

Comparing perceptions of climate-related environmental changes for Tuvalu, Samoa, and Tonga: Supplementary information¹

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Part I: Results for the first two qualitative questions

This section presents additional results for the first two qualitative questions of our survey:

(1) “Do you perceive any changes concerning the weather in the last years since you remember? If so, try to list at least five and explain each one and whether they have effect (either positive or negative) on the island you are living on, on the sea, on plants, animals and your livelihood.”

(2) “Do you think there will be changes concerning the weather, the environment, the sea, the plants and animals in the future? If so, please name at least five and explain their consequences for your livelihood and the life on the islands.”

¹ This is the online appendix from: Beyerl, K., Mieg, H.A., & Weber, E. (2019): Comparing perceptions of climate-related environmental changes for Tuvalu, Samoa, and Tonga. In: Klöck, C. & Fink, M. (eds.): *Dealing with climate change on small islands: Towards effective and sustainable adaptation?* (pp. 143–174). Göttingen: Göttingen University Press. <https://doi.org/10.17875/gup2019-1215>.

Table S1: Categories for qualitative data for changes of weather patterns

Changes of weather patterns	Tuvalu		Samoa		Tonga	
	present	future	present	future	present	future
General change / great change / worse		25		18	1	21
Change of weather (patterns) / unpredictable	6	6	12	13	13	14
Change of seasons (general)	4				23	15
• Longer dry season / drought	5	2	9	2		
• Wet / rainy season		1				
○ Shorter / less intense	2	1	2			
○ More intense			1			1
• Hot season (warmer/longer) / cold season warmer/shorter	11	3	1		11	4
○ Cyclone season	1				1	
○ Unregularly / mixed up / unpredictable seasons	6		10		14	8
○ Strong wind in different season	1					
Change of climate / climate change	2	3		1	23	21
Global warming	1	1	2	3		
Temperature (general)						
• Warmer / very hot / increased heat of the sun	32	9	50	18	55	52
• Colder / lack of sunshine					1	
• More extremes	1				1	
• Quick change of temperatures					9	
Wind (general)			1			
• Strong wind (stronger, more frequent, unpredictable)	9	1	3		3	1
• Less wind						1
• Storms / cyclones / hurricanes (unspecified)	2		5		8	5
○ More	2	2	6	8	4	3
○ Less	1					
• Less thunderstorms	2					
• More thunderstorms	1		1			
Rain (general)	1		1			
No or less rain / drought / lack of water (general)	31	13	34	9	11	
More rain / too much rain / intense and heavy rain			21	1	25	8

Table S2: Categories for qualitative data for changes of and effects on the abiotic environment

Changes of and effects on abiotic environment	Tuvalu		Samoa		Tonga	
	present	future	present	future	present	future
Air pollution			4	1		
Water pollution (general and also by rubbish taken to the sea by the water)					5	
Environmental pollution / degradation / damage / change general	1			14	10	18
Affected ozone layer			1	1		
Changes of the sea (general / affects the land)		7	2	1		
Changes of the land / soil (general)	2	2		1		1
Erosion (unspecified) / loss of land	1	1	1	3	8	8
Erosion due to human activities (sand/coral/mineral mining, deforestation)		1		7		
Flooding (unspecified)	1		7	3		
Rising sea temperature				1		
Sea Level Rise (general)	10	2	11	11	33	54
• Flooding with seawater / inundation	6	1	4	8	10	7
• Salt water intrusion / salty groundwater	4	3			2	
• Erosion / degrading or changing coast-lines	6	2	9	4	17	20
• Higher waves	2		3	3		2
• Melting poles / icebergs			2	3		
• No sea level rise	2					
Changed tides / king tides (incl. moon)	5	2	2		6	1
Changed sea currents	2					1
Rough seas / strong waves	2		2		1	
Storm surges			3	1		
Effects of (no) rain on land and soils						
• Erosion / change of relief (unspecified)			2	1	10	7
• Landslides			3	2		
• Flooding			16		14	2
• Runoff			4			
• Dried up (soil, rivers, water resources)	4	2	15	1		
• Fills up water resources			1		16	1
• No groundwater					1	
Effects of human developments						
• New building projects (wharf)						1
• Use of chemicals						1

Table S3: Categories for qualitative data for changes of geophysical hazards

Geophysical Hazards	Tuvalu		Samoa		Tonga	
	present	future	present	future	present	future
Natural disasters / hazards			2	3	2	1
More tsunamis	6	1	2	3	9	14
More earthquakes	1	1	1	1	9	7

Table S4: Categories for qualitative data for changes of plants

Terrestrial plants (incl. crops / plantations)	Tuvalu		Samoa		Tonga	
	present	future	present	future	present	future
Affect plants / crops / gardens (unspecified)	43	21	40	33	104	38
<i>Names of mentioned species</i>						
• Pulaka (smaller, withered)	5	1				
• Taro	1				1	
• Coconut (smaller coconuts)	2					
• Less mangroves			2		1	1
• Tausunu	1					
• Lautii	1					
• Breadfruit (smaller not on season)	4	1			2	
• Banana (smaller)	4					
• Mangos (smaller fruits)				1		
• Pandanus	1					
• Potatoes	1					
• Cucumbers	1					
• Pawpaw (bigger fruits)	2					
• Yams					1	
• Cassava					1	
Trees: less / unhealthy / dying and dead	14	3		4	10	6
Edible plants / Vegetables / Fruits (less / more)	TO 4	3	1	3	18	4
Loss medicinal and traditional plants				1	8	5
(New) grasses affected / Invasive species	1	1	1			
More weeds			1			
Affected coastal vegetation				1	13	9
<i>Effects of climatic and weather changes</i>						
• Temperature / hot sun / quick change	4	2	11	4	37	12
• Rain helps plants			2		16	
• Drought / Lack of water	13	3	15	1	10	2
• Sea level rise, salt water intrusion, erosion, flooding with seawater	3	1	1		16	10
• Flooding (rain / unspecified) / erosion	1		4		11	2
• Strong wind / Cyclones	2		2	1	8	4
• Change of seasons / planting and ripe times	2	1	3		9	1
Natural disasters (unspecified and earthquake, tsunami)					2	1
<i>Effects of human activities</i>						
• Deforestation / cutting of trees		2	4	15	1	1
• Pollution				1		
• Use of Fertilizers	2					
• Development / building projects	1	1				
• Change of farming practices	1	1				
Diseases / Pests / special insects	1			1		
Bush fires / Fire hazard due to drought			7	1		

Table S5: Categories for qualitative data for changes of marine life

Changes of Marine Life	Tuvalu		Samoa		Tonga	
	present	future	present	future	present	future
General / destruction / decrease	6	8		13	21	7
Migration of marine life				1		
Restoration marine resources				1		
Number of fish (unspecific)	1					
• Decline / decrease	1	2	1	2	3	4
• Increasing change		2				
Turtles (unspecific)	1					
Shells (less)			1	1	1	3
Seaweed (increase/decrease)	1					2
Coral Reef						
• Growing	1	1				
• Unhealthy / coral bleaching		1	1	4		3
Less mangroves						1
Effects of climatic changes, pollution, etc.						
• Temperature	1	1		1	8	1
• Sea level rise / higher tides / light				1	1	2
• pollution due to erosion					1	
• Earthquakes					1	
Effects of human activities						
• Pollution				5	1	
• Fishing practices / overfishing					3	1
• Coral / sand mining & land reclamation / erosion		1		4	1	1
• Marine reserve				1		

