



Tokyo Olympic and Paralympic Games Environmental Update

September 2020

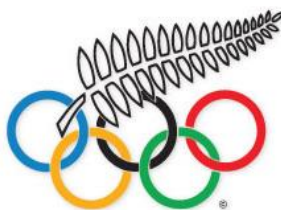


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Overview

This report provides an update on the environmental conditions experienced during the Tokyo Olympic (23rd July – 8th August) and Paralympic periods (24th August – 5th September) in 2020. Data was collected from the Japanese Met Agency, an online weather source previously verified to have the most accurate and reliable environmental information for each Olympic zone.

This environmental update includes:

- The environmental conditions from 2020 during the Olympic ([Table 1](#)) and Paralympic ([Table 2](#)) periods.
- Comparison of 2020 data with historical (2016 to 2019) data for each Olympic and Paralympic venue.
- A summary of air and water quality in the Tokyo region from 2018.
- COVID-19 considerations specific to the heat management strategies for Tokyo.

Key Definitions

Dry Bulb Temperature

- The air temperature that does not consider solar radiation (from the sun) or humidity.

Relative Humidity

- The proportion of water held in the air at a given temperature. Note that hotter air can hold more water thus the relative humidity will decrease as air temperature increases.

Feels Like Temperature

- Is an indication of how hot the environment is by taking into account the dry bulb temperature, humidity, wind, and solar radiation. This is also referred to as Heat index and is similar to Wet Bulb Globe Temperature (WBGT) which is used by the IOC and IPC.

Key Observations from 2020

Olympic Period (23rd July – 8th August)

- Tokyo Central had fewer hot days (i.e., 'Feels like' >30°C) compared to all but one year since 2016 (by 1-4 days depending on the year).
- Although there were more hotter days in previous years (except 2016) Tokyo Central still saw 13/17 days reach a 'Feels like' temperature above 30°C (5-year average: 14/17), whilst 8/17 peaked over 35°C (5-year average: 11/17) and 2/17 exceeded 40°C (5 year average: 5/17).
- Lower temperatures were likely, at least in part, driven by the 49 mm increase in rainfall during the Olympic period compared to the hottest of the past 5 years (2019) with the 5-year average 10 mm lower than 2020. In addition, both 2018 and 2019 had a heat wave during the Olympic period.

Paralympic Period (24th August – 5th September)

- 2020 was the hottest of the past five years.
- Tokyo Central saw 11/13 days reach a 'Feels like' temperature above 30°C (5-year average: 10/13), whilst 10/13 peaked over 35°C (5-year average: 6/13) and 4/13 exceeded 40°C (5-year average: 2/13).
- The rainfall during the Paralympic period was lower compared to other years with a total of 47 mm falling across 6 days compared to the 5-year average of 54 mm.

Venue Microclimates

Factors such as shade, wind, solar radiation, and proximity to heat absorbing surfaces (e.g., roads, concrete buildings) can create microclimates which can increase (or decrease) the overall heat stress on an individual at a given training or competition venue. HPSNZ staff that visited Tokyo in 2018 and 2019 commented on microclimates that, at competition venues, were 5-10°C hotter than what was forecasted on a given day for their location. Staff should be aware that forecasted daily weather conditions during the Olympic and Paralympic Games are more likely to underestimate the microclimate where an event is taking place.

Summary

The conditions across the past five years further indicate that Tokyo 2021 is likely to be the hottest Olympic and Paralympic games to date with 'Feels like' temperatures reaching between 38 - 48°C (year and venue dependant). The temperatures in 2020 did indicate a slightly cooler year for the Olympic period but a hotter year for the Paralympic period. During the 2020 Olympic period 13 of the 17 days exceeded a 'Feels like' temperature of 30°C whilst 10 of the 13 days during the Paralympic games exceeded 35°C.

Hot environments are known to decrease athletic performance across a range of events. Therefore, sports need to make sure they adequately prepare athletes, coaches and support staff members acknowledging individuals respond differently to the heat. Accordingly, it is highly recommended to consult HPSNZ athlete performance support staff (listed below) or their dedicated heat lead to optimally implement a sport-specific heat management plan.

