Earth's Future

Supporting Information for

Assessment of 21st century changing sea surface temperature, rainfall, and sea surface height patterns in the tropical Pacific Islands using CMIP6 greenhouse warming projections

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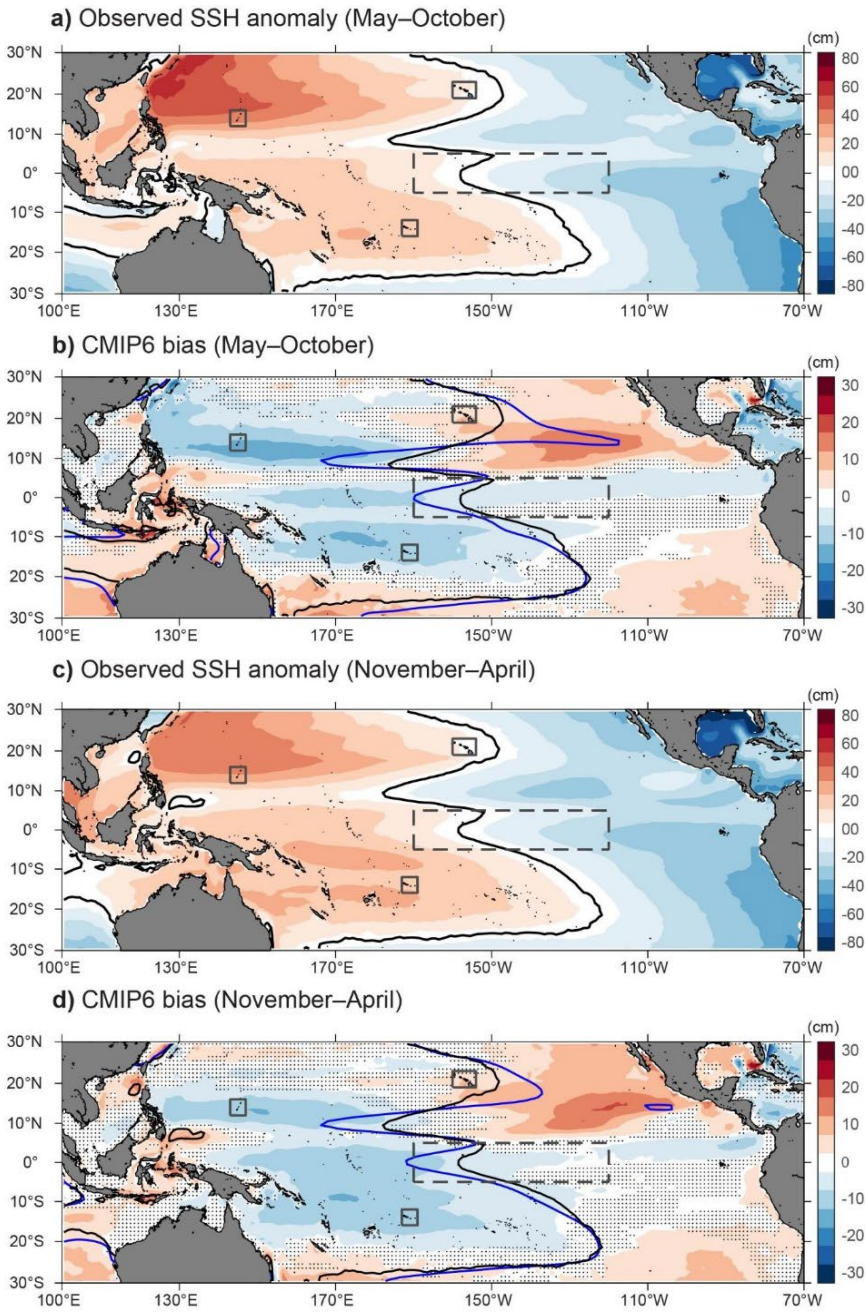

Figure S1. Observed SSH anomaly and CMIP6 bias with respect to the tropical Pacific spatial mean during 1993–2014 (cm, color bars). a, c) Observed seasonal mean SSH during May–October and November–April, respectively. **b, d)** Multi-model mean SSH bias for the historical experiment relative to observations during the respective seasons. Contour lines depict the zero SSH, for the observed (black) and historical (blue) conditions. Black stippling indicates where less than 66% of models agree on the sign of the bias.

