al., (2010)	+	+	+	-	-	+	+
Czuba et al., (2022)	-	+	+	-	-	+	-
Welch et al., (2014)	+	+	-	-	-	-	-
Pfeiffer et al., (2000)	+	-	-	-	-	+	+
Cabalar et al., (2016)	+	-	-	-	-	+	+

Author	Sediment Transport	Bed-load	Sediment Analysis	Shear Stress Calculations	Shear Velocity Calculations	Sieve Analysis	Flow Calculations
Grischek et al., (2016)	-	-	-	-	-	-	-
Ghani et al., (2017)	+	+	+	+	+	+	+
Pholkern et al., (2015)	+	+	+	+	+	-	+
Tao et al., (2019)	+	+	+	-	-	-	-
Koren et al., (2021)	-	-	-	-	-	-	-
Brunke (1999)	+	+	+	+	+	-	-
Wang et al., (2015)	-	-	-	-	-	-	-
Harvey et al., (2015)	+	+	+	-	-	-	-
Cui et al., (2021)	-	-	-	-	-	-	-
Pedretti et al., (2012)	+	+	+	-	-	-	-
Kim et al., (2010)	-	-	-	-	-	-	+

Author	Sediment Transport	Bed-load	Sediment Analysis	Shear Stress Calculations	Shear Velocity Calculations	Sieve Analysis	Flow Calculations
Seytoux et al., (2017)	-	-	-	-	-	-	+
Doble et al., (2012)	-	-	-	-	-	-	-
Delfs et al., (2012)	-	-	-	-	-	-	-
Zhang et al., (2020)	-	-	-	-	-	-	+
Zheng et al., (2014)	+	+	+	-	-	-	-
Du et al., (2014)	+	+	+	-	-	-	-
Rehg et al., (2005)	+	+	+	-	-	-	+
Hoehn et al., (2006)	+	+	+	-	-	-	+
Moutsopoulos (2013)	-	-	-	-	-	-	-
Rudnick et al., (2015)	-	-	-	-	-	-	+
Schulz (2020)	-	-	-	-	-	-	+
Kaleris 1998)	+	+	+	-	-	-	+
Dimkic et al., (2011)	-	-	-	-	-	-	+
Levy et al., (2011)	+	+	+	-	-	-	-
Nguyen et al., (2021)	-	-	-	-	-	-	-
Boukhemacha et al., (2015)	-	-	-	-	-	-	-
Schälchli (1992)	+	+	+	+	+	-	+
Descloux et al., (2010)	+	+	+	-	-	-	-
Czuba et al., (2022)	+	+	+	+	+	-	+
Welch et al., (2014)	-	-	-	-	-	-	-
Pfeiffer et al., (2000)	+	+	+	-	-	-	+
Cabalar et al., (2016)	+	+	+	-	-	-	+

Author	Water Turbidity	Sinusoidal Cyclic Disturbances	River-level Oscillations	Porosity	Pressure Propagation	Storativity	Transmissivity
Grischek et al., (2016)	-	-	-	-	-	-	-
Ghani et al., (2017)	+	-	-	-	-	-	-
Pholkern et al., (2015)	+	-	-	-	-	-	-
Tao et al., (2019)	-	-	-	-	-	-	-
Koren et al., (2021)	-	+	+	+	+	+	+
Brunke (1999)	-	-	-	+	-	-	-
Wang et al., (2015)	-	-	-	-	-	-	+
Harvey et al., (2015)	-	-	-	-	-	-	-
Cui et al., (2021)	-	-	-	-	-	-	-
Pedretti et al., (2012)	-	-	-	+	-	-	-
Kim et al., (2010)	-	-	-	+	-	-	-
Seytoux et al., (2017)	-	-	-	-	-	-	-
Doble et al., (2012)	-	-	-	-	-	-	+
Delfs et al., (2012)	-	-	-	-	-	-	-
Zhang et al., (2020)	-	-	-	-	-	-	-
Zheng et al., (2014)	-	-	-	+	-	-	-
Du et al., (2014)	-	-	-	+	-	-	-
Rehg et al., (2005)	-	+	-	+	+	-	-
Hoehn et al., (2006)	-	-	-	-	-	-	-
Moutsopoulos (2013)	-	-	-	-	-	-	-
Rudnick et al., (2015)	-	-	-	-	-	-	-
Schulz (2020)	-	-	-	+	-	-	-
Kaleris 1998)	-	-	-	-	-	-	-
Dimkic et al., (2011)	-	-	-	+	-	-	-

Author	Water Turbidity	Sinusoidal Cyclic Disturbances	River-level Oscillations	Porosity	Pressure Propagation	Storativity	Transmissivity
Levy et al., (2011)	-	-	-	-	-	-	-
Nguyen et al., (2021)	-	-	-	-	-	-	-
Boukhemacha et al., (2015)	-	-	-	-	-	-	-
Schälchli (1992)	-	-	-	+	-	-	-
Descloux et al., (2010)	-	-	-	+	-	-	-
Czuba et al., (2022)	-	-	-	+	-	-	-
Welch et al., (2014)	-	-	-	-	+	-	-
Pfeiffer et al., (2000)	-	-	-	+	-	-	-
Cabalar et al., (2016)	-	-	-	-	-	-	-

Author	Filtration	Heat Tracing	Mass Balance	Heterogeneity	Darcy's Law	Temporal Variability	Density
Grischek et al., (2016)	-	-	-	-	-	-	-
Ghani et al., (2017)	-	-	-	-	-	-	-
Pholkern et al., (2015)	-	-	-	-	-	-	-
Tao et al., (2019)	-	-	-	-	-	-	-
Koren et al., (2021)	-	-	-	-	-	-	-
Brunke (1999)	+	-	-	-	-	-	-
Wang et al., (2015)	-	-	-	-	-	-	-
Harvey et al., (2015)	-	-	-	-	-	-	-
Cui et al., (2021)	-	+	-	-	-	-	-
Pedretti et al., (2012)	+	-	+	+	+	+	-
Kim et al., (2010)	-	-	-	-	+	+	+
Seytoux et al., (2017)	-	-	-	-	-	-	-

Author	Filtration	Heat Tracing	Mass Balance	Heterogeneity	Darcy's Law	Temporal Variability	Density
Doble et al., (2012)	-	-	-	-	-	+	-
Delfs et al., (2012)	-	-	-	-	-	-	-
Zhang et al., (2020)	-	-	-	-	-	-	-
Zheng et al., (2014)	-	-	-	-	+	-	+
Du et al., (2014)	-	-	-	-	-	-	-
Rehg et al., (2005)	-	-	-	-	+	+	-
Hoehn et al., (2006)	-	+	-	-	-	-	+
Moutsopoulos (2013)	-	-	-	-	-	-	-
Rudnick et al., (2015)	-	+	+	-	-	-	-
Schulz (2020)	-	-	+	-	-	-	-
Kaleris 1998)	-	-	-	-	-	-	-
Dimkic et al., (2011)	-	+	-	-	+	-	-
Levy et al., (2011)	+	+	-	-	-	+	-
Nguyen et al., (2021)	-	-	-	-	-	-	-
Boukhemacha et al., (2015)	-	-	-	-	-	-	-
Schälchli (1992)	-	-	-	-	+	-	-
Descloux et al., (2010)	-	-	-	-	-	-	+
Czuba et al., (2022)	-	-	-	-	-	-	-
Welch et al., (2014)	-	-	-	-	-	+	-
Pfeiffer et al., (2000)	+	-	-	-	-	+	-
Cabalar et al., (2016)	-	-	-	-	-	-	+

Author	Biofilm	MODFLOW	Seepage	Wetted Parameter	Storage	Spatial Variability	Coupling Flux
Grischek et al., (2016)	-	-	-	-	-	-	-
Ghani et al., (2017)	-	-	-	-	-	-	-

Author	Biofilm	MODFLOW	Seepage	Wetted Parameter	Storage	Spatial Variability	Coupling Flux
Pholkern et al., (2015)	-	-	-	-	-	-	-
Tao et al., (2019)	-	-	-	-	-	-	-
Koren et al., (2021)	-	-	-	-	-	-	-
Brunke (1999)	-	-	-	-	-	-	-
Wang et al., (2015)	-	-	-	-	-	-	-
Harvey et al., (2015)	-	-	-	-	-	-	-
Cui et al., (2021)	-	-	-	-	-	-	-
Pedretti et al., (2012)	-	-	-	-	-	-	-
Kim et al., (2010)	+	-	-	-	-	-	-
Morel-Seytoux et al., (2017)	-	+	+	+	-	-	-
Doble et al., (2012)	-	-	-	-	+	-	-
Delfs et al., (2012)	-	-	-	-	-	+	+
Zhang et al., (2020)	-	-	-	-	-	-	-
Zheng et al., (2014)	-	-	-	-	-	-	-
Du et al., (2014)	-	-	-	-	-	-	-
Rehg et al., (2005)	-	-	-	-	-	+	+
Hoehn et al., (2006)	-	-	-	-	-	-	-
Moutsopoulos (2013)	-	+	-	-	-	-	-
Rudnick et al., (2015)	-	-	-	-	-	+	-
Schulz (2020)	-	-	-	-	-	-	-
Kaleris 1998)	-	-	+	-	-	-	-
Dimkic et al., (2011)	-	-	-	-	+	+	+
Levy et al., (2011)	-	-	+	-	-	+	-
Nguyen et al., (2021)	-	-	-	+	-	-	-
Boukhemacha et al., (2015)	-	+	-	+	-	-	-

Author	Biofilm	MODFLOW	Seepage	Wetted Parameter	Storage	Spatial Variability	Coupling Flux
Schälchli (1992)	-	-	+	-	-	-	-
Descloux et al., (2010)	-	-	-	-	-	-	-
Czuba et al., (2022)	-	-	-	+	-	-	-
Welch et al., (2014)	-	-	-	-	-	-	+
Rinck-Pfeiffer et al., (2000)	-	-	-	-	-	+	-
Cabalar et al., (2016)	-	-	-	-	-	-	-

Author	Recharge Capacity	Kozeny-Carman Equation	Permeability	Pumping	Hyporheic Exchange	Tracers	Travel Times
Grischek et al., (2016)	-	-	-	-	-	-	-
Ghani et al., (2017)	-	-	-	-	-	-	-
Pholkern et al., (2015)	-	-	-	-	-	-	-
Tao et al., (2019)	-	-	-	-	-	-	-
Koren et al., (2021)	-	-	-	-	-	-	-
Brunke (1999)	-	-	-	-	-	-	-
Wang et al., (2015)	-	-	-	-	-	-	-
Harvey et al., (2015)	-	-	-	-	-	-	-
Cui et al., (2021)	-	-	-	-	-	-	-
Pedretti et al., (2012)	-	-	-	-	-	-	-
Kim et al., (2010)	-	-	-	-	-	-	-
Seytoux et al., (2017)	-	-	-	-	-	-	-
Doble et al., (2012)	-	-	-	-	-	-	-
Delfs et al., (2012)	-	-	-	-	-	-	-
Zhang et al., (2020)	+	+	-	-	-	-	-
Zheng et al., (2014)	+	+	+	-	-	-	-

Author	Recharge Capacity	Kozeny-Carman Equation	Permeability	Pumping	Hyporheic Exchange	Tracers	Travel Times
Du et al., (2014)	-	-	-	-	-	-	-
Rehg et al., (2005)	-	-	-	+	+	+	-
Hoehn et al., (2006)	-	-	-	-	-	+	+
Moutsopoulos (2013)	-	-	+	-	-	-	-
Rudnick et al., (2015)	-	-	-	-	-	-	-
Schulz (2020)	-	-	+	-	-	-	-
Kaleris 1998)	-	-	-	-	-	-	-
Dimkic et al., (2011)	-	-	-	-	-	-	-
Levy et al., (2011)	-	-	-	-	-	+	-
Nguyen et al., (2021)	-	-	+	-	-	-	-
Boukhemacha et al., (2015)	-	-	-	-	-	-	-
Schälchli (1992)	-	-	-	-	-	-	-
Descloux et al., (2010)	-	-	-	-	-	-	-
Czuba et al., (2022)	-	-	-	-	-	-	-
Welch et al., (2014)	-	-	-	-	-	-	-
Pfeiffer et al., (2000)	-	-	-	-	-	+	-
Cabalar et al., (2016)	-	+	-	-	-	-	-

Author	Advection-dispersion Equation	Solute Transport	Seepage Velocity	Sinusoidal Temperature Fluctuation	Boussinesq Equation	Adomian Decomposition Method
Grischek et al., (2016)	-	-	-	-	-	-
Ghani et al., (2017)	-	-	-	-	-	-
Pholkern et al., (2015)	-	-	-	-	-	-
Tao et al., (2019)	-	-	-	-	-	-

Author	Advection-dispersion Equation	Solute Transport	Seepage Velocity	Sinusoidal Temperature Fluctuation	Boussinesq Equation	Adomian Decomposition Method
Koren et al., (2021)	-	-	-	-	-	-
Brunke (1999)	-	-	-	-	-	-
Wang et al., (2015)	-	-	-	-	-	-
Harvey et al., (2015)	-	-	-	-	-	-
Cui et al., (2021)	-	-	-	-	-	-
Pedretti et al., (2012)	-	-	-	-	-	-
Kim et al., (2010)	-	-	-	-	-	-
Seytoux et al., (2017)	-	-	-	-	-	-
Doble et al., (2012)	-	-	-	-	-	-
Delfs et al., (2012)	-	-	-	-	-	-
Zhang et al., (2020)	-	-	-	-	-	-
Zheng et al., (2014)	-	-	-	-	-	-
Du et al., (2014)	-	-	-	-	-	-
Rehg et al., (2005)	-	-	-	-	-	-
Hoehn et al., (2006)	+	+	+	+	-	-
Moutsopoulos (2013)	-	-	-	-	+	+
Rudnick et al., (2015)	-	-	-	-	-	-
Schulz (2020)	-	-	-	-	-	-
Kaleris 1998)	-	-	-	-	-	-
Dimkic et al., (2011)	-	-	-	-	-	-
Levy et al., (2011)	-	-	-	-	-	-
Nguyen et al., (2021)	-	-	-	-	-	-
Boukhemacha et al., (2015)	-	-	-	-	-	-
Schälchli (1992)	-	-	-	-	-	-

Author	Advection-dispersion Equation	Solute Transport	Seepage Velocity	Sinusoidal Temperature Fluctuation	Boussinesq Equation	Adomian Decomposition Method
Descloux et al., (2010)	-	-	-	-	-	-
Czuba et al., (2022)	-	-	-	-	-	-
Welch et al., (2014)	-	-	-	-	-	-
Pfeiffer et al., (2000)	-	-	-	-	-	-
Cabalar et al., (2016)	-	-	-	-	-	-

Author	Discharge	Dupuit Discharge Formula	Evapotranspiration	Diffusivity	Muckenhoupt Class Weights	Degenerate Parameters
Grischek et al., (2016)	-	-	-	-	-	-
Ghani et al., (2017)	-	-	-	-	-	-
Pholkern et al., (2015)	-	-	-	-	-	-
Tao et al., (2019)	-	-	-	-	-	-
Koren et al., (2021)	-	-	-	-	-	-
Brunke (1999)	-	-	-	-	-	-
Wang et al., (2015)	-	-	-	-	-	-
Harvey et al., (2015)	-	-	-	-	-	-
Cui et al., (2021)	-	-	-	-	-	-
Pedretti et al., (2012)	-	-	-	-	-	-
Kim et al., (2010)	-	-	-	-	-	-
Seytoux et al., (2017)	-	-	-	-	-	-
Doble et al., (2012)	-	-	-	-	-	-
Delfs et al., (2012)	-	-	-	-	-	-
Zhang et al., (2020)	-	-	-	-	-	-
Zheng et al., (2014)	-	-	-	-	-	-

Author	Discharge	Dupuit Discharge Formula	Evapotranspiration	Diffusivity	Muckenhoupt Class Weights	Degenerate Parameters
Du et al., (2014)	-	-	-	-	-	-
Rehg et al., (2005)	-	-	-	-	-	-
Hoehn et al., (2006)	-	-	-	-	-	-
Moutsopoulos (2013)	+	+	-	-	-	-
Rudnick et al., (2015)	+	-	+	-	-	-
Schulz (2020)	-	-	-	+	+	+
Kaleris 1998)	+	-	-	-	-	-
Dimkic et al., (2011)	+	-	-	-	-	-
Levy et al., (2011)	-	-	-	-	-	-
Nguyen et al., (2021)	-	-	-	-	-	-
Boukhemacha et al., (2015)	+	-	-	-	-	-
Schälchli (1992)	+	-	-	-	-	-
Descloux et al., (2010)	+	-	-	-	-	-
Czuba et al., (2022)	+	-	-	-	-	-
Welch et al., (2014)	-	-	-	-	-	-
Pfeiffer et al., (2000)	-	-	-	-	-	-
Cabalar et al., (2016)	-	-	-	-	-	-

Author	Sediment Size	Water Balance	Hydraulic Resistance	Well Aging	Finite Element Method	Specific Drawdown	Clogging Layer Thickness
Grischek et al., (2016)	-	-	-	-	-	-	-
Ghani et al., (2017)	-	-	-	-	-	-	-
Pholkern et al., (2015)	-	-	-	-	-	-	-
Tao et al., (2019)	-	-	-	-	-	-	-

Author	Sediment Size	Water Balance	Hydraulic Resistance	Well Aging	Finite Element Method	Specific Drawdown	Clogging Layer Thickness
Koren et al., (2021)	-	-	-	-	-	-	-
Brunke (1999)	-	-	-	-	-	-	-
Wang et al., (2015)	-	-	-	-	-	-	-
Harvey et al., (2015)	-	-	-	-	-	-	-
Cui et al., (2021)	-	-	-	-	-	-	-
Pedretti et al., (2012)	-	-	-	-	-	-	-
Kim et al., (2010)	-	-	-	-	-	-	-
Seytoux et al., (2017)	-	-	-	-	-	-	-
Doble et al., (2012)	-	-	-	-	-	-	-
Delfs et al., (2012)	-	-	-	-	-	-	-
Zhang et al., (2020)	-	-	-	-	-	-	-
Zheng et al., (2014)	-	-	-	-	-	-	-
Du et al., (2014)	-	-	-	-	-	-	-
Rehg et al., (2005)	-	-	-	-	-	-	-
Hoehn et al., (2006)	-	-	-	-	-	-	-
Moutsopoulos (2013)	-	-	-	-	-	-	-
Rudnick et al., (2015)	-	-	-	-	-	-	-
Schulz (2020)	-	-	-	-	-	-	-
Kaleris 1998)	+	+	+	-	-	-	-
Dimkic et al., (2011)	-	-	+	+	+	+	+
Levy et al., (2011)	-	-	-	-	-	-	+
Nguyen et al., (2021)	-	-	-	-	-	-	+
Boukhemacha et al., (2015)	-	-	-	-	-	-	+
Schälchli (1992)	+	-	-	-	-	-	-

Author	Sediment Size	Water Balance	Hydraulic Resistance	Well Aging	Finite Element Method	Specific Drawdown	Clogging Layer Thickness
Descloux et al., (2010)	-	-	-	-	-	-	-
Czuba et al., (2022)	+	-	-	-	-	-	-
Welch et al., (2014)	-	-	-	-	-	-	-
Pfeiffer et al., (2000)	-	-	-	-	-	-	-
Cabalar et al., (2016)	-	-	-	-	-	-	-

Author	Sewer Exfiltration	Soil Matrix	Urban-GW Interaction	Manning's Equation	Bedform
Grischek et al., (2016)	-	-	-	-	-
Ghani et al., (2017)	-	-	-	-	-
Pholkern et al., (2015)	-	-	-	-	-
Tao et al., (2019)	-	-	-	-	-
Koren et al., (2021)	-	-	-	-	-
Brunke (1999)	-	-	-	-	-
Wang et al., (2015)	-	-	-	-	-
Harvey et al., (2015)	-	-	-	-	-
Cui et al., (2021)	-	-	-	-	-
Pedretti et al., (2012)	-	-	-	-	-
Kim et al., (2010)	-	-	-	-	-
Seytoux et al., (2017)	-	-	-	-	-
Doble et al., (2012)	-	-	-	-	-

Author	Sewer Exfiltration	Soil Matrix	Urban-GW Interaction	Manning's Equation	Bedform
Delfs et al., (2012)	-	-	-	-	-
Zhang et al., (2020)	-	-	-	-	-
Zheng et al., (2014)	-	-	-	-	-
Du et al., (2014)	-	-	-	-	-
Rehg et al., (2005)	-	-	-	-	-
Hoehn et al., (2006)	-	-	-	-	-
Moutsopoulos (2013)	-	-	-	-	-
Rudnick et al., (2015)	-	-	-	-	-
Schulz (2020)	-	-	-	-	-
Kaleris (1998)	-	-	-	-	-
Dimkic et al., (2011)	-	-	-	-	-
Levy et al., (2011)	-	-	-	-	-
Nguyen et al., (2021)	+	+	+	-	-
Boukhemacha et al., (2015)	+	-	+	-	-
Schälchli (1992)	-	-	-	-	-
Descloux et al., (2010)	-	-	-	-	-
Czuba et al., (2022)	-	-	-	+	-
Welch et al., (2014)	-	-	-	-	-
Pfeiffer et al., (2000)	-	-	-	-	-
Cabalar et al., (2016)	-	-	-	-	+

Table 4 Most and Least sensitve Parameters based on First-order Indices and Least-order Indices

Article	Parameters	Symbols	FOI Most	TOI Most	FOI Least	TOI Least
Zheng et al., (2014)	*Initial saturated permeability coefficient before recharge during recharge [m/d]*	K_0	n_0	n_0	S	n
	Porosity of the sand media [-]	n				
	Initial porosity of aquifer media [-]	n_0				
	Korenzy constant based on solid volume	c				
	Specific surface area based on solid volume	S				
Schulz (2020)	*Korenzy constant*	c_0	θ	θ	σ_0	c_0
	Specific surface with respect to the unit volume of the solid matrix	σ_0				
	Porosity	θ				
Seytoux et al., (2017)	*Horizontal hydraulic conductivity*	K_H	D_{aq}	D_{aq}	L	$\Gamma_{anis\text{-}stand\text{-}\Delta\text{-}rcl}$
	Half width of the river	B				
	Depth in the river	H				
	Clogging Layer Correction	$\Gamma_{anis\text{-}stand\text{-}\Delta\text{-}rcl}$				
	Grid size	G				
	Aquifer thickness	D_{aq}				
	Length of the river reach within the river cell	L				
	Head in river	h_S				
	Head in aquifer	h_a				
Doble et al., (2012)	*Saturated hydraulic conductivity of the surface soil or clogging layer [LT⁻¹]*	K_c	d_{gw}	d_{gw}	S_y	x_w
	Height of the wave above the bankfull elevation	h_w				
	Thickness of the clogging layer	d_c				
	Depth of groundwater, taken at the centre of the flood wave extent	d_{gw}				

	Aquifer specific yield	S_y				
	Duration of the flood wave	t_w				
	Aquifer transmissivity	Taq				
	Lateral extent of flooding	x_w				
Pedretti et al., (2012)	*I(x, t=0), Initial infiltration capacity [LT-1]*	I0 (x)	I0 (x)	I0 (x)	mp	v_a
	Coefficient of proportionality [-]	mp				
	Filtration coefficient [L-1]	λz				
	Average particle attachment velocity to the soil matrix	v_a				
	Time [T]	t				
Kim et al., (2010)	*Transmissivity of aquifer*	T	A	A	Δh	Δh
	Hydraulic head loss [mm]	Δh				
	Length of the glass bead layer [mm]	L_t				
	Cross-sectional area of the glass bead layer [mm²]	A				
Delfs et al., (2012)	*Λ_1 and Λ_2 are parameters implemented into OGS code.*	Λ_1	h_g	h_g	Λ_1	Λ_1
	Λ_1 and Λ_2 are parameters implemented into OGS code.	Λ_2				
	The water height in the river	h				
	Water table height	h_g				
Zhang et al., (2020)	*Initial water absorbing capacity*	E_{t0}	E_{t0}	E_{t0}	E_t	E_t
	Water absorbing capacity at time t	E_t				
Du et al., (2014)	*Flow rate [$m^3 d^{-1}$]*	Q	Δh	Δh	l	Q
	Distance between any two piezometric tubes along the column [m]	l				
	Inner diameter of the column [m]	r				
	Hydraulic head difference at a difference l [m]	Δh				

Rehg et al., (2005)	Effective stream depth (total volume of stream water per unit bed area)	d	θ	θ	d	d
	Average depth of solute penetration into the bed	m				
	Bulk porosity	θ				
Hoehn et al., (2006)	Path length from the infiltration point in the river to a nearby monitoring well	x	n_e	τ_w	τ_w	n_e
	Flow-effective porosity of the riverbed and aquifer materials	n_e				
	Mean residence time of freshly infiltrated water	τ_w				
Moutsopoulos (2013)	Hydraulic conductivity of the aquifer	K	κ	κ	b	b
	Length of the base of semipervious layer of rectangular shape	b				
	Hydraulic conductivity of the clogging layer	κ				
Rudnick et al., (2015)	Soil heat flux density	G	$clogg_{max}$	$clogg_{max}$	G	Grad-norm
	Hydraulic gradients	k				
	Vertical hydraulic gradient of the cell normalized by the steepest negative gradient of −0.25 m/m	Grad-norm				
	Hydraulic gradient	k_0				
	Maximum assumed clogging factor of 100 (–)	$clogg_{max}$				
Kaleris (1998)	Water depth in the stream [m]	a	$RL_{i,j}$	$RL_{i,j}$	$\Psi_{i,j}$	$\Psi_{i,j}$
	Pressure head below the clogging layer [m]	$\Psi_{i,j}$				
	Stream bed area corresponding to the node (i j) [m^2]	A				
	Hydraulic resistance of the clogging layer at the node (i, j) [s^{-1}]	$RL_{i,j}$				
Dimkic et al., (2011)	Conductivity of the well-lateral colmated layer [$L\ T^{-1}$]	K_L	K_L	L	d	d

	Thickness of the colmated layer [L]	*d*				
	Piezometric head drop at the colmated layer, the local drawdown	*ΔS*				
	Radius of the well lateral [L]	*r*				
	Length of the well lateral [L]	*L*				
Nguyen et al., (2021)	*Wastewater in pipe (L)*	*h*	*h*	*h*	W_p	W_p
	Hydraulic conductivity of colmation layer (L T^{-1})	k_c				
	Thickness of the colmation layer (L)	*B*				
	Wetted perimeter generated with the water level in the sewer (L)	W_p				
	Length of the sewer segment of interest (L)	*L*				
	Percentage of leaking surfaces from the total area under the wetted perimeter.	$\%_{leak}$				
Boukhemacha et al., (2015)	*Hydraulic conductivity of the clogging layer [m/day], 0.15 – 33.09 (literature), 7.34 – 29.37 (NEIMO calibration)*	*K*	*K*	*K*	W_p	W_p
	Hydraulic head difference between the water level in the sewer and the hydraulic head of the surrounding groundwater (taken to be null) [m]	*ΔH*				
	Thickness of the clogging layer [m] = 0.1	*B*				
	Wetted parameter [m]	W_p				
	Sewer segment length [m]	*L*				
	Percentage of the leaky area from the total area generated by the wetted perimeter	$\%_{leaks}$				
Descloux et al., (2010)	*Total mass of sample core [kg] 9.17*	*Mt*	*Mt*	*Vt*	*P*	*P*
	Mass of wet sediments	*Mw*				
	Water density [kg/m^3], 1000	*P*				
	Total volume of sample core 12	*Vt*				

Pholkern et al., (2015)	*Outflow / Infiltration discharge [m^3/s]*	*Q*	*Δh*	*Δh*	*L*	*Q*
	Thickness of sediment layer [m] 0.1	*L*				
	Area of flow [m^2]	*A*				
	Head difference [m]	*Δh*				
Pfeiffer et al., (2000)	*Flow rate (m^3 /day)*	*Q*	*r*	*r*	*Δh*	*Q*
	Length (m) of the column between any two pressure sensors	*Δx*				
	Radius	*r*				
	Difference in hydraulic head between the same two points along the column.	*Δh*				
Cabalar et al., (2016)	*Acceleration due to gravity*	*g*	d_10	d_10	n	g
		v				
		n				
	Grain size	d_10				
Cabalar et al., (2016)	*Acceleration due to gravity*	*g*	d_10	d_10	n	g
		v				
		n				
	Grain size	d_10				
Schälchli (1992)	*Initial (maximum) hydraulic conductivity*	K_0	t	*α*	K_0	t
	Time [T]	t				
	Clogging exponent	*α*				
Grischek et al., (2016)	*Aquifer hydraulic conductivity (m/s)*	*k*	*M*	*w*	*w*	*M*
	Saturated thickness of aquifer below the river (m)	*M*				
	Infiltration resistance (s)	*w*				
Ghani et al., (2017)	*Volume of discharge (cm3)*	*Q*	*h*	*h*	*Q*	*L*
	Length of specimen (cm)	*L*				
	Cross sectional area of permeameter(cm2)	*A*				

	Time for discharge (s)	*t*				
	Hydraulic head difference (H1-H2)	*h*				
Tao et al., (2019)	*Magnitude of depth-average flow velocity (m/s)*	*U*	*D50*	*D50*	*U*	*g*
	Acceleration due to gravity (m/s2)	*g*				
	H1/6/n is the Chézy friction coefficient (m1/2/s)	*C*				
	Relative density(ρs − ρw)/ρw	*Δ*				
	Median grainsize (m/s)	*D50*				
Koren et al., (2021)		*w*	*S*	*S*	*T*	*T*
	Coefficient of aquifer elastic storativity	*S*				
	Transmissivity of aquifer	*T*				
Brunke (1999)	*Density of water*	*p*	*D*	*D*	*Ps*	*g*
	Acceleration due to gravity	*g*				
	Hydraulic radius	*R*				
	Slope	*S*				
	Density of the sediment	*Ps*				
	Grain size	*D*				
Wang et al., (2015)	*Hydraulic conductivity [L/T]*	*k0*	*k0*	*m0*	*m0*	*k0*
	Thickness[L]of the semi pervious layer of the riverbed	*m0*				
Cui et al., (2021)	*Gravitational acceleration*	g	*d10*	*d10*	*v*	*g*
	Kinematic viscosity	v				
	Porosity	n				
	Grain diameter (mm)	d10				

Table 5 FAST Indices

Article	Parameters	Symbols	FAST Indices
Zheng et al., (2014)	*Initial saturated permeability coefficient before recharge during recharge [m/d]*	K_0	0.0733785
	Porosity of the sand media [-]	n	0.0795767
	Initial porosity of aquifer media [-]	n_0	0.0800003
	Korenzy constant based on solid volume	c	0.0367467
	Specific surface area based on solid volume	S	0.0602339
Schulz (2020)	*Korenzy constant*	c_0	0.0633462
	Specific surface with respect to the unit volume of the solid matrix	σ_0	0.0653129
	Porosity	θ	0.102019
Seytoux et al., (2017)	*Horizontal hydraulic conductivity*	K_H	0.238503
	Half width of the river	B	0.0689796
	Depth in the river	H	0.0729481
	Clogging Layer Correction	$\Gamma_{anis\text{-}stand\text{-}\Delta\text{-}rcl}$	0.0751846
	Grid size	G	0.0787874
	Aquifer thickness	D_{aq}	0.0859392
	Length of the river reach within the river cell	L	0.206199
	Head in river	h_S	0.0763781
	Head in aquifer	h_a	0.122009
Doble et al., (2012)	*Saturated hydraulic conductivity of the surface soil or clogging layer [LT^-1]*	K_c	0.229013
	Height of the wave above the bankfull elevation	h_w	0.0259208
	Thickness of the clogging layer	d_c	0.140516
	Depth of groundwater, taken at the centre of the flood wave extent	d_{gw}	0.365261
	Aquifer specific yield	S_y	0.0649274