- **Physiology Heat Team:** Julia Casadio (Julia.Casadio@hpsnz.org.nz), Lorenz Kissling (Lorenz.Kissling@hpsnz.org.nz) and Andrew Kilding (Andrew.Kilding@hpsnz.org.nz)
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Environmental data was collected by Ben Day (Data Analyst, HPSNZ) and the final report was produced by the Physiology Heat Team in consultation with Performance Health and Performance Nutrition.

NSO Checklist

Check the below objectives, are you on your way to being complete? Below is an example of where we would currently expect sports to be. Give yourself a rating and work with your heat lead to get every objective **blue**.

NSO Heat Strategy Checklist	Expected Progress
1. Events in hot/humid locations have been identified where heat strategies can be trialled and fine-tuned (2018-2021)	Complete
2. An optimised heat acclimation/acclimatization (HA) strategy, measuring thermoregulation and performance outcomes, has been trialled and fine-tuned	Complete
3. Optimised cooling strategies (pre/during/post) have been trialled and fine-tuned in training and competition for days > 27°C	Complete
4. For outdoor events, warmup modification has been considered and optimised for days > 27°C	Complete
5. Optimised nutrition and hydration strategies are in place for competition in hot conditions	Complete
6. Athletes at risk of EHI and/or slow to respond to HA have been identified through heat response testing and HA blocks	Complete
7. Individualised heat management protocols are developed for at risk athletes to optimise their performance in the heat	On Track
8. An adequate pre-games environment has been selected that will aid in acclimatisation or acclimation, COVID-19 dependent	Planned
9. Coaches and support staff are educated and physically ready for the conditions expected in Tokyo	On Track
10. Key team members have bought into the heat strategy, are well aligned, and there is staff appointed to deliver cooling strategies at Games time	Complete
11. There is a high level of confidence that the heat management strategies in place will enable this sport to excel in the Tokyo environment	On Track

Ratings: Red = nothing started/planned, Orange = Planned, Green = On track, Blue = Complete

Environmental Data: Olympics

Table 1: Historical environmental data during the Olympic period for 2016 to 2020.

Historic Environmental Data	Lead-in Period 10 Jul – 22 Jul					Olympic Games Period 23 Jul – 9 Aug				
	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
Tokyo Central										
Max daytime temperature (°C)	33	34	35	30	31	37	36	37	35	34
Average daytime temperature (°C)	25	28	30	23	24	27	27	28	29	26
Min daytime temperature (°C)	20	23	24	19	18	20	21	20	23	21
Relative Humidity at hottest part of day (%)	57	50	64	69	65	38	50	38	61	51
Max daytime 'Feels like' temperature (°C)	40	40	47	37	37	40	47	47	48	43
% Days 'Feels like' >30°C	62	100	100	38	54	74	79	84	100	74
% Days 'Feels like' >35°C	31	92	92	8	31	47	58	68	89	47
% Days 'Feels like' >40°C	8	8	85	0	0	5	26	47	68	11
Total Rainfall in Period (mm)	67	11	4	109	78	46	69	119	30	79
Days raining (%)	54	8	8	77	77	21	42	32	26	37
Sapporo (e.g., Marathon)										
Max daytime temperature (°C)	28	35	-	28	29	31	29	33	33	30
Average daytime temperature (°C)	21	24	-	21	21	24	22	24	25	23
Min daytime temperature (°C)	16	17	-	17	16	17	17	17	19	18
Relative Humidity at hottest part of day (%)	52	38	-	56	47	46	50	59	59	58
Max daytime 'Feels like' temperature (°C)	28	36	-	28	29	34	30	40	40	33
% Days 'Feels like' >30°C	0	46	23	0	0	42	0	37	68	16
% Days 'Feels like' >35°C	0	23	8	0	0	0	0	11	26	0
% Days 'Feels like' >40°C	0	0	8	0	0	0	0	5	0	0
Total Rainfall in Period (mm)	39	55	37	22	6	82	20	3	50	19
Days raining (%)	23	46	46	38	8	26	26	5	37	32