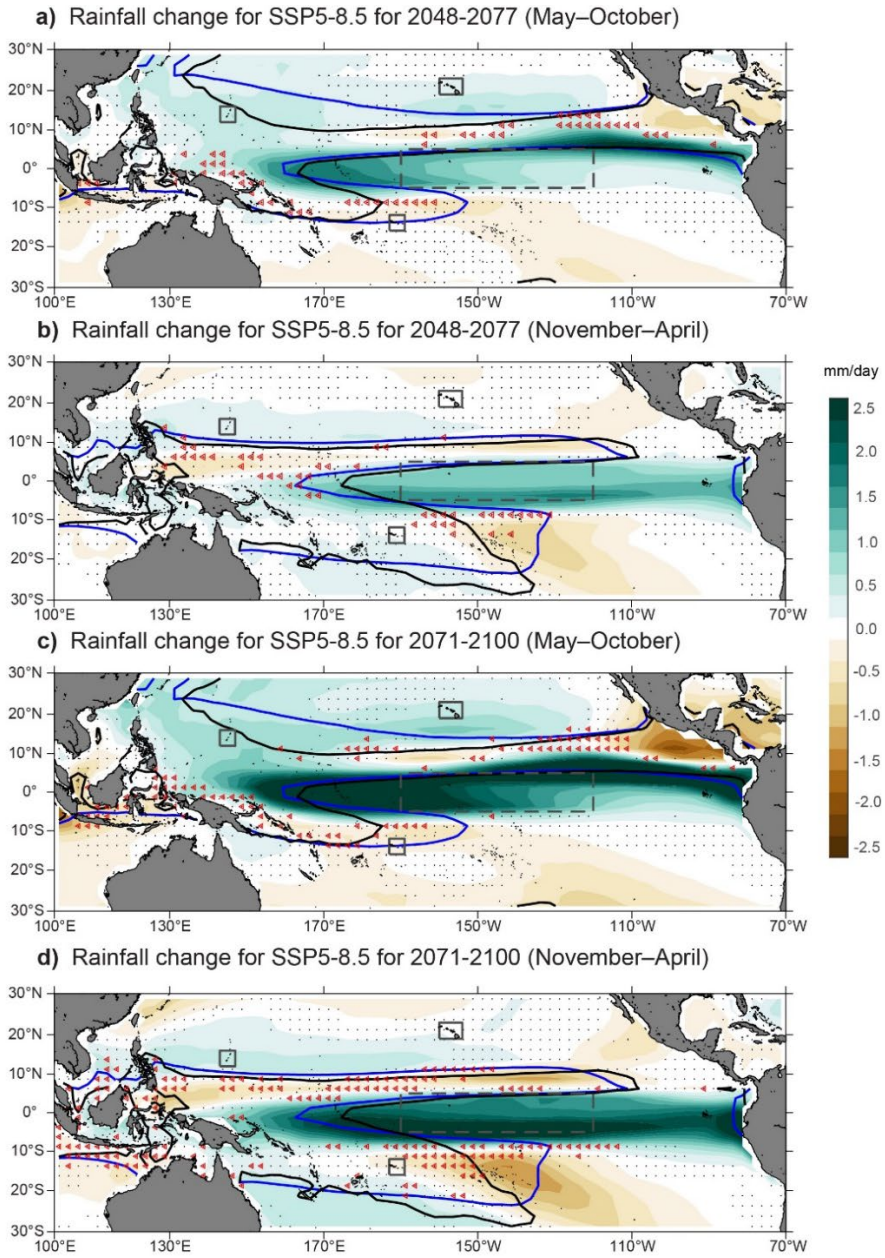

Figure S2. Projected rainfall changes for the SSP5-8.5 experiment during 2048–2077 (a, b) and 2071–2100 (c, d) relative to the historical experiment (1985–2014). Multi-model mean projections (mm/day, color bar) during two seasons are shown (**a** and **c**, May–October; **b** and **d**, November–April). Contour lines depict the 5 mm/day seasonal mean rainfall for the observed (black) and historical (blue) conditions. Black stippling indicates where less than 66% of models agree on the sign of future change and red stippling indicates where in those places more than 66% models project large changes (exceeding ±0.5 mm/day).