Table S6: Categories for qualitative data for unspecific changes

Unspecific	Tuvalu		Samoa		Tonga	
	present	future	present	future	present	future
Depends on God	1	3				
All living things affected / will die		3	2			
No changes (hopefully)		2				1
Not sure / don't know		4		1		1

Table S7: Categories for qualitative data for changes of terrestrial animals

(Terrestrial) Animals	Tuvalu		Samoa		Tonga	
	present	future	present	future	present	future
Affect animals / less animals / smaller animals	10	12	9	18	41	12
Animals migration / habitat loss				7		1
<i>Names of mentioned species</i>						
• Pigs	2			1	3	
• Chicken	1		2	3	1	
• Birds (less, e.g. pigeons)	1	1	2			
• Bats			1			
• Mosquitoes (increase)			2		3	
<i>Effects of climatic and weather changes</i>						
• Temperature	2	1	3	3	19	5
• Drought / lack of water	5	1	2	1	2	1
• Rain / flooding / (rain helps)					8	
• Sea level rise / flooding seawater			1		1	
• Change of seasons					5	1
• Cyclones				1	2	
• Natural disasters (earthquake, tsunami)					1	
• Less food for animals					1	3
<i>Effects of human activities</i>						
• Deforestation			1	4		
• Consumption				2		
Diseases / pests / health effects / new insects			1	1	15	5

Part II: Results for the third qualitative question

This section presents results for the third qualitative question: “What do you think are the reasons for changes in weather and environment?”

Table S8: Categories for human activities and societal change as reason for perceived environmental change

	Tuvalu	Samoa	Tonga
<i>Human activities</i>			
• General	21	33	34
• Population growth / overpopulation	3	1	
• Deforestation / cutting of trees / destroying habitats	7	13	1
• Pollution general ((dirty) environment)	3	5	2
○ Air		4	1
– Burning general	1	1	
– Burning of trees / firewood	1		1
– Burning of chemicals	1		
– Burning of rubbish (instead of recycling); burning also steel and aluminum	4	1	9
– Burning of plastics		5	5
– Cars, motorbikes, motorboats, trucks	8	5	1
– Fossil fuels (oil / gas) / release of gases	11	2	3
– Smoking	1		
– Gas cylinder for cooking instead of firewood	1		
– Increase CO ₂ / release GHG / methane / poisonous gases / carbon emission	1	9	
– Refrigerator gases		1	
○ Land / Soil	1	2	
○ Sea / Water	1	3	
• Sand and coral mining / land reclamation / mineral mining		3	1
• Modern and new technologies / machines / factories (in wealthy countries) / industries / industrial activities / inorganic products	12	14	
• Electricity use / non-renewable energy		2	
• Overuse / abuse/ consumption patterns / high demands / no wise use		4	5
• Overfishing / chemicals for fishing		1	
• Use / burning of chemicals / poisonous materials	1	1	
• Dumping of (toxic) wastes / litter	1	4	
• Cities and towns			
• Infrastructure development projects		1	
○ New bridge			
○ New wharf			2
○ Building of seawall	1		
○ Building of floorshore (foreshore)			
○ Building of river dams			
• Different building materials (corrugated iron)	1		
• Farming practices / use of fertilizer	1		
<i>Societal change</i>			
• New denominations	2		
• Advance in knowledge / work of scientists	9		

• Modernization / development in livelihood / imported canned foods	1	1
• Greed / economic activities	2	4
• Authorities don't control / government failure		1
• Migration / Immigration / new cultures / urban drift	2	
• Bad manners of youth	1	
• Irresponsible behaviour, not taking care of environment / laziness / selfish behaviour / value money more than consequences	3	8

Table S9: Categories for natural processes as reason for perceived environmental change

	Tuvalu	Samoa	Tonga
Natural Processes / everything changes	3	5	18
Global warming	1	5	4
Climate change	1	2	
Ozone depletion / ozone hole		2	2
UV rays		1	
Change in temperature / higher temperatures		1	2
Sea level rise	5	2	2
Melting of poles	1	2	1
Increased heat of the sun	5	1	
El Niño			5
Hurricanes / strong winds	1		1
Drought	2		
Erosion / changing relief of the earth		3	

Table S10: Counts for the category “God as reason for perceived environmental change”

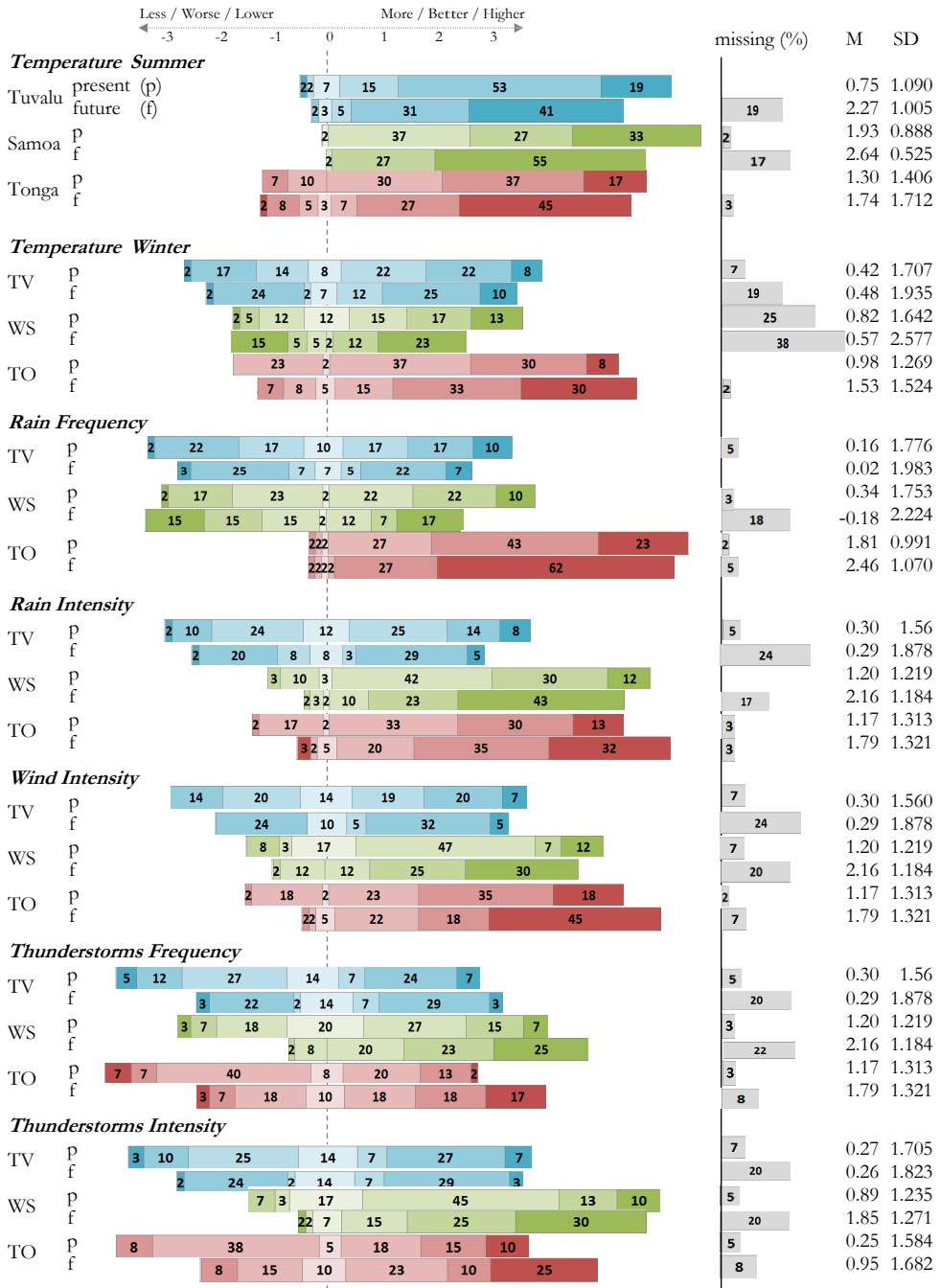
	Tuvalu	Samoa	Tonga
God	8	3	7
End of time	1		