	Duration of the flood wave	t_w	0.177092
	Aquifer transmissivity	*Taq*	0.0242165
	Lateral extent of flooding	x_w	0.0240933
Pedretti et al., (2012)	*I(x, t=0), Initial infiltration capacity [LT-1]*	*I0 (x)*	0.997041
	Coefficient of proportionality [-]	*mp*	0.000163685
	Filtration coefficient [L-1]	λz	0.000125046
	Average particle attachment velocity to the soil matrix	v_a	6.67481e-07
	Time [T]	*t*	0.000148
Kim et al., (2010)	*Transmissivity of aquifer*	*T*	0.0110379
	Hydraulic head loss [mm]	Δh	3.42233e-05
	Length of the glass bead layer [mm]	L_t	0.240908
	Cross-sectional area of the glass bead layer [mm^2]	*A*	0.838554
Delfs et al., (2012)	*Λ_1 and Λ_2 are parameters implemented into OGS code.*	Λ_1	0.171326
	Λ_1 and Λ_2 are parameters implemented into OGS code.	Λ_2	0.115065
	The water height in the river	*h*	0.0818247
	Water table height	h_g	0.505848
Zhang et al., (2020)	*Initial water absorbing capacity*	E_{t0}	0.948207
	Water absorbing capacity at time t	E_t	0.00204975
Du et al., (2014)	*Flow rate [m^{3}d^{-1}]*	*Q*	0.0814078
	Distance between any two piezometric tubes along the column [m]	*l*	0.0779471
	Inner diameter of the column [m]	*r*	0.0705313
	Hydraulic head difference at a difference l [m]	Δh	0.0827625
Rehg et al., (2005)	*Effective stream depth (total volume of stream water per unit bed area)*	*d*	0.143207
	Average depth of solute penetration into the bed	*m*	0.122489
	Bulk porosity	θ	0.322687
Hoehn et al., (2006)	*Path length from the infiltration point in the river to a nearby monitoring well*	*x*	0.0635262
	Flow-effective porosity of the riverbed and aquifer materials	n_e	0.123553

	Mean residence time of freshly infiltrated water	τ_w	0.139327
Moutsopoulos (2013)	*Hydraulic conductivity of the aquifer*	K	0.0690113
	Length of the base of semipervious layer of rectangular shape	b	0.159831
	Hydraulic conductivity of the clogging layer	κ	0.454331
Rudnick et al., (2015)	*Soil heat flux density*	G	0.0240908
	Hydraulic gradients	k	0.103195
	Vertical hydraulic gradient of the cell normalized by the steepest negative gradient of −0.25 m/m	*Grad-norm*	0.0255932
	Hydraulic gradient	k_0	0.0844287
	Maximum assumed clogging factor of 100 (–)	$clogg_{max}$	0.380096
Kaleris 1998)	*Water depth in the stream [m]*	a	0.085248
	Pressure head below the clogging layer [m]	$\Psi_{i,j}$	0.0750853
	Stream bed area corresponding to the node (i j) [m^2]	A	0.0781512
	Hydraulic resistance of the clogging layer at the node (i, j) [s^{-1}]	$RL_{i,j}$	0.106727
Dimkic et al., (2011)	*Conductivity of the well-lateral colmated layer [$L\ T^{-1}$]*	K_L	0.23083
	Thickness of the colmated layer [L]	d	0.00106568
	Piezometric head drop at the colmated layer, the local drawdown	ΔS	0.202816
	Radius of the well lateral [L]	r	0.264773
	Length of the well lateral [L]	L	0.177846
Nguyen et al., (2021)	*Wastewater in pipe (L)*	h	0.338312
	Hydraulic conductivity of colmation layer ($L\ T^{-1}$)	k_c	0.392218
	Thickness of the colmation layer (L)	B	0.00153785
	Wetted perimeter generated with the water level in the sewer (L)	W_p	0.000217995
	Length of the sewer segment of interest (L)	L	0.332389
	Percentage of leaking surfaces from the total area under the wetted perimeter.	$\%_{leak}$	0.195707
Boukhemacha et al., (2015)	*Hydraulic conductivity of the clogging layer [m/day], 0.15 – 33.09 (literature), 7.34 – 29.37 (NEIMO calibration)*	K	0.335956

	Hydraulic head difference between the water level in the sewer and the hydraulic head of the surrounding groundwater (taken to be null) [m]	ΔH	0.395361
	Thickness of the clogging layer [m] = 0.1	B	0.0015362
	Wetted parameter [m]	W_p	0.000217278
	Sewer segment length [m]	L	0.331956
	Percentage of the leaky area from the total area generated by the wetted perimeter	$\%_{leaks}$	0.195704
Descloux et al., (2010)	*Total mass of sample core [kg] 9.17*	Mt	0.350274
	Mass of wet sediments	Mw	0.235125
	Water density [kg/m^3], 1000	P	0.00126947
	Total volume of sample core 12	Vt	0.140883
Pholkern et al., (2015)	*Outflow / Infiltration discharge [m^3/s]*	Q	0.0805606
	Thickness of sediment layer [m] 0.1	L	0.0814811
	Area of flow [m^2]	A	0.0683833
	Head difference [m]	Δh	0.0810631
Pfeiffer et al., (2000)	*Flow rate (m^3 /day)*	Q	0.252247
	Length (m) of the column between any two pressure sensors	Δx	0.0698749
	Radius	r	0.324603
	Difference in hydraulic head between the same two points along the column.	Δh	0.128718
Cabalar et al., (2016)	*Acceleration due to gravity*	g	6.96074e-05
		v	0.166643
		n	0.0129774
	Grain size	d_10	0.76323
Cabalar et al., (2016)	*Acceleration due to gravity*	g	7.98897e-05
		v	0.2221
		n	0.216404
	Grain size	d_10	0.783892
Schälchli (1992)	*Initial (maximum) hydraulic conductivity*	K_0	0.209492

	Time [T]	*t*	0.472875
	Clogging exponent	*α*	0.127371
Grischek et al., (2016)	*Aquifer hydraulic conductivity (m/s)*	*k*	0.289317
	Saturated thickness of aquifer below the river (m)	*M*	0.250077
	Infiltration resistance (s)	*w*	0.471395
Ghani et al., (2017)	*Volume of discharge (cm3)*	*Q*	0.0923415
	Length of specimen (cm)	*L*	0.0729258
	Cross sectional area of permeameter(cm2)	*A*	0.0722299
	Time for discharge (s)	*t*	0.0813951
	Hydraulic head difference (H1-H2)	*h*	0.125881
Tao et al., (2019)	*Magnitude of depth-average flow velocity (m/s)*	*U*	0.160244
	Acceleration due to gravity (m/s2)	*g*	0.0590449
	H1/6/n is the Chézy friction coefficient (m1/2/s)	*C*	0.0410315
	Relative density(ρs − ρw)/ρw	*Δ*	0.0769761
	Median grainsize (m/s)	*D50*	0.316703
Koren et al., (2021)		*w*	0.435288
	Coefficient of aquifer elastic storativity	*S*	0.529202
	Transmissivity of aquifer	*T*	0.0104233
Brunke (1999)	*Density of water*	*ρ*	0.0628476
	Acceleration due to gravity	*g*	0.0758071
	Hydraulic radius	*R*	0.067325
	Slope	*S*	0.00966818
	Density of the sediment	*Ps*	0.038419
	Grain size	*D*	0.12331
Wang et al., (2015)	*Hydraulic conductivity [L/T]*	*k0*	0.31713
	Thickness[L]of the semi pervious layer of the riverbed	*m0*	0.468831
Cui et al., (2021)	*Gravitational acceleration*	*g*	0.0610823
	Kinematic viscosity	*ν*	0.0784258
	Porosity	*n*	0.0656045

	Grain diameter (mm)	*d10*	0.0803036

Table 6 Sobol indices and Optimal Inputs

Article	First Order Indices	Total Order Indices	Optimal Inputs
Zheng et al., (2014)	-0.00903959	0.00515316	2.20E-04
	-0.00870381	-1.38E-13	5.00E-01
	1	1.0087	9.90E-01
	-0.0118258	0.0296913	3.52E+00
	-0.145612	0.43338	9.86E+00
Schulz (2020)	-0.0201689	0.0437378	4.02E+02
	-0.0203562	0.645367	1.00E+00
	0.985809	1.03409	-3.00E+00
Seytoux et al., (2017)	0.129918	0.110153	9.14E-01
	-0.0164417	7.58E-16	1.00E+01
	-0.0164417	7.58E-16	1.50E+00
	-0.0164417	5.69E-16	1.00E-02
	-0.034778	0.551755	4.00E+02
	0.356889	0.953538	1.00E-01
	-0.0591219	0.225473	9.00E+01
	-0.0165791	9.27E-05	1.00E+01
	0.0248323	0.0312974	1.30E+02
Doble et al., (2012)	0.036047	0.469555	1.70E-02
	0.033823	0.433652	1.00E+01
	0.0700048	0.122725	7.00E+00
	0.437864	0.89932	1.00E-02
	-0.0160319	0.0360859	2.42E+02
	0.0676353	0.0523304	1.00E-01
	0.00989235	0.00366115	9.00E+01
	0.00268777	0.00173142	1.30E+02
Pedretti et al., (2012)	0.999156	0.870537	1.00E-05
	0.136031	0.000933148	1.00E+00

	0.139958	0.00035092	3.63E-01
	0.13749	2.79E-06	1.10E-05
	0.13731	0.000641881	1.00E+02
Kim et al., (2010)	0.0648774	0.0164657	1.86E+03
	0.0618126	-2.73E-16	1.00E-03
	0.248268	0.283935	1.30E+02
	0.585619	0.645615	9.00E+01
Delfs et al., (2012)	0.091938	0.182039	1.00E+00
	0.252023	0.376505	1.00E-01
	0.254644	0.186083	1.00E+00
	0.362292	0.666798	1.00E+01
Zhang et al., (2020)	0.999656	0	1.43E-01
	-0.0355463	0	6.28E+00
Du et al., (2014)	0.0591762	0.00444871	0.004992
	0.0333257	0.171589	1.00E+00
	0.0419325	0.451128	4.3155752
	0.368628	0.872661	4.1
Rehg et al., (2005)	-0.128585	0.373459	1.5
	-0.0601137	0.627742	0.18
	0.3872	0.7015	0.99
Hoehn et al., (2006)	-0.0128778	0.102935	10
	0.0191238	0.0445288	-3
	-0.391791	1.00068	1
Moutsopoulos (2013)	-0.0438464	0.254368	1.00E-12
	-0.0496101	0.153699	1.00E+00
	0.564772	1.02834	5.00E+01
Rudnick et al., (2015)	-0.00828519	0.00361901	9.00E-01
	0.0505858	0.402405	1.00E+00
	-0.00702523	0.000268988	-2.50E-01

	0.0028972	0.00992127	2.00E-02
	0.57688	0.947734	1.00E+02
Kaleris 1998)	0.108492	0.0105749	1.50E+00
	0.117599	0.00621088	2.00E+00
	0.113425	0.0177414	4.00E+02
	0.71928	0.756216	1.00E-12
Dimkic et al., (2011)	0.329926	0.203095	1.00E-01
	0.0994834	0.00115416	1.10E-01
	0.19751	0.244717	1.00E-03
	0.133271	0.188708	1.00E+00
	0.209995	0.309647	1.00E+00
Nguyen et al., (2021)	0.268363	0.386614	0.00E+00
	0.182783	0.359333	4.09E-01
	-0.00227884	0.00152919	1.10E-01
	-0.00993451	8.63E-08	9.99E+01
	0.0387578	0.239546	1.00E+00
	0.116153	0.228167	5.00E-03
Boukhemacha et al., (2015)	0.266466	0.384269	1.00E-01
	0.184559	0.361532	0.00E+00
	-0.00222142	0.00152844	1.10E-01
	-0.00990753	8.61E-08	9.99E+01
	0.0392449	0.239273	1.00E+00
	0.116777	0.22816	5.00E-03
Descloux et al., (2010)	0.534418	0.487096	1.00E+00
	0.0945905	0.148534	5.00E+00
	0.0528694	1.50E-09	1.00E+03
	0.3402	0.498562	1.00E+00
Pholkern et al., (2015)	0.020594	0.00347053	4.99E-03
	0.0107956	0.0227105	3.00E-03

	0.0329896	0.514633	5.65E+00
	0.267529	0.842007	4.10E+00
Pfeiffer et al., (2000)	0.0668982	0.19032	4.99E-03
	0.0425869	0.405161	1.00E+00
	0.579263	0.78121	5.00E+00
	0.00201209	0.365927	1.00E-03
Cabalar et al., (2016)	-0.0819419	1.93E-07	9.8
	0.123099	0.260732	4.39
	-0.0883531	0.0105105	0.34
	0.650553	0.864061	0.09
Cabalar et al., (2016)	-0.0157505	1.64E-07	9.8
	0.0706415	0.192323	3.06424371
	0.17051	0.315303	0.34
	0.397052	0.607559	0.09
Schälchli (1992)	0.151708	0.527614	9.70E-05
	0.280101	0.410574	3.79E+00
	0.20041	0.62494	9.35E-01
Grischek et al., (2016)	0.415293	0.366026	1.00E-12
	0.474256	0.354964	4.99E-01
	0.307262	0.389686	1.00E-05
Ghani et al., (2017)	-0.0351395	0.374354	4.99E-03
	-0.0222249	0.0894789	1.00E+00
	-0.0260268	0.396476	5.27E+00
	0.441476	0.299372	5.27E+00
	0.569188	0.758684	4.10E+00
Tao et al., (2019)	-0.0221944	0.179119	4.00E+01
	-0.0199014	8.15E-08	9.80E+00
	-0.0197839	0.00172876	1.56E-02
	-0.0109476	0.0359562	9.35E-01

	0.970109	1.00848	6.40E+01
Koren et al., (2021)	0.469436	0.494611	9.70E-05
	0.566234	0.523307	1.00E-01
	0.077902	0.00379803	1.86E+03
Brunke (1999)	-0.0355529	9.99E-16	1.00E+03
	-0.0355529	1.67E-16	9.80E+00
	-0.0326391	0.00960111	5.00E+00
	-0.0333942	0.00987242	9.35E-01
	-0.0355563	3.59E-09	9.35E-01
	0.982746	1.0341	2.00E-02
Wang et al., (2015)	0.491051	0.480837	0.017
	0.488939	0.662266	1.00E+01
Cui et al., (2021)	-0.0326803	0.00078734	
	-0.036251	0.0418122	
	-0.0237317	0.0757649	
	0.0901196	1.01973	

Table 7 Normalised and Standardised values

Article	Normalized first order indices using MinMaxScaler	Standardized first order indices using StandardScaler
Zheng et al., (2014)	1.41421354	-0.41348924
	0.11950667	-0.41269131
	1	1.98432127
	0.11678149	-0.42011021
	0	-0.73803051
Schulz (2020)	1.86E-04	-0.70690931
	0.00E+00	-0.70730424
	1.00E+00	1.41421354
Seytoux et al., (2017)	0.45441021	0.73641445
	0.10259368	-0.45027724
	0.10259368	-0.45027724
	0.10259368	-0.45027724
	0.05851733	-0.5989486
	1	2.57671136
	0	-0.79632998
	0.10226357	-0.45139072
	0.20180754	-0.1156248
Doble et al., (2012)	0.11473765	-0.32008814
	0.10983772	-0.33619683
	0.18955173	-0.07413457
	1	2.59023917
	0	-0.69729173
	0.18433132	-0.09129682
	0.05711499	-0.50952443
	0.04124222	-0.56170665
Pedretti et al., (2012)	1	1.99998639
	0	-0.50483208

	0.00454923	-0.49343708
	0.00169036	-0.50059803
	0.00148229	-0.50111921
Kim et al., (2010)	0.00585106	-0.82180073
	0	-0.83617124
	0.35596311	0.03809229
	1	1.61987968
Delfs et al., (2012)	0	-1.53690248
	0.59212962	0.12228431
	0.60182585	0.14945379
	1	1.26516437
Zhang et al., (2020)	1	1
	0	-1
Du et al., (2014)	0.07709627	-0.47386044
	0	-0.65781708
	0.02566887	-0.59656951
	1	1.72824703
Rehg et al., (2005)	0	-0.85148965
	0.13275118	-0.55212226
	1	1.40361191
Hoehn et al., (2006)	0.92212126	0.61963314
	1	0.79111081
	0	-1.41074394
Moutsopoulos (2013)	0.00938127	-0.69708633
	0	-0.71708012
	1	1.41416645
Rudnick et al., (2015)	0	-0.57597149
	0.1006058	-0.31771458
	0.00215316	-0.57044429

	0.0191098	-0.5269163
	1	1.99104666
Kaleris 1998)	0	-0.59513725
	0.01490968	-0.56044156
	0.0080771	-0.57634138
	1	1.73192019
Dimkic et al., (2011)	1	1.71571039
	0	-1.19381761
	0.42538179	0.04384261
	0.14662221	-0.76721619
	0.47956177	0.2014808
Nguyen et al., (2021)	1	1.66970299
	0.69248833	0.82612592
	0.02750893	-0.99806949
	0	-1.07353297
	0.17496483	-0.59356316
	0.45306699	0.1693367
Boukhemacha et al., (2015)	1	1.65450442
	0.70363702	0.84455306
	0.02781061	-1.00246082
	0	-1.07846641
	0.17784797	-0.59241309
	0.45838368	0.17428283
Descloux et al., (2010)	1	1.43109482
	0.08663951	-0.82576421
	0	-1.03984524
	0.59667974	0.43451463
Pholkern et al., (2015)	0.03816549	-0.583887
	0	-0.67559671

	0.08644736	-0.46786815
	1	1.72735186
Pfeiffer et al., (2000)	0.1124055	-0.44850471
	0.07028978	-0.55157268
	1	1.72366726
	0	-0.72358986
Cabalar et al., (2016)	0.00867662	-0.773915
	0.28616856	-0.09222758
	0	-0.79523001
	1	1.66137259
Schälchli (1992)	2.50E-04	-0.70684169
	1	1.41421353
	0	-0.70737184
Grischek et al., (2016)	0.64691736	0.23653549
	1	1.08922479
	0	-1.32576028
Ghani et al., (2017)	0.00E+00	-0.83458396
	0.02137021	-0.78572351
	0.01507902	-0.80010756
	0.78867029	0.96861733
	1	1.45179769
Tao et al., (2019)	0	-0.51006272
	0.00231079	-0.5042627
	0.00242921	-0.50396547
	0.01133411	-0.48161447
	1	1.99990536
Koren et al., (2021)	0.80177839	0.46535782
	1	0.92385971
	0	-1.38921753

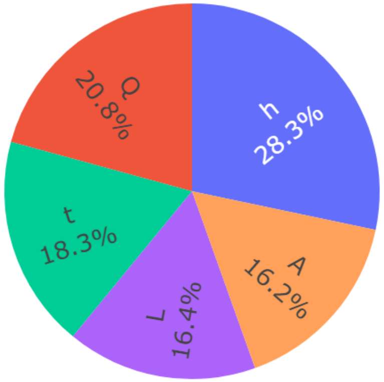
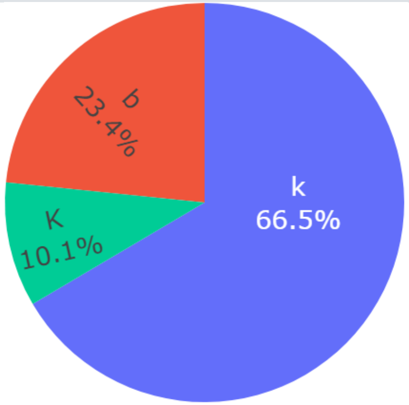
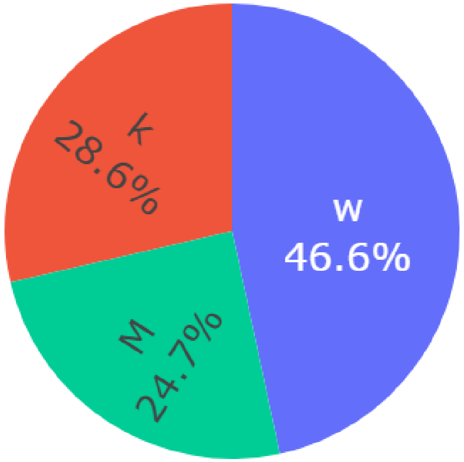
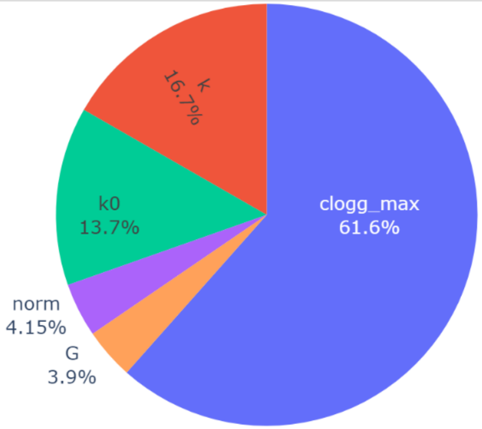
Brunke (1999)	3.34E-06	-0.44988567
	3.34E-06	-0.44988566
	2.86E-03	-0.44220006
	2.12E-03	-0.44419157
	0.00E+00	-0.44989464
	1.00E+00	2.23605759
Wang et al., (2015)	1.00E+00	1
	0.00E+00	-1
Cui et al., (2021)	0.028256	-0.60925848
	0.00E+00	-0.67714851
	0.09906765	-0.43912098
	1.00E+00	1.72552797

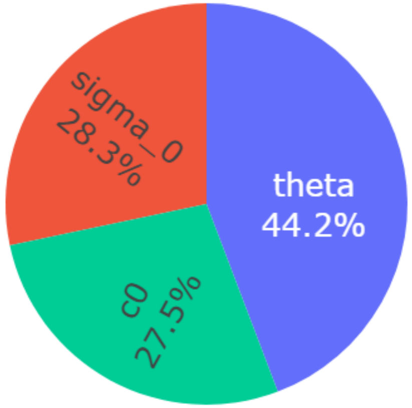
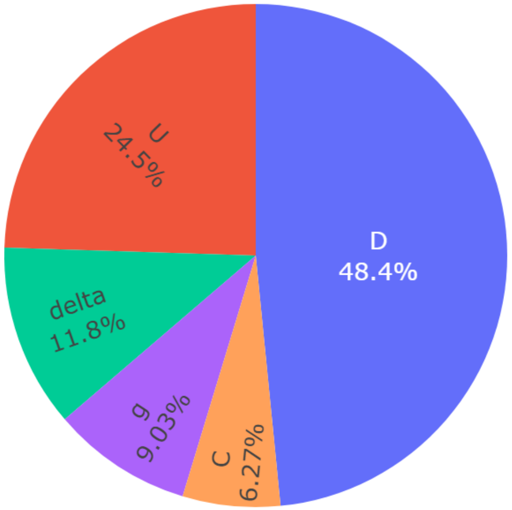
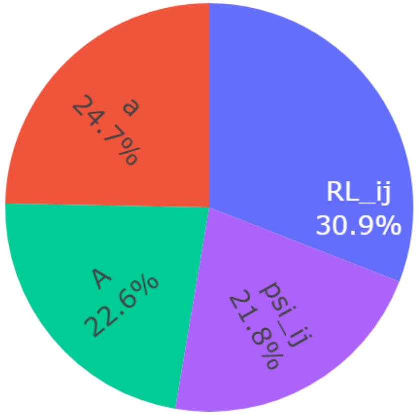
Table 8 Optimization values

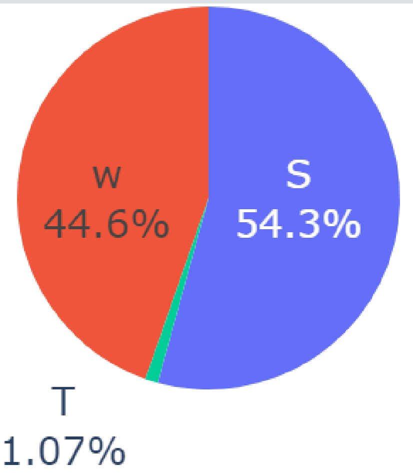
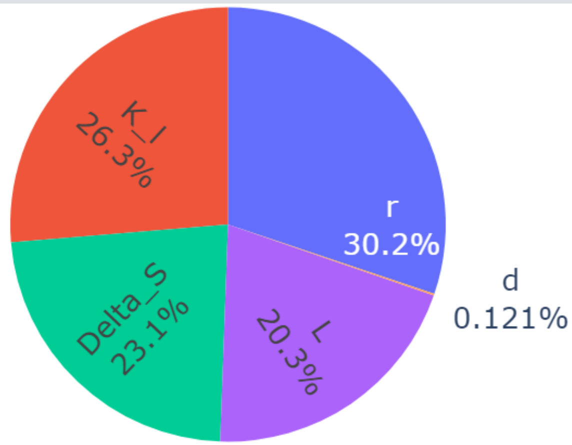
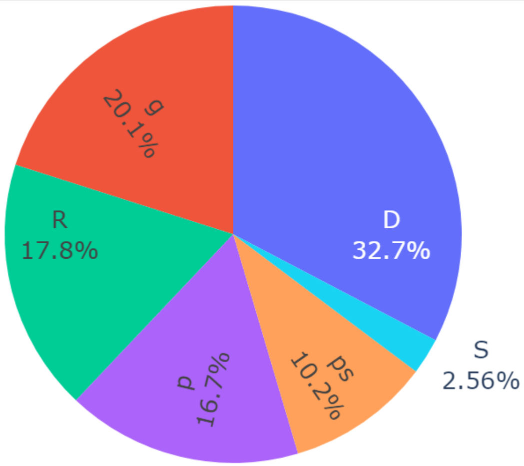
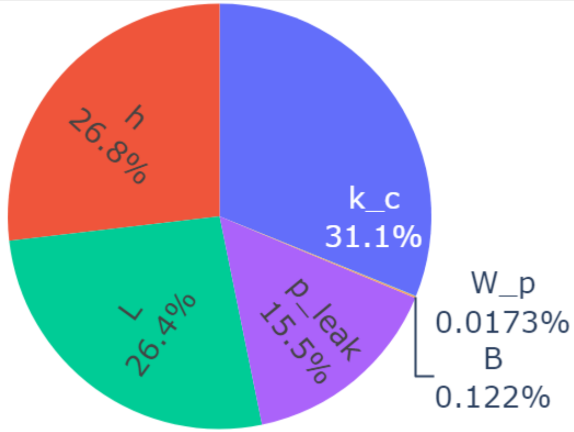
Article	Objective Function Value	Mean	Standard Deviation
Zheng et al., (2014)	7.76E-06	0.002271459	0.030893674
Schulz (2020)	-678.375	87116.97975	6988752.846
Seytoux et al., (2017)	4.938994749	4.957069758	4.949973807
Doble et al., (2012)	0.001708418	0.000138653	0.037555487
Pedretti et al., (2012)	1.00E-05	2.139509385	266.4423891
Kim et al., (2010)	118899720.6	118986428.4	13250404.75
Delfs et al., (2012)	-2.446453152	-2.461514893	4.67909719
Zhang et al., (2020)	-42.93006993	-43.59276479	69.88435014
Du et al., (2014)	2.08E-05	-5.36E-06	0.001395597
Rehg et al., (2005)	0.893814802	0.862002074	93.90119208
Hoehn et al., (2006)	-30	-1.637285952	482.376645
Moutsopoulos (2013)	2.00E-14	1.26E-07	2.15E-05
Rudnick et al., (2015)	0.623357772	0.029366779	7.212725237
Kaleris 1998)	-2E+14	25.82176959	1140.062554
Dimkic et al., (2011)	0.005711987	-0.489090969	391.4367115
Nguyen et al., (2021)	0	2.96845957	216.8696761
Boukhemacha et al., (2015)	0	20.8343409	1744.171268
Descloux et al., (2010)	-400000	46807.51357	4757790.752
Pholkern et al., (2015)	6.46E-07	-1.33E-05	0.001145948
Pfeiffer et al., (2000)	6.36E-08	3.34E-06	0.000646979
Cabalar et al., (2016)	4.49E-05	0.550863178	0.80412342
Cabalar et al., (2016)	1.94E-05	0.433023287	1.1482912
Schälchli (1992)	2.79E-05	2.20E+16	4.51E+18
Grischek et al., (2016)	2.23E-09	nan	nan
Ghani et al., (2017)	4.39E-05	5.52E-06	0.000888268
Tao et al., (2019)	2457106398	1.83408E+14	2.57E+16
Koren et al., (2021)	5.11E-05	nan	nan

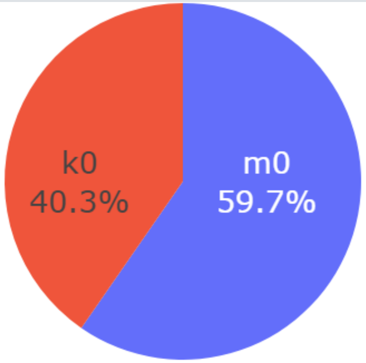
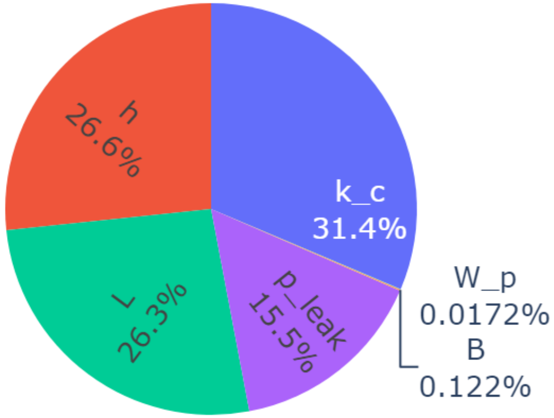
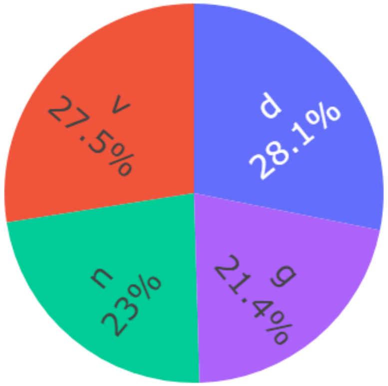
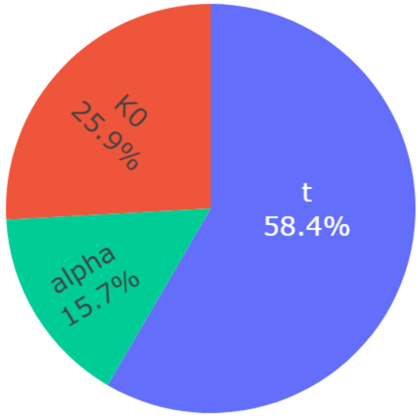
Brunke (1999)	-233.9688046	-0.348377606	57.39202573
Wang et al., (2015)	0.0017	0.000580577	0.103167735

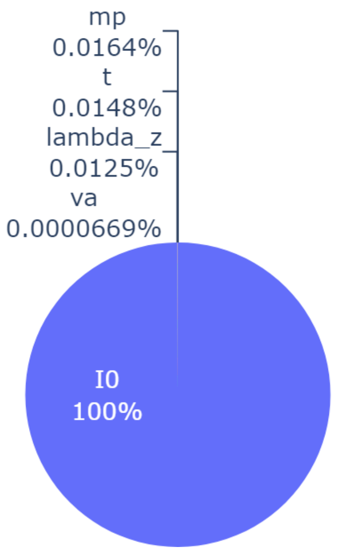
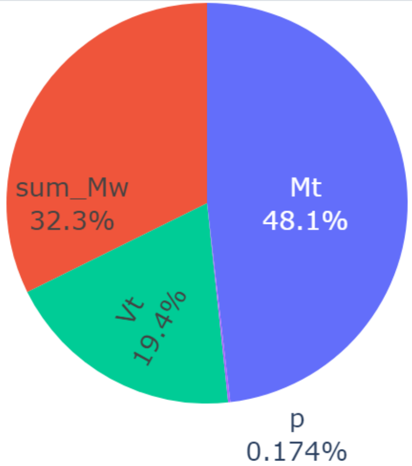
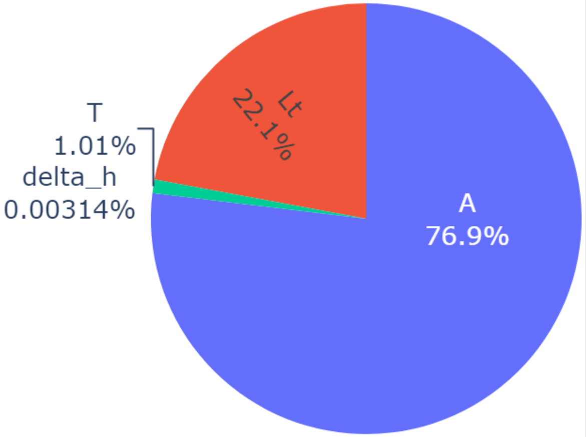
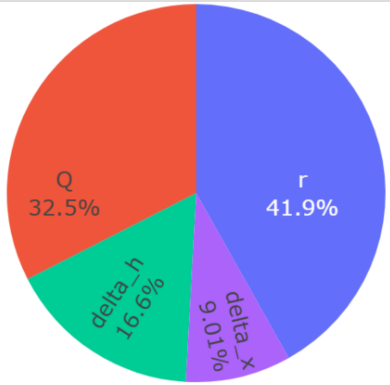
Supplement B (FAST Analysis)