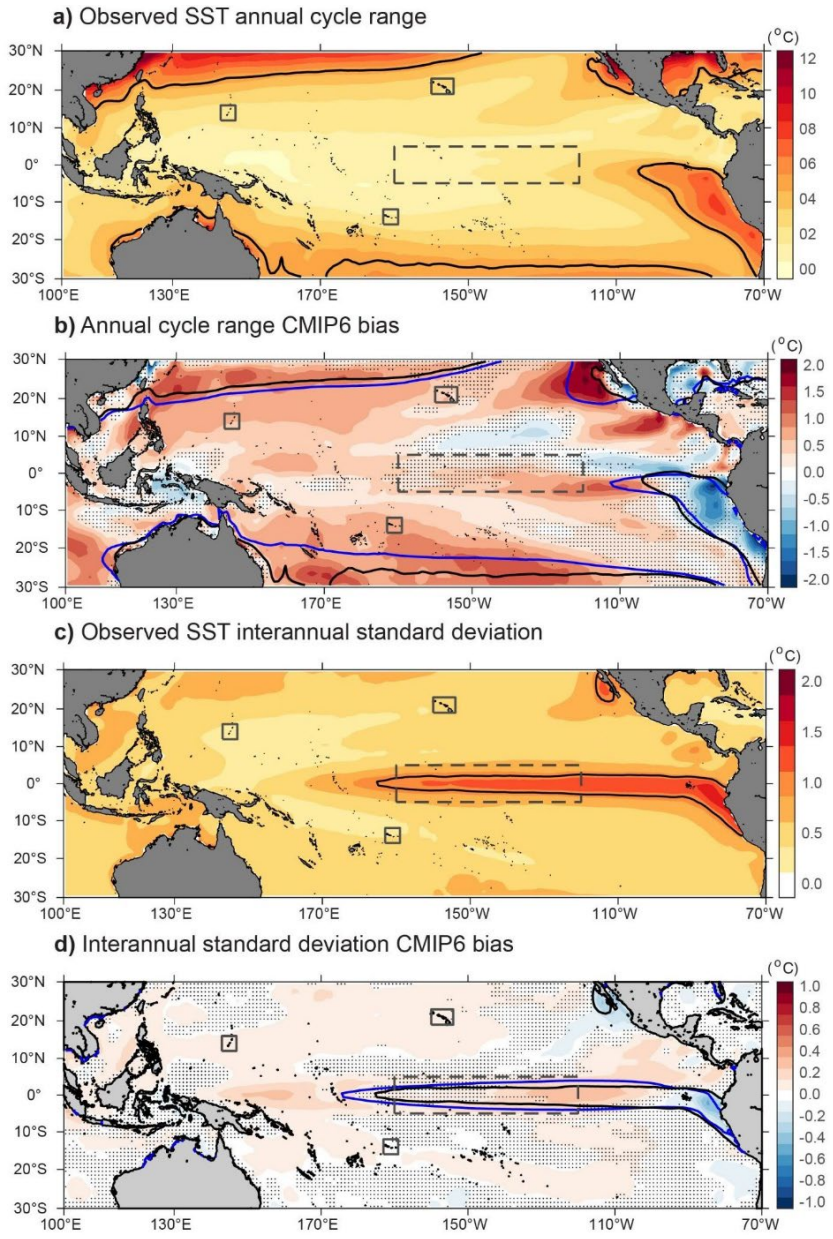

Figure S3. Observed SST and CMIP6 bias for the annual cycle range and interannual standard deviation during 1985–2014 (°C, color bars). a, c) Observed annual cycle range and interannual standard deviation, respectively. **b, d)** Multi-model mean bias for the historical experiment relative to observations of the annual cycle range and interannual standard deviation, respectively. Contour lines depict the annual cycle range of 5 °C (**a** and **b**) and interannual standard deviation of 1 °C (**c** and **d**) for the observed (black) and historical (blue) conditions. Black stippling indicates where less than 66% of models agree on the sign of the bias.