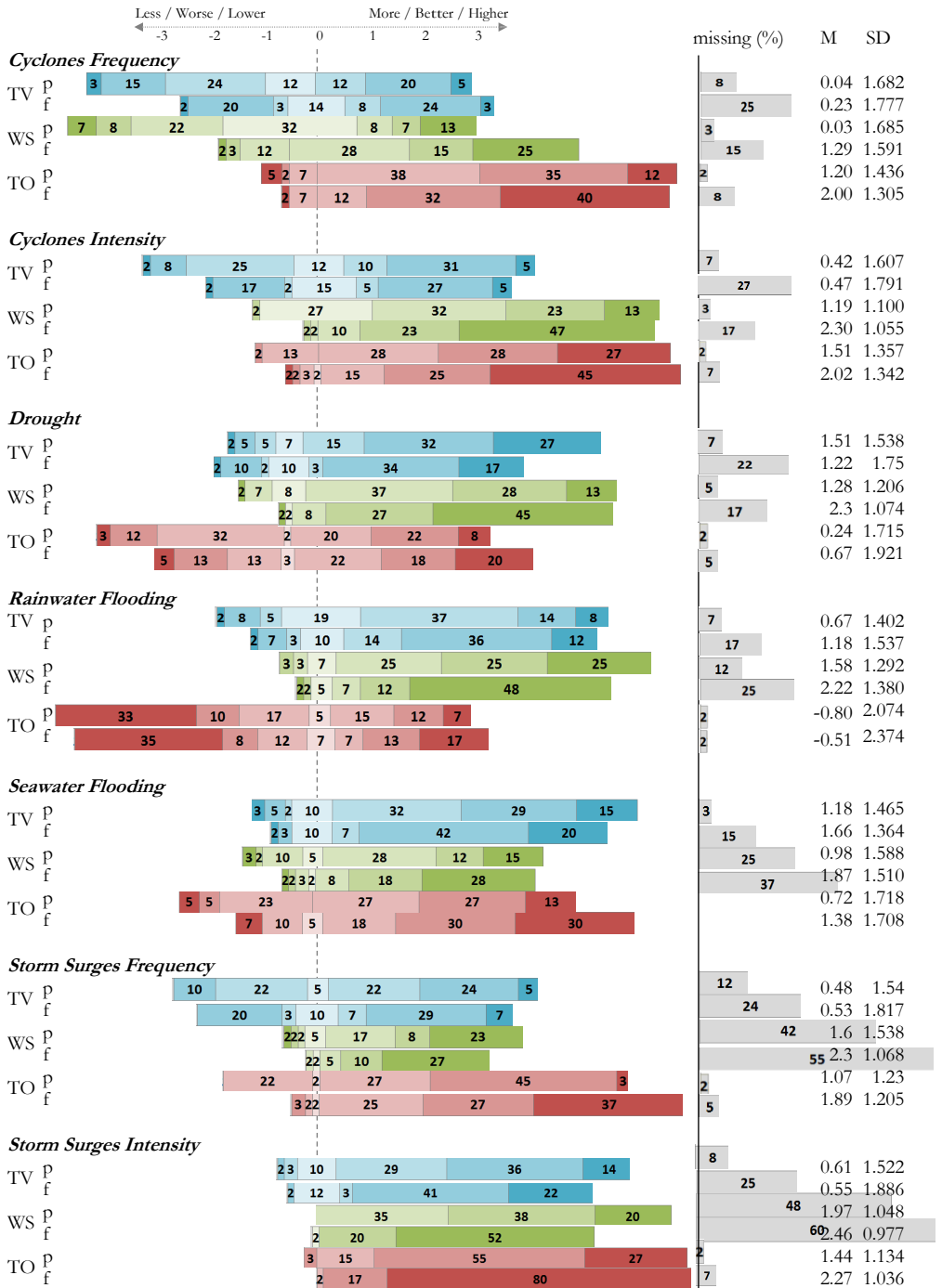
Table S11: Counts for the category “Don't know the reason for perceived environmental change”

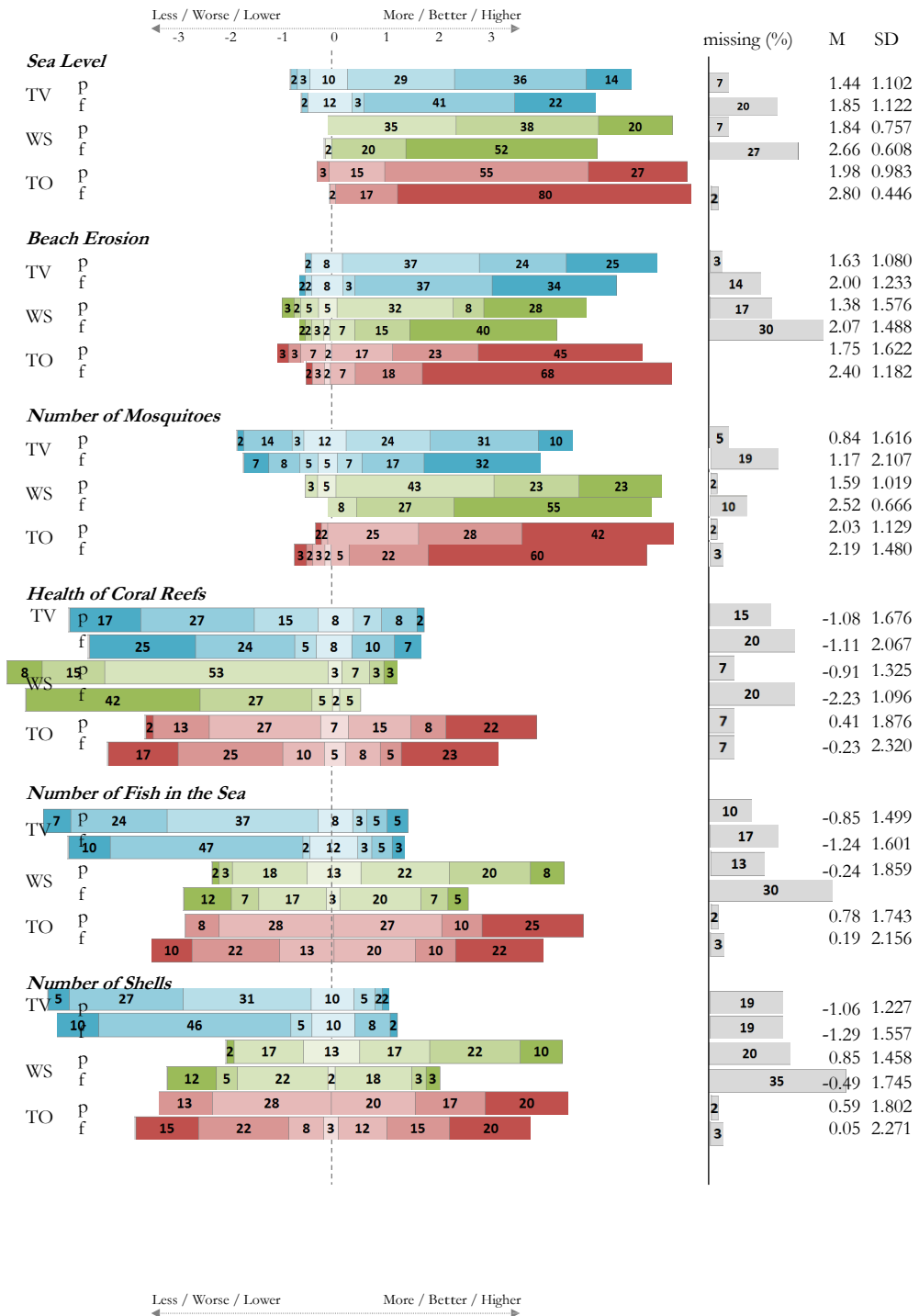
	Tuvalu	Samoa	Tonga
Don't know / missing / none	9	14	0