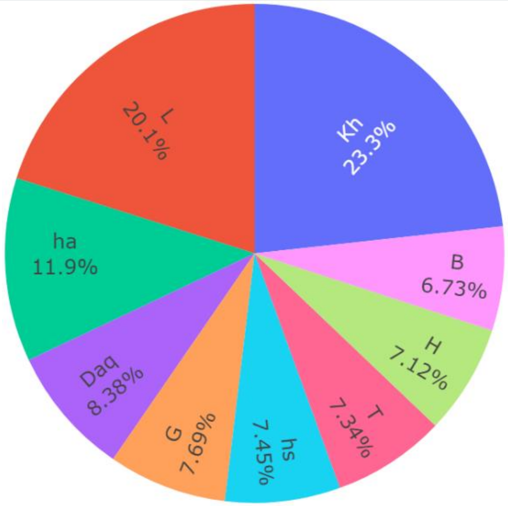
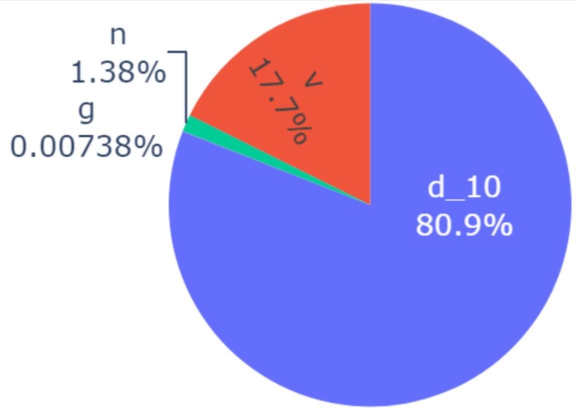
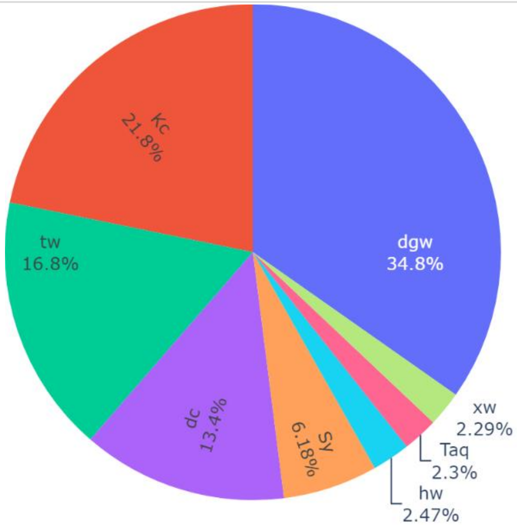
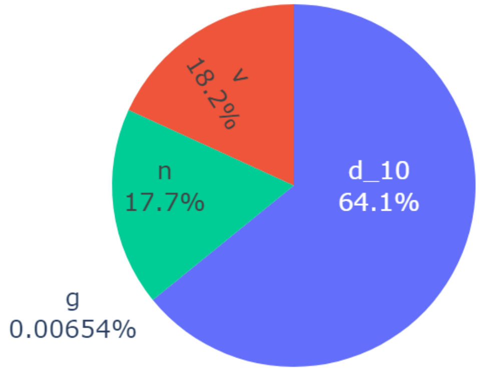
Author		Author	
Grischek et al., (2016)		Moutsopoulos (2013)	
Ghani et al., (2017)		Rudnick et al., (2015)	

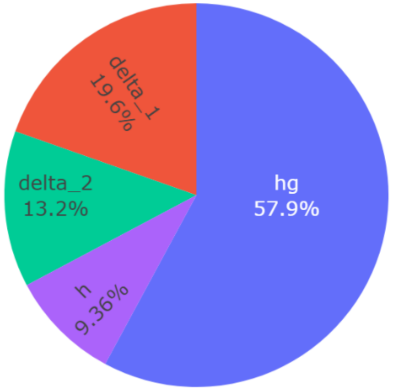
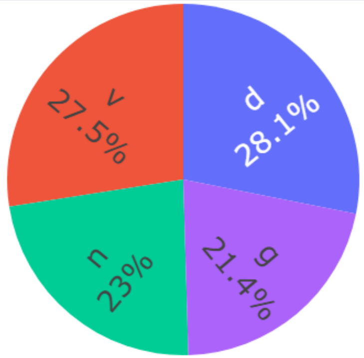
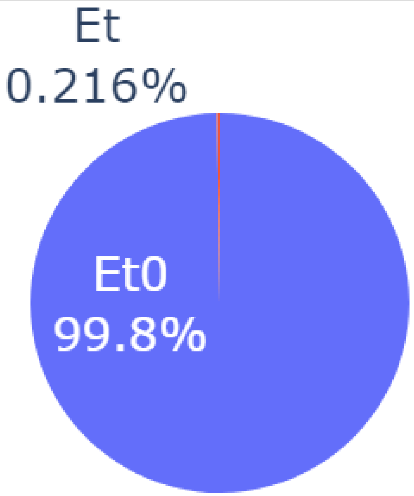
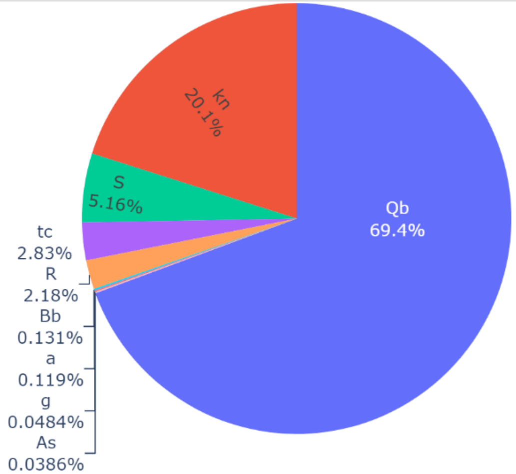
<table>
<tr><th>Author</th><th></th><th>Author</th><th></th></tr>
<tr><td>Pholkern et al., (2015)</td><td>
</td><td>Schulz (2020)</td><td>
</td></tr>
<tr><td>Tao et al., (2019)</td><td>
</td><td>Kaleris (1998)</td><td>
</td></tr>
</table>

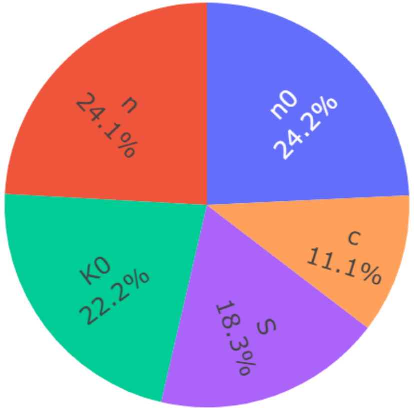
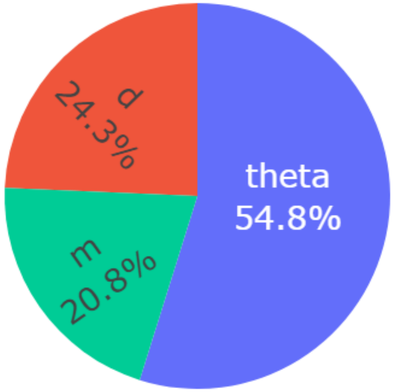
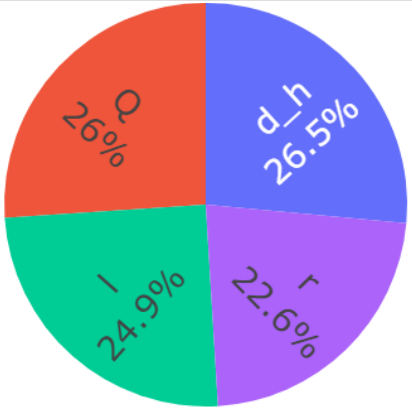
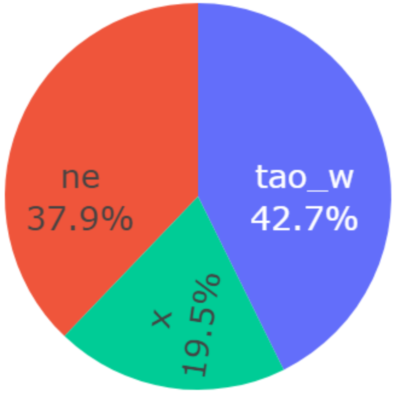
<table>
<tr><th>Author</th><th></th><th>Author</th><th></th></tr>
<tr><td>Koren et al., (2021)</td><td></td><td>Dimkic et al., (2011)</td><td></td></tr>
<tr><td>Brunke (1999)</td><td></td><td>Nguyen et al., (2021)</td><td></td></tr>
</table>

Author		Author	
Wang et al., (2015)		Boukhemacha et al., (2015)	
Cui et al., (2021)		Schälchli (1992)	

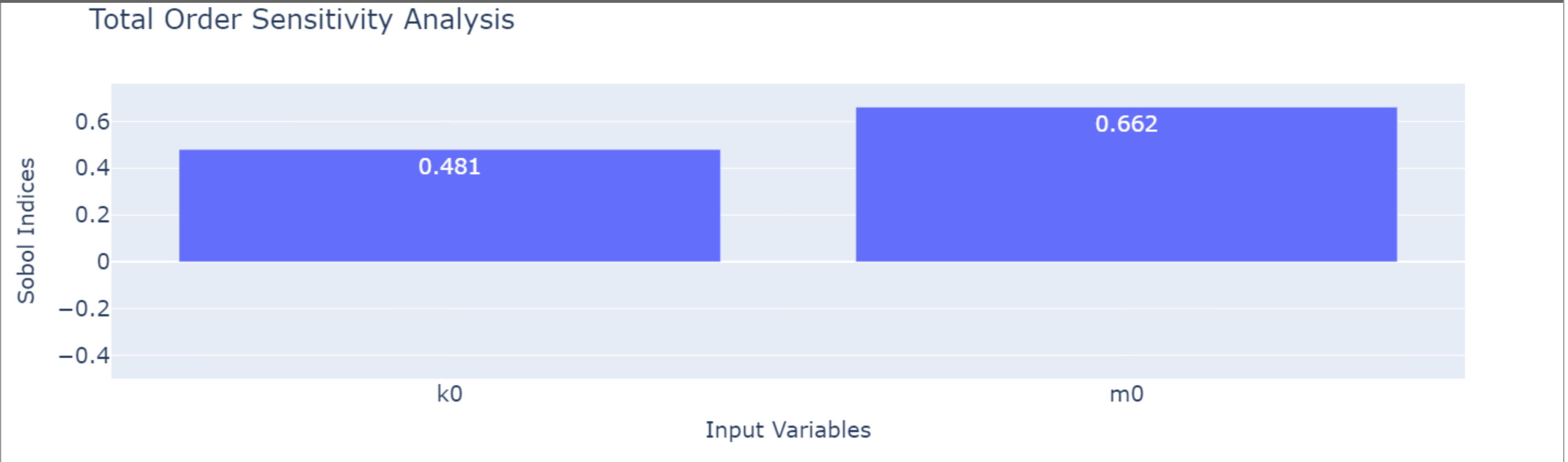
<table>
<tr><th>Author</th><th></th><th>Author</th><th></th></tr>
<tr><td>Pedretti et al., (2012)</td><td>
</td><td>Descloux et al., (2010)</td><td>
</td></tr>
<tr><td>Kim et al., (2010)</td><td>
</td><td>Pfeiffer et al., (2000)</td><td>
</td></tr>
</table>

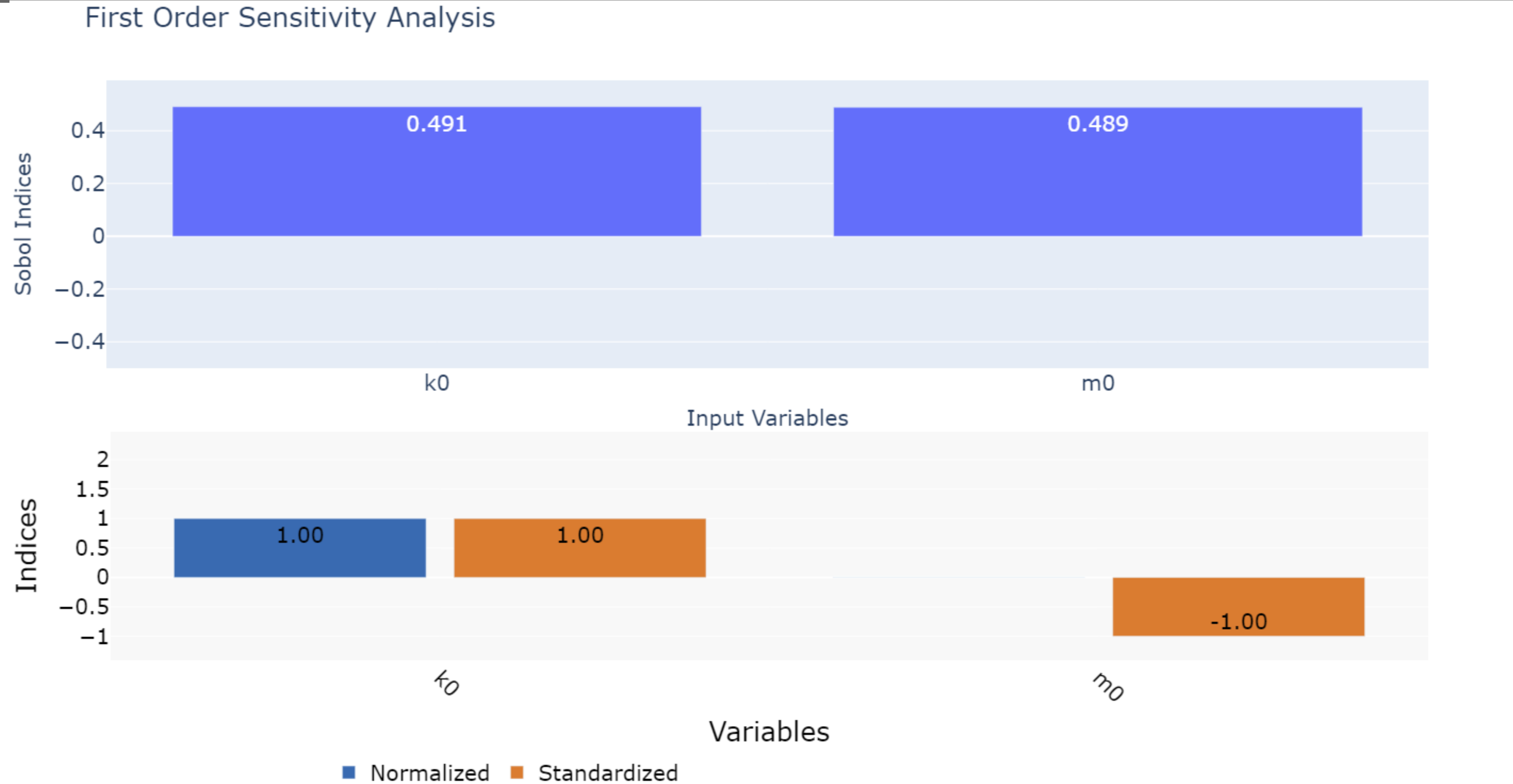
Author		Author	
Seytoux et al., (2017)		Cabalar et al., (2016)	
Doble et al., (2012)		Cabalar et al., (2016)	

Author		Author	
Delfs et al., (2012)		Cui et al., (2021)	
Zhang et al., (2020)		Czuba et al., (2022)	

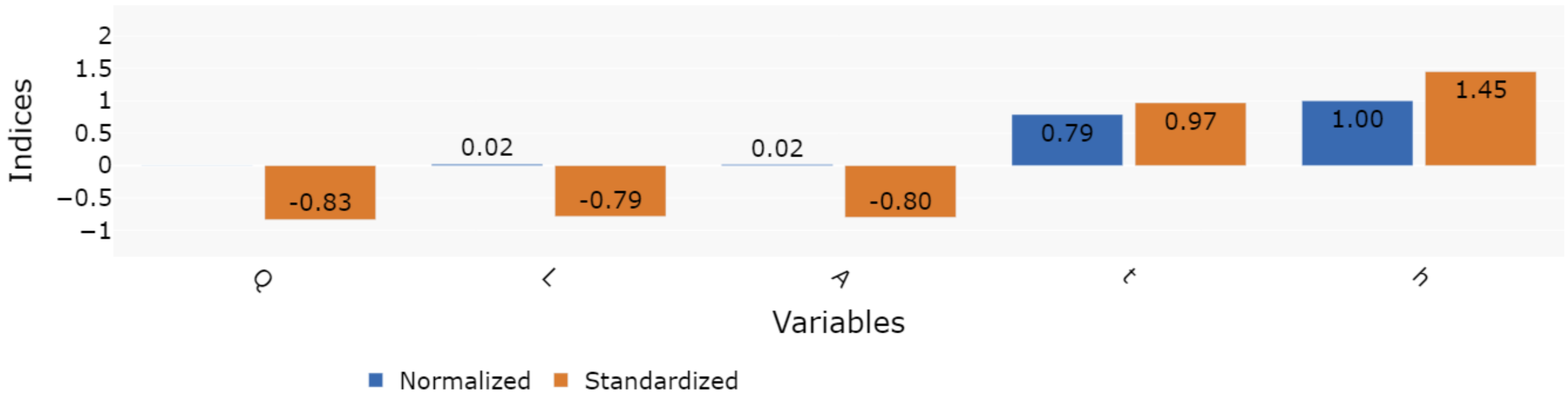
Author		Author	
Zheng et al., (2014)		Rehg et al., (2005)	
Du et al., (2014)		Hoehn et al., (2006)	

Supplement C (Sobol Analysis, Normalisation, and Standardisation)

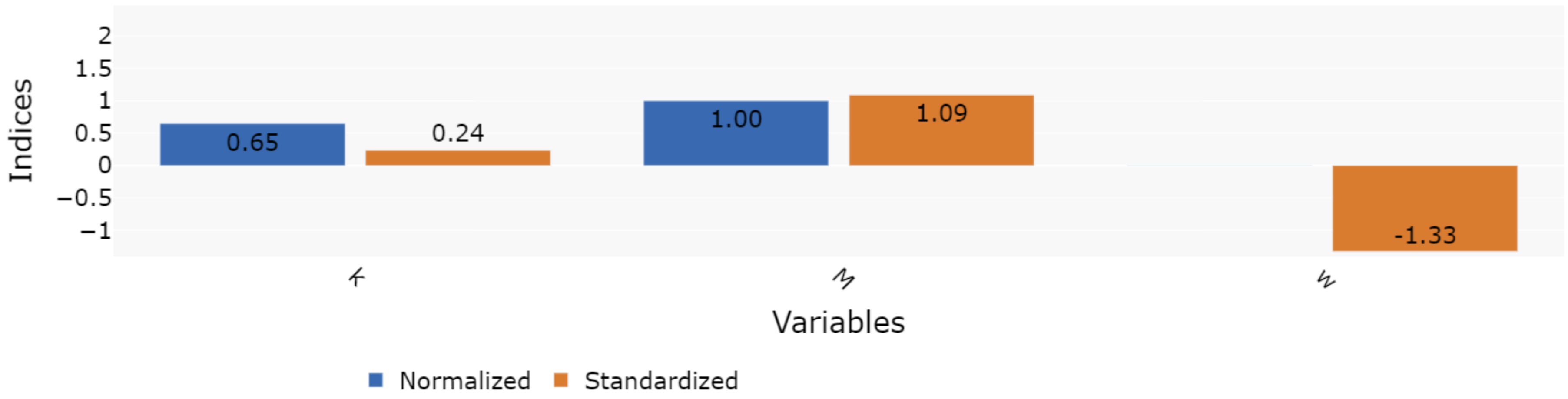
Authors	
Wang et al., (2015)	

Authors	
Wang et al., (2015)	

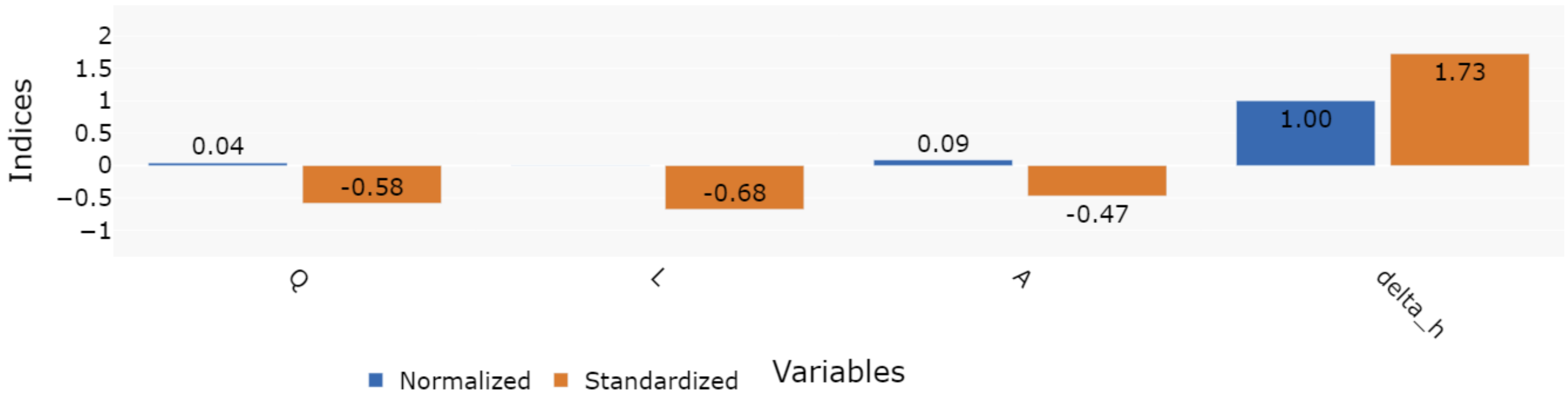
Ghani et al., (2017)

Authors	
Ghani et al., (2017)	

Authors	
Grischek et al., (2016)	

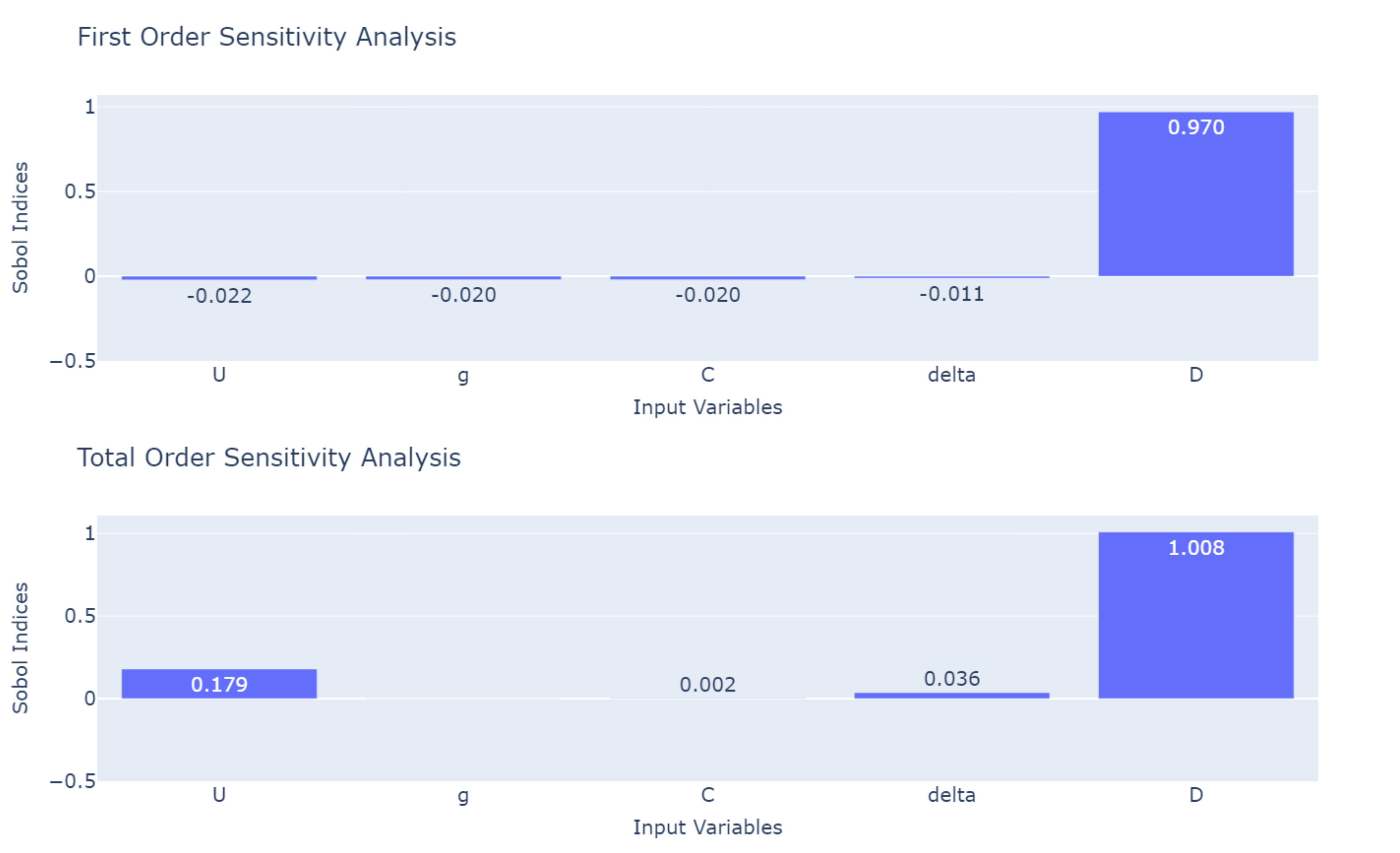
Authors	
Grischek et al., (2016)	

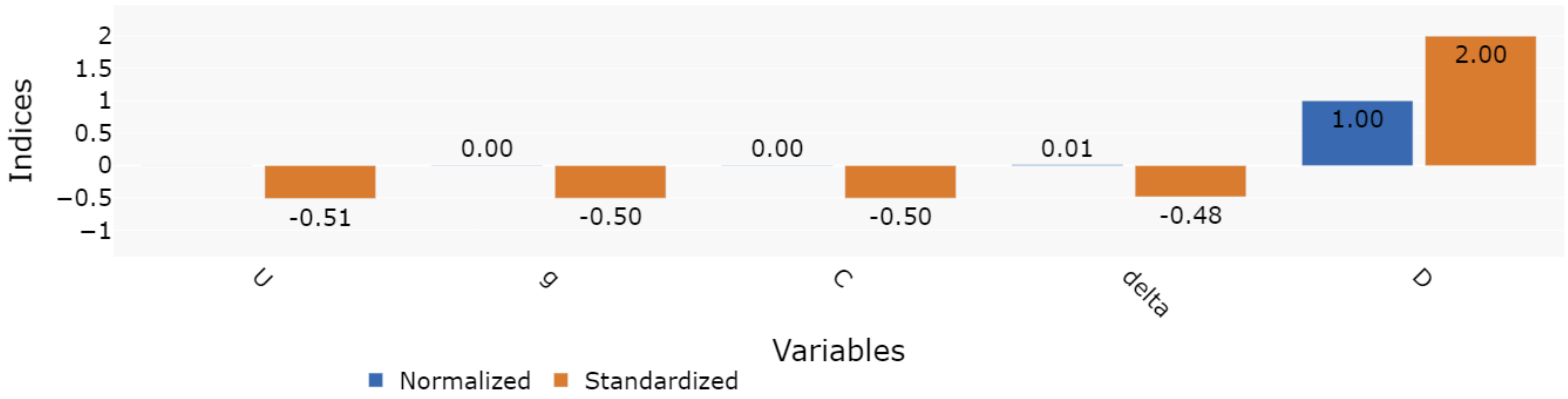
Pholkern et al., (2015)

Authors	
	

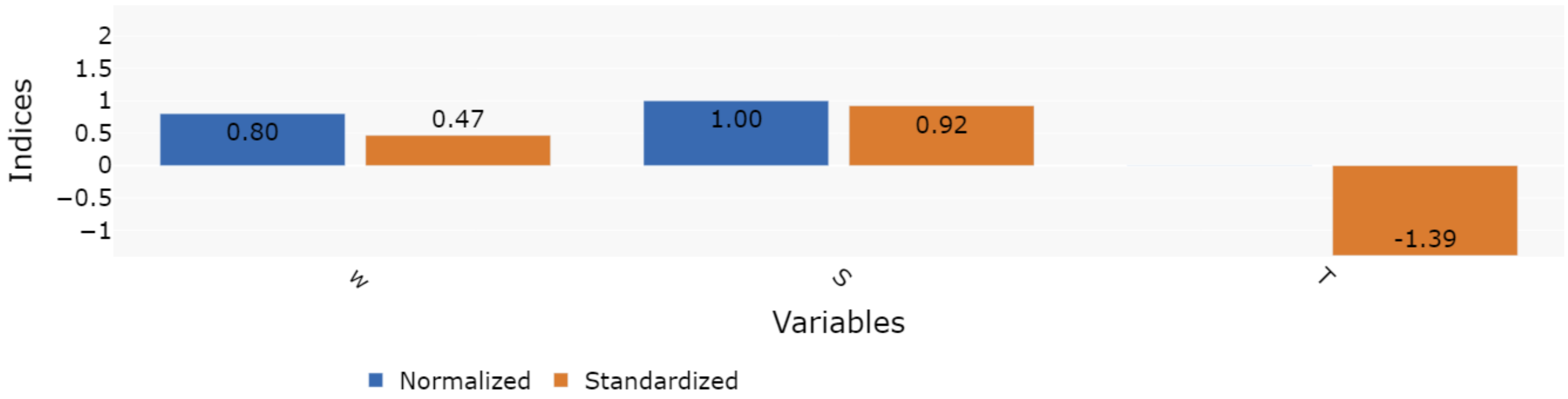
Indices
2
1.5
1
0.5
0
−0.5
−1
0.04
-0.58
-0.68
0.09
-0.47
1.00
1.73
Q
L
A
delta_h
Normalized
Standardized
Variables

Tao et al., (2019)



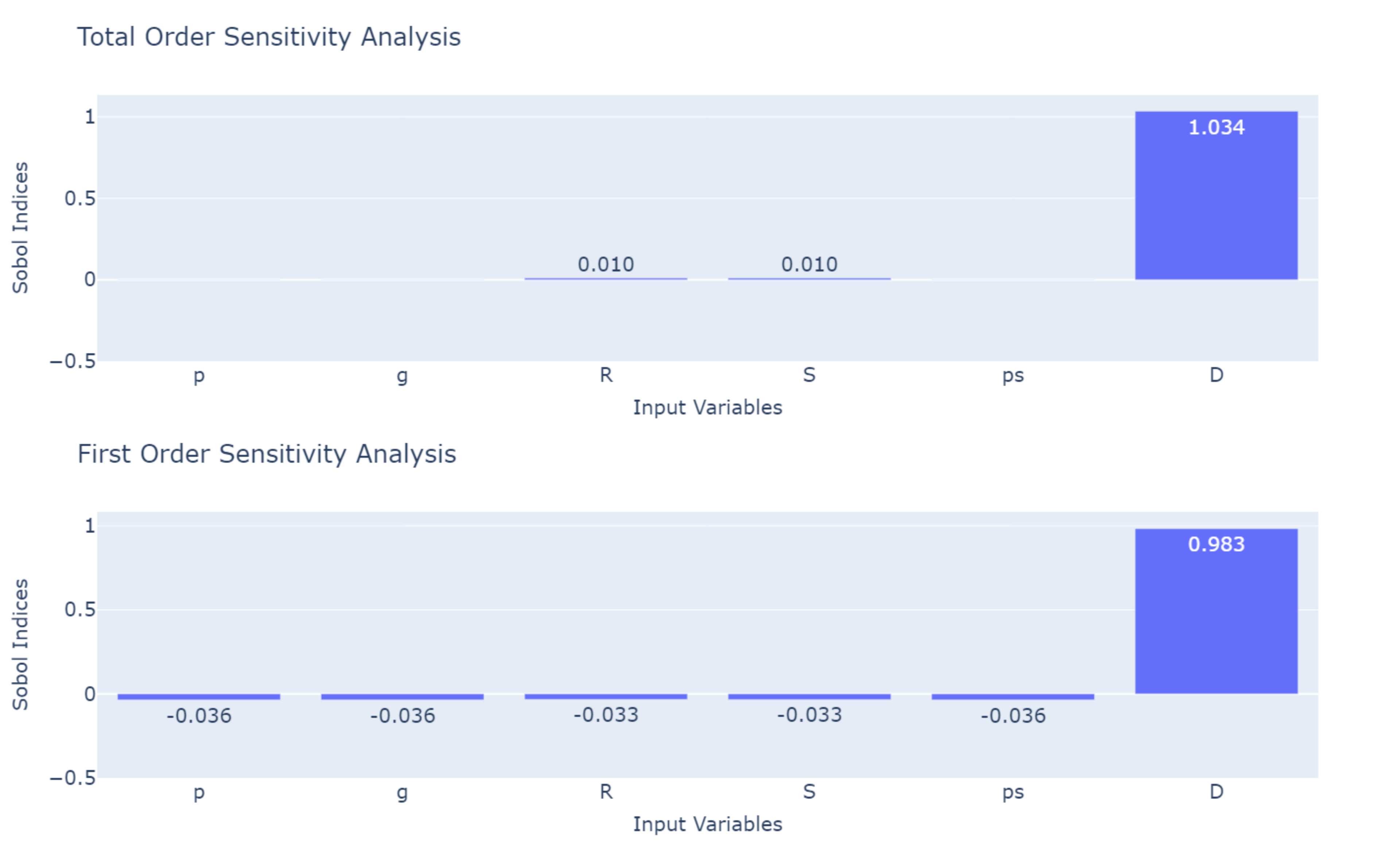
Authors	
	 Indices 2 1.5 1 0.5 0 −0.5 −1 -0.51 0.00 -0.50 0.00 -0.50 0.01 -0.48 1.00 2.00 U g C delta D Variables Normalized Standardized