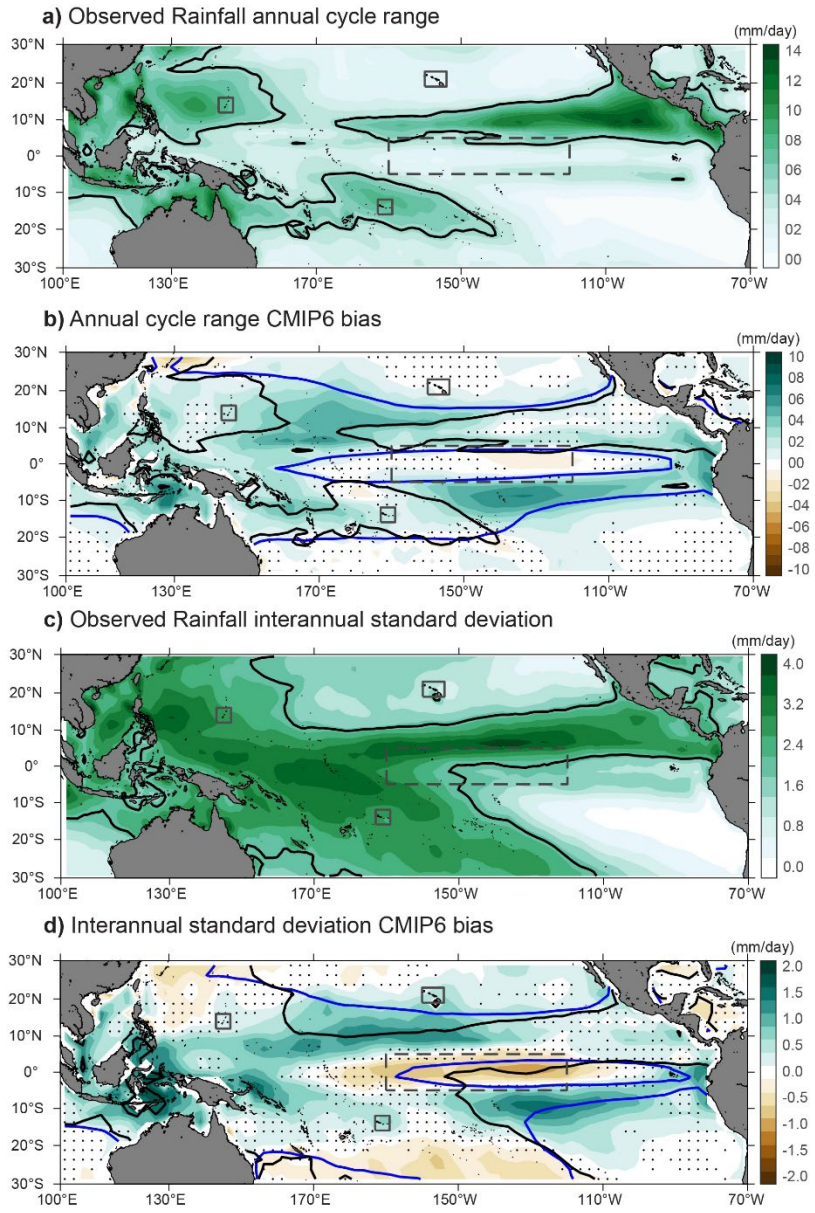

Figure S4. Observed Rainfall and CMIP6 bias for annual cycle range and interannual standard deviation during 1985–2014 (mm/day, color bars). a, c) Observed annual cycle range and interannual standard deviation, respectively. **b, d)** Multi-model mean bias for the historical experiment relative to observations of the annual cycle range and interannual standard deviation, respectively. Contour lines depict annual cycle range of 5 mm/day (a and b) and inter-annual variability with a standard deviation of 2 mm/day (c and d) for the observed (black) and historical (blue) conditions. Black **s**tippling indicates where less than 66 % of models agree on the sign of bias.