Izu (e.g., Cycling)	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
Max daytime temperature (°C)	31	33	34	28	-	33	32	34	35	34
Average daytime temperature (°C)	25	27	29	23	-	26	26	28	28	26
Min daytime temperature (°C)	20	22	24	18	-	20	21	22	23	20
Relative Humidity at hottest part of day (%)	66	65	64	75	-	62	65	64	54	55
Max daytime 'Feels like' temperature (°C)	37	40	43	32	-	41	40	44	43	40
% Days 'Feels like' >30°C	54	100	100	38	54	68	74	95	100	68
% Days 'Feels like' >35°C	15	46	92	0	23	32	37	68	79	42
% Days 'Feels like' >40°C	0	8	23	0	8	5	5	26	53	0
Total Rainfall in Period (mm)	105	15	9	111	252	13	53	69	35	86
Days raining (%)	46	8	8	77	69	11	32	32	16	42
Tsujido (e.g., Yachting)	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
Max daytime temperature (°C)	34	33	31	29	30	35	33	34	32	32
Average daytime temperature (°C)	25	27	28	23	24	27	27	28	28	26
Total Rainfall in Period (mm)	68	28	15	81	125	34	110	92	11	50
Days raining (%)	31	8	8	77	77	26	37	37	21	42
Tokorozawa (e.g., Golf)	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
Max daytime temperature (°C)	33	34	37	30	32	36	35	39	36	34
Average daytime temperature (°C)	24	27	29	22	23	26	26	28	28	25
Total Rainfall in Period (mm)	89	26	1	97	77	8	110	144	61	163
Days raining (%)	46	8	8	69	92	16	42	37	21	53
Nerima (e.g., Shooting)	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
Max daytime temperature (°C)	34	36	37	32	33	37	36	39	36	36
Average daytime temperature (°C)	26	29	30	23	24	27	27	29	30	27
Total Rainfall in Period (mm)	119	20	35	107	65	16	76	105	20	104
Days raining (%)	46	8	8	62	77	21	53	37	21	47
Mobara (e.g., Surfing)	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
Max daytime temperature (°C)	31	36	36	30	32	38	35	36	36	35
Average daytime temperature (°C)	25	28	29	23	24	26	27	28	29	26

Total Rainfall in Period (mm)	31	0	0	94	111	38	61	66	11	36
Days raining (%)	38	0	0	62	92	37	42	26	16	26
Fuchū (e.g., Heritage Zone)	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
Max daytime temperature (°C)	34	35	35	31	33	38	36	38	36	35
Average daytime temperature (°C)	25	28	29	23	23	27	27	28	29	26
Total Rainfall in Period (mm)	94	38	32	96	62	26	83	125	19	117
Days raining (%)	46	8	8	77	77	21	42	37	21	53
Edogawa (e.g., Tokyo Bay Zone)	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
Max daytime temperature (°C)	32	33	34	29	30	38	34	36	33	31
Average daytime temperature (°C)	25	27	29	23	23	27	27	28	28	26
Total Rainfall in Period (mm)	73	6	2	94	74	35	53	65	28	49
Days raining (%)	62	8	8	69	85	21	42	26	16	32

Note: Only Tokyo, Sapporo and Izu have humidity data therefore they were the only locations where we can calculate 'Feels like' temperature.

* **Olympic Sports in Tokyo Bay Zone:** Volleyball, Gymnastics, BMX, Skateboarding, Tennis, Marathon Swim, Triathlon, Volleyball, Basketball, Sport Climbing, Hockey, Equestrian, Canoe (Sprint), Rowing, Canoe (Slalom), Archery, Aquatics (Swimming, Diving, Artistic Swimming, Water Polo), Taekwondo, Wrestling and Fencing.

* **Olympic Sports in Heritage Zone:** Athletics, Table Tennis, Handball, Judo, Karate, Weightlifting, Boxing, Equestrian, Badminton, Fencing, Football, Rugby, Pentathlon, Cycling (Road).

Environmental Data: Paralympics

Table 2: Historical environmental data during the Paralympic period for 2016 to 2020.