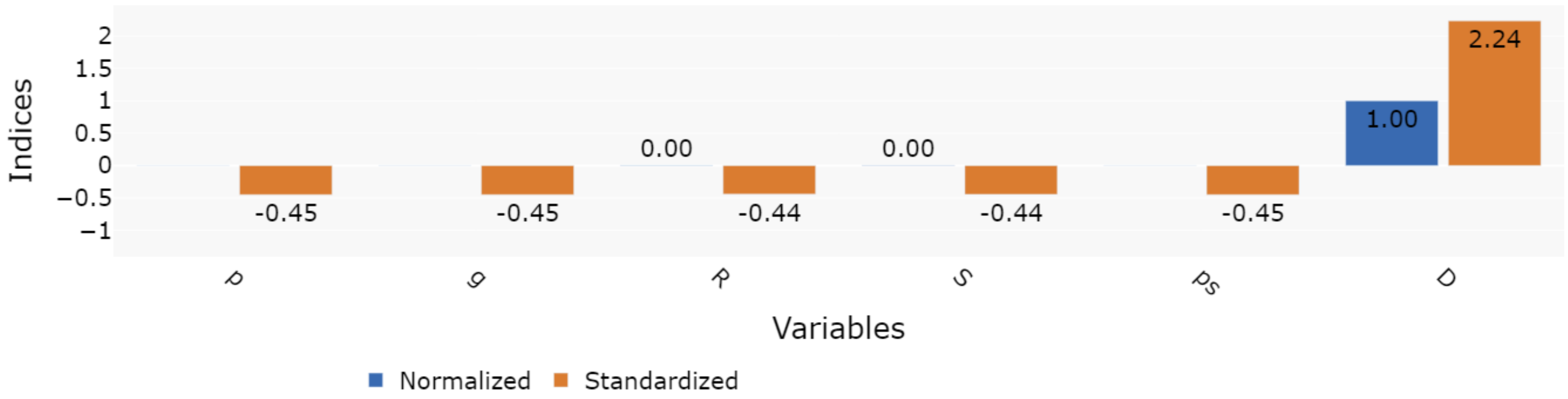
Koren et al., (2021)

Authors	
	

Indices
2
1.5
1
0.5
0
−0.5
−1
0.80
0.47
1.00
0.92
-1.39
W
S
T
Variables
Normalized
Standardized

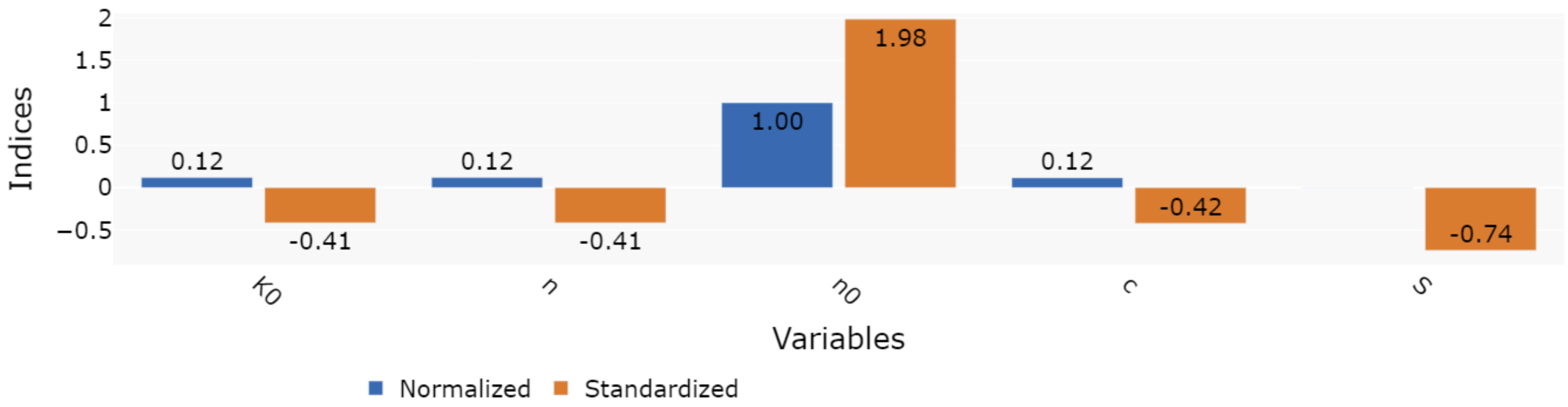
Brunke (1999)


Total Order Sensitivity Analysis
Sobol Indices
1
0.5
0
−0.5
0.010
0.010
1.034
p
g
R
S
ps
D
Input Variables
First Order Sensitivity Analysis
Sobol Indices
1
0.5
0
−0.5
-0.036
-0.036
-0.033
-0.033
-0.036
0.983
p
g
R
S
ps
D
Input Variables

Authors	
	

Indices
2
1.5
1
0.5
0
−0.5
−1
-0.45
-0.45
0.00
-0.44
0.00
-0.44
-0.45
1.00
2.24
p
g
R
S
ps
D
Variables
Normalized
Standardized

Zheng et al., (2014)

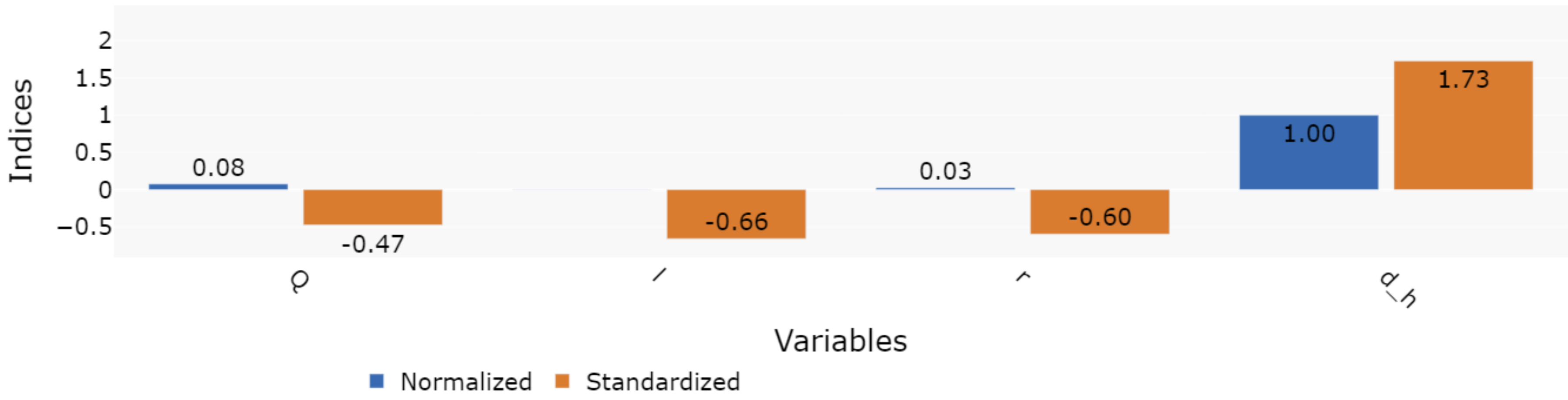
Authors	
	

Indices
2
1.5
1
0.5
0
−0.5
0.12
-0.41
0.12
-0.41
1.00
1.98
0.12
-0.42
-0.74
k0
n
n0
c
s
Variables
Normalized
Standardized

Du et al., (2014)

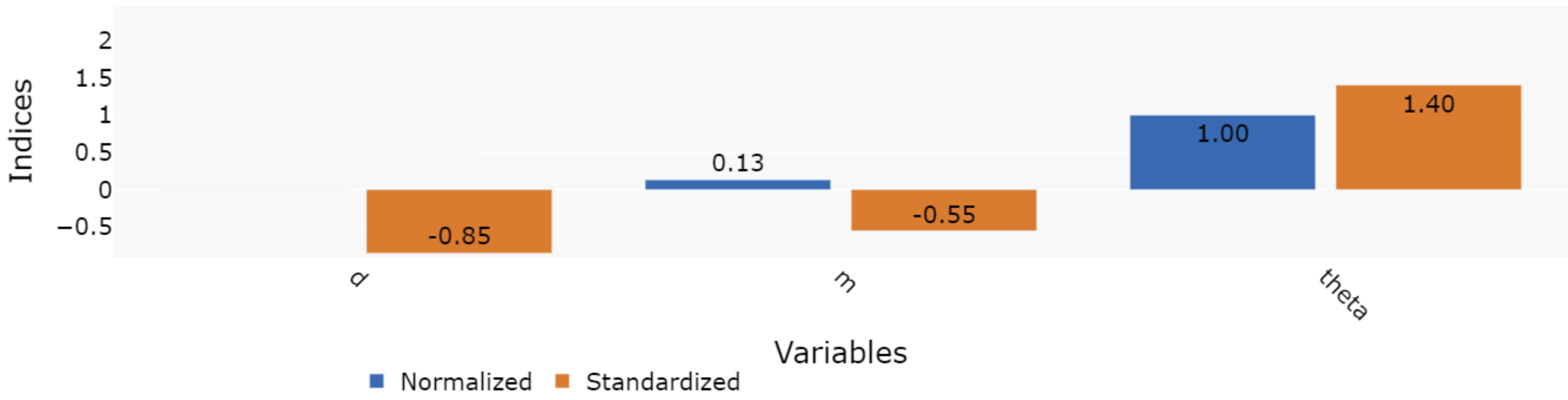
First Order Sensitivity Analysis
Sobol Indices
0.4
0.2
0
−0.2
−0.4
0.059
0.033
0.042
0.369
Q
l
r
d_h
Input Variables
Total Order Sensitivity Analysis
Sobol Indices
0.8
0.6
0.4
0.2
0
−0.2
−0.4
0.004
0.172
0.451
0.873
Q
l
r
d_h
Input Variables

Authors	



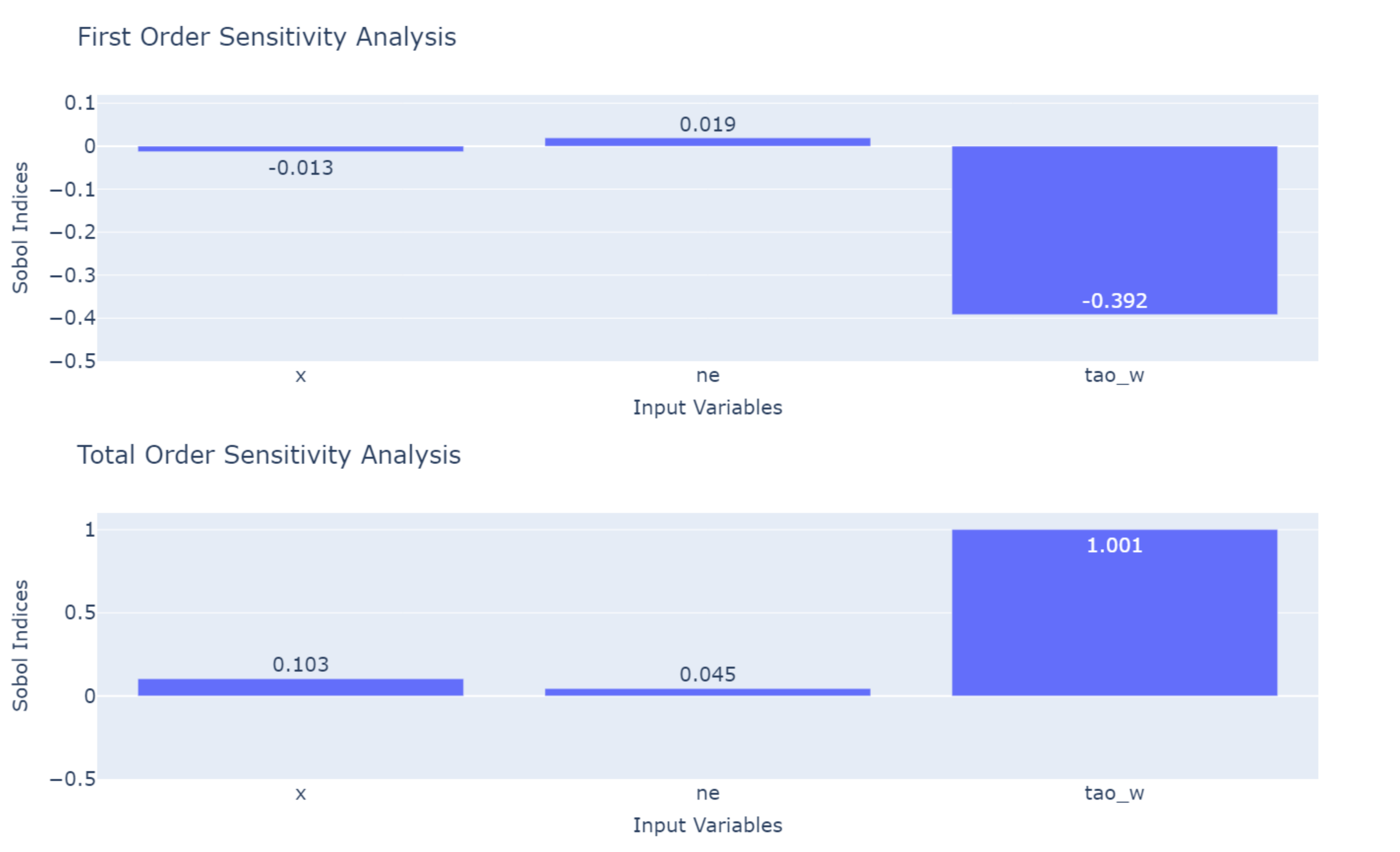
Indices
2
1.5
1
0.5
0
−0.5
0.08
-0.47
-0.66
0.03
-0.60
1.00
1.73
Variables
Normalized
Standardized

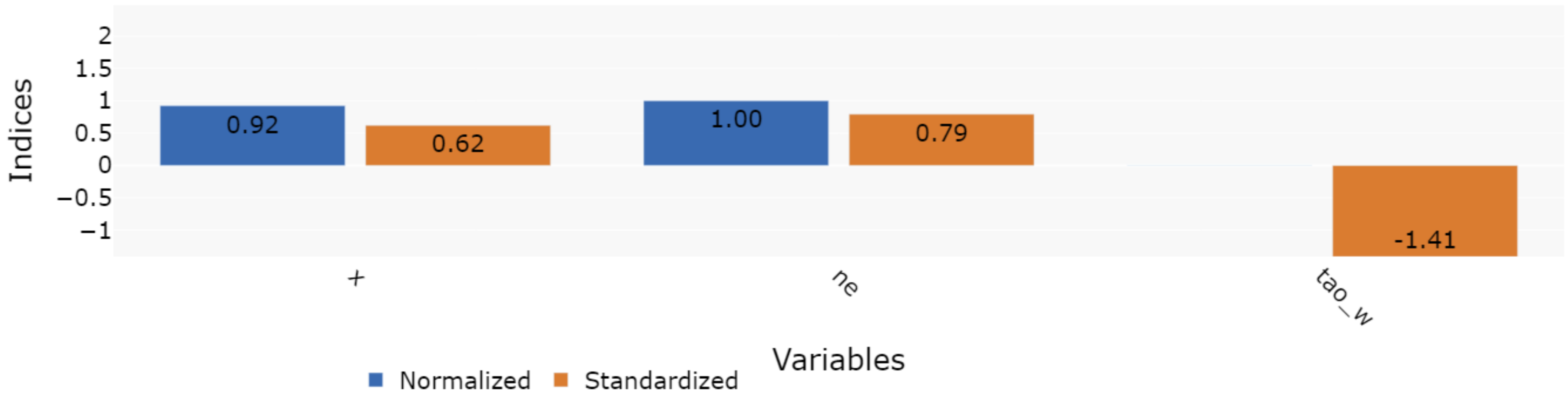
Rehg et al., (2005)

Authors	
	

Indices
2
1.5
1
0.5
0
−0.5
-0.85
0.13
-0.55
1.00
1.40
d
m
theta
Variables
Normalized
Standardized

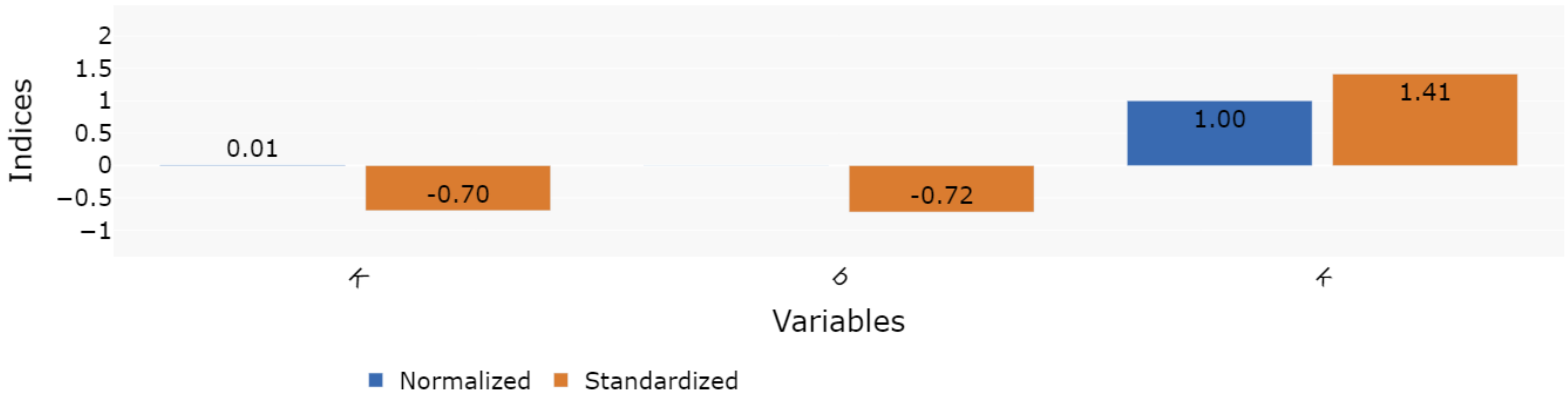
Hoehn et al., (2006)



Authors	
	

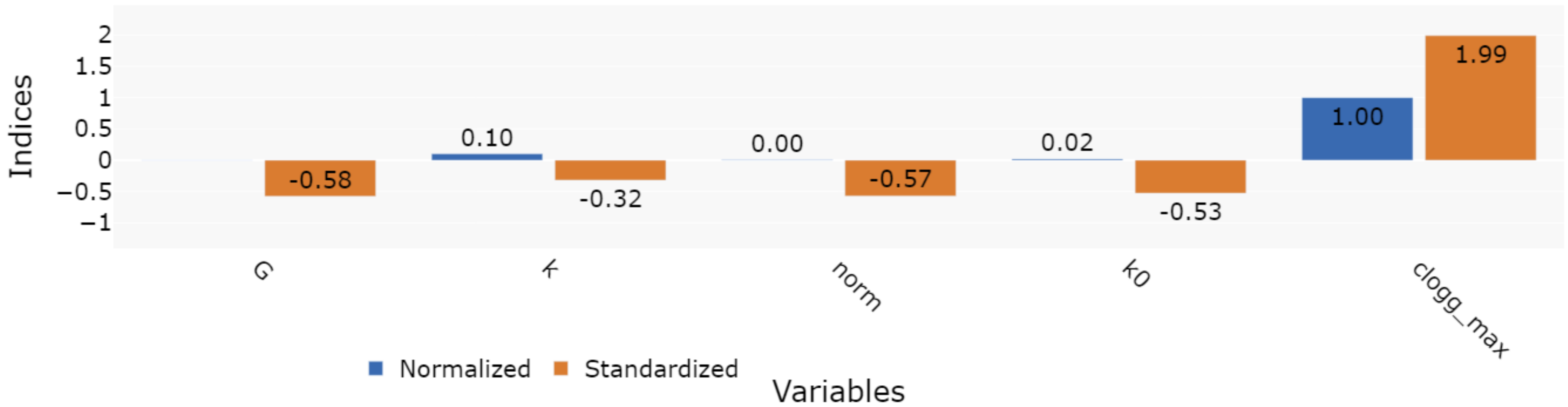
Indices
2
1.5
1
0.5
0
−0.5
−1
0.92
0.62
1.00
0.79
-1.41
x
ne
tao_w
Variables
Normalized
Standardized

Moutsopoulos (2013)

Authors	
	Indices
2
1.5
1
0.5
0
−0.5
−1
0.01
-0.70
-0.72
1.00
1.41
Variables
Normalized
Standardized

Rudnick et al., (2015)

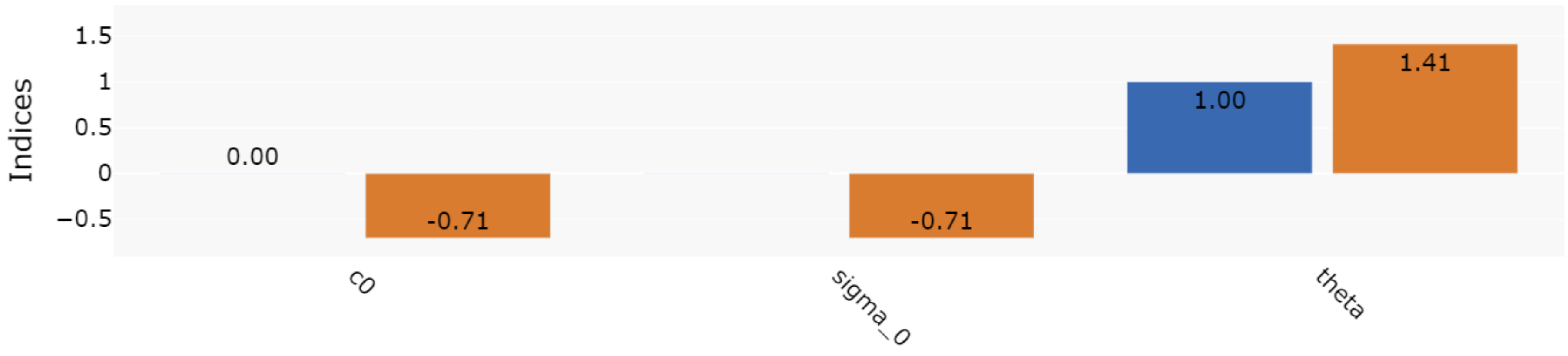
Authors	



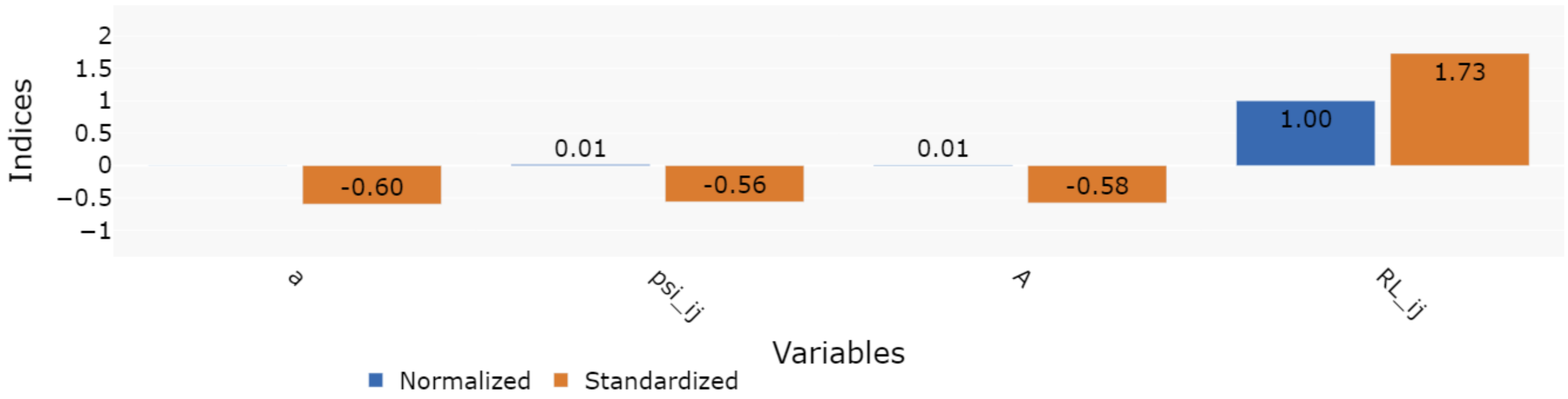
Indices
2
1.5
1
0.5
0
−0.5
−1
0.10
0.00
0.02
1.00
1.99
-0.58
-0.32
-0.57
-0.53
G
k
norm
k0
clogg_max
Normalized
Standardized
Variables


Schulz (2020)
First Order Sensitivity Analysis
Sobol Indices
1
0.5
0
−0.5
−1
0.986
-0.020
-0.020
c0
sigma_0
theta
Input Variables
Total Order Sensitivity Analysis
Sobol Indices
1
0.5
0
−0.5
−1
1.034
0.645
0.044
c0
sigma_0
theta
Input Variables

Authors	


Indices
1.5
1
0.5
0
−0.5
0.00
-0.71
-0.71
1.00
1.41
c0
sigma_0
theta
Normalized
Standardized
Variables

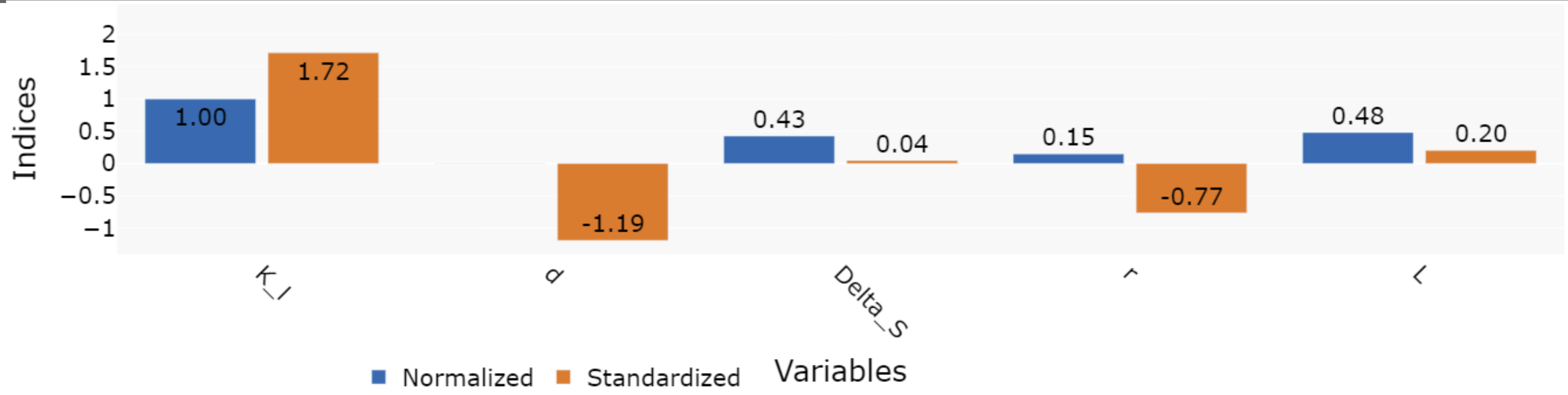
Kaleris (1998)

Authors	
	

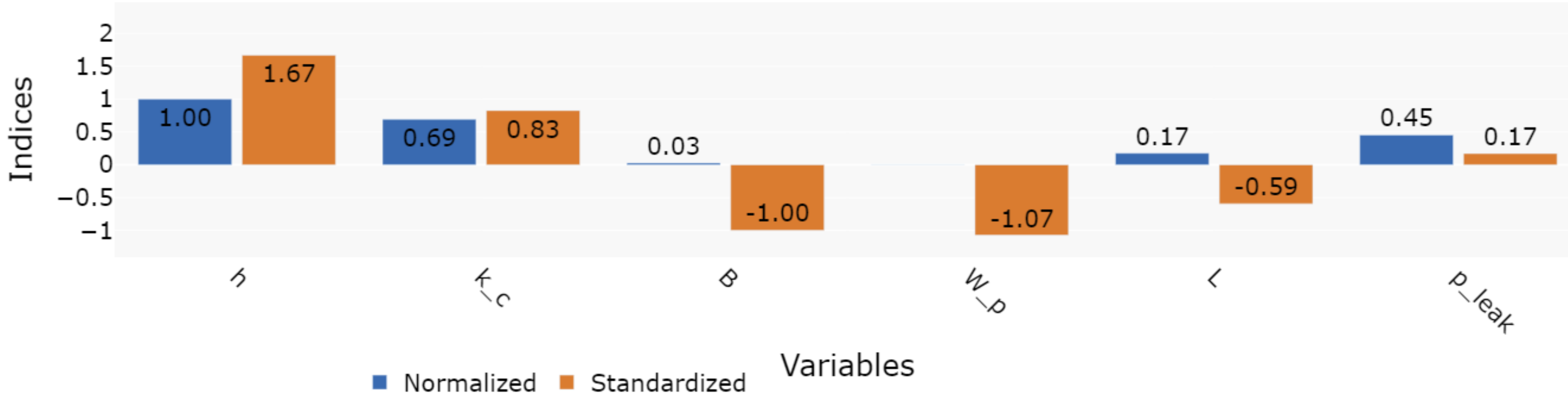
Indices
2
1.5
1
0.5
0
−0.5
−1
-0.60
0.01
-0.56
0.01
-0.58
1.00
1.73
a
psi_ij
A
RL_ij
Variables
Normalized
Standardized


Dimkic et al., (2011)
First Order Sensitivity Analysis
Sobol Indices
0.4
0.2
0
−0.2
−0.4
0.330
0.099
0.198
0.133
0.210
K_l
d
Delta_S
r
L
Input Variables
Total Order Sensitivity Analysis
Sobol Indices
0.4
0.2
0
−0.2
−0.4
0.203
0.001
0.245
0.189
0.310
K_l
d
Delta_S
r
L
Input Variables

Authors

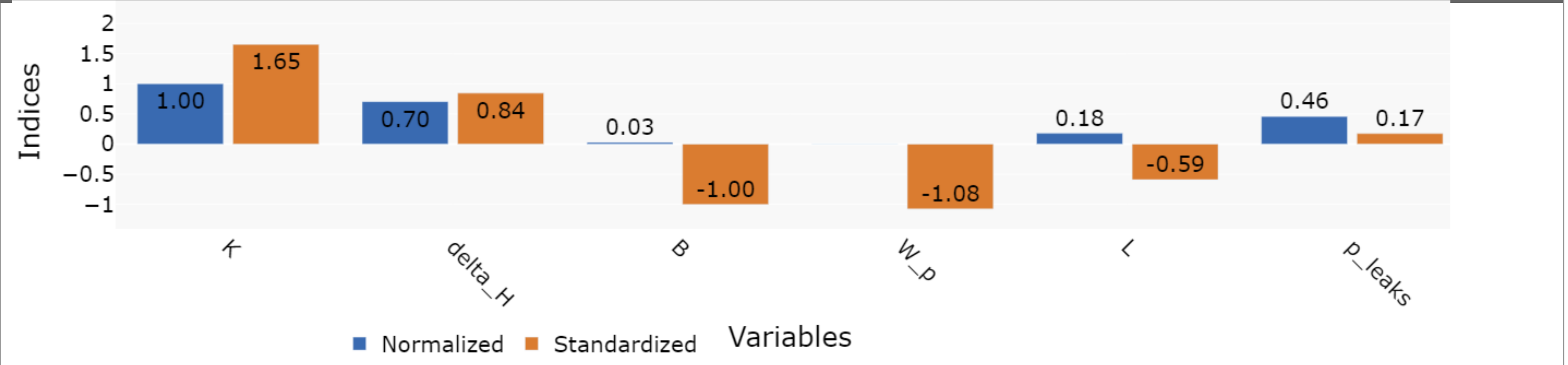

Indices
2
1.5
1
0.5
0
−0.5
−1
1.00
1.72
-1.19
0.43
0.04
0.15
-0.77
0.48
0.20
K_I
Delta_S
Normalized
Standardized
Variables