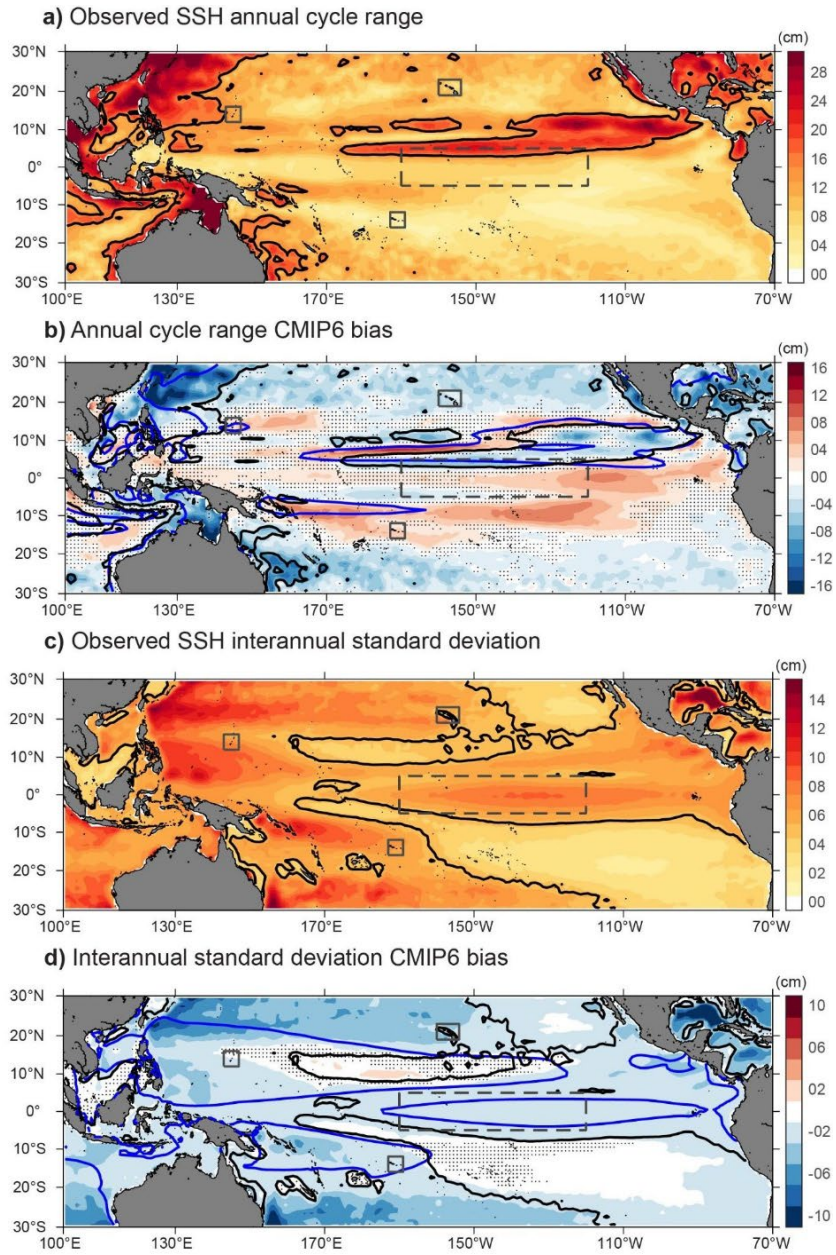

Figure S5. Observed SSH and CMIP6 bias for annual cycle range and interannual standard deviation during 1993–2014 (cm, color bars). a, c) Observed annual cycle range and interannual standard deviation, respectively. **b, d)** Multi-model mean bias for the historical experiment relative to observations of the annual cycle range and interannual standard deviation, respectively. Contour lines depict annual cycle range of 15 cm (**a** and **b**) and inter-annual variability with a standard deviation of 5 cm (**c** and **d**) for the observed (black) and historical (blue) conditions. Black stippling indicates where less than 66 % of models agree on the sign of bias.

Table S1. Similar to Table 3, but for regional changes in the seasonal mean of SST and rainfall for the other parts of the USAPI. Regions are indicated in Figure 2 (triangles ordered from east-to-west). Projections are for a single grid point located nearest to the islands, noting that the SST is on a 1° latitude × longitude grid (labeled O for ocean) and rainfall is on a 2.5° grid (labeled A for atmosphere). SSH projections for these locations are unavailable from the NOAA *Sea Level Rise Viewer*.

Region	Tropical Pacific warming	SST (ºC)		Rainfall (mm/day)	
		Nov-Apr	May-Oct	Nov-Apr	May-Oct
Majuro O (7.5 °N, 171.5 °E) A (6.25 °N, 171.25 °E)	0.7 ℃	0.7 ± 0.2	0.7 ± 0.3	- 0.1 ± 0.7	0.2 ± 0.6