Part III: Distribution of responses to quantitative questions

This section presents the distribution of responses (in percent) to the quantitative questions about perceptions of climate-related environmental changes; this includes percentage of missing values, mean values, and standard deviations (legend and color code are found below).







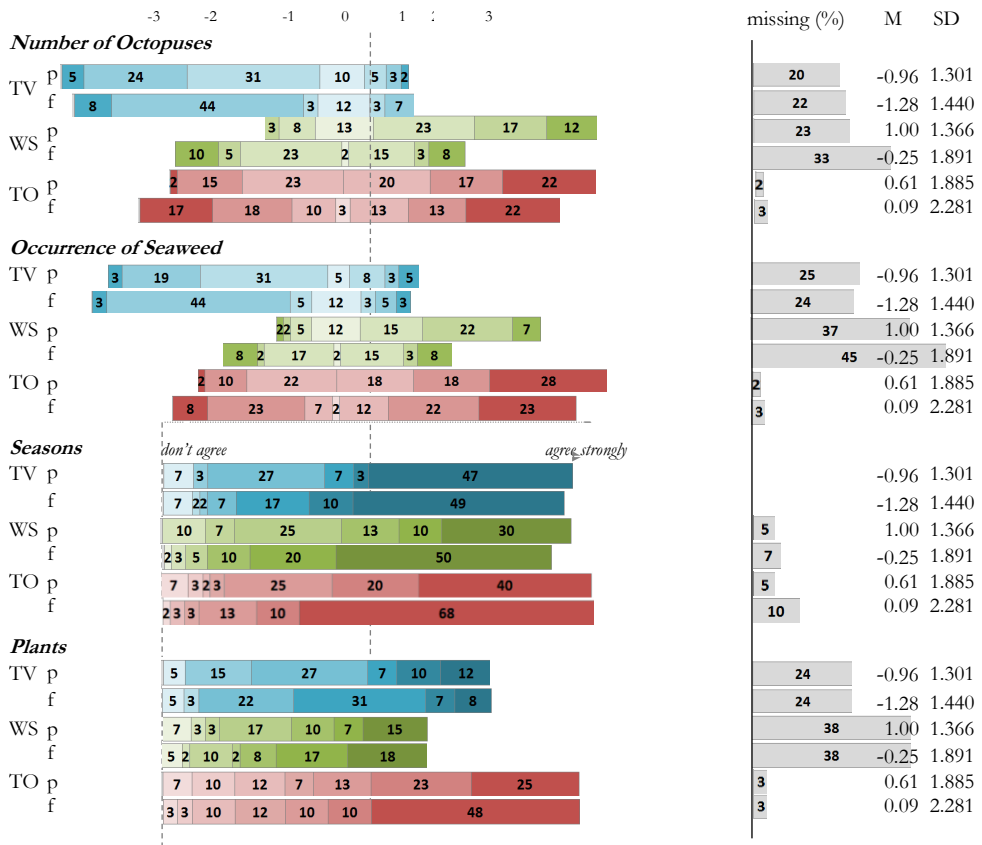
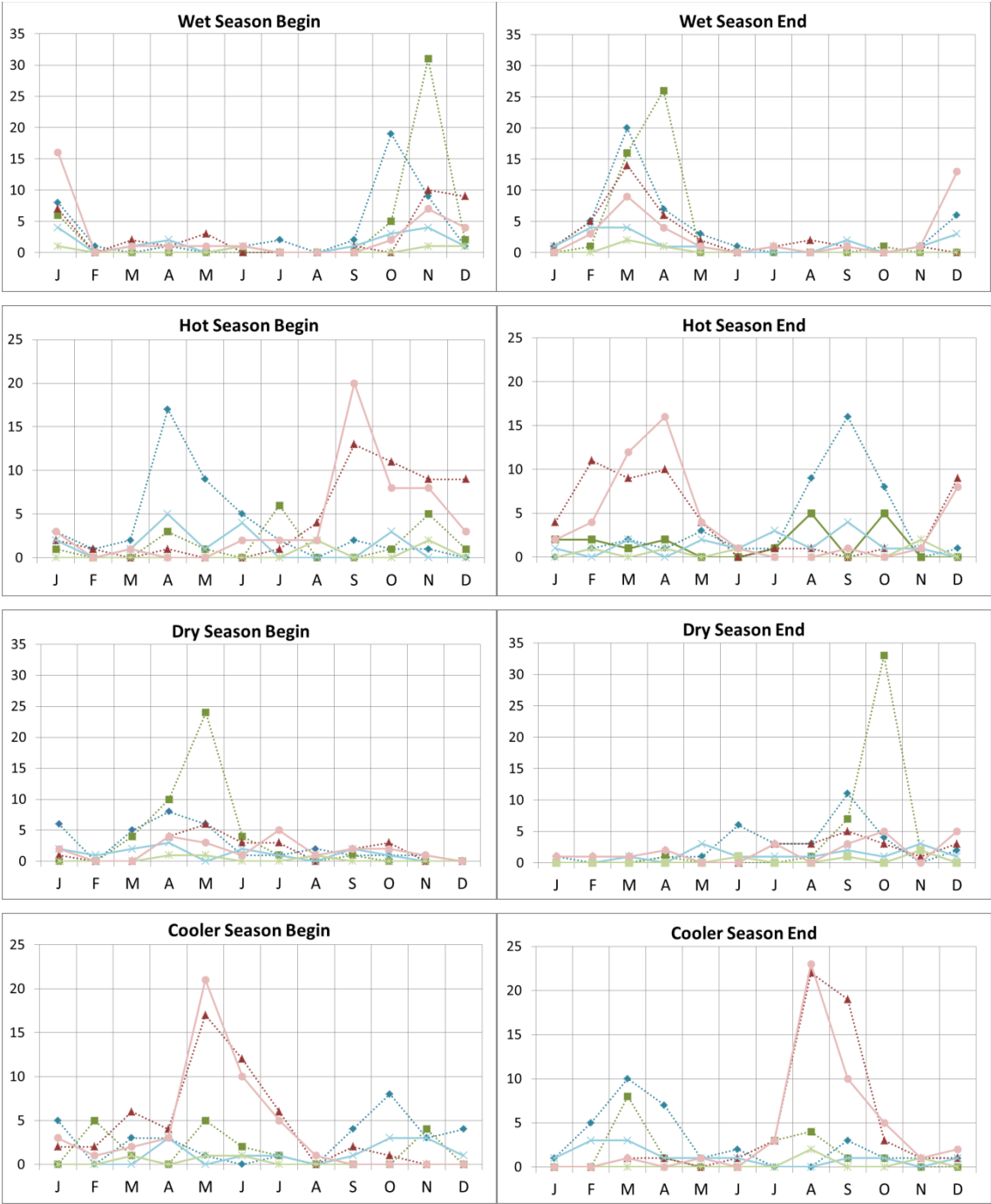