Nguyen et al., (2021)

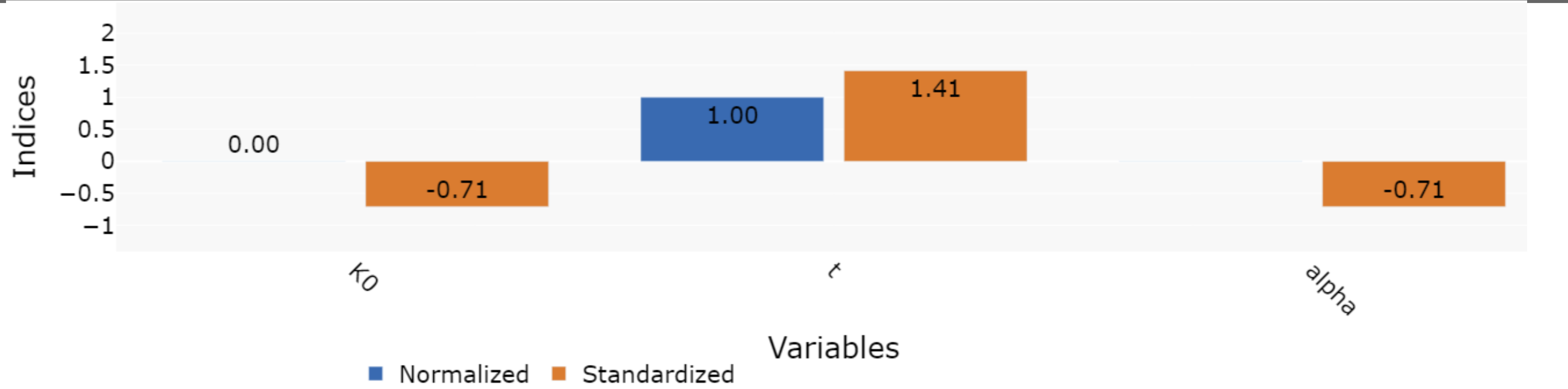
Authors	
	Indices 2 1.5 1 0.5 0 −0.5 −1 1.00 1.67 0.69 0.83 0.03 -1.00 -1.07 0.17 -0.59 0.45 0.17 h k_c B W_p L p_leak Variables Normalized Standardized

Boukhemacha et al., (2015)

Authors


Indices
2
1.5
1
0.5
0
−0.5
−1
1.00
1.65
0.70
0.84
0.03
-1.00
-1.08
0.18
-0.59
0.46
0.17
K
delta_H
B
W_p
L
p_leaks
Normalized
Standardized
Variables

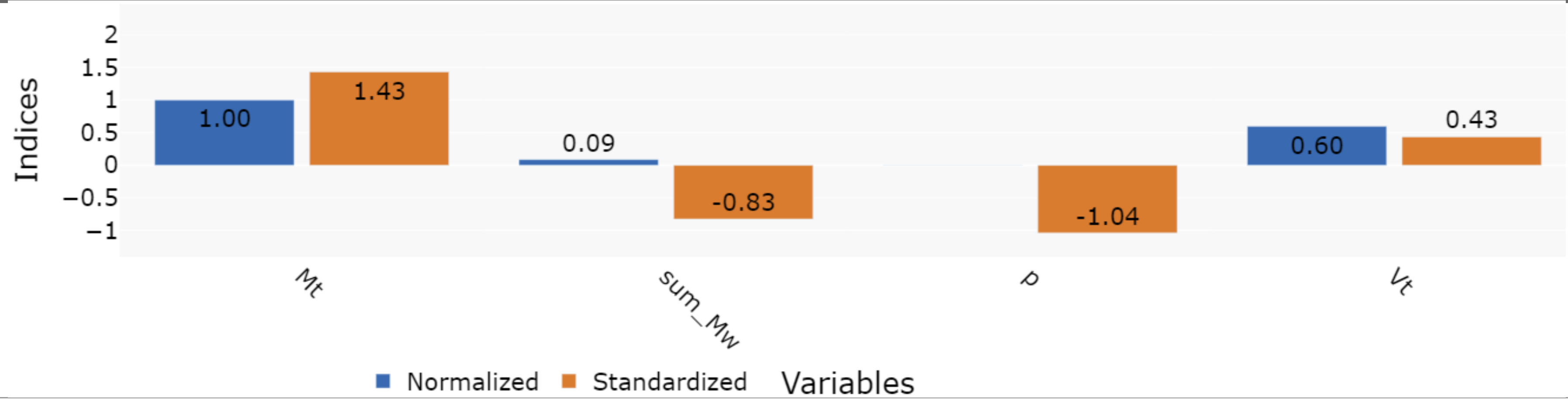

Schälchli (1992)
First Order Sensitivity Analysis
Sobol Indices
0.2
0
−0.2
−0.4
0.152
0.280
0.200
K0
t
alpha
Input Variables
Total Order Sensitivity Analysis
Sobol Indices
0.6
0.4
0.2
0
−0.2
−0.4
0.528
0.411
0.625
K0
t
alpha
Input Variables

Authors	
	

Indices
2
1.5
1
0.5
0
−0.5
−1
0.00
-0.71
1.00
1.41
-0.71
K0
t
alpha
Variables
Normalized
Standardized

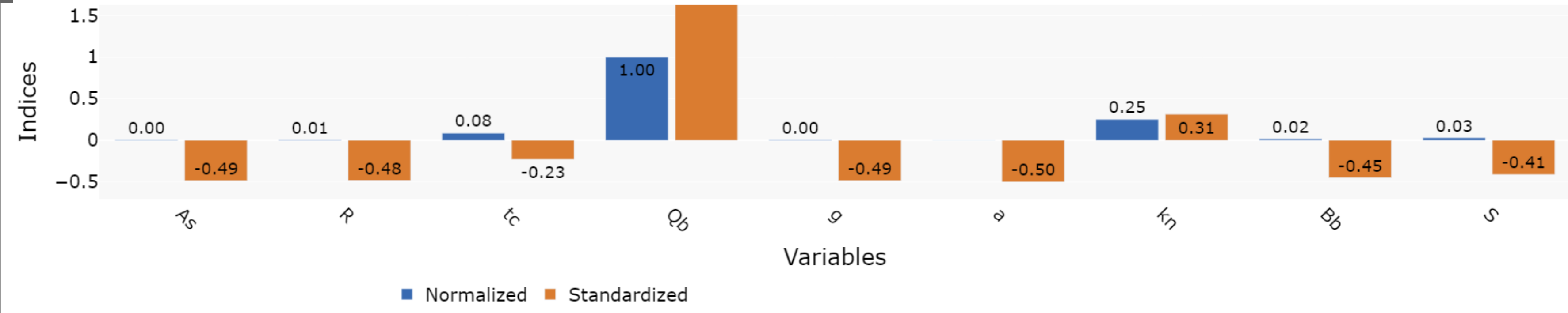
Descloux et al., (2010)

Authors	

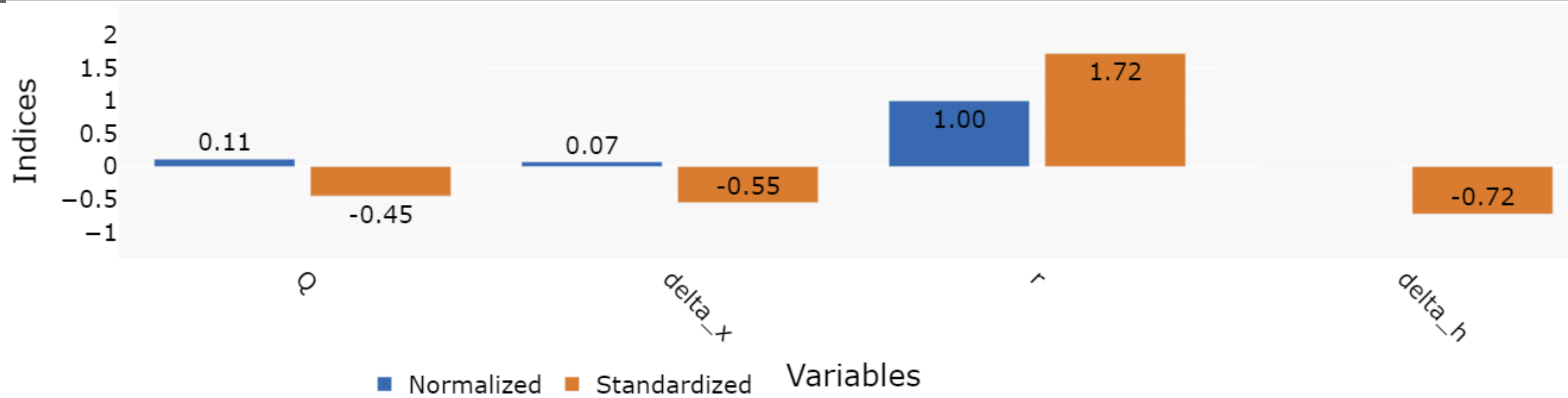

Indices
2
1.5
1
0.5
0
−0.5
−1
1.00
1.43
0.09
-0.83
-1.04
0.60
0.43
Mt
sum_Mw
p
Vt
Normalized
Standardized
Variables

Czuba et al., (2022)

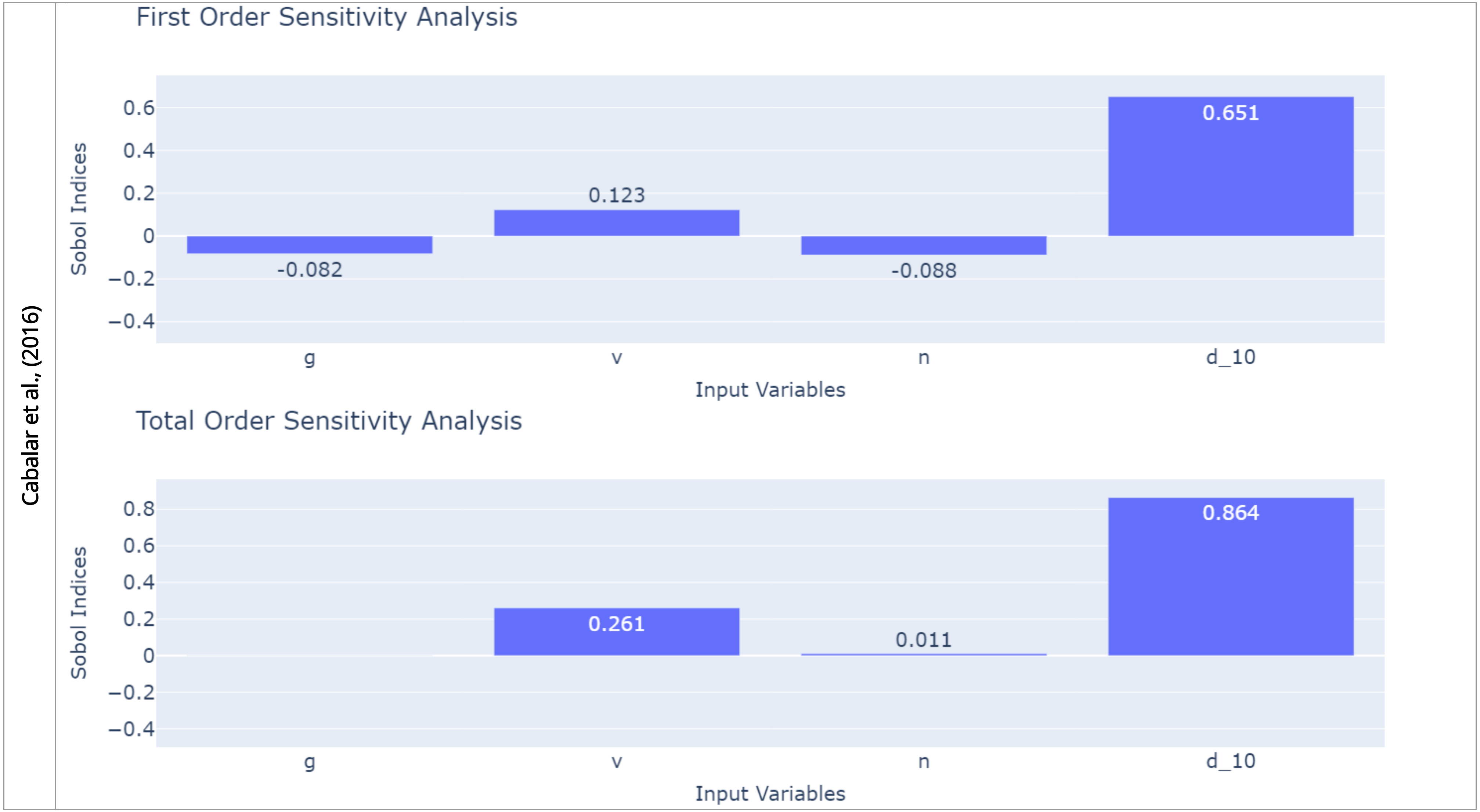
Authors	


Indices
1.5
1
0.5
0
−0.5
0.00
-0.49
0.01
-0.48
0.08
-0.23
1.00
0.00
-0.49
-0.50
0.25
0.31
0.02
-0.45
0.03
-0.41
As
R
tc
Qb
g
a
kn
Bb
S
Variables
Normalized
Standardized

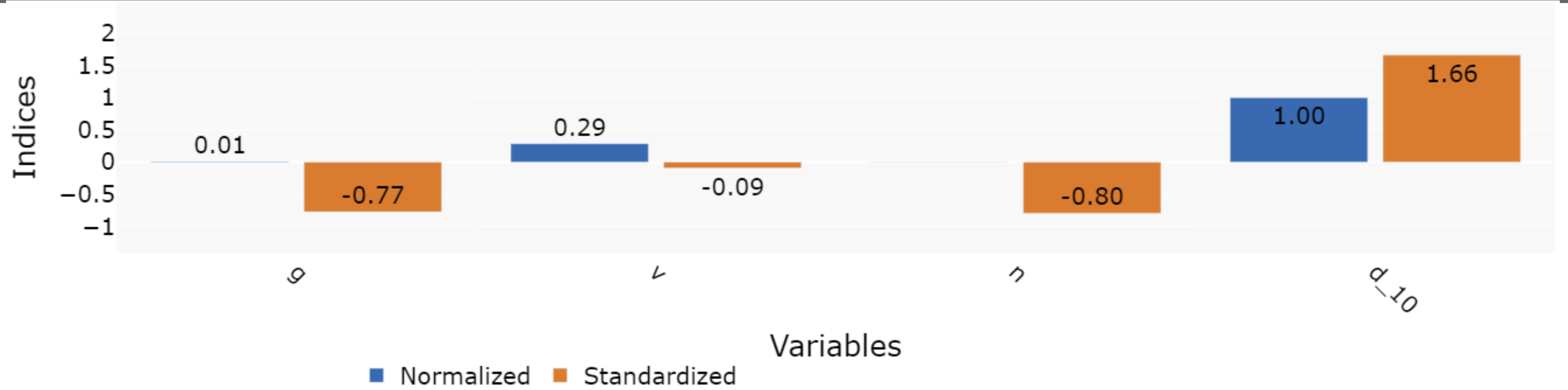
Pfeiffer et al., (2000)

Authors	
	

Indices
2
1.5
1
0.5
0
−0.5
−1
0.11
-0.45
0.07
-0.55
1.00
1.72
-0.72
Q
delta_x
r
delta_h
Normalized
Standardized
Variables



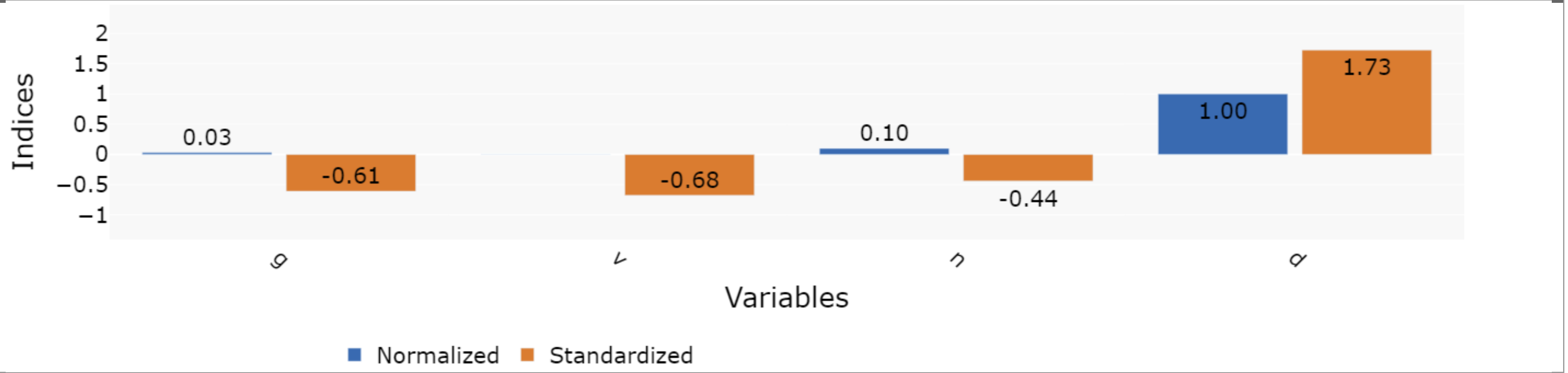
Cabalar et al., (2016)
First Order Sensitivity Analysis
Sobol Indices
0.6
0.4
0.2
0
−0.2
−0.4
0.651
0.123
-0.082
-0.088
g
v
n
d_10
Input Variables
Total Order Sensitivity Analysis
Sobol Indices
0.8
0.6
0.4
0.2
0
−0.2
−0.4
0.864
0.261
0.011
g
v
n
d_10
Input Variables

Authors	
	

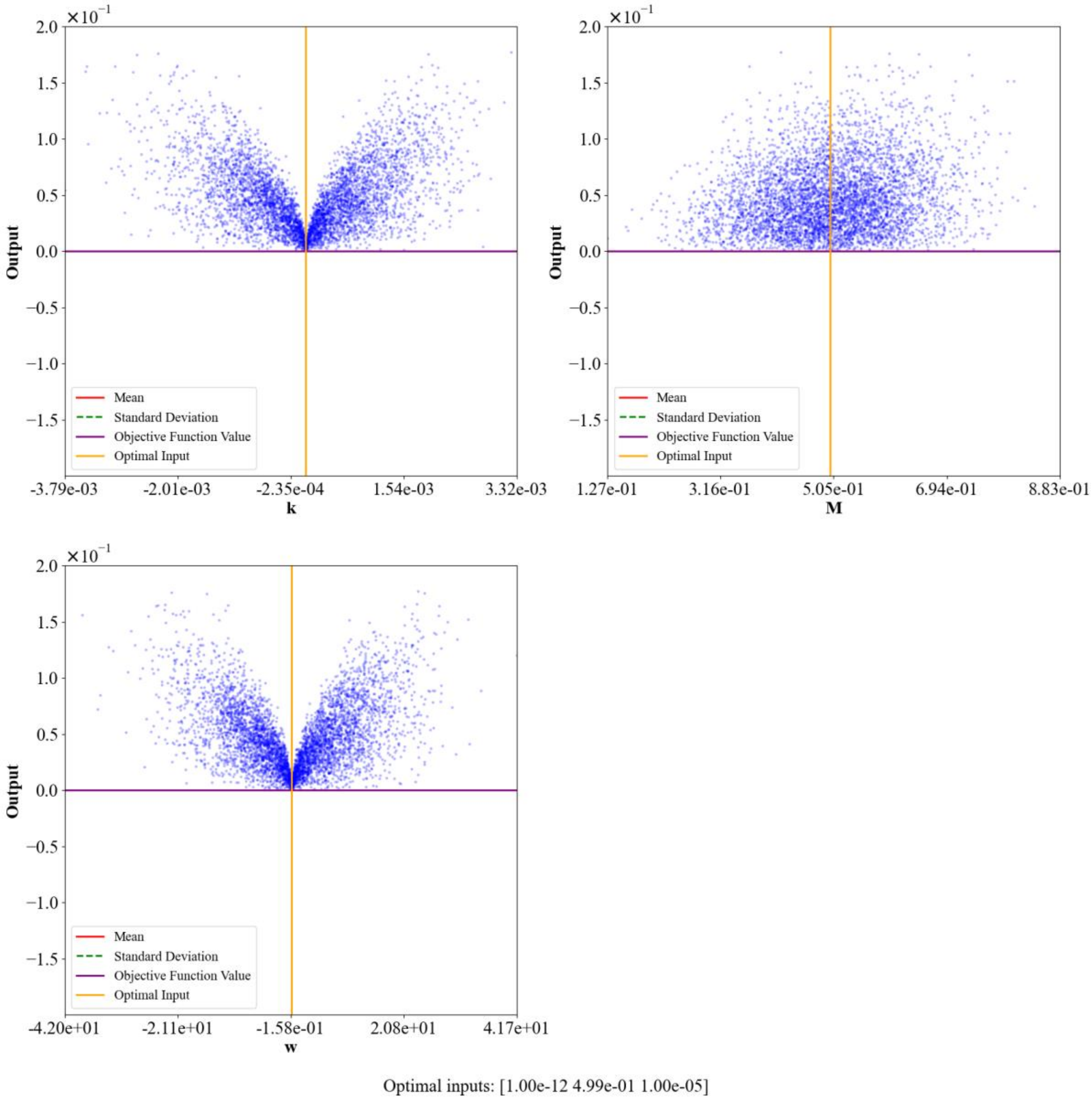
Indices
2
1.5
1
0.5
0
−0.5
−1
0.01
-0.77
0.29
-0.09
-0.80
1.00
1.66
g
v
n
d_10
Variables
Normalized
Standardized


Cabalar et al., (2016)
First Order Sensitivity Analysis
Sobol Indices
0.4
0.2
0
−0.2
−0.4
-0.016
0.071
0.171
0.397
g
v
n
d_10
Input Variables
Total Order Sensitivity Analysis
Sobol Indices
0.6
0.4
0.2
0
−0.2
−0.4
0.192
0.315
0.608
g
v
n
d_10
Input Variables

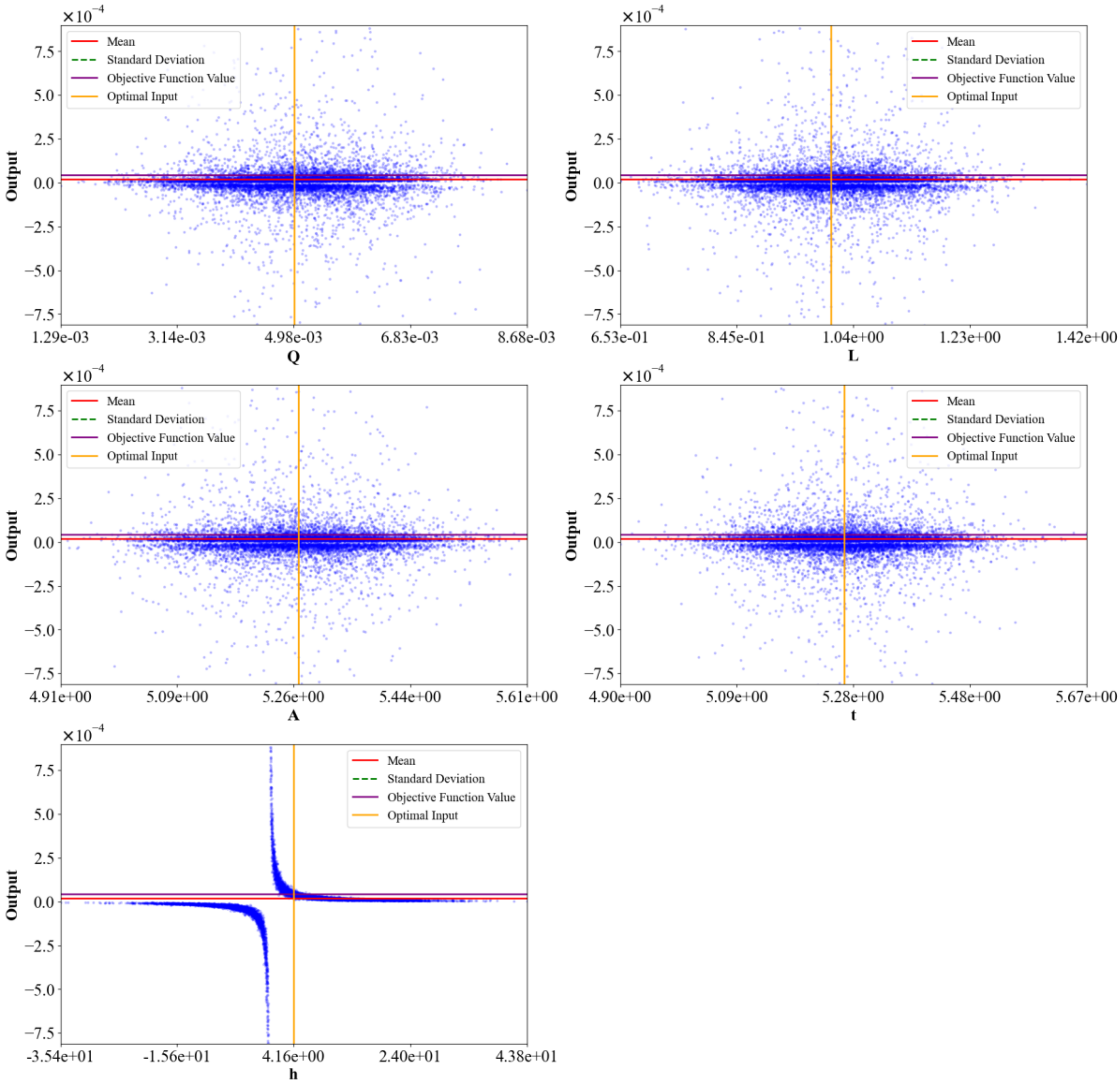
Authors


Indices
2
1.5
1
0.5
0
−0.5
−1
0.03
-0.61
-0.68
0.10
-0.44
1.00
1.73
Variables
Normalized
Standardized

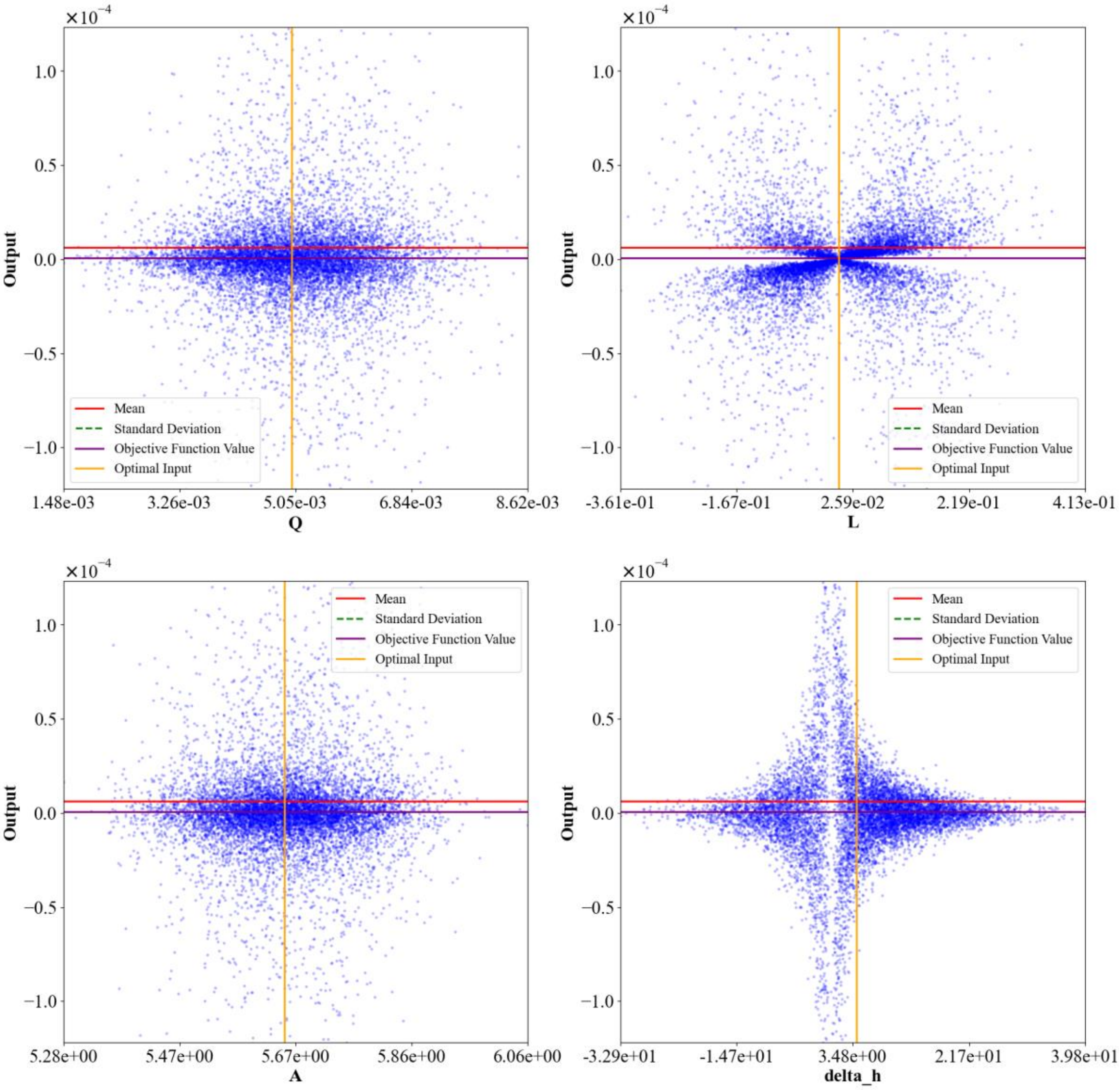
Supplement D (Optimisation Simulations)

<table>
<tr><th>Author</th><th></th></tr>
<tr><td>Grischek et al., (2016)</td><td>