	1.8 ℃	1.7 ± 0.3	1.7 ± 0.3	0.1 ± 0.9	0.3 ± 0.9
Kwajalein O (8.5 °N, 167.5 °E) A (8.75 °N, 168.75 °E)	0.7 ℃	0.7 ± 0.2	0.7 ± 0.3	0.2 ± 0.7	0.2 ± 0.3
	1.8 ℃	1.8 ± 0.3	1.7 ± 0.3	0.3 ± 0.6	0.2 ± 0.7
Kosrae O (5.5 °N, 162.5 °E) A (6.25 °N, 163.75 °E)	0.7 ℃	0.7 ± 0.2	0.7 ± 0.2	- 0.1 ± 0.7	0.2 ± 0.5
	1.8 ℃	1.7 ± 0.3	1.7 ± 0.3	- 0.2 ± 0.9	0.3 ± 0.8
Pohnpei O (6.5 °N, 158.5 °E) A (6.25 °N, 158.75 °E)	0.7 ℃	0.7 ± 0.2	0.7 ± 0.2	- 0.2 ± 0.8	0.2 ± 0.5
	1.8 ℃	1.7 ± 0.3	1.6 ± 0.3	- 0.2 ± 0.9	0.4 ± 0.8
Chuuk O (7.5 °N, 151.5 °E) A (6.25 °N, 151.25 °E)	0.7 ℃	0.7 ± 0.2	0.7 ± 0.2	0.0 ± 0.8	0.3 ± 0.4
	1.8 ℃	1.7 ± 0.3	1.7 ± 0.3	-0.2 ± 0.9	0.5 ± 0.6
Yap O (9.5 °N, 138.5 °E) A (8.75 °N, 138.75 °E)	0.7 ℃	0.7 ± 0.2	0.7 ± 0.2	0.1 ± 0.8	0.0 ± 0.6
	1.8 ℃	1.8 ± 0.2	1.8 ± 0.2	0.1 ± 0.9	0.4 ± 0.8
Koror O (7.5 °N, 134.5 °E) A (6.25 °N, 133.75 °E)	0.7 ℃	0.7 ± 0.1	0.7 ± 0.1	0.0 ± 0.9	0.0 ± 0.5
	1.8 ℃	1.8 ± 0.2	1.8 ± 0.2	- 0.2 ± 0.9	0.3 ± 0.5

Table S2. Similar to Table 4, but for regional changes in the annual cycle (range) and interannual variability (standard deviation) of SST (ºC), rainfall (mm/day), and SSH (cm) for the other parts of the USAPI. Regions are indicated in Figure 2 (triangles ordered from east-to-west). Projections are for a single grid point located nearest to the islands, noting that the SST is on a 1° latitude × longitude grid (labeled O for ocean) and rainfall is on a 2.5° grid (labeled A for atmosphere).