Figure S1: Distribution of responses (in percent) to the quantitative questions about perceptions of climate-related environmental changes; percentage of missing values, mean values, standard deviations



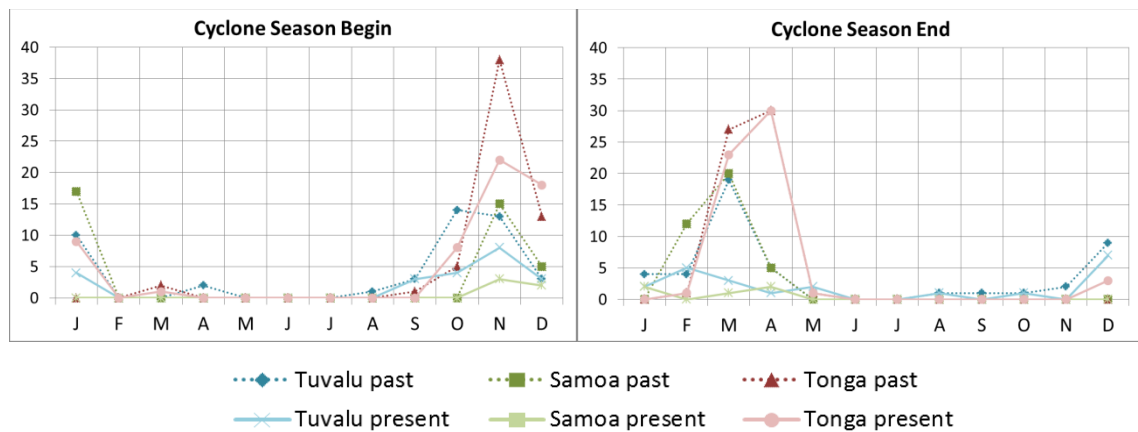


Figure S2: Perception of begin and end of seasons in the past and present, red boxes stand for theoretical “objective” begin and end

Part IV: Variables based on factor analyses and results of ordinal correlation analyses

Table S12: Variables and composite variables based on factor analyses

Final variable	Initial variables
Temperature summer	-
Temperature winter	-
Drought	-
Seasons	-
Plants	-
Sea level rise	-
Mosquitoes	-
Flooding with rainwater	-
Rain	Rain frequency Rain intensity
Storms	Wind intensity Frequency thunderstorms Intensity thunderstorms Frequency cyclones Intensity cyclones Frequency of storm surges Intensity of storm surges
Sea life	Number of fish in the sea, Number of shells, Number of octopuses, Occurrence of seaweed, Health of coral reefs
Flooding seawater	Beach erosion, Damage due to king tides, Flooding with seawater

Table S13: Ordinal correlations (Spearman Rho) of climate-related environmental changes with selected socio-demographic variables for Tuvalu

Tuvalu (Spearman Rho)		Age	Years on island	Gender	Number of inhabitants	Distance to the sea	Ownership	Plant for daily diet	Sell fruits and vegetables	Fish for daily diet	Sell fish	Education	Daily activities	n nature	Socio-economic status	Religiousness self-assessment	Religiousness church activities	Religiousness overall
Present																		
Temperature summer		-.159	.046	.081	-.193	-.132	-.146	-.245	-.164	.008	-.112	-.008	.054	.159	.262	.262	.040	.076
Temperature winter		.100	-.094	-.255	.396*	-.136	-.173	-.123	.049	-.122	.102	-.185	.167	-.226	-.280*	-.274	-.274	-.276
Rain+		.267*	.076	-.122	.488**	-.294*	-.275*	-.007	-.003	-.332*	-.076	-.187	.286	-.129	-.200	.501**	.482**	
Drought		-.079	.071	-.211	.066	-.001	-.060	-.125	-.037	-.028	-.214	-.032	.331*	.184	-.074	.443**	.451**	
Wind and storms+		.217	0.00	-.200	.575**	-.187	-.201	.112	.007	-.173	.026	-.329*	.325*	-.151	.406**	.588**	.588**	
Seasons		-.243	.151	.225	-.535**	.173	.317*	.090	-.022	.119	.033	.246	-.213	.293*	.381*	.336*	.363*	
Plants		.007	.227	-.193	-.148	-.180	-.032	.002	-.065	.192	-.015	.162	.498**	.349*	.516*	.212	.250	
Flooding with rainwater		.192	.089	.107	.136	.214	-.011	.125	.023	-.114	.007	.047	.008	.049	.277*	-.219	-.241	
Number of mosquitoes		-.145	.027	.174	-.212	.030	-.009	-.215	-.015	.104	.117	-.012	.063	.118	.073	.194	.196	
Sea Level		.109	.161	-.305*	.187	-.061	.104	.083	-.171	-.102	-.036	-.143	.280	.000	-.034	-.270	-.267	
Flooding with sea water+		.022	.201	-.155	.180	-.014	.115	0.00	-.157	-.037	-.025	-.021	.311*	.061	.084	-.172	-.158	
Sea life+		-.051	-.167	.184	-.360*	.054	.075	.046	.189	.300*	-.121	.248	-.160	-.008	.086	.179	.143	
Future																		
Temperature summer		-.205	.042	.387**	.437**	.311*	-.270	-.150	.049	.048	-.160	-.057	-.060	.089	.338*	.061	.093	
Temperature winter		.075	-.190	-.159	.394*	-.049	-.157	-.092	.141	-.145	-.011	.012	.210	-.229	-.317*	-.282	-.273	
Rain+		.165	.017	-.162	.595**	-.027	-.220	-.078	.067	-.380**	.062	-.130	.240	-.151	.514**	.524**	.505**	
Drought		-.134	-.185	.096	-.035	.054	-.158	-.061	.264	.038	-.248	.281	-.072	.083	.346*	-.298	-.349*	
Wind and storms+		.169	-.096	-.216	.542**	-.078	-.159	.033	.063	-.269	.021	-.195	.291	-.203	.522**	.467**	.469**	
Seasons		-.172	.105	.232	-.608**	.095	.242	-.035	.038	.140	.002	.246	-.137	.231	.354**	.374*	.392*	
Plants		.361*	.310*	.240	-.547**	.020	.364*	.126	-.021	.229	.233	.438**	.093	.192	.341*	.276	.266	
Flooding with rainwater		.128	.076	-.016	.104	.056	-.046	-.118	-.099	-.206	.056	-.213	.066	.071	-.188	-.164	-.194	
Number of mosquitoes		-.030	.080	.265	-.174	.112	-.075	-.003	-.009	.123	-.062	.160	-.188	.293*	.184	.286	.282	
Sea Level		.026	.177	-.044	-.201	.121	.124	.193	.132	.089	.054	.060	.018	.156	.054	.100	.084	
Flooding with sea water+		-.049	.110	-.056	-.040	.203	.036	-.095	-.182	-.077	-.042	-.105	.045	.117	.264	-.009	-.001	
Sea life+		-.019	-.057	.119	-.235	-.216	.053	-.014	.238	.157	.090	.220	.064	-.042	.229	.213	.189	

b = 0.05; **=p<0.01 (two-tailed); + = composite variables

Table 14: N for ordinal correlations of climate-related environmental changes with selected socio-demographic variables for Tuvalu