Historic Environmental Data	Lead-in Period 10 Aug – 23 Aug					Paralympic Games Period 24 Aug – 5 Sep				
	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
Tokyo Central										
Max daytime temperature (°C)	34	33	34	35	37	33	35	35	34	35
Average daytime temperature (°C)	27	25	27	28	30	27	25	27	26	28
Min daytime temperature (°C)	23	21	19	23	24	21	17	21	21	22
Relative Humidity at hottest part of day (%)	59	56	65	55	53	59	52	58	60	56
Max daytime 'Feels like' temperature (°C)	43	38	43	43	49	38	44	45	43	45
% Days 'Feels like' >30°C	100	69	69	100	100	93	47	80	87	87
% Days 'Feels like' >35°C	46	38	69	85	92	33	33	53	40	80
% Days 'Feels like' >40°C	8	0	38	38	77	0	20	27	7	33
Total Rainfall in Period (mm)	309	113	11	70	60	64	52	67	42	47
Days raining (%)	62	62	15	62	23	33	47	67	33	33
Sapporo (e.g., Marathon)										
Max daytime temperature (°C)	29	29	29	31	33	31	29	27	28	33
Average daytime temperature (°C)	24	21	21	22	23	23	20	21	21	23
Min daytime temperature (°C)	19	17	14	18	16	16	13	14	15	14
Relative Humidity at hottest part of day (%)	50	60	71	50	53	50	33	61	35	57
Max daytime 'Feels like' temperature (°C)	31	30	33	34	38	33	29	29	28	38
% Days 'Feels like' >30°C	8	8	8	8	46	27	0	0	0	47
% Days 'Feels like' >35°C	0	0	0	0	15	0	0	0	0	13
% Days 'Feels like' >40°C	0	0	0	0	0	0	0	0	0	0
Total Rainfall in Period (mm)	236	63	162	63	37	30	12	88	37	71
Days raining (%)	54	23	77	38	38	27	20	53	40	20
Izu (e.g., Cycling)										
	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020

Max daytime temperature (°C)	33	31	34	33	35	31	34	33	33	33
Average daytime temperature (°C)	26	25	27	28	29	26	25	27	26	27
Min daytime temperature (°C)	22	21	21	24	25	21	18	21	21	22
Relative Humidity at hottest part of day (%)	57	66	58	63	61	71	59	65	53	58
Max daytime 'Feels like' temperature (°C)	40	37	41	43	44	38	42	42	38	41
% Days 'Feels like' >30°C	85	46	77	100	92	80	47	80	67	93
% Days 'Feels like' >35°C	23	23	54	69	85	27	33	40	20	67
% Days 'Feels like' >40°C	0	0	15	8	46	0	7	7	0	13
Total Rainfall in Period (mm)	185	63	33	74	0	53	23	181	61	126
Days raining (%)	54	46	38	46	0	33	27	47	27	47
Tsujido (e.g., Yachting)	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
Max daytime temperature (°C)	34	31	33	34	36	33	33	33	31	34
Average daytime temperature (°C)	27	26	27	29	29	27	25	27	27	29
Total Rainfall in Period (mm)	160	68	8	59	9	29	21	80	49	48
Days raining (%)	38	54	31	31	15	40	33	33	20	40
Tokorozawa (e.g., Golf)	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
Max daytime temperature (°C)	35	33	34	36	38	32	34	37	32	35
Average daytime temperature (°C)	26	24	26	27	29	25	24	26	25	27
Total Rainfall in Period (mm)	329	135	22	137	5	131	72	167	41	78
Days raining (%)	54	85	31	62	23	47	27	60	60	47
Nerima (e.g., Shooting)	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
Max daytime temperature (°C)	35	33	35	36	39	34	36	37	34	36
Average daytime temperature (°C)	27	25	27	29	30	26	25	27	26	28
Total Rainfall in Period (mm)	295	191	38	60	48	89	24	165	37	77
Days raining (%)	62	62	31	62	15	40	40	60	27	47
Mobara (e.g., Surfing)	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
Max daytime temperature (°C)	34	36	35	36	37	33	37	37	35	37
Average daytime temperature (°C)	27	26	27	28	29	27	25	28	27	28
Total Rainfall in Period (mm)	238	43	26	28	7	85	61	27	49	35