Region	GMST warming	SST (ºC)		Rainfall (mm/day)		SSH (cm)	
		Annual Cycle	Interannual Variability	Annual Cycle	Interannual Variability	Annual Cycle	Interannual Variability
Majuro O (7.5 °N, 171.5 °E) A (6.25 °N, 171.25 °E)	1.5 ℃	- 0.1 ± 0.1	0.02 ± 0.04	- 0.5 ± 1.8	0.1 ± 0.4	- 0.1 ± 1.8	0.9 ± 1.0
	3.0 ℃	- 0.1 ± 0.2	0.04 ± 0.06	- 0.4 ± 2.1	0.3 ± 0.4	0.2 ± 2.6	1.0± 1.2
Kwajalein O (8.5 °N, 167.5 °E) A (8.75 °N, 168.75 °E)	1.5 ℃	- 0.1 ± 0.1	0.01 ± 0.04	-0.3 ± 1.2	0.2 ± 0.3	- 1.0 ± 2.6	0.7 ± 0.8
	3.0 ℃	- 0.1 ± 0.2	0.02 ± 0.06	-0.1 ± 1.5	0.3 ± 0.3	-0.3 ± 3.7	1.0± 1.1
Kosrae O (5.5 °N, 162.5 °E) A (6.25 °N, 163.75 °E)	1.5 ℃	- 0.1 ± 0.1	0.01 ± 0.05	0.3 ± 1.7	0.2 ± 0.3	0.9 ± 1.7	0.9 ± 1.2
	3.0 ℃	- 0.2 ± 0.2	0.04 ± 0.08	-0.3 ± 2.0	0.3 ± 0.4	1.1 ± 2.4	1.3± 1.3
Pohnpei O (6.5 °N, 158.5 °E) A (6.25 °N, 158.75 °E)	1.5 ℃	- 0.1 ± 0.1	0.01 ± 0.05	0.2 ± 1.6	0.2 ± 0.3	0.2 ± 1.1	0.9 ± 1.0
	3.0 ℃	- 0.2 ± 0.2	0.04 ± 0.06	0.0 ± 1.8	0.3 ± 0.4	0.7 ± 2.0	1.3 ± 1.3
Chuuk O (7.5 °N, 151.5 °E) A (6.25 °N, 151.25 °E)	1.5 ℃	- 0.0 ± 0.1	0.02 ± 0.06	0.3 ± 1.2	0.2 ± 0.4	-1.4 ± 2.4	0.8 ±0.9
	3.0 ℃	- 0.1 ± 0.2	0.04 ± 0.06	0.6 ± 1.1	0.4 ± 0.4	- 0.4 ± 2.6	1.3± 1.3
Yap O (9.5 °N, 138.5 °E) A (8.75 °N, 138.75 °E)	1.5 ℃	- 0.1 ± 0.2	0.02 ± 0.07	-0.1 ± 1.3	0.1 ± 0.4	- 1.8 ± 3.0	0.6 ± 1.1
	3.0 ℃	- 0.1 ± 0.2	0.04 ± 0.06	0.5 ± 1.4	0.3 ± 0.5	- 1.2 ± 2.8	1.0 ± 1.1
Koror O (7.5 °N, 134.5 °E) A (6.25 °N, 133.75 °E)	1.5 ℃	- 0.1 ± 0.2	0.01 ± 0.07	0.0 ±1.2	0.1 ± 0.3	- 1.7 ± 2.7	0.5 ± 08
	3.0 ℃	- 0.1 ± 0.3	0.04 ± 0.06	0.1 ± 1.4	0.3 ± 0.5	- 1.3 ± 2.7	1.1 ± 1.3