Tuvalu (N)		Age	Years on island	Gender	Number of inhabitants	Distance to the sea	Ownership	Plant for daily diet	Sell fruits and vegetables	Fish for daily diet	Sell fish	Education	Daily activities in nature	Socio-economic status	Religiousness self-assessment	Religiousness church activities	Religiousness overall
Present																	
Temperature summer		56	57	56	43	57	55	57	57	57	57	55	43	56	53	43	41
Temperature winter		54	55	54	41	55	53	55	55	55	55	53	41	54	51	42	40
Rain ⁺		55	56	55	42	56	54	56	56	56	56	54	42	55	53	44	41
Drought		54	55	54	42	55	53	55	55	55	55	53	41	54	52	42	40
Wind and storms ⁺		56	57	56	43	57	55	57	57	57	57	55	43	56	53	44	41
Seasons		55	56	55	42	56	55	56	56	56	56	54	43	55	53	42	41
Plants		45	45	45	34	45	44	45	45	45	45	43	33	45	42	36	34
Flooding with rainwater		54	55	54	41	55	53	55	55	55	55	53	41	54	51	41	39
Number of mosquitoes		55	56	55	43	56	54	56	56	56	56	54	42	55	53	43	41
Sea Level		54	55	54	41	55	53	55	55	55	55	53	42	54	51	42	40
Flooding with sea water ⁺		56	57	56	43	57	55	57	57	57	57	55	43	56	53	43	41
Sea life ⁺		54	55	54	41	55	53	55	55	55	55	53	42	54	51	42	40
Future																	
Temperature summer		47	48	47	40	48	46	48	48	48	48	46	35	47	45	39	37
Temperature winter		47	48	47	40	48	46	48	48	48	48	46	35	47	45	39	37
Rain ⁺		45	46	45	40	46	44	46	46	46	46	45	33	45	44	40	38
Drought		45	46	45	39	46	44	46	46	46	46	44	33	45	44	38	36
Wind and storms ⁺		48	49	48	42	49	47	49	49	49	49	47	35	48	46	41	39
Seasons		54	55	54	41	55	54	55	55	55	55	53	42	54	52	41	40
Plants		45	45	45	34	45	44	45	45	45	45	43	33	45	42	36	34
Flooding with rainwater		48	49	48	39	49	47	49	49	49	49	47	36	48	45	39	37
Number of mosquitoes		47	48	47	41	48	46	48	48	48	48	46	35	47	45	40	38
Sea Level		46	47	46	39	47	45	47	47	47	47	45	35	46	44	39	37
Flooding with sea water ⁺		50	51	50	41	51	49	51	51	51	51	49	38	50	47	41	39
Sea life ⁺		50	51	50	41	51	49	51	51	51	51	49	38	50	47	40	38

⁺ = composite variables; varying N due to pairwise deletion

Table S15: Ordinal correlations (Spearman Rho) of climate-related environmental changes with selected socio-demographic variables for Samoa

Samoa (Spearman Rho))		Age	Years on island	Gender	Number of inhabitants	Distance to the sea	Ownership	Plant for daily diet	Sell fruits and vegetables	Fish for daily diet	Sell fish	Education	Daily activities in nature	Socio-economic status	Religiousness self-assessment	Religiousness church activities	Religiousness Overall
Present																	
Temperature summer		.190	.138	-.169	-.396**	-.115	-.005	.045	.208	.428**	.306*	-.065	.295*	-.079	.272*	.457**	.462**
Temperature winter		.153	.092	-.054	-.312	.131	.078	.035	-.140	.054	-.055	.079	.060	-.063	.171	.494**	.492**
Rain+		-.007	.197	-.102	-.340*	-.046	.027	.169	.004	.156	.055	-.120	.136	-.022	.027	.465**	.474**
Drought		.229	.175	-.016	-.236	-.188	-.119	.226	.351**	.359**	.339*	-.211	.367**	-.306*	.002	.263	.246
Wind and storms+		.164	-.020	-.076	-.577**	-.250	.055	.060	.285*	.325*	.325*	-.145	.435**	-.130	.136	.533**	.509**
Seasons		-.103	-.192	.183	.307*	.021	.222	-.168	.113	-.151	-.064	.071	-.098	.018	.072	-.148	-.126
Plants		-.104	-.254	-.018	-.226	-.112	-.236	-.242	.102	-.070	.000	-.041	.104	.229	.094	.086	.105
Flooding with rainwater		.017	-.096	.051	-.202	-.006	.111	-.048	.045	.287*	.236	.029	.156	-.147	.214	.292*	.304*
Number of mosquitoes		-.139	-.203	-.142	.054	.158	.099	-.224	-.189	.163	.146	.165	.087	.032	.144	.238	.283*
Sea Level		-.019	-.115	-.070	-.290*	-.339*	-.201	.049	.204	.294*	.236	-.076	.277	.013	.300*	.398**	.450**
Flooding with sea water+		.117	-.034	-.067	-.620**	-.380*	-.141	.154	.325*	.344*	.344*	-.118	.577**	-.052	.347*	.501**	.526**
Sea life+		.137	.084	.057	-.152	-.212	-.023	.004	-.063	-.047	-.033	-.172	-.061	.038	.035	-.170	-.162
Future																	
Temperature summer		.189	.217	-.118	.012	-.148	.215	-.185	.128	.271	.244	-.026	.080	-.053	.380**	-.051	.004
Temperature winter		.259	.300	-.141	-.409*	.036	-.050	.253	.011	.141	.060	-.176	.130	-.111	.162	.457**	.433**
Rain+		.148	.225	-.090	-.287	-.029	-.059	.276	-.004	.276	.247	-.008	.163	-.197	-.011	.440**	.434**
Drought		.356*	.259	-.093	-.141	-.276	.233	.010	.266	.201	.153	-.121	.292	-.155	.123	.190	.145
Wind and storms+		.260	.163	-.005	-.212	-.124	.106	.042	.078	.219	.174	-.179	.221	-.159	.092	.475**	.440**
Seasons		.030	-.034	-.032	.096	-.072	.225	-.151	.101	-.145	-.092	.027	.050	.052	.233	-.151	-.123
Plants		-.261	-.296	-.021	-.087	-.232	-.055	-.271	.045	-.018	.056	-.072	.182	.105	.152	.023	.049
Flooding with rainwater		.192	.073	.099	-.204	-.281	-.111	.018	-.003	.209	.138	-.084	.020	.061	.063	.168	.183
Number of mosquitoes		-.157	-.248	-.195	.345*	.220	.167	-.427**	-.301*	.012	.102	.044	-.171	.004	.018	-.040	-.032
Sea Level		-.126	-.065	-.221	.036	-.199	-.108	-.241	-.162	.040	-.014	-.098	-.104	.130	.033	.030	.046
Flooding with sea water+		.081	.010	-.068	-.512**	-.381*	-.179	.069	.121	.364*	.250	-.135	.380*	-.069	.168	.415**	.429**
Sea life+		.134	.161	.067	-.129	-.099	-.237	.242	-.181	.148	-.032	-.149	.041	.063	.003	.090	.086