Days raining (%)	54	62	38	54	8	40	47	33	33	47
Fuchū (e.g., Heritage Zone)	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
Max daytime temperature (°C)	34	34	34	35	38	33	35	36	33	35
Average daytime temperature (°C)	27	25	27	28	30	26	25	27	26	28
Total Rainfall in Period (mm)	289	77	48	106	11	97	41	106	116	101
Days raining (%)	54	46	38	54	15	47	47	60	40	60
Edogawa (e.g., Tokyo Bay Zone)	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
Max daytime temperature (°C)	32	32	33	-	35	32	34	35	-	34
Average daytime temperature (°C)	27	26	27	-	29	27	25	27	-	28
Total Rainfall in Period (mm)	152	46	4	-	14	23	43	30	37	28
Days raining (%)	38	62	8	46	15	27	40	40	27	33

Note: Only Tokyo, Sapporo and Izu have humidity data therefore they were the only locations where we can calculate 'Feels like' temperature.

*** Paralympic Sports in Tokyo Bay Zone:** Wheelchair Basketball, Boccia, Wheelchair Tennis, Triathlon, Football 5-a-side, Canoe, Rowing, Archery, Swimming, Sitting Volleyball, Goalball, Taekwondo and Wheelchair Fencing.

*** Paralympic Sports in Heritage Zone:** Athletics, Table Tennis, Badminton, Wheelchair Rugby, Judo, Powerlifting, Equestrian, Wheelchair Basketball.

Pollution

Air Quality

- A global air pollution standard measurement is the particulate matter in the air that are $< 2.5 \mu\text{m}$ ($\text{PM}_{2.5}$). The annual mean $\text{PM}_{2.5}$ level for Tokyo is $14 \mu\text{g}/\text{m}^3$. This is double the amount experienced in Auckland ($7 \mu\text{g}/\text{m}^3$) but is below the World Health Organisation exposure limit of $25 \mu\text{g}/\text{m}^3$ over a 24h period. Overall, the $\text{PM}_{2.5}$ expected for Tokyo Olympics is much better than recent games: Beijing (2008): $56 \mu\text{g}/\text{m}^3$ and Rio de Janeiro (2016): $36 \mu\text{g}/\text{m}^3$.
- SO_2 , NO_2 and CO measures are generally low and below NZ thresholds.

Considerations

- Athletes who already suffer from respiratory tract conditions or disease (e.g., exercise induced asthma) could be at a greater risk of experiencing these symptoms (e.g., chest tightness, wheezing, coughing) when training or competing in Tokyo conditions. Identify the athletes at potential risk pre-games and refer to medical lead for any additional support.

Water Quality

Drinking Water and Ice

- Suitable for human consumption and unlikely to present any major risk. However, we would still recommend bottled water for athletes.

Water Quality at Outdoor Venues

- Generally poor and considered unsuitable for swimming due to the elevated concentrations of faecal indicator bacteria present. However, the metropolitan government have proposed several strategies (e.g., underwater screens to filter water and prevent flow of bacteria) to be implemented in time for the 2020 Games.
- Day-to-day water quality varies significantly depending on weather conditions (particularly rainfall). The swim of the 2019 Para-triathlon test event was cancelled as *Escherichia coli* (*E. coli*) levels were more than two times over the international triathlon unit limits (water was at level 4 – the highest risk level). According to Tokyo Government officials, increased rainfall from a typhoon caused the increased *E. coli* levels as when the rainfall exceeded the capacity of sewage facilities, sewage diluted with rainwater may be released into the bay.

Considerations

- Water quality at outdoor venues is poor due to the high level of faecal bacteria, which worsens following rainfall. Athletes competing in outdoor water events may be at an increased risk of illness.

Tokyo Heat Management Strategy: COVID-19 Considerations

Due to the COVID-19 pandemic, the type of preparation that sports can expect to complete before the Games is currently unknown. Therefore, NSOs are advised to plan and prepare for multiple scenarios. From a heat perspective, some likely possibilities are described below along with some resources that may assist NSOs in their scenario planning.

1) *Normal Preparation*

- No restrictions on travel or competition and heat strategy plans can roll out as originally planned.

2) *Overseas Heat Acclimatisation Limited*

- Many sports had original plans to prepare for the heat by training or competing at hot/humid locations overseas.
- This is possible if the threat of COVID-19 is minimal and sports are free to travel internationally.
- [Appendix A](#) provides some locations and their expected environmental conditions that *may* be suitable locations for heat acclimatization and potentially lower COVID-19 risk when data was collected in July 2020.
- To check for COVID-19 restrictions in different countries contact Ben Day (Ben.Day@hpsnz.org.nz) who can provide access to the HPSNZ COVID-19 travel restrictions app.

3) *Domestic Heat Acclimation*

- Travel restrictions are still in place (overseas and/or in New Zealand) requiring NSOs to complete their heat preparation in New Zealand.
- There are numerous facilities that could be used for heat acclimation around the country, most of which will still operate at COVID-19 Alert Level 1 and 2, however not all chamber facilities are open during level 2 (See [Appendix B](#) for more information)
- We have heat chamber (or similar) facilities located around the country with more information on each venue located in [Appendix B](#).

4) *Home-based Heat Acclimation*

- NSOs are in New Zealand and the COVID-19 alert system is at Level 3 or 4.
- Heat preparation will have to be completed at home facilities which will require support from HPSNZ support staff to plan and develop safe and effective protocol. See [Appendix C](#) for some brief instructions on creating your own D.I.Y. Chamber.

If you have any questions regarding environmental conditions, booking requirements or require advice and support to plan for different scenarios contact your HPSNZ physiologist/heat lead or email Lorenz (Lorenz.Kissling@hpsnz.org.nz).

Appendix A: Heat Acclimatisation Locations with Low* COVID-19 Risk

The below data highlights the apparent or 'Feels like' temperature across a range of locations that *may* have a lower risk of COVID-19 (*Low at the time of data collection but this is likely to change with time) and could provide adequate heat stress for acclimatization. The environmental data covers 5 years across May to August from 2016 to 2020. In summary, Darwin and Singapore look to match the heat and humidity of Tokyo the best and likely provide the better heat acclimatization environment. In addition, May is the hotter month regardless of location.

Darwin, Australia

May			
Feels Like Temperature	Average	Range	Percent of Tokyo
Morning (9 am – 12 pm)	31.7°C	29.9 – 34.4°C	92%
Afternoon (1 pm – 3 pm)	33.6°C	32.2 – 35.3°C	94%
Evening (4 pm – 7 pm)	31.1°C	29.6 – 33.2°C	89%
June			
Feels Like Temperature	Average	Range	Percent of Tokyo
Morning (9 am – 12 pm)	29.4°C	28.2 – 31.8°C	85%
Afternoon (1 pm – 3 pm)	31.8°C	30.7 – 34.0°C	89%
Evening (4 pm – 7 pm)	29.0°C	27.6 – 31.5°C	83%
July			
Feels Like Temperature	Average	Range	Percent of Tokyo
Morning (9 am – 12 pm)	28.8°C	27.9 – 30.4°C	84%
Afternoon (1 pm – 3 pm)	31.1°C	30.1 – 32.7°C	87%
Evening (4 pm – 7 pm)	27.8°C	27.0 – 29.1°C	79%
August			
Feels Like Temperature	Average	Range	Percent of Tokyo
Morning (9 am – 12 pm)	30.2°C	23.9 – 34.9°C	88%
Afternoon (1 pm – 3 pm)	31.9°C	29.0 – 35.4°C	89%
Evening (4 pm – 7 pm)	28.6°C	23.1 – 33.3°C	81%

Singapore

May			
Feels Like Temperature	Average	Range	Percent of Tokyo
Morning (9 am – 12 pm)	37.1°C	35.1 – 38.8°C	108%
Afternoon (1 pm – 3 pm)	38.6°C	36.5 – 40.7°C	108%

Evening (4 pm – 7