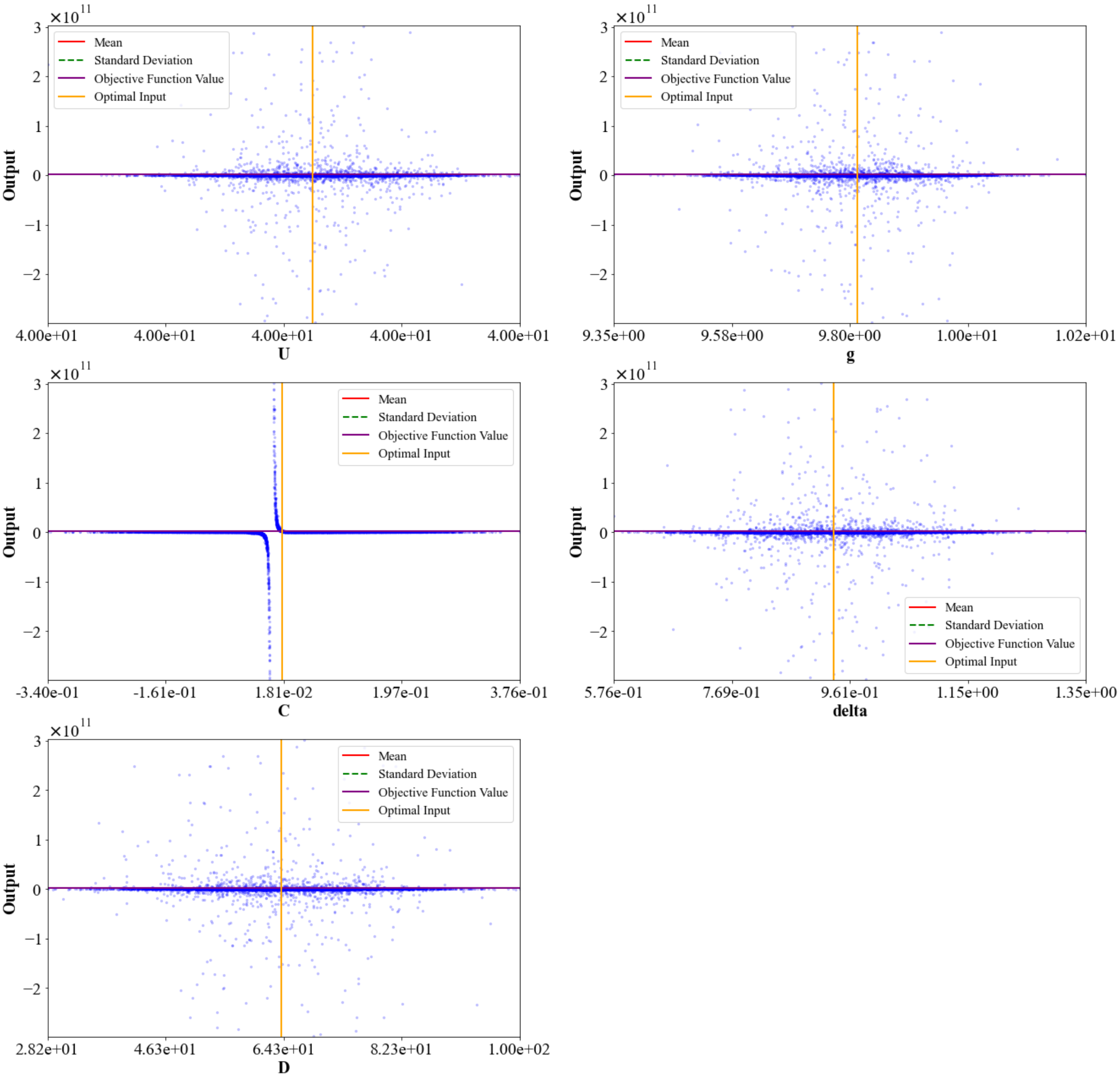
</td></tr>
</table>

<table>
<tr><th>Author</th><th></th></tr>
<tr><td>Ghani et al., (2017)</td><td>


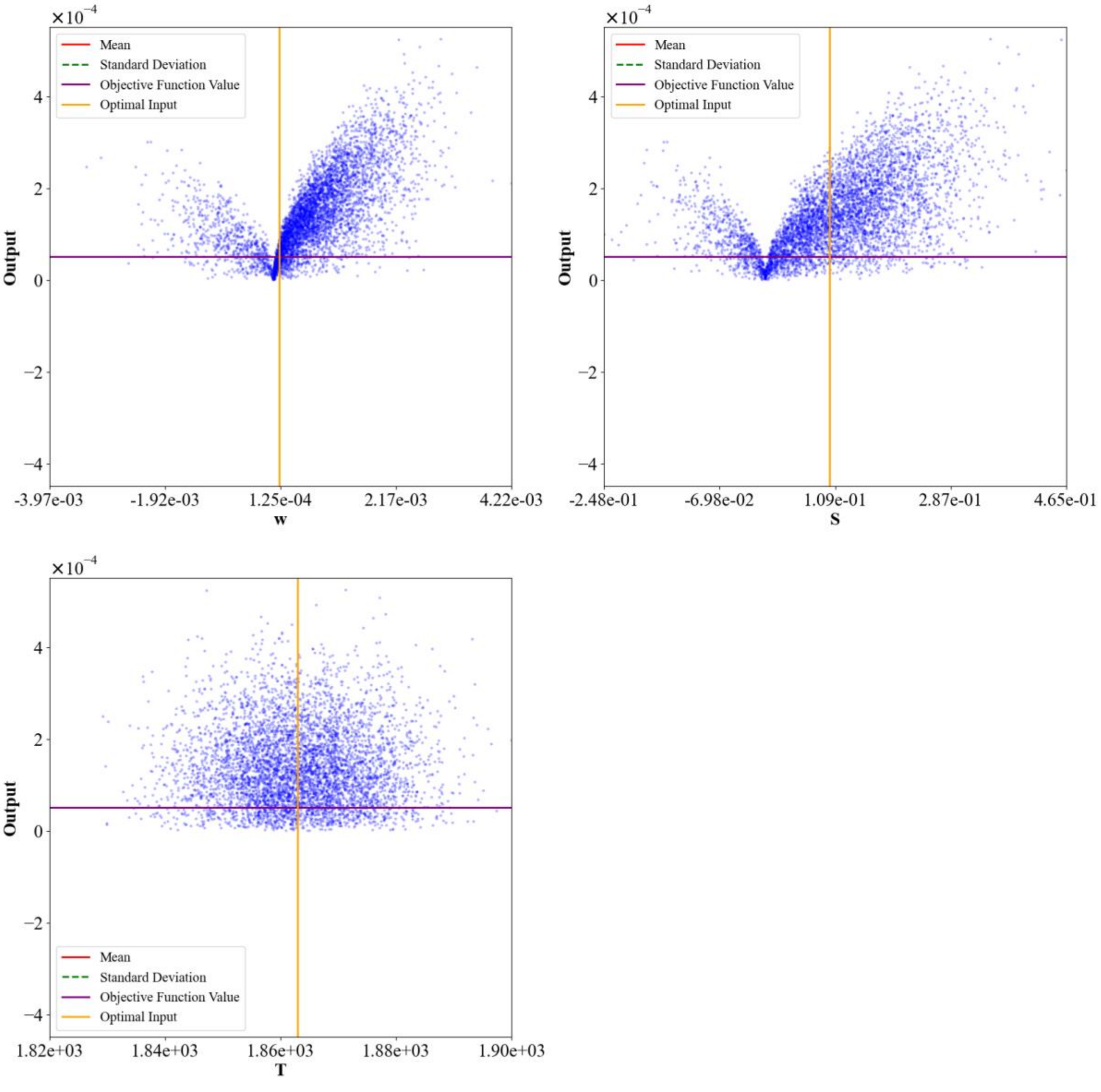
Optimal inputs: [4.99200000e-03 1.00000000e+00 5.26909941e+00 5.26909941e+00 4.10000000e+00]
</td></tr>
</table>

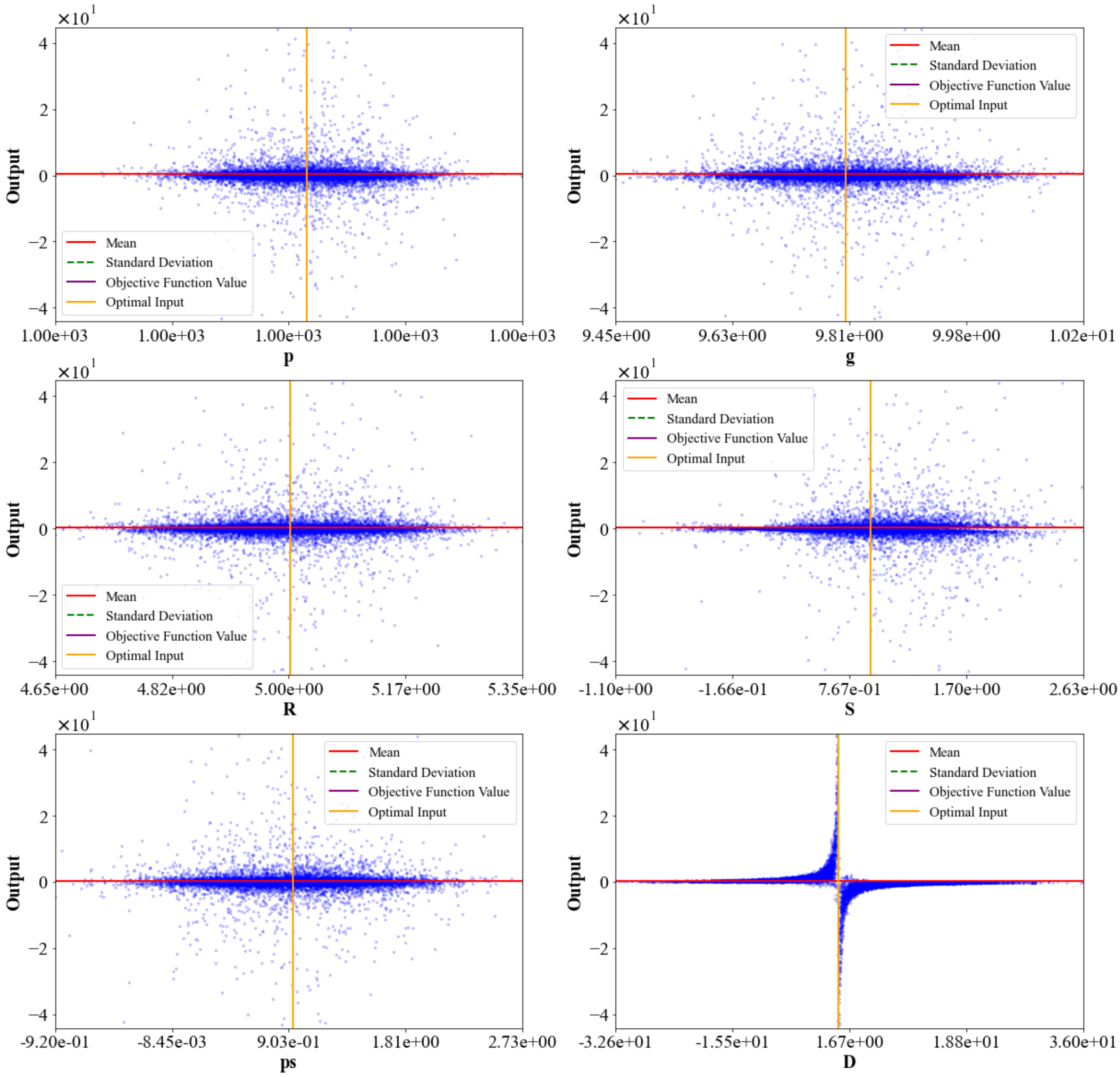
<table>
<tr><th>Author</th><th></th></tr>
<tr><td>Pholkern et al., (2015)</td><td>


Optimal inputs: [4.99200000e-03 3.00000000e-03 5.65000319e+00 4.10000000e+00]
</td></tr>
</table>

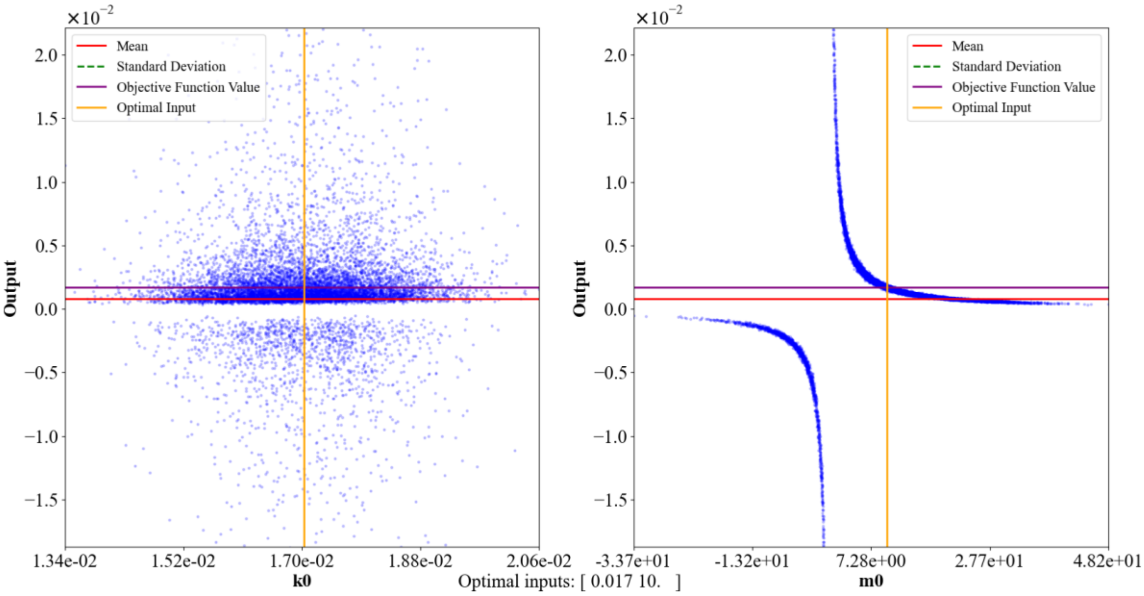
<table>
<tr><th>Author</th><th></th></tr>
<tr><td>Tao et al., (2019)</td><td>


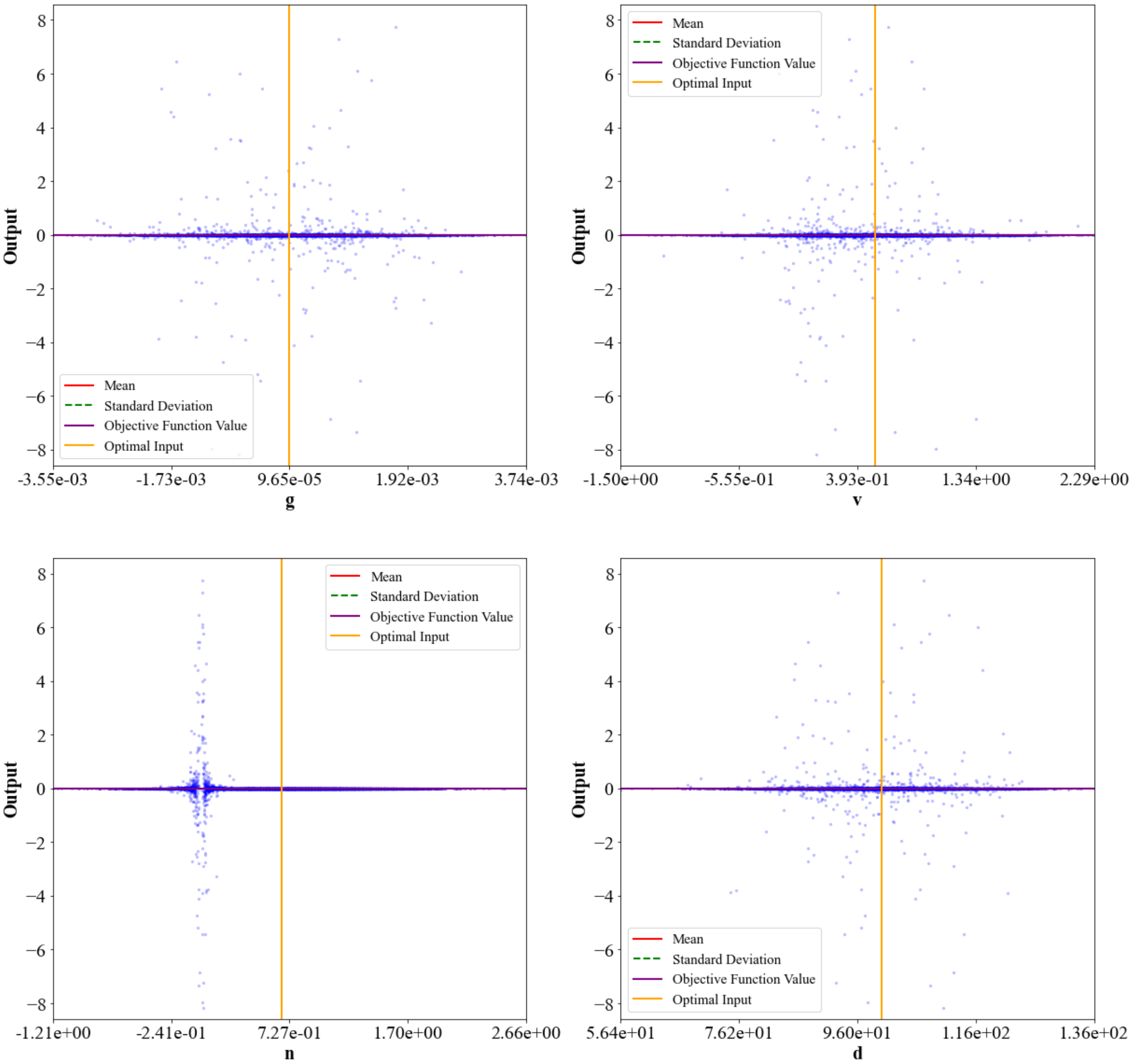
Optimal inputs: [4.00e+01 9.81e+00 1.56e-02 9.35e-01 6.40e+01]
</td></tr>
</table>

Author	
Koren et al., (2021)	 Optimal inputs: [9.70000000e-05 1.00000000e-01 1.86000011e+03]

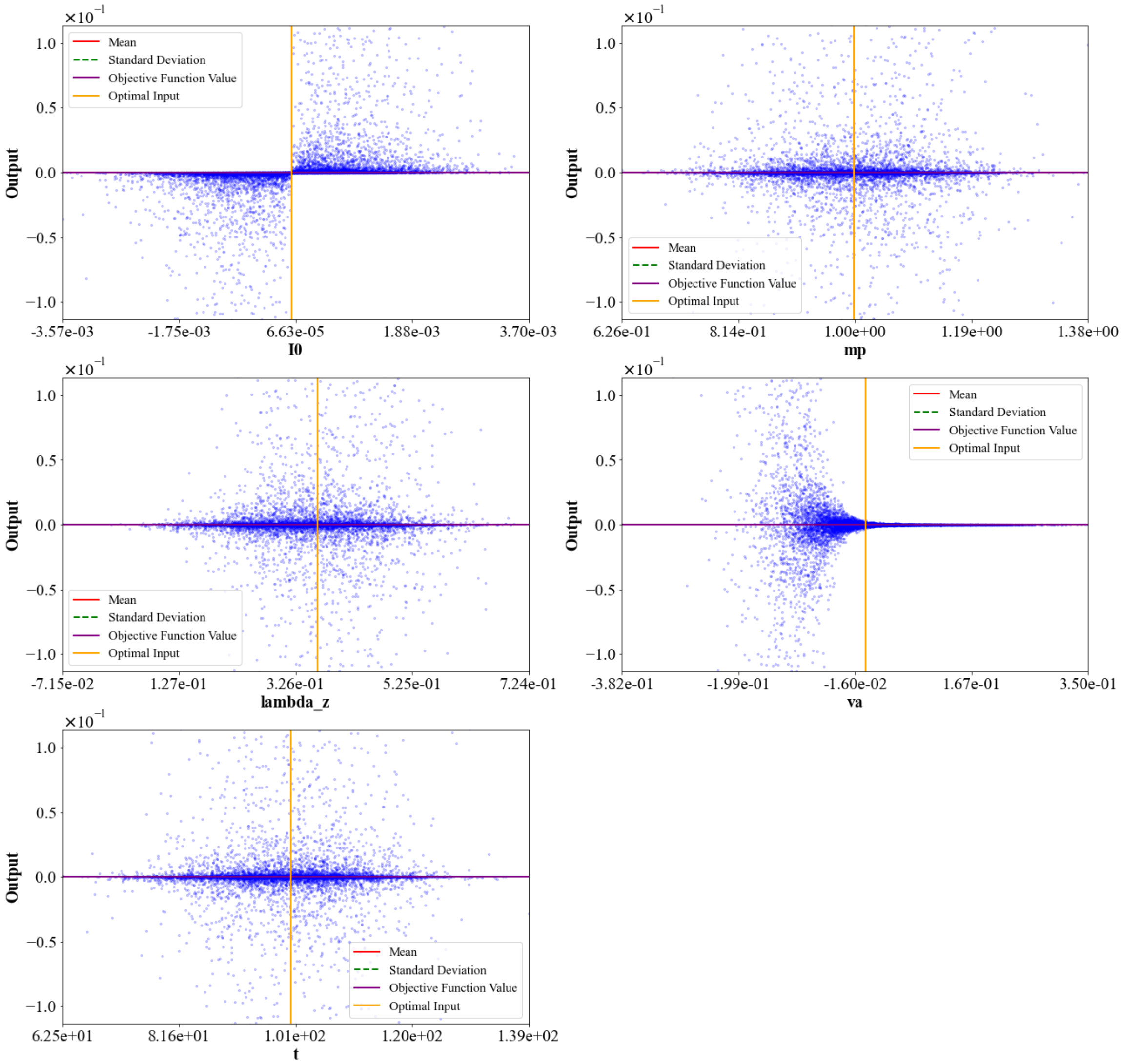
<table>
<tr><th>Author</th><th></th></tr>
<tr><td>Brunke (1999)</td><td>


Optimal inputs: [9.998e+02 9.800e+00 5.000e+00 9.350e-01 9.350e-01 2.000e-02]
</td></tr>
</table>

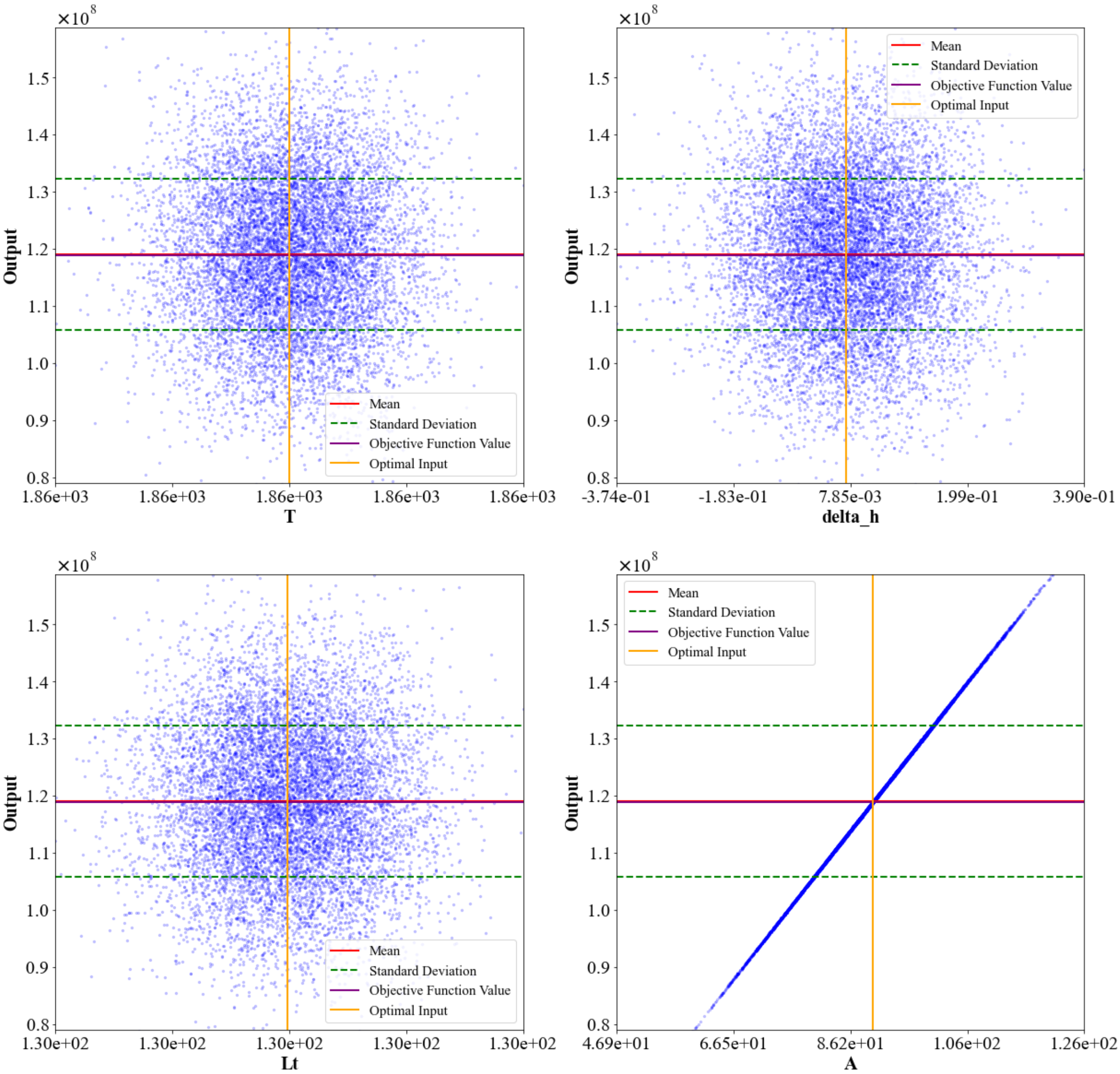
<table>
<tr><th>Author</th><th></th></tr>
<tr><td>Wang et al., (2015)</td><td>
</td></tr>
</table>

<table>
<tr><th>Author</th><th></th></tr>
<tr><td>Cui et al., (2021)</td><td>


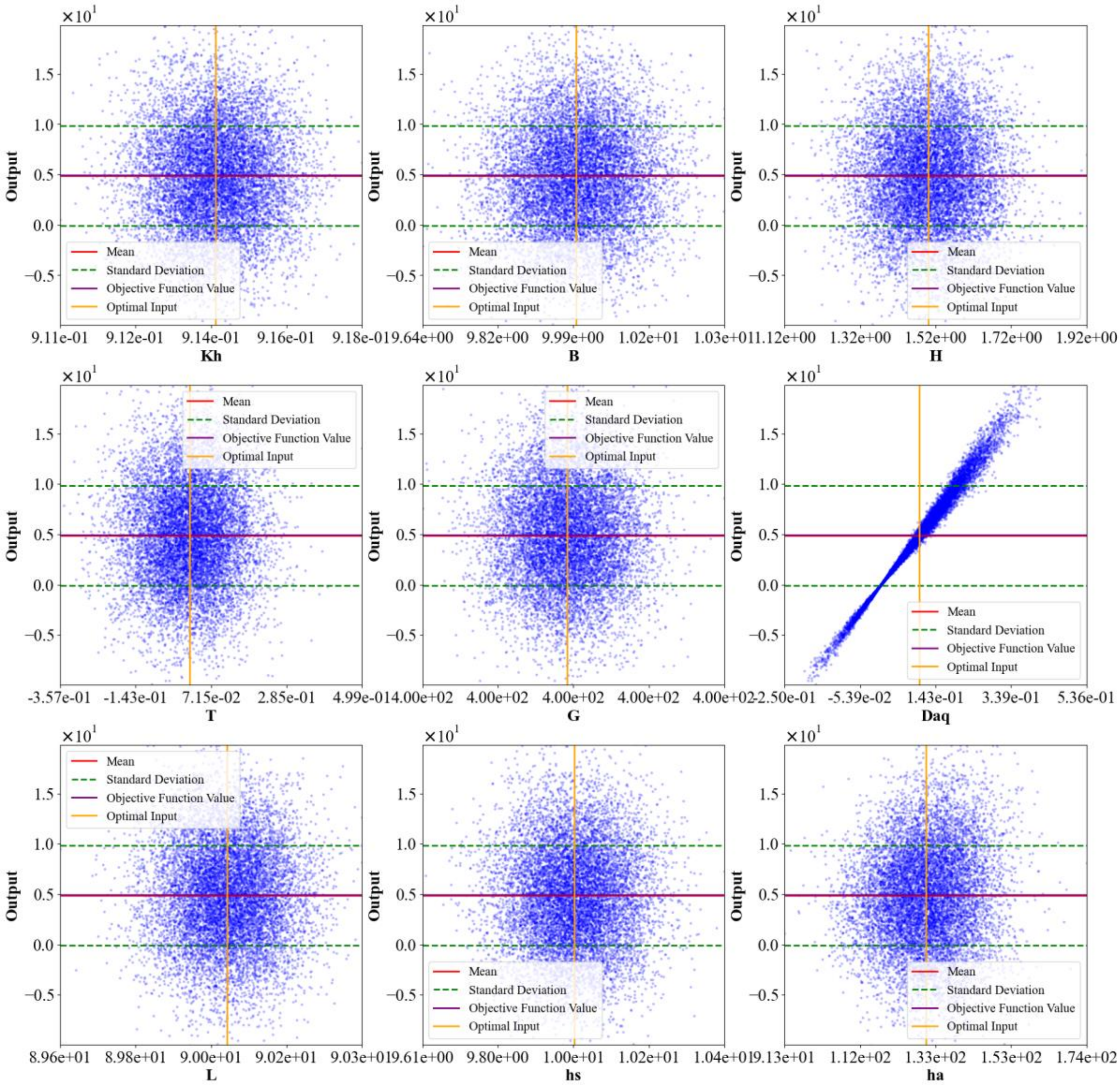
Optimal inputs: [9.70000000e-05 5.32832578e-01 6.64163125e-01 1.00000328e+02]
</td></tr>
</table>

<table>
<tr><th>Author</th><th></th></tr>
<tr><td>Pedretti et al., (2012)</td><td>


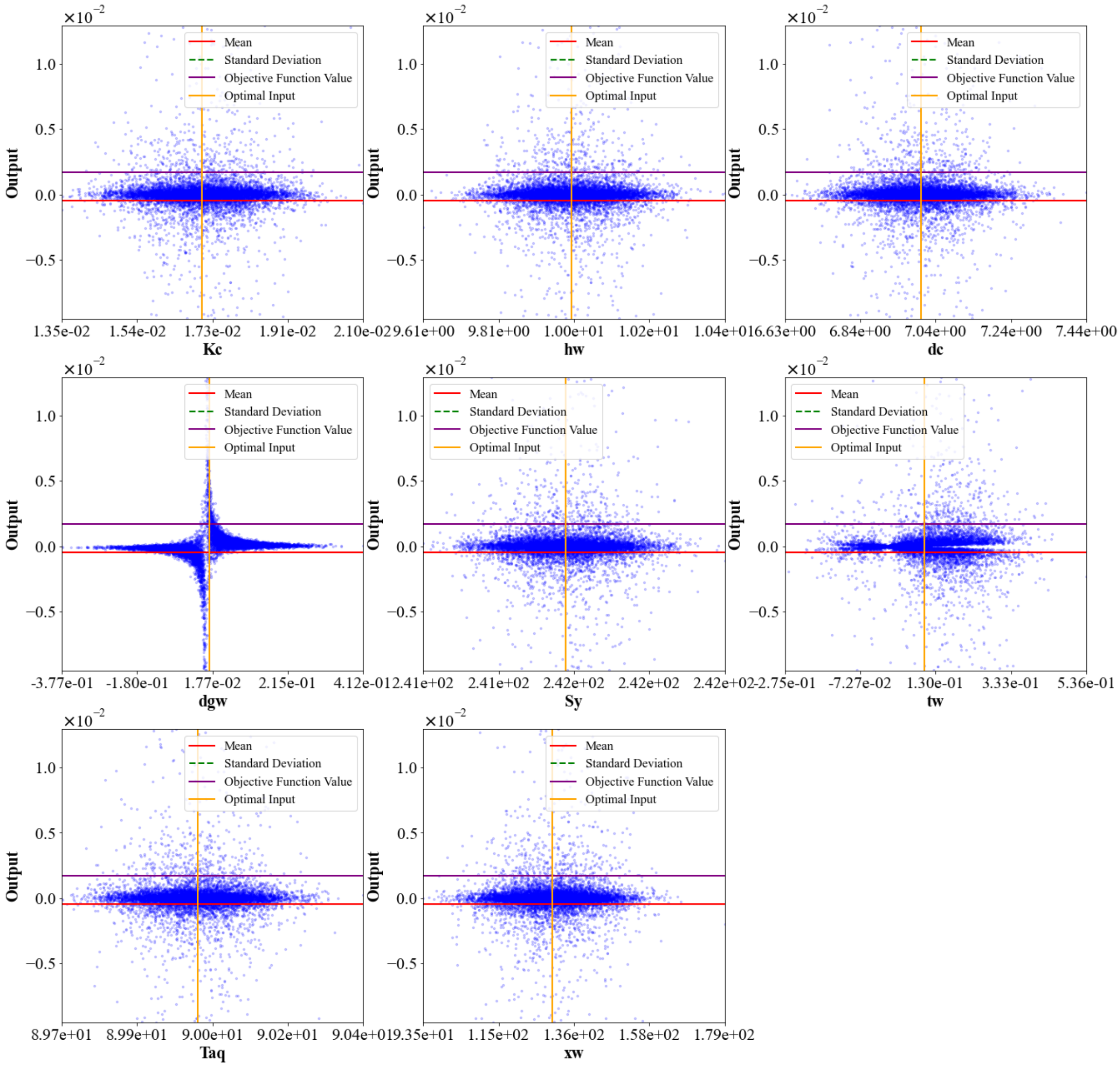
Optimal inputs: [1.0000000e-05 1.0000004e+00 3.6300000e-01 1.1000000e-05 1.0000000e+02]
</td></tr>
</table>

<table>
<tr><th>Author</th><th></th></tr>
<tr><td>Kim et al., (2010)</td><td>

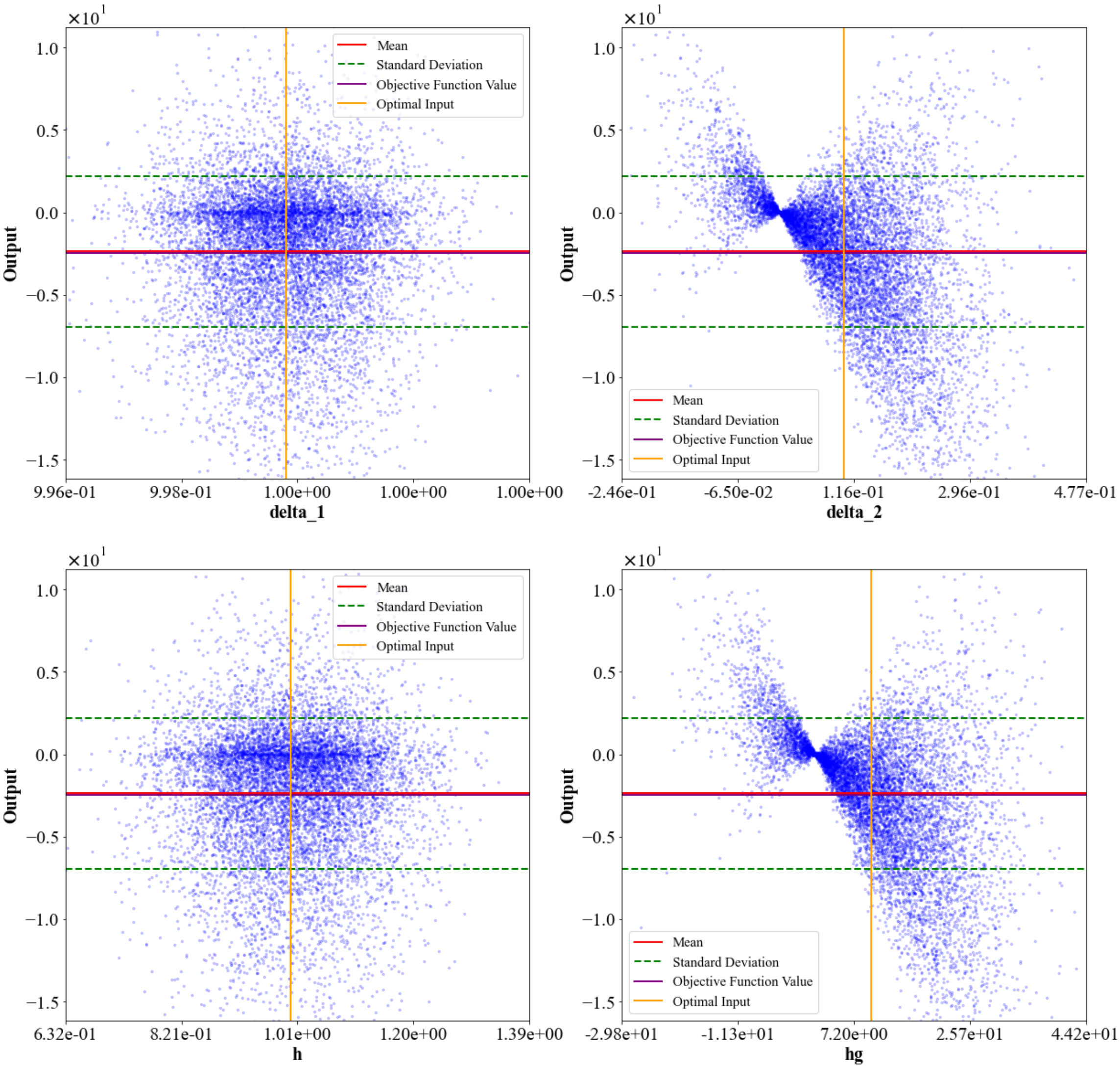
Optimal inputs: [1.86e+03 1.00e-03 1.30e+02 9.00e+01]</td></tr>
</table>

<table>
<tr><th>Author</th><th></th></tr>
<tr><td>Seytoux et al., (2017)</td><td>


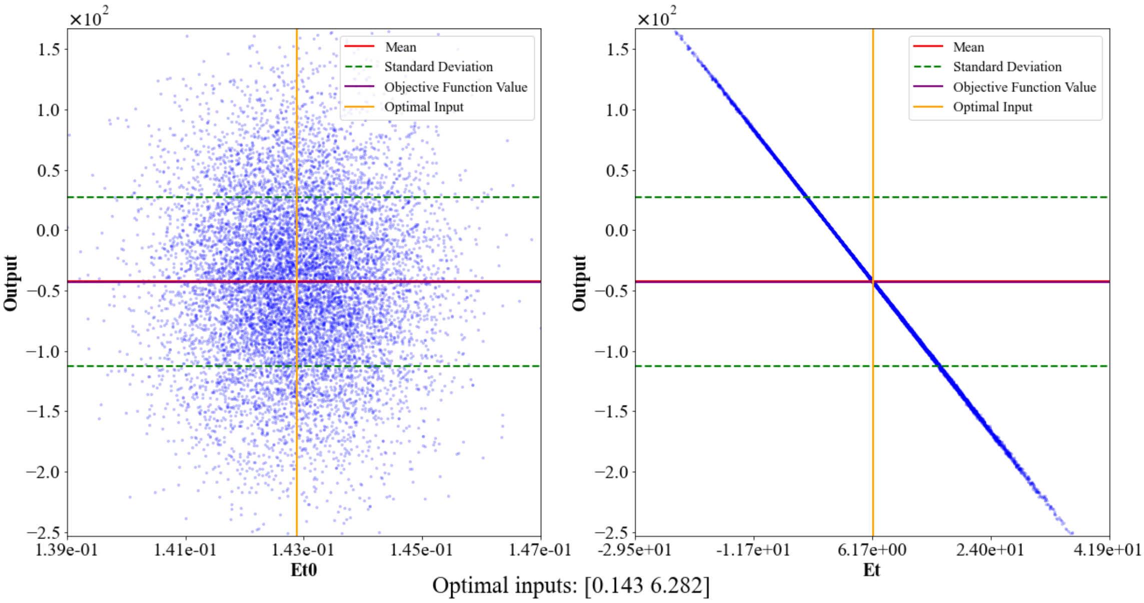
Optimal inputs: [9.144e-01 1.000e+01 1.500e+00 1.000e-02 4.000e+02 1.000e-01 9.000e+01 1.000e+01 1.300e+02]
</td></tr>
</table>

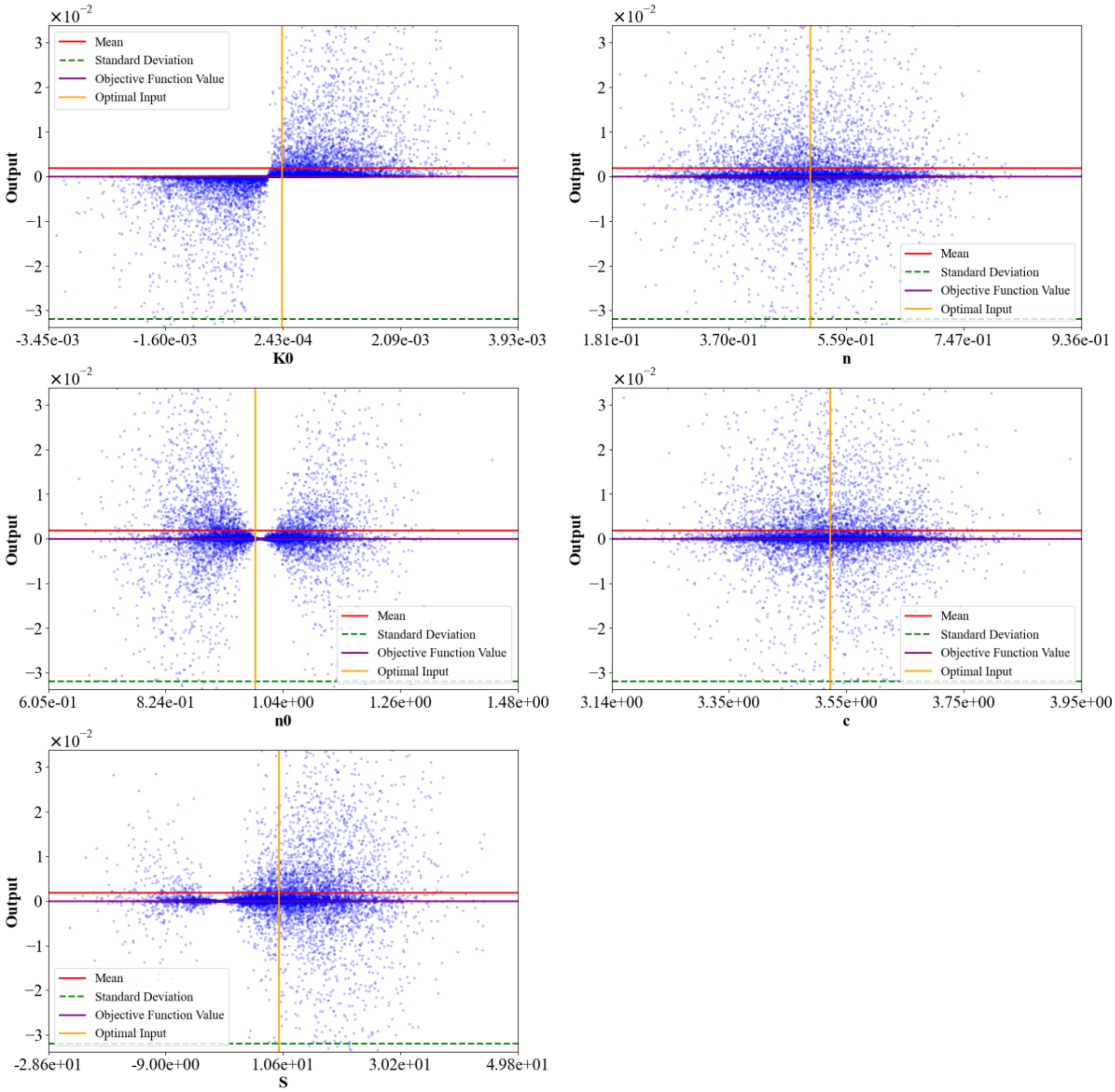
<table>
<tr><th>Author</th><th></th></tr>
<tr><td>Doble et al., (2012)</td><td>


Optimal inputs: [1.70000000e-02 1.00000000e+01 7.00000000e+00 1.00000000e-02 2.41660571e+02 1.00000000e-01 9.00090920e+01 1.30000000e+02]
</td></tr>
</table>

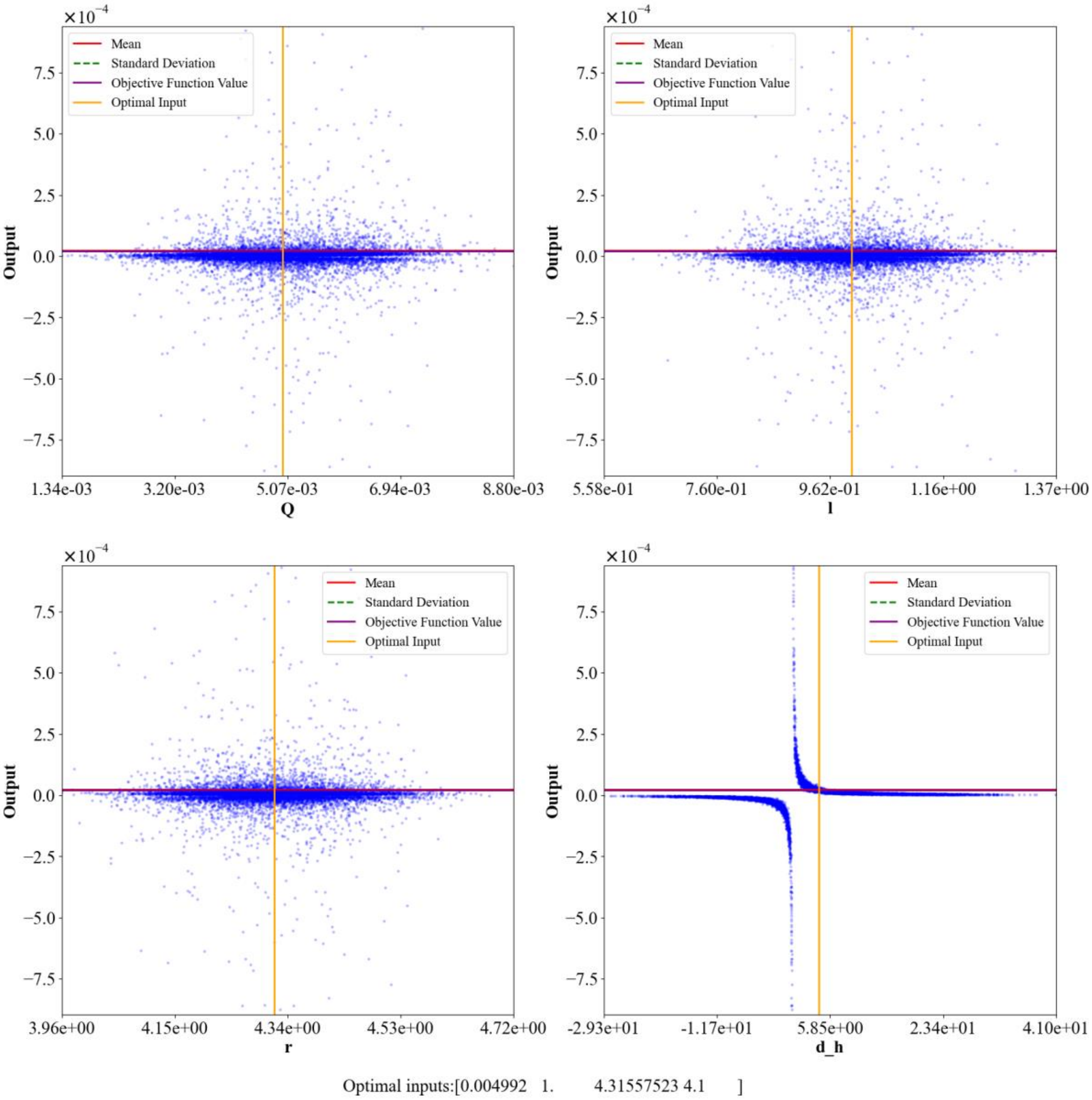
<table>
<tr><th>Author</th><th></th></tr>
<tr><td>Delfs et al., (2012)</td><td>


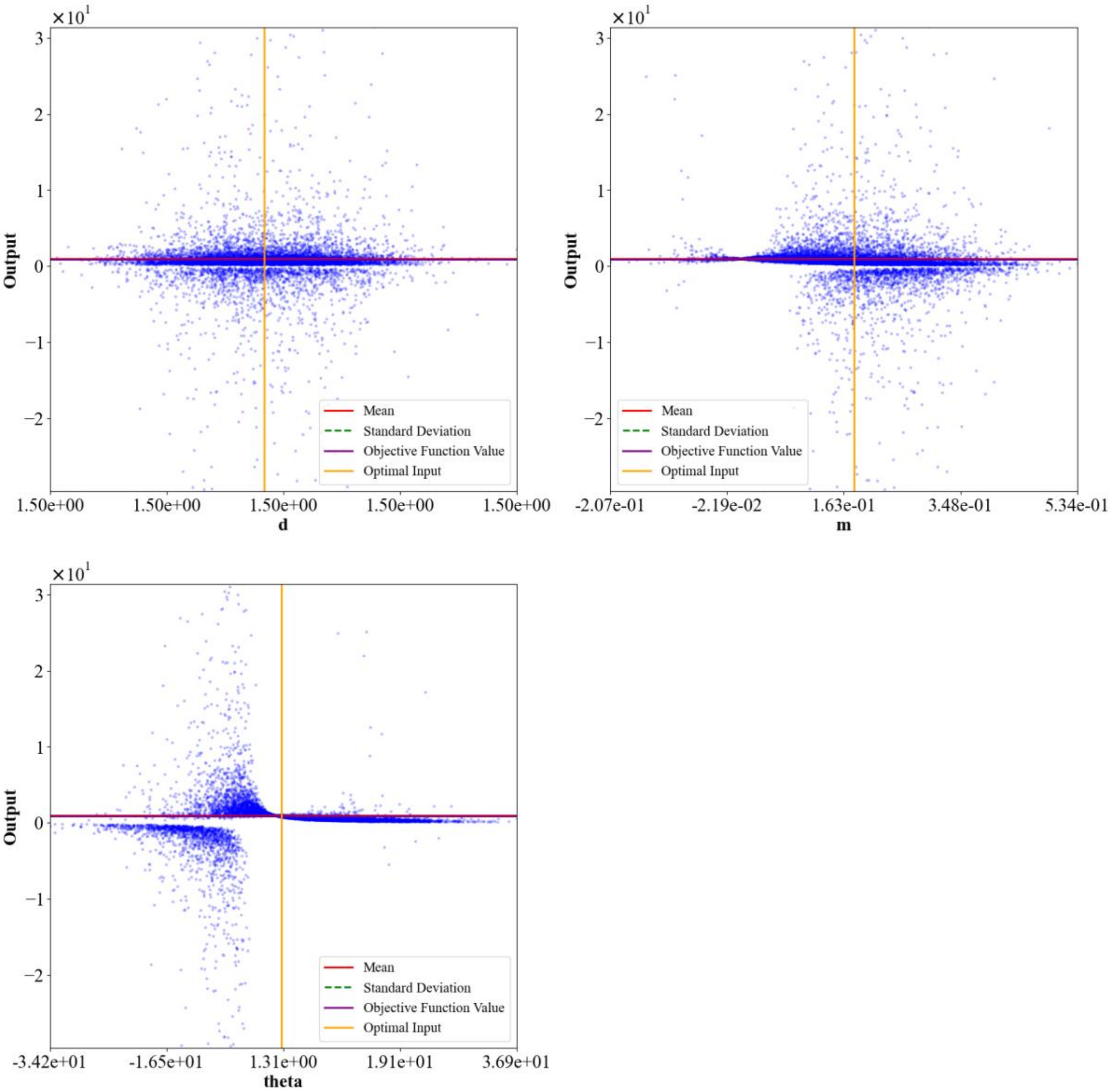
Optimal inputs: [1.   0.1 1. 10.]
</td></tr>
</table>

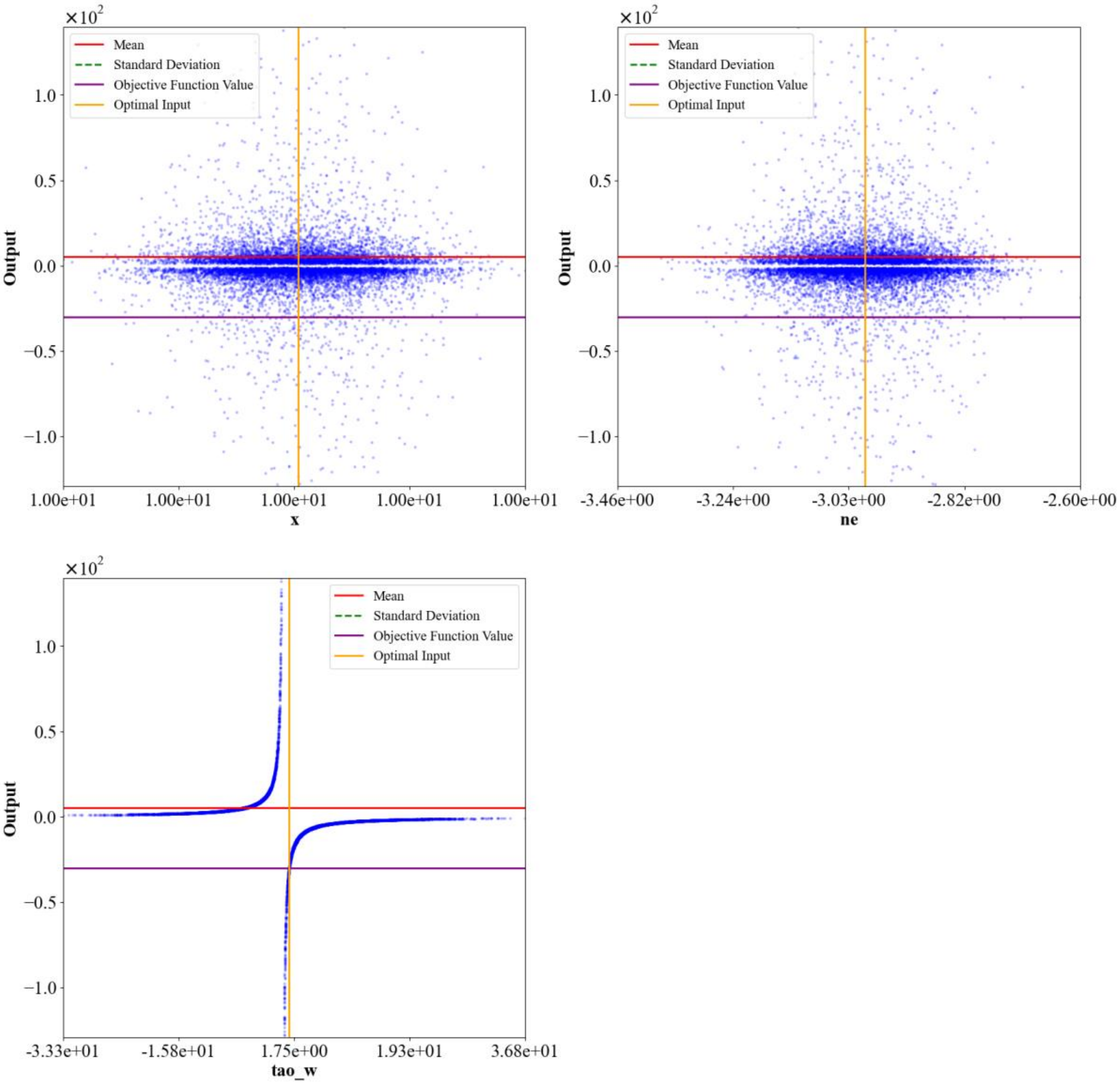
Author	
Zhang et al., (2020)	

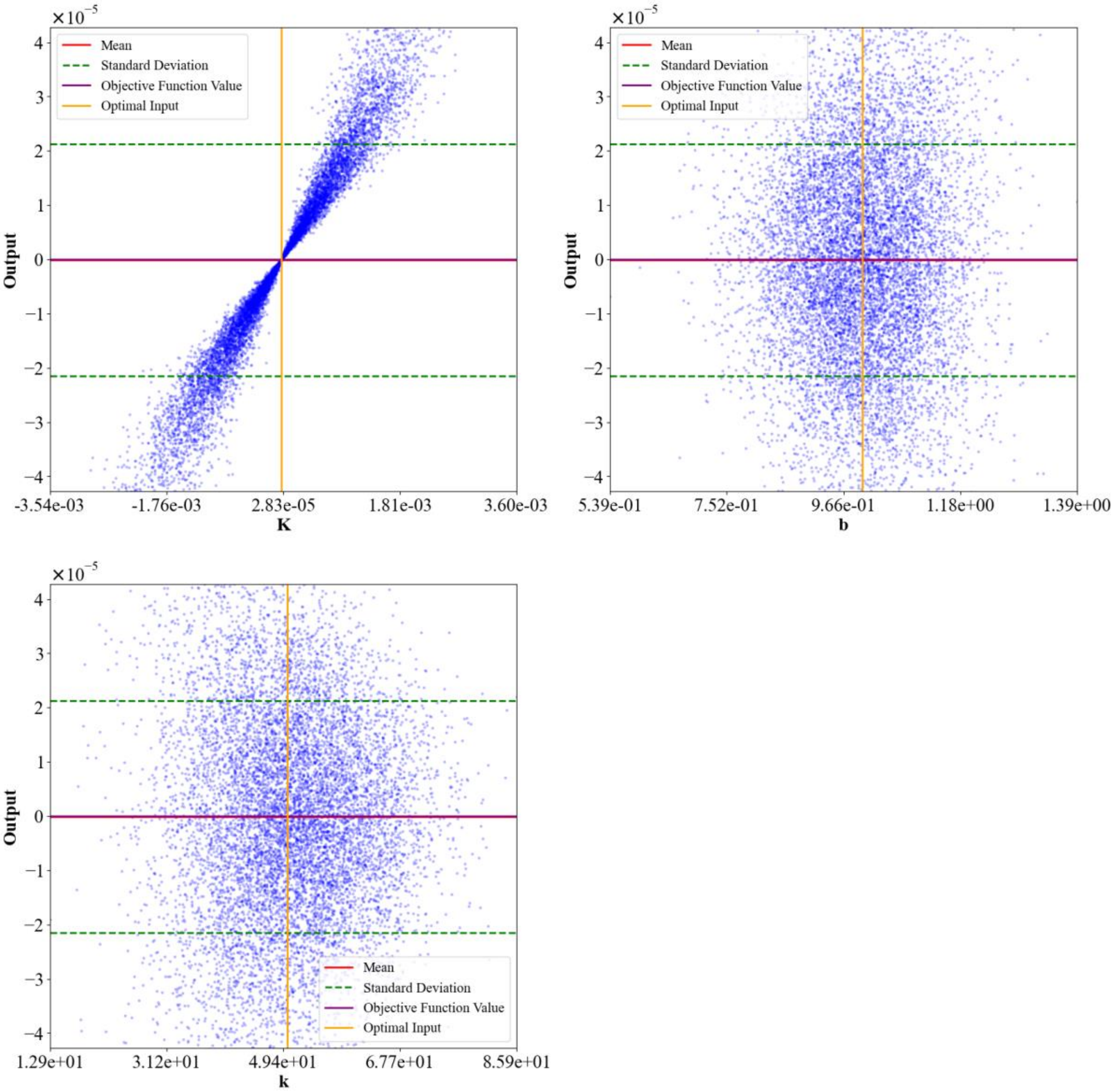
<table>
<tr><th>Author</th><th></th></tr>
<tr><td>Zheng et al., (2014)</td><td>


Optimal inputs: [2.20000000e-04 5.00000000e-01 9.90000000e-01 3.52000000e+00
9.85920001e+00]
</td></tr>
</table>

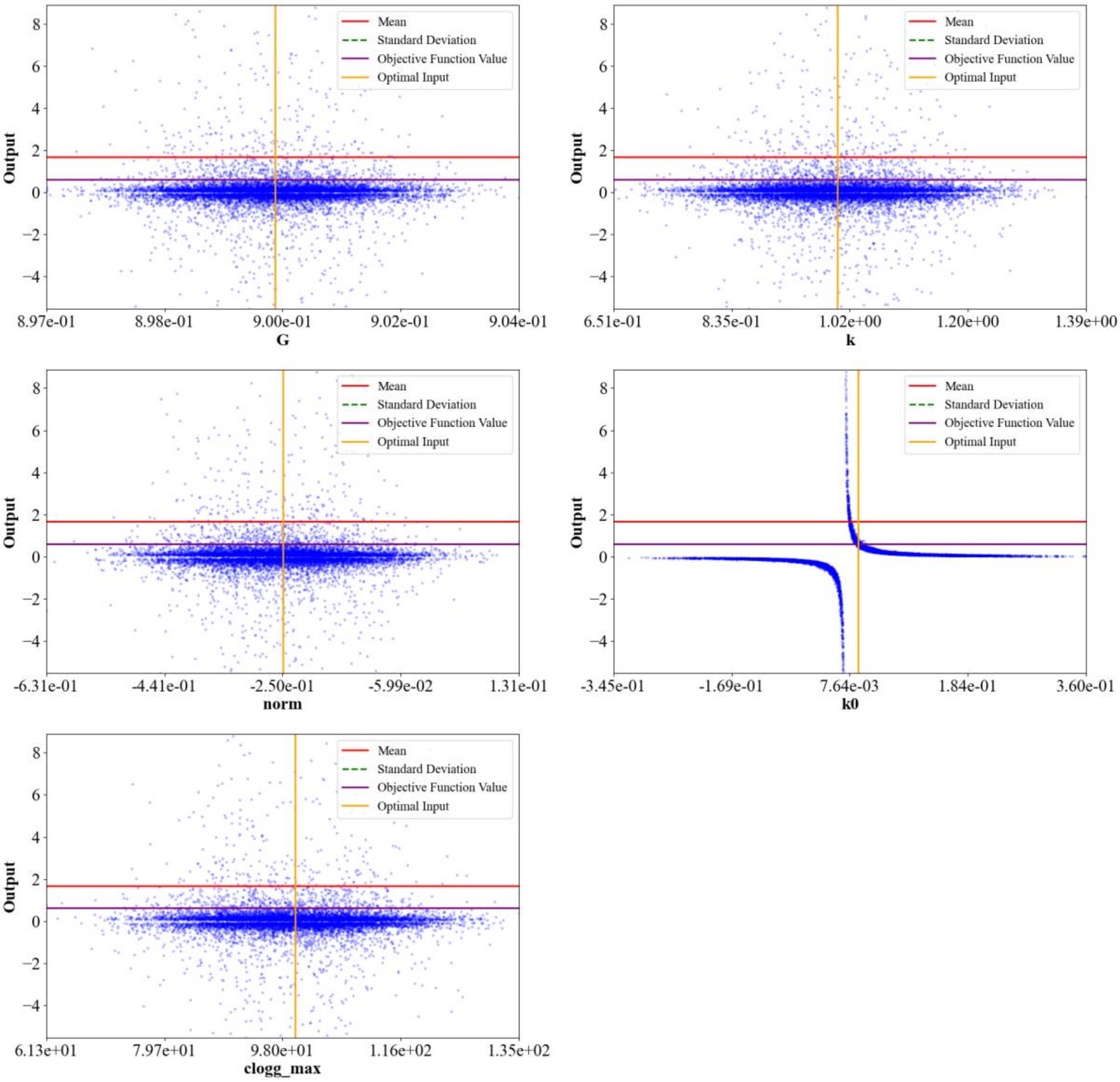
Author	
Du et al., (2014)	

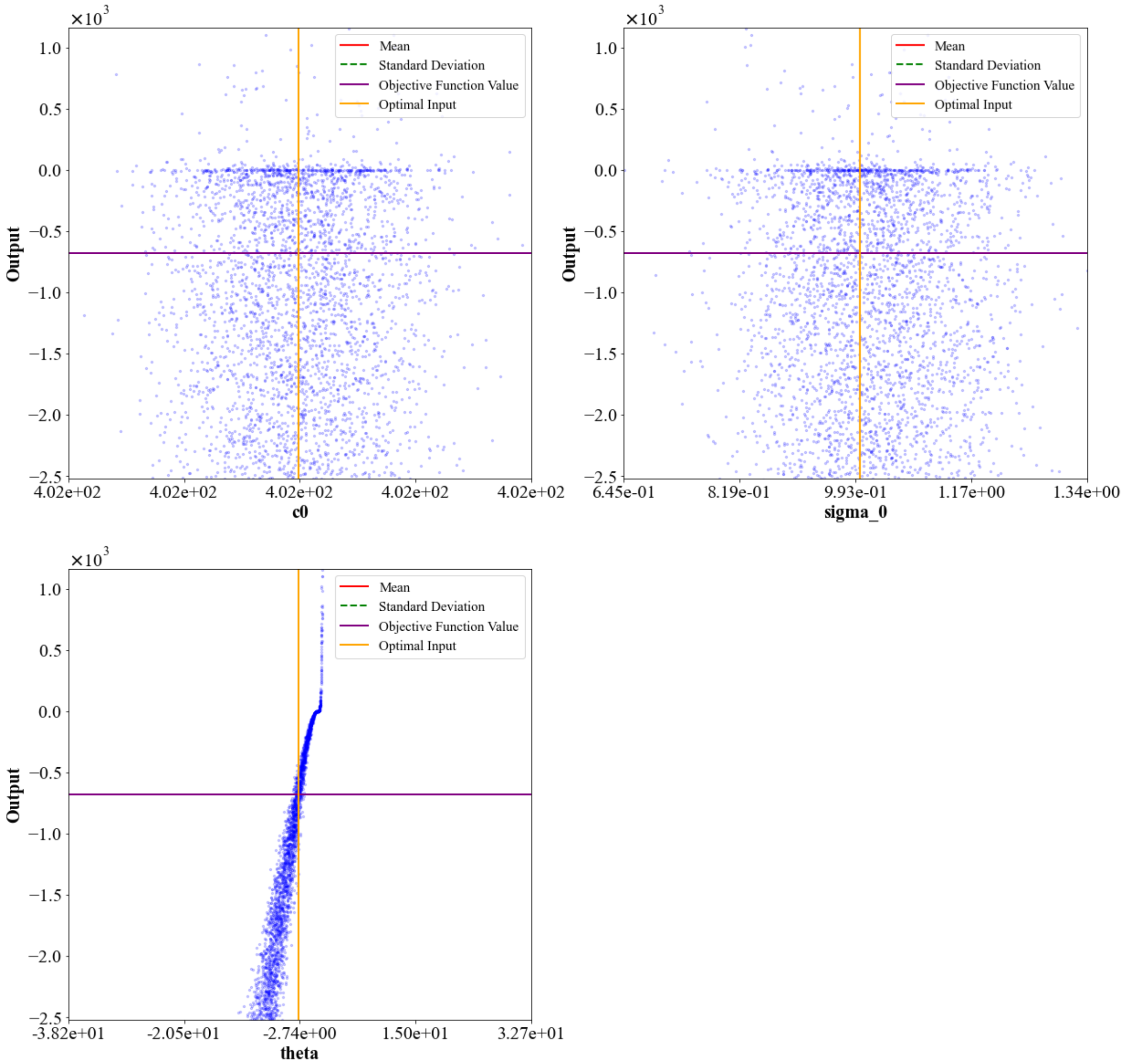
Author	
Rehg et al., (2005)	 Optimal inputs: [1.5 0.18 0.99]

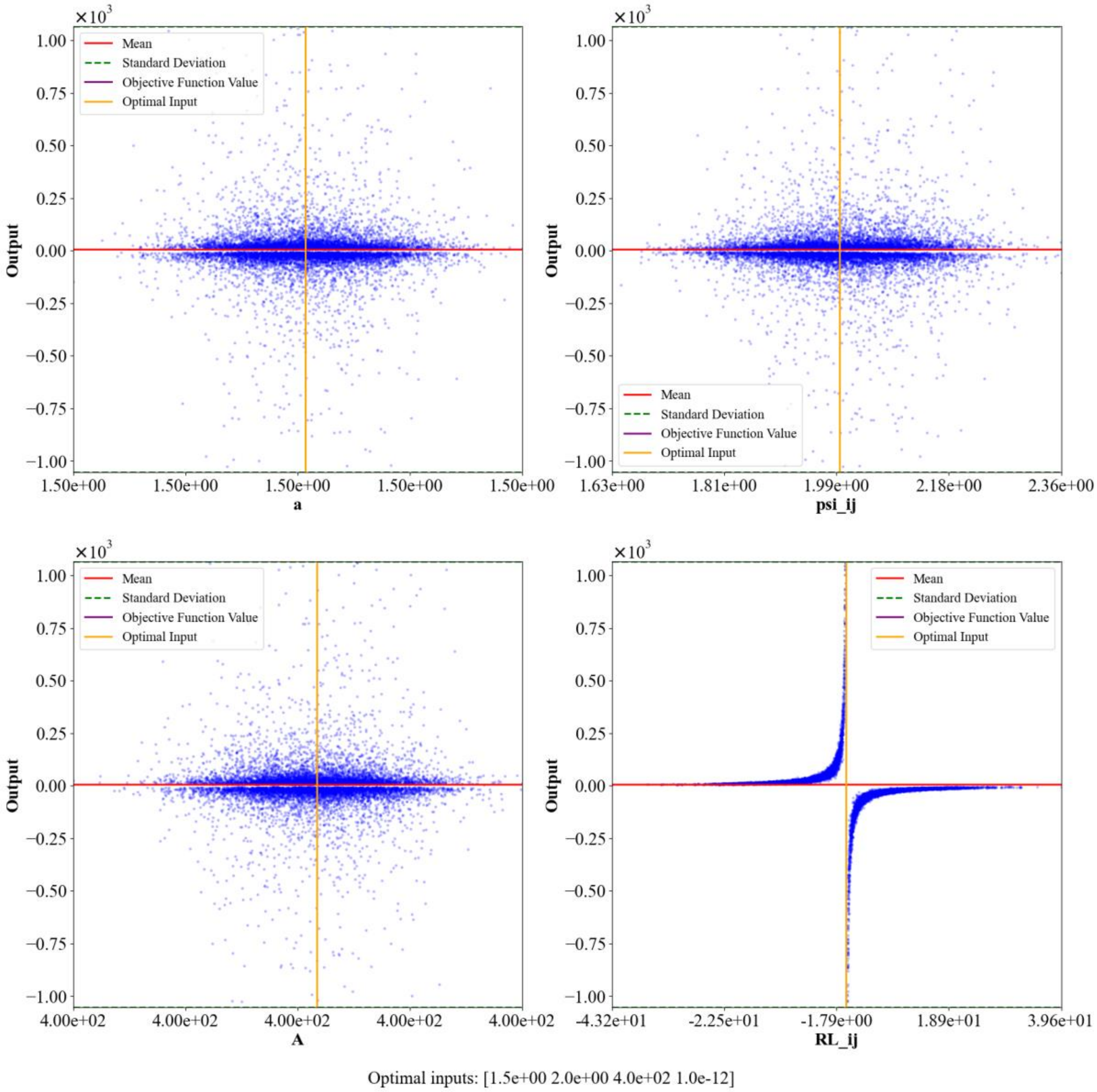
Author	
Hoehn et al., (2006)	 Optimal inputs: [10. -3. 1.]

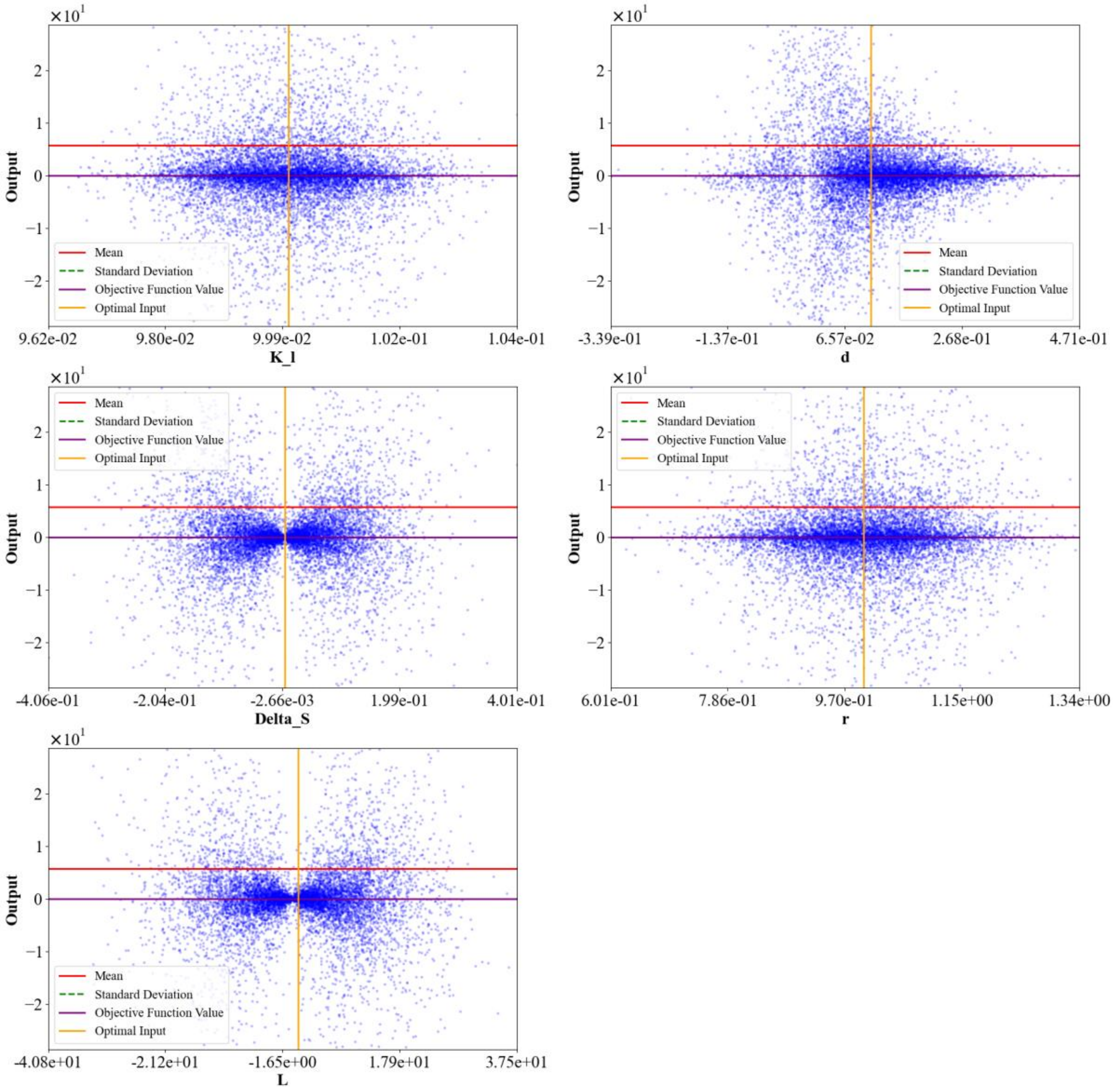
<table>
<tr><th>Author</th><th></th></tr>
<tr><td>Moutsopoulos (2013)</td><td>


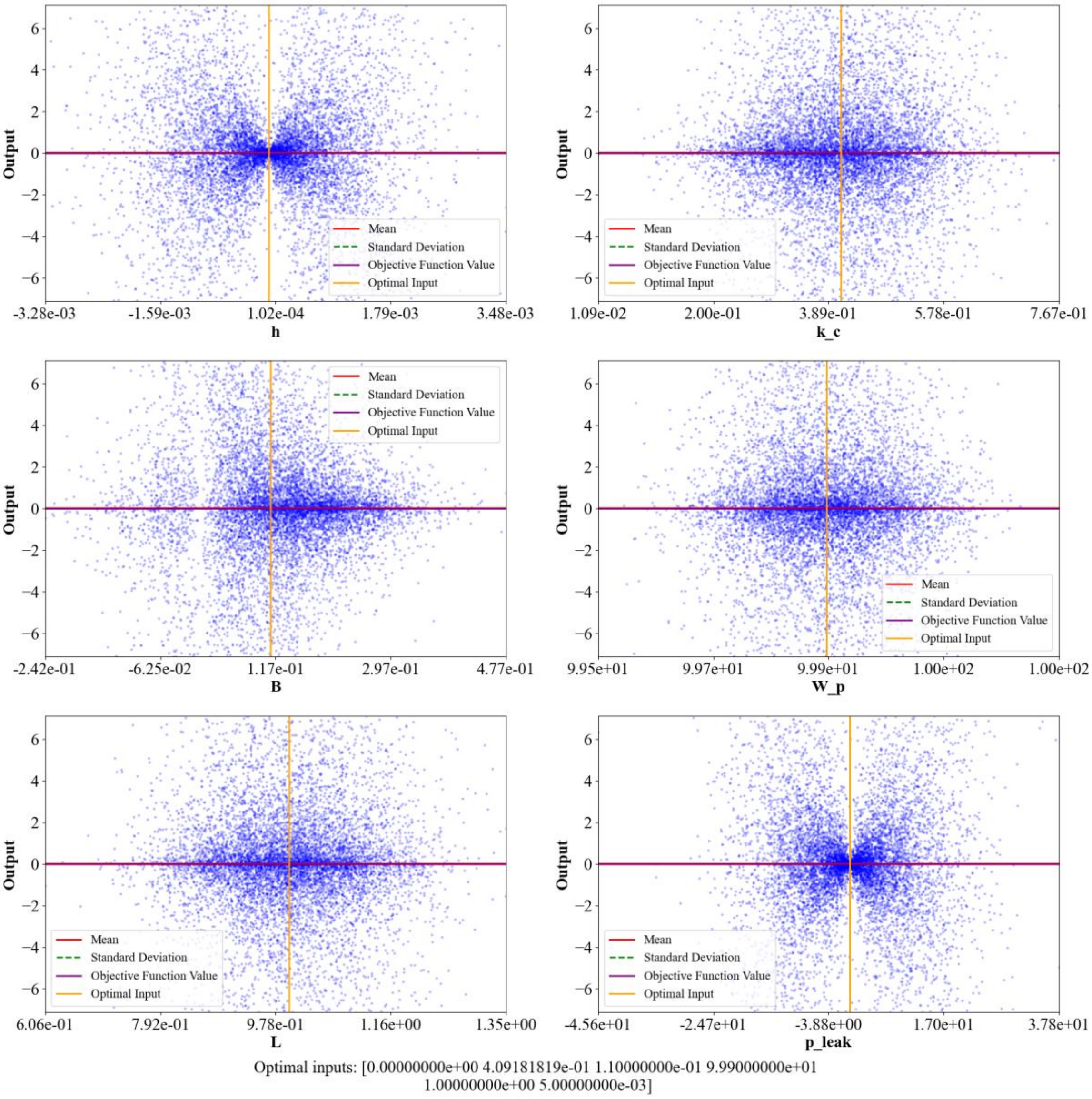
Optimal inputs: [1.e-12 1.e+00 5.e+01]
</td></tr>
</table>

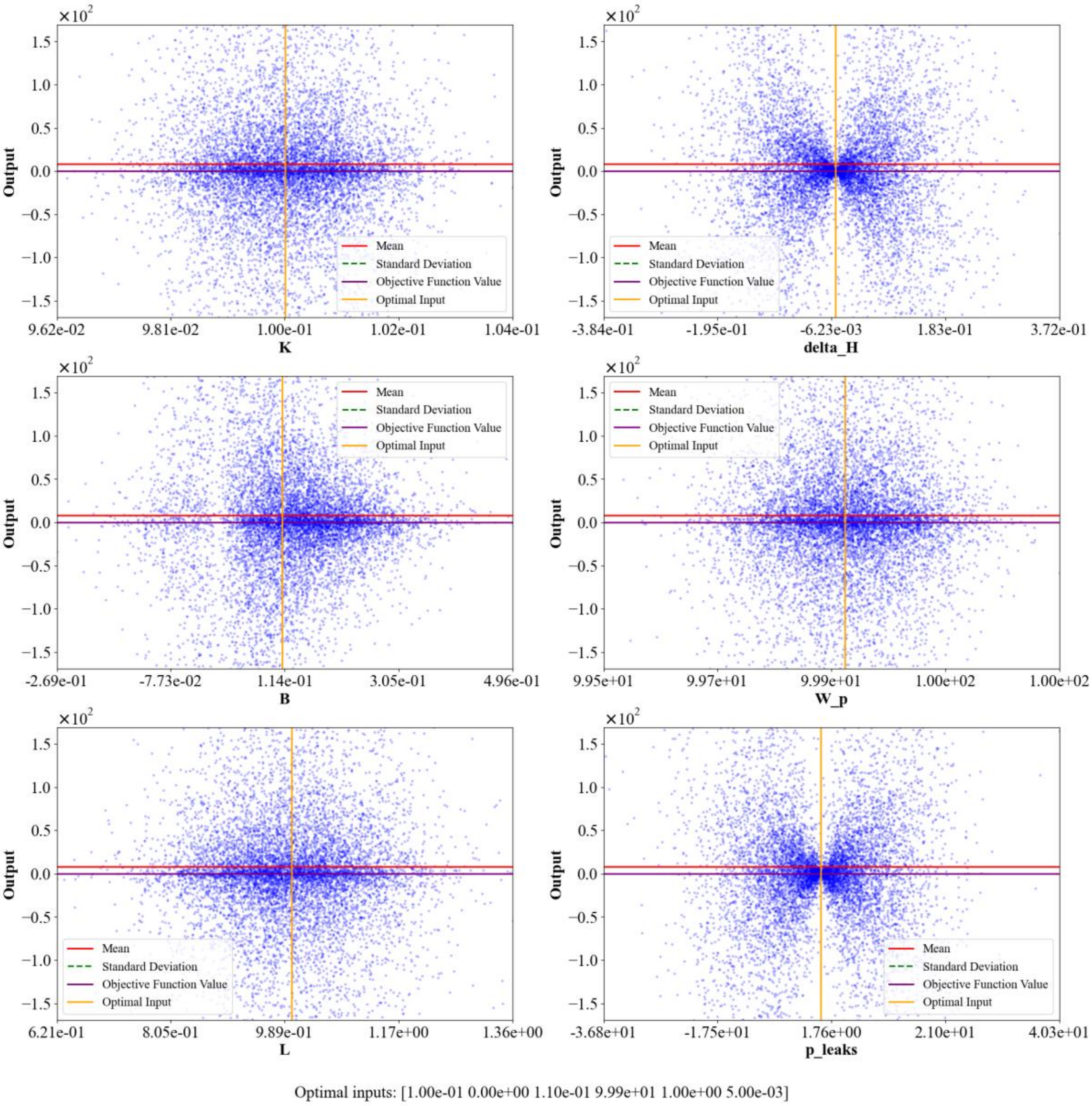
Author	
Rudnick et al., (2015)	 Optimal inputs: [9.0e-01 1.0e+00 -2.5e-01 2.0e-02 1.0e+02]

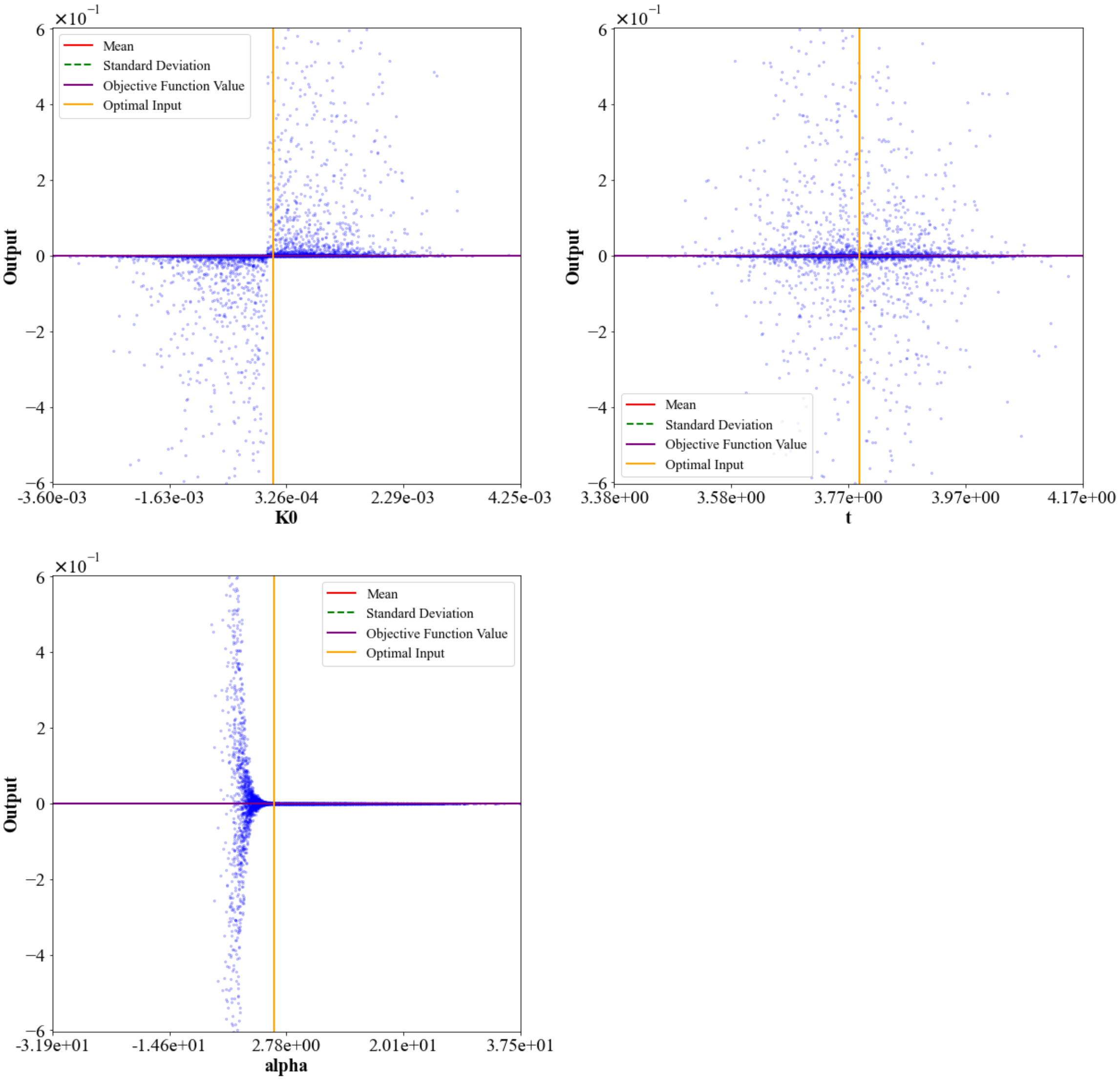
Author	
Schulz (2020)	 Optimal inputs: [402. 1. -3.]

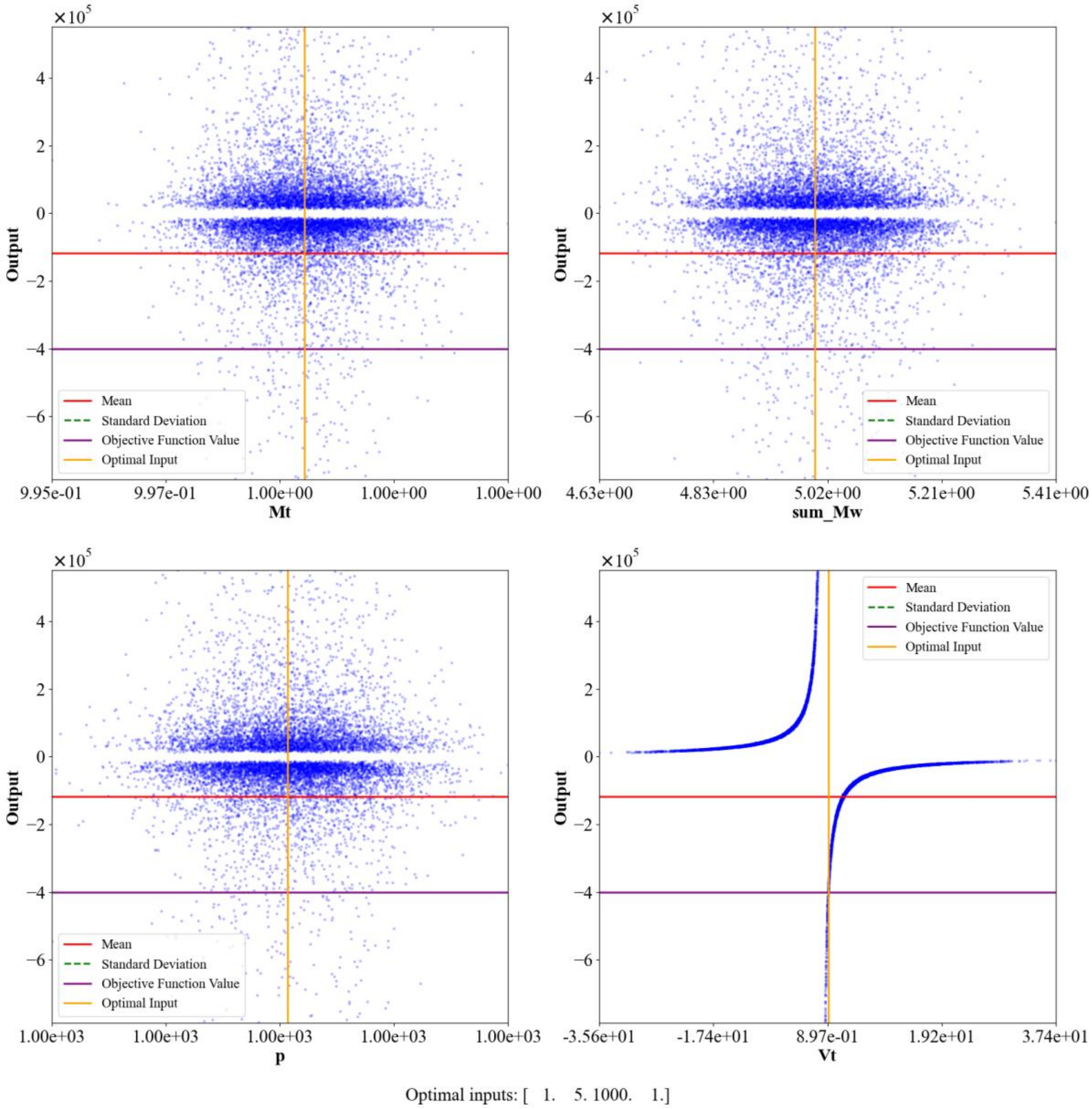
Author	
Kaleris 1998)	

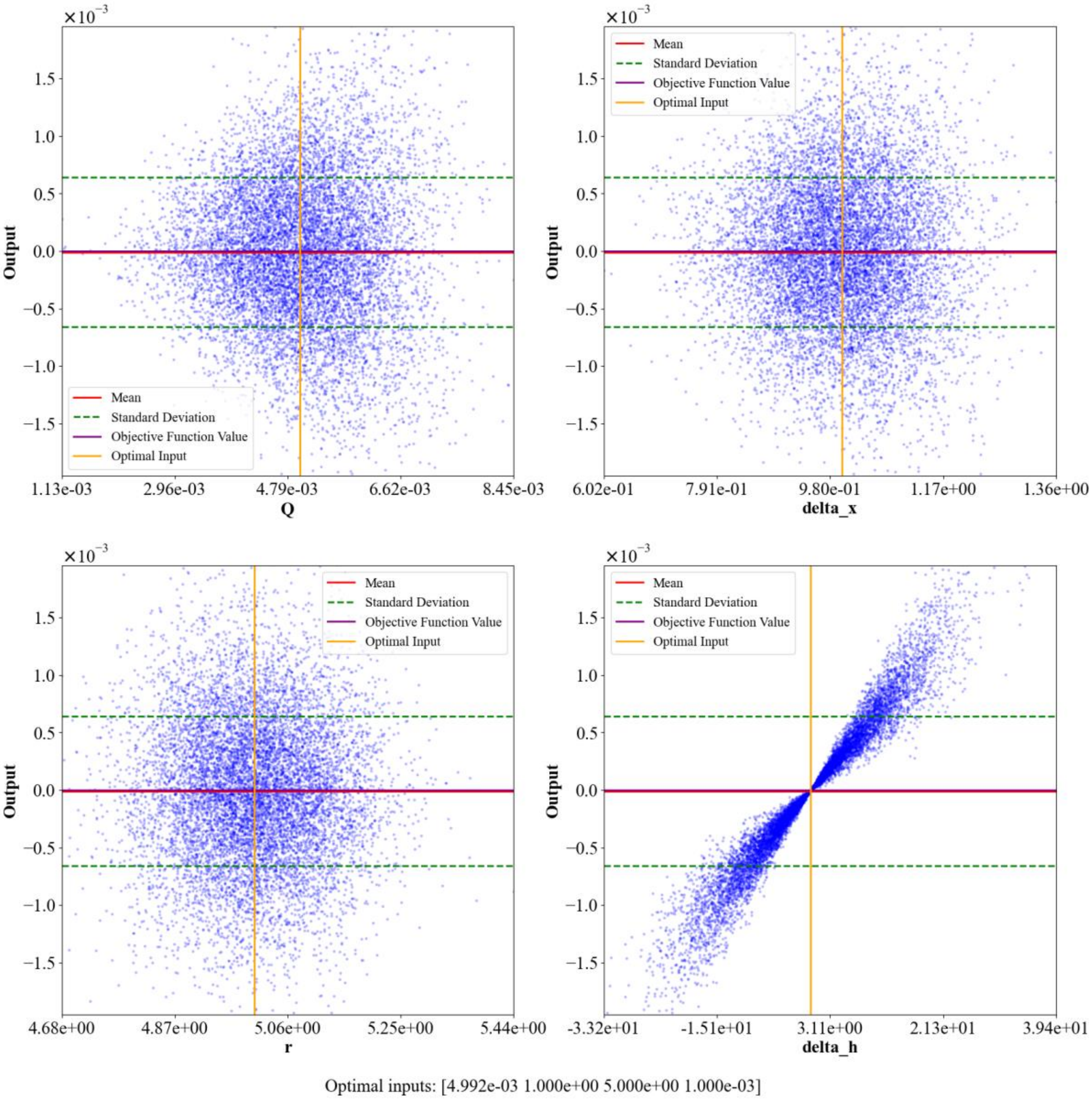
Author	
Dimkic et al., (2011)	 Optimal inputs: [1.0e-01 1.1e-01 1.0e-03 1.0e+00 1.0e+00]

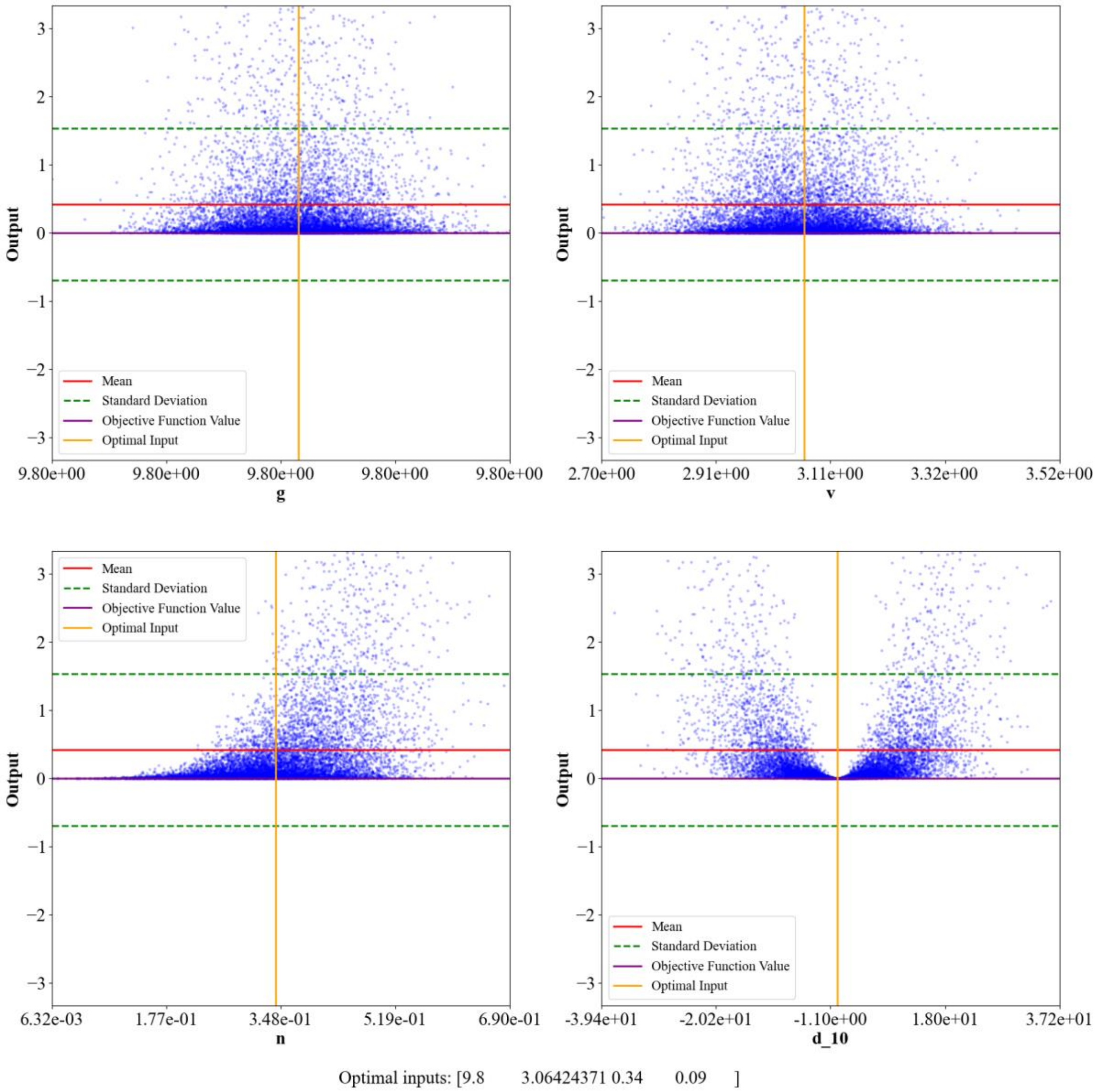
Author	
Nguyen et al., (2021)	

<table>
<tr><th>Author</th><th></th></tr>
<tr><td>Boukhemacha et al., (2015)</td><td>
</td></tr>
</table>

Author	
Schälchli (1992)	 Optimal inputs: [9.70000000e-05 3.79167117e+00 9.35000000e-01]

Author	
Descloux et al., (2010)	

Author	
Pfeiffer et al., (2000)	

Author	
Cabalar et al., (2016)	

Author	
Cabalar et al., (2016)