* $p = 0.05$; ** $= p < 0.01$ (two-tailed); + = composite variables

Table S16: N for ordinal correlations of climate-related environmental changes with selected socio-demographic variables for Samoa

Samoa (N)	Overall																	
	Age	Years on island	Gender	Number of inhabitants	Distance to the sea	Ownership	Plant for daily diet	Sell fruits and vegetables	Fish for daily diet	Sell fish	Education	Daily activities in nature	Socio-economic status	Religiousness self-assessment	Religiousness church activities	Religiousness		
Present																		
Temperature summer	58	57	59	50	46	53	57	57	57	57	58	51	59	56	56	53		
Temperature winter	44	44	45	38	33	40	43	43	43	43	45	38	45	45	43	43		
Rain+	59	58	60	51	47	53	58	58	58	58	59	52	60	57	57	54		
Drought	56	55	57	49	44	50	55	55	55	55	56	50	57	54	54	51		
Wind and storms+	59	58	60	51	47	53	58	58	58	58	59	52	60	57	57	54		
Seasons	56	55	57	48	44	51	55	55	55	55	56	49	57	54	54	51		
Plants	37	37	37	31	25	34	37	37	37	37	36	32	37	36	35	34		
Flooding with rainwater	52	51	53	46	43	49	51	51	51	51	52	46	53	50	51	48		
Number of mosquitoes	58	57	59	51	46	52	57	57	57	57	58	52	59	56	56	53		
Sea Level	55	54	56	49	45	50	54	54	54	54	55	50	56	53	54	51		
Flooding with sea water+	50	49	51	43	39	46	49	49	49	49	50	43	51	49	48	46		
Sea life+	58	57	59	50	46	52	57	57	57	57	58	51	59	56	56	53		
Future																		
Temperature summer	49	48	50	42	39	44	49	49	49	49	49	43	50	47	47	44		
Temperature winter	36	36	37	31	27	32	36	36	36	36	37	31	37	37	35	35		
Rain+	49	48	50	43	38	45	48	48	48	48	49	45	50	47	47	44		
Drought	49	48	50	42	38	44	48	48	48	48	49	43	50	47	47	44		
Wind and storms+	53	52	54	46	42	48	52	52	52	52	53	47	54	51	51	48		
Seasons	53	52	54	46	43	49	53	53	53	53	54	47	54	51	52	49		
Plants	37	37	37	31	25	34	37	37	37	37	36	32	37	36	35	34		
Flooding with rainwater	44	43	45	39	36	41	43	43	43	43	44	39	45	42	42	39		
Number of mosquitoes	53	52	54	47	42	47	52	52	52	52	53	48	54	51	51	48		
Sea Level	43	42	44	36	34	39	43	43	43	43	43	37	44	41	42	39		
Flooding with sea water+	43	42	44	37	34	39	42	42	42	42	42	37	44	42	41	39		
Sea life+	51	50	51	43	39	46	50	50	50	50	50	45	51	48	48	45		

+ = composite variables; varying N due to pairwise deletion

Table S17: Ordinal correlations (Spearman Rho) for ordinal correlations of climate-related environmental changes with selected socio-demographic variables for Tonga

Tonga (Spearman Rho)		Age	Years on island	Gender	Number of inhabitants	Distance to the sea	Ownership	Plant for daily diet	Sell fruits and vegetables	Fish for daily diet	Sell fish	Education	Daily activities in nature	Socio-economic status	Religiousness self-assessment	Religiousness church activities	Religiousness Overall
Present																	
Temperature summer	.011	.203	-.050	.234	.191	.056	-.232	.032	.027	.033	-.241	.359**	.069	.175	-.089	-.047	
Temperature winter	.023	.062	-.069	.128	.032	-.040	-.215	-.051	-.090	-.056	-.332*	-.444**	.054	.339**	-.159	-.140	
Rain ⁺	.034	.115	-.047	.311*	.140	.038	-.111	.125	-.010	-.210	-.069	-.012	.286*	.299*	.049	.134	
Drought	.088	.098	-.032	.366**	.198	.088	-.279*	-.030	-.145	.016	-.049	-.449**	.211	.212	-.114	-.101	
Wind and storms ⁺	.014	.079	-.162	.112	.113	.021	.005	.148	-.098	-.223	-.094	-.203	.105	.285*	-.147	-.062	
Seasons	.175	.190	-.114	.025	-.032	.176	-.054	-.046	.129	.002	.106	.309*	.345**	-.144	-.068	-.059	
Plants	.209	.186	-.384**	.050	-.166	.198	.102	.116	.177	-.176	-.025	.188	.200	.188	-.043	.011	
Flooding with rainwater	-.133	.023	-.078	.318*	.268*	.110	-.368**	.012	-.159	-.027	-.148	-.365**	-.078	.417**	-.024	.068	
Number of mosquitoes	-.094	.233	-.140	.054	.010	.009	-.316*	.067	-.047	.110	.089	-.024	.021	.154	-.117	-.068	
Sea Level	-.127	-.071	-.138	.203	-.096	-.003	-.172	-.037	.094	-.068	-.043	-.006	.146	.017	-.073	-.052	
Flooding with sea water ⁺	-.062	.164	.125	.126	.323*	.187	.064	.091	.172	-.031	.061	.160	-.033	.101	.139	.201	
Sea life ⁺	.149	.043	-.029	.112	.270*	-.077	-.300*	.011	.021	.146	-.212	-.245	-.047	.211	-.305*	-.284*	
Future																	
Temperature summer	-.049	.182	.071	-.030	.248	.005	-.160	.124	-.028	.140	-.275*	-.117	.010	.167	.059	.111	
Temperature winter	-.045	-.003	.023	.059	.015	-.105	-.316*	-.094	-.116	-.094	-.330*	-.312*	.001	.191	-.160	-.151	
Rain ⁺	.043	.164	-.213	.200	-.210	.052	.067	.146	.047	-.114	-.042	-.019	.328*	.172	.025	.083	
Drought	.106	.029	-.008	.359**	.218	.013	-.260	-.017	-.229	-.103	.030	-.395**	.354**	.208	-.192	-.191	
Wind and storms ⁺	.103	.090	-.032	.035	.040	.004	.022	.054	-.199	-.330	-.130	-.108	.086	.276*	-.055	.019	
Seasons	-.064	.085	.067	-.061	-.033	.047	.001	-.201	.064	-.005	.004	.132	-.004	-.092	-.064	-.061	
Plants	.249	.153	-.393**	.123	-.108	.235	.082	.012	.267*	-.153	.138	.127	.128	.153	-.017	.019	
Flooding with rainwater	-.170	-.063	-.111	.215	.228	.064	-.349**	-.037	-.282*	-.182	-.052	-.336**	-.087	.304*	-.099	-.019	
Number of mosquitoes	-.249	.051	-.022	-.181	-.067	-.118	-.168	-.140	.092	.148	.126	.175	-.011	-.067	.017	.025	
Sea Level	-.100	.030	-.054	.151	.090	.131	.112	.111	-.003	-.167	-.158	.013	.169	-.035	.071	.081	
Flooding with sea water ⁺	-.054	.003	.084	-.008	-.253	.242	.061	-.047	.025	-.204	.048	.247	-.142	-.130	.202	.234	
Sea life ⁺	.042	.005	-.041	-.025	.188	-.004	-.299*	-.004	.137	.244	-.146	-.273*	-.201	.098	-.206	-.188	

*p = 0.05; **p < 0.01 (two-tailed); + = composite variables

Table S18: N for ordinal correlations of climate-related environmental changes with selected socio-demographic variables for Tonga

Tonga (N)		Age	Years on island	Gender	Number of inhabitants	Distance to the sea	Ownership	Plant for daily diet	Sell fruits	Fish for daily diet	Sell fish	Education	Daily activities in nature	Socio-economic status	Religiousness self-assessment	Religiousness church activities	Religiousness Overall
Present																	
Temperature summer		59	58	60	60	59	58	60	60	60	60	58	59	58	58	59	58
Temperature winter		59	58	60	60	59	58	60	60	60	60	58	59	58	58	59	58
Rain ⁺		58	57	59	59	58	57	59	59	59	59	57	58	57	57	58	57
Drought		58	57	59	59	58	57	59	59	59	59	57	58	57	57	58	57
Wind and storms ⁺		58	57	59	59	58	57	59	59	59	59	57	58	57	57	58	57
Seasons		59	58	60	60	59	58	60	60	60	60	58	59	58	58	59	58
Plants		57	56	58	58	57	56	58	58	58	58	56	57	57	56	57	56
Flooding with rainwater		58	57	59	59	58	57	59	59	59	59	57	59	57	57	58	57
Number of mosquitoes		58	57	59	59	58	57	59	59	59	59	57	58	57	57	58	57
Sea Level		59	58	60	60	59	58	60	60	60	60	58	59	58	58	59	58
Flooding with sea water ⁺		59	58	60	60	59	58	60	60	60	60	58	59	58	58	59	58
Sea life ⁺		59	58	60	60	59	58	60	60	60	60	58	59	58	58	59	58
Future																	
Temperature summer		57	56	58	58	57	56	58	58	58	58	57	57	57	56	57	56
Temperature winter		58	57	59	59	58	57	59	59	59	59	58	58	57	57	58	57
Rain ⁺		57	56	58	58	57	56	58	58	58	58	56	58	56	56	57	56
Drought		56	55	57	57	56	55	57	57	57	57	56	57	55	55	56	55
Wind and storms ⁺		57	56	58	58	57	56	58	58	58	58	56	57	56	56	57	56
Seasons		59	58	60	60	59	58	60	60	60	60	58	59	58	58	59	58
Plants		57	56	58	58	57	56	58	58	58	58	56	57	57	56	57	56
Flooding with rainwater		58	57	59	59	58	57	59	59	59	59	57	59	57	57	58	57
Number of mosquitoes		57	56	58	58	57	56	58	58	58	58	56	57	56	56	57	56
Sea Level		58	57	59	59	58	57	59	59	59	59	57	58	57	57	58	57
Flooding with sea water ⁺		59	58	60	60	59	58	60	60	60	60	58	59	58	58	59	58
Sea life ⁺		59	58	60	60	59	58	60	60	60	60	58	59	58	58	59	58

⁺ = composite variables; varying N due to pairwise deletion

Part V: Other information

Table S19: places of residence of survey respondents

Tuvalu			
<i>Funafuti</i>			
Alapi	2	Niutao	1
Elisalas Residence	1	Serala	1
Fakaifou	18	Te Vao	1
Funafuti	7	Tuvalu side	1
Kavatoetoe	4	Vaiaku	7
Lofeagai	2	Vao side	1
Nanumasa	1		
<i>Vaitupu</i>			
Asau	6	Tegao Village	1
Tefagaefa	1	Tumaseu	4
Samoa: Upolu			
Afega	8	Samatau	1
Alafua	1	Sapoe	8
Fuanai	1	Tanugamanono	1
Laulii	2	Toamua	1
Letogo	1	Toomatogi	1
Letolto	1	Tuanai	11
Matautu-uta	2	Tufuiopa	2
Matautuutu	1	Uoala	1
Matauufunuta	1	Utulaelae	3
Moataa	2	Vaimea (part of Apia)	1
Motootua	3	Vaitele	1
Nuu	1	Vaitele-Uta (Apia)	1
Papaloloa	1	Vaivase-Uta	1
Tonga			
<i>Lifuka</i>			
Ha'ato'u	2	Koulo	5
Hihifo	7	Pangai	2
Holopeka	3	Pangao	1
<i>Tongatapu</i>			
'Ahau	5	Patangata (Nuku'alofa area)	20
Kanokupolu	5	Sopu / Nuku'alofa	9

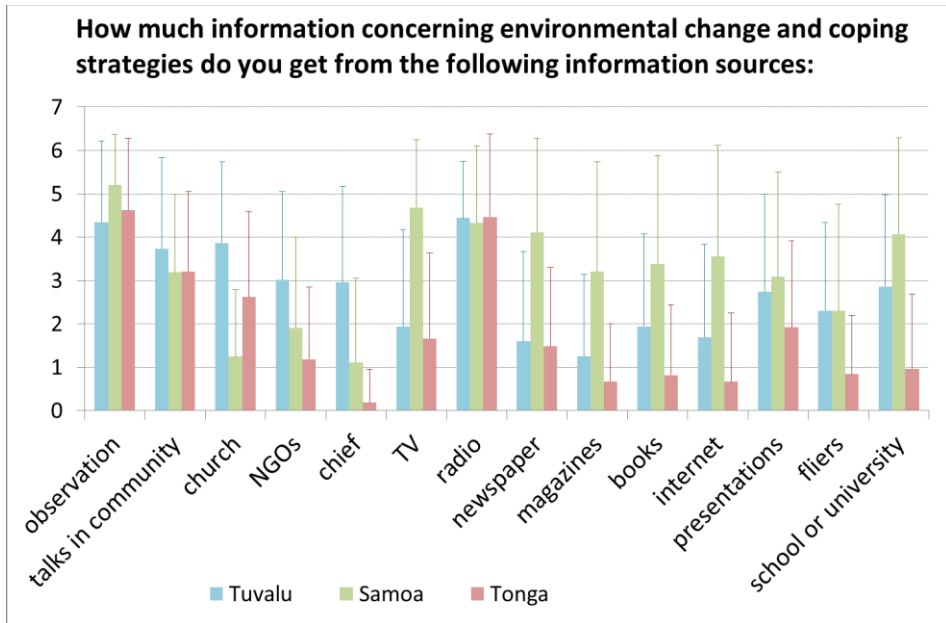


Figure S3: Mean values and standard deviations for the ranking of sources of information

	Tuvalu	Samoa	Tonga
Age		-	-
			-
Years on Island	-	-	-
		-	-
Gender 1 - female 2 - male	 	-	
Size of Settlements (number of inhabitants)	   	   	   
Distance to the sea (in meters)	 	 	 
Ownership (1 - no; 2 - yes)	 	-	-
Plant for daily diet (1 - no; 2 - yes)	-	-	   
Sell fruits and veggies (1 - no; 2 - yes)	-	   	-
Fish for daily diet (1 - no; 2 - yes)	 	   	-
Sell fish (1 - no; 2 - yes)	-	   	-
Education	 	-	 
Daily activities in nature	   	   	   
Socio-economic status	   	   	   
Religiousness self-assessment	   	   	  
Religiousness church activities	 	 	-

Figure S4: Significant ordinal correlations (Spearman Rho, $p \leq 0.05$, two-sided) between socio-demographic variables and perceived climate-related environmental changes