Table S1. Parameters for the top-ranked model in terms of combined statistics of bias, RMSE and R^2 for all four regions/countries together and for each region/country separately. For all four regions/countries together, also the parameter range for the 50 highest ranked combinations is shown (min_50, max_50). The k_0 values are the results of the calibration, LPJ-GUESS was run with k_0 of 0.003. The numbers in parenthesis is the order number (from smallest to largest) of the seven values tested within the full parameter range (Table 2).

Table S1a. Run with SSC, calibration data 2011-2019 for Austria and Switzerland included.

	k_1	k_2	k_{gc_min}	k_{pyw}	k_3	k_4	k_5	$k_0 \times 1000$
All four	0.05 (4)	0.15 (1)	-1 (7)	0.25 (1)	0.08 (6)	0.4 (4)	14 (5)	2.20
min_50	0.005 (1)	0.15 (1)	-1.25 (6)	0.25 (1)	0.005 (1)	0.4 (4)	14 (5)	
max_50	0.5 (7)	0.15 (1)	-1 (7)	0.33 (2)	0.15 (7)	0.5 (5)	20 (6)	
S Sweden	0.012 (2)	0.15 (1)	-1.5 (5)	1 (4)	0.009 (2)	0.8 (7)	27 (7)	0.0764
Switzerland	0.12 (5)	0.15 (1)	-1.25 (6)	1 (4)	0.15 (7)	0.8 (7)	14 (5)	17.6
Austria	0.012 (2)	0.2 (2)	-2.5 (1)	1 (4)	0.08 (6)	0.8 (7)	27 (7)	0.0026
NE France	0.005 (1)	0.4 (5)	-2.5 (1)	3 (6)	0.15 (7)	0.35 (3)	20 (6)	0.081

Table S1b. Run without SSC, calibration data 2011-2019 for Austria and Switzerland not included.

	k_1	k_2	k_{gc_min}	k_{pyw}	k_3	k_4	k_5	$k_0 \times 1000$
All four	0.005 (1)	0.15 (1)	-1 (7)	4 (7)	0.005 (1)	0.65 (6)	14 (5)	0.144
min_50	0.005 (1)	0.15 (1)	-1 (7)	2 (5)	0.005 (1)	0.5 (5)	14 (5)	
max_50	0.5 (7)	0.2 (2)	-1 (7)	4 (7)	0.15 (7)	0.65 (6)	20 (6)	
S Sweden	0.012 (2)	0.15 (1)	-1.25 (6)	2 (5)	0.15 (7)	0.8 (7)	27 (7)	0.140
Switzerland	0.005 (1)	0.15 (1)	-1 (7)	0.25 (1)	0.15 (7)	0.4 (4)	27 (7)	0.078
Austria	0.12 (5)	0.35 (4)	-1 (7)	1 (4)	0.005 (1)	0.5 (5)	20 (6)	0.199
NE France	0.012 (2)	0.5 (7)	-1 (7)	4 (7)	0.017 (3)	0.65 (6)	20 (6)	0.272

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Table S1c. Run without SSC, calibration data 2011-2019 for Austria and Switzerland included.

	k_1	k_2	k_{gc_min}	k_{pyw}	k_3	k_4	k_5	$k_0 \times 1000$
All four	0.005 (1)	0.15 (1)	-1.5 (5)	3 (6)	0.005 (1)	0.65 (6)	27 (7)	0.010
min_50	0.005 (1)	0.15 (1)	-2 (3)	2 (5)	0.005 (1)	0.65 (6)	27 (7)	
max_50	0.5 (7)	0.15 (1)	-1 (7)	4 (7)	0.15 (7)	0.8 (7)	27 (7)	
S Sweden	0.012 (2)	0.15 (1)	-1.25 (6)	2 (5)	0.15 (7)	0.8 (7)	27 (7)	0.159
Switzerland	0.005 (1)	0.15 (1)	-1 (7)	0.25 (1)	0.08 (6)	0.35 (3)	27 (7)	0.044
Austria	0.12 (5)	0.2 (2)	-2.5 (1)	4 (7)	0.05 (5)	0.65 (6)	27 (7)	0.025
NE France	0.012 (2)	0.5 (7)	-1.25 (6)	4 (7)	0.05 (5)	0.5 (5)	20 (6)	0.498
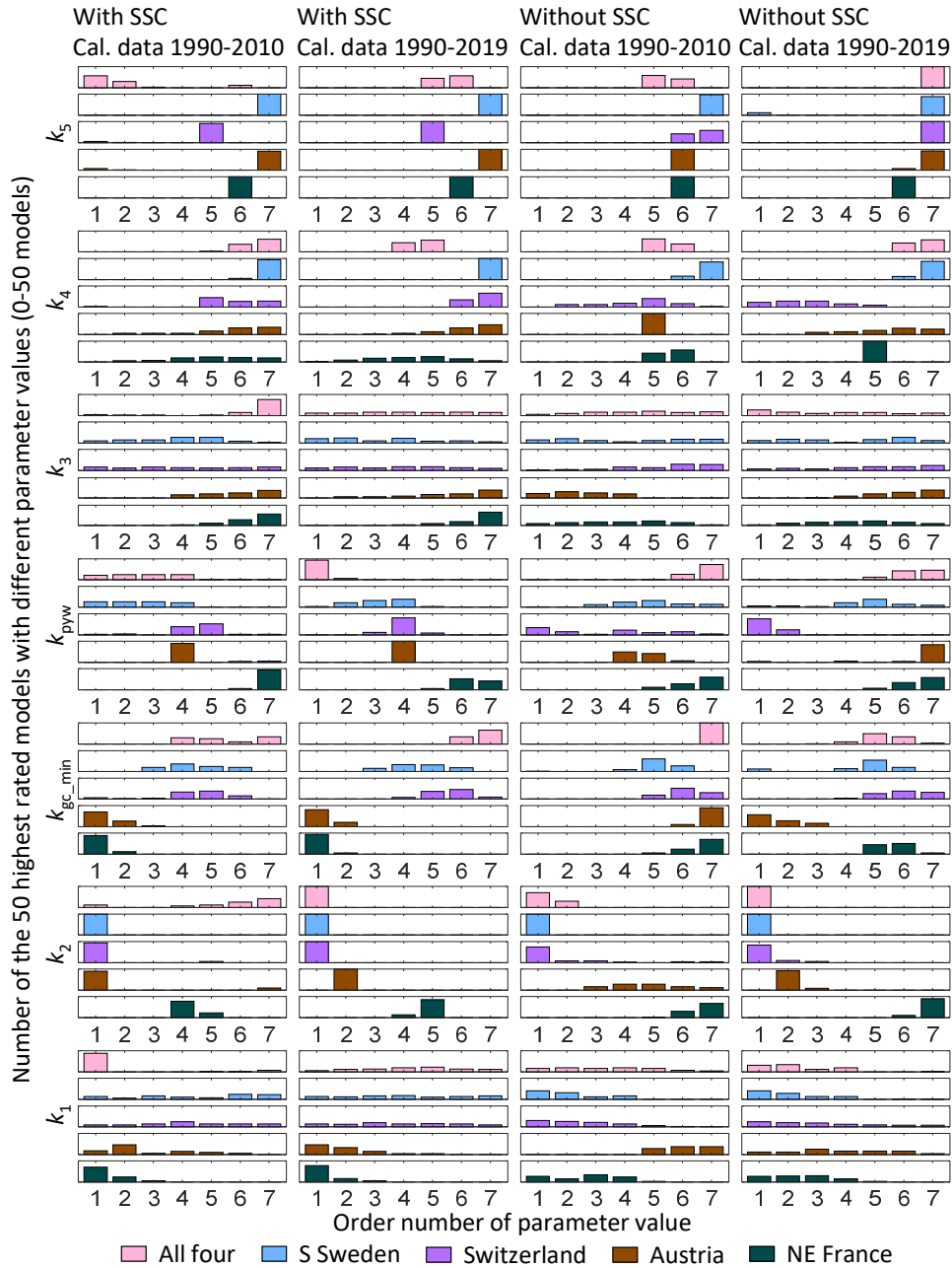
Figure S1. Histograms showing the number of the 50 highest ranked models, with the best combined statistics of bias, RMSE and R^2, diveded in order number of the tested parameters (see Table 2) over all for regions/countries and separately for each region/country. The calibration was done both with and without salvage and sanitary cutting (SSC) and including SBB damage statistics for Austria and Switzerland 2011-2019.

Table S2. Statistics for different parameter settings; "default", the top-ranked model in terms of combined statistics of bias, RMSE and R^2 for all four regions/countries together and for each region/country separately.

Table S2a. Run with SSC, calibration data 2011-2019 for Austria and Switzerland included.

	Default			Combined all four			Region/country		
	R^2	RMSE	Bias	R^2	RMSE	Bias	R^2	RMSE	Bias
All four	0.34	0.33%	0.13%	0.38	0.23%	0.03%			
S Sweden	0.54	0.33%	0.25%	0.56	0.13%	0.07%	0.74	0.09%	0.03%
Switzerland	0.40	0.29%	0.02%	0.46	0.27%	-0.11%	0.47	0.27%	-0.01%
Austria	0.13	0.22%	0.10%	0.27	0.22%	0.12%	0.46	0.15%	0.00%
NE France	0.28	0.57%	-0.25%	0.24	0.69%	-0.12%	0.46	0.62%	-0.01%

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Table S2b. Run without SSC, calibration data 2011-2019 for Austria and Switzerland not included.

	Default			Combined all four			Region/country		
	R^2	RMSE	Bias	R^2	RMSE	Bias	R^2	RMSE	Bias
All four	0.35	0.25%	0.03%	0.41	0.22%	0.01%			
S Sweden	0.68	0.23%	0.14%	0.66	0.14%	0.06%	0.81	0.08%	0.01%
Switzerland	0.32	0.31%	-0.11%	0.35	0.31%	-0.14%	0.45	0.32%	0.00%
Austria	0.08	0.15%	0.00%	0.25	0.14%	-0.06%	0.32	0.13%	0.02%
NE France	0.34	0.59%	-0.17%	0.40	0.79%	0.17%	0.45	0.67%	0.00%

Table S2c. Run without SSC, calibration data 2011-2019 for Austria and Switzerland included.

	Default			Combined all four			Region/country		
	R^2	RMSE	Bias	R^2	RMSE	Bias	R^2	RMSE	Bias
All four	0.36	0.31%	0.08%	0.46	0.26%	0.07%			
S Sweden	0.68	0.30%	0.18%	0.81	0.09%	0.02%	0.81	0.08%	0.02%
Switzerland	0.34	0.28%	-0.07%	0.34	0.51%	0.24%	0.50	0.31%	0.00%
Austria	0.05	0.21%	-0.01%	0.43	0.16%	-0.06%	0.50	0.15%	-0.03%
NE France	0.35	0.62%	-0.07%	0.24	0.92%	0.36%	0.43	0.68%	0.03%

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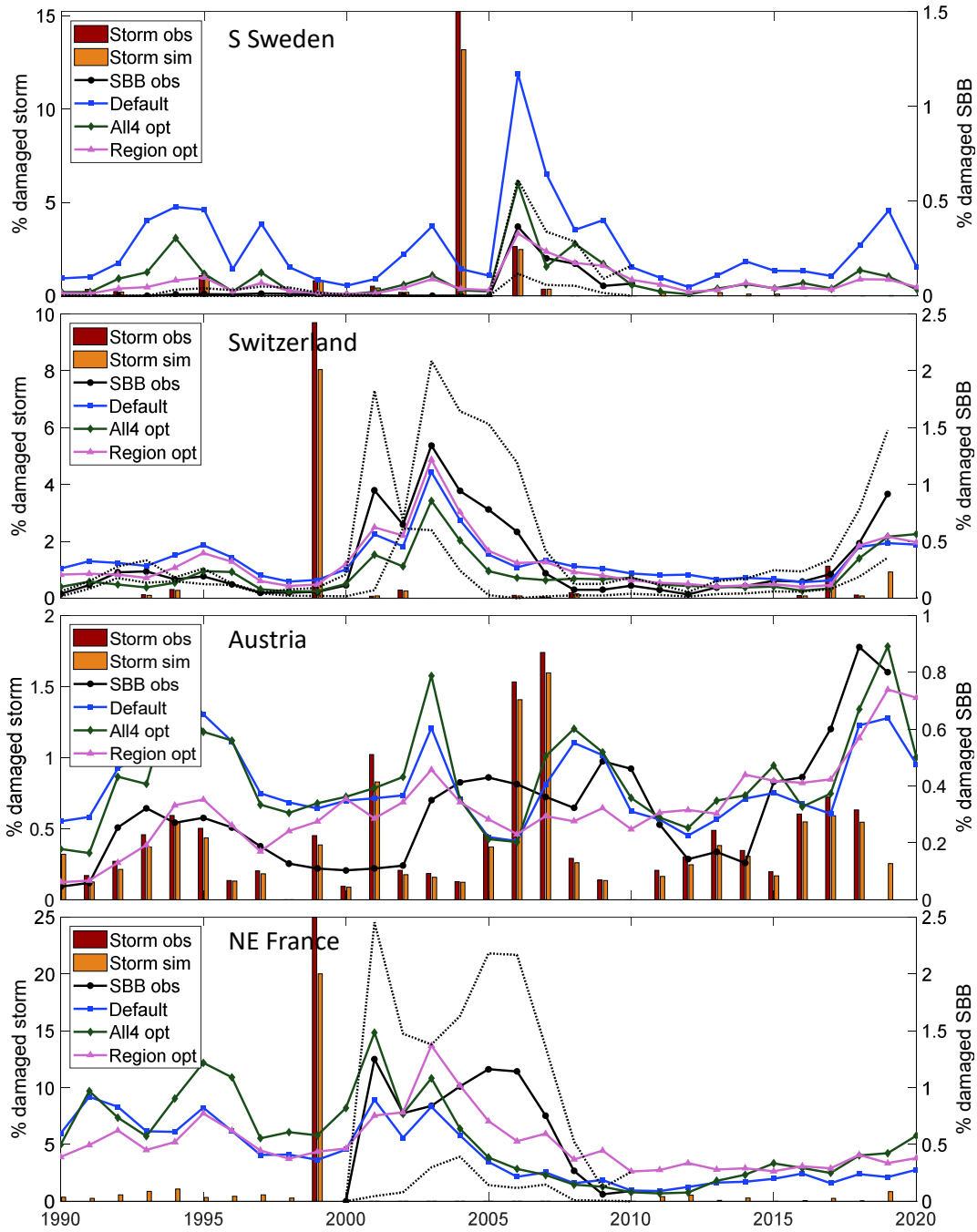
Figure S2. Observed and modelled fraction of spruce forest damaged by storm (left y-axis) and spruce bark beetle (SBB, right y-axis) in four regions/countries, with modelled SBB damage from different parameter settings (Table 2). Same as Figure 4 but includes also observed damage data in 2011-2019 for Switzerland and Austria in the calibration.

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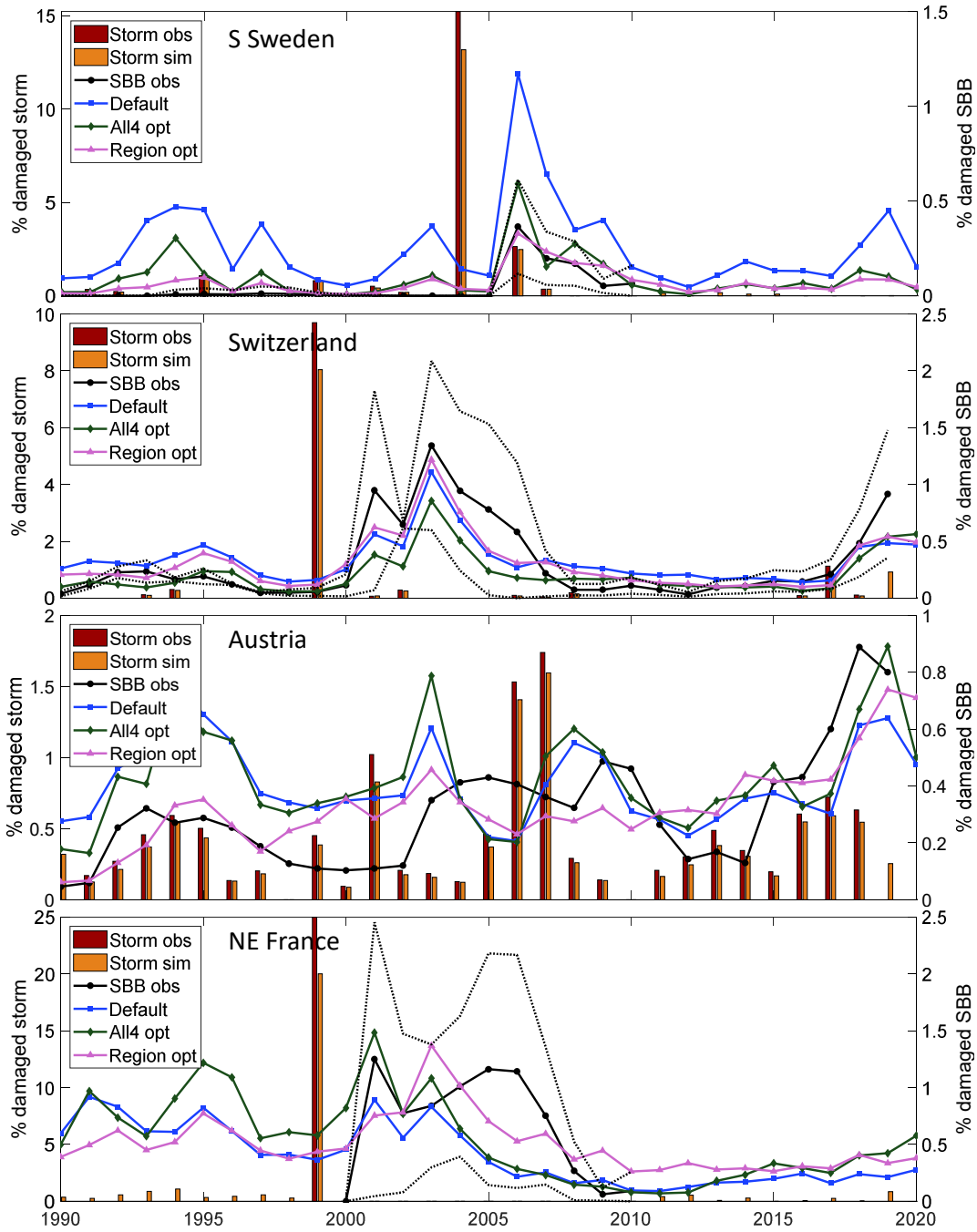
Figure S3. Observed and modelled fraction of spruce forest damaged by storm (left y-axis) and spruce bark beetle (SBB, right y-axis) in four regions/countries, with modelled SBB damage from different parameter settings (Table 2). Same as Figure 4 but the model was run without the functionality for salvage cutting of storm felled trees and sanitary cutting of infested trees.

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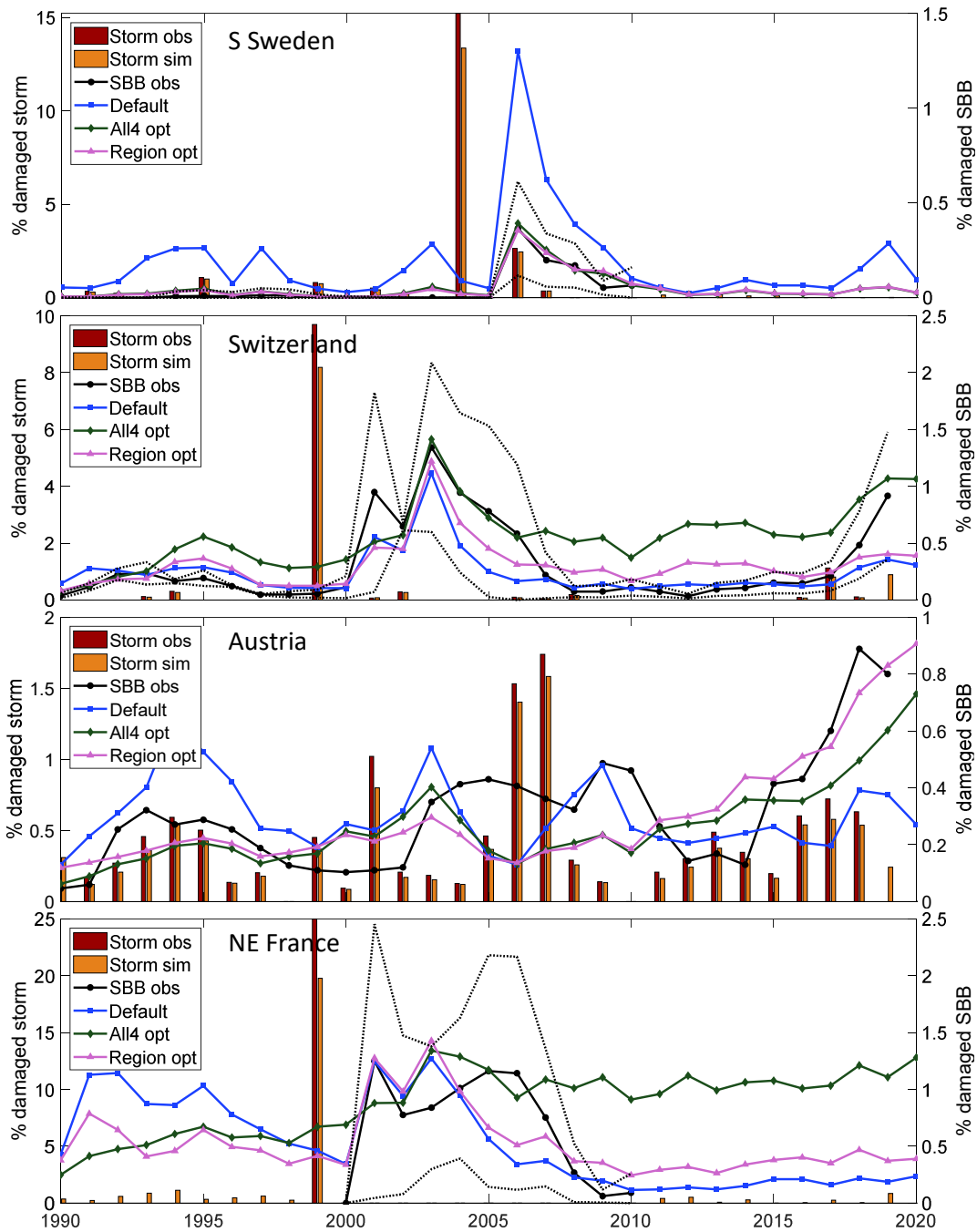
Figure S4. Observed and modelled fraction of spruce forest damaged by storm (left y-axis) and spruce bark beetle (SBB, right y-axis) in four regions/countries, with modelled SBB damage from different parameter settings (Table 2). Same as Figure S3 but includes also observed damage data in 2011-2019 for Switzerland and Austria in the calibration.

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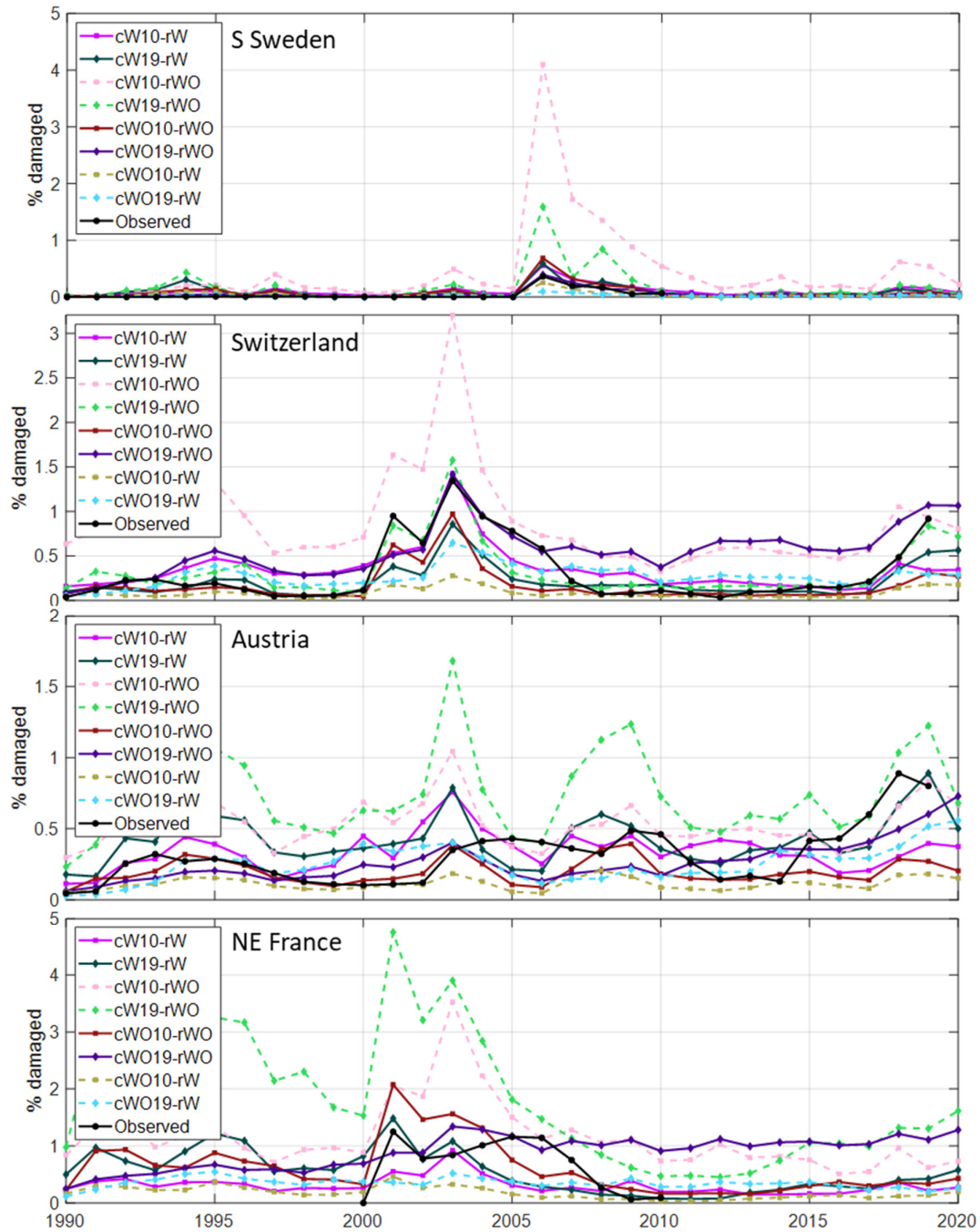
Figure S5. Test of the sensitivity to include salvage cutting of storm felled trees and sanitary cutting of infected trees (SSC) for the fraction of *Ips* killed trees. The calibrations with (cW) and without (cWO) SSC using only data for 1990-2010 (10) and including 2011-2019 data for Austria and Switzerland (19) were then run both with (rW) and without (rWO) SSC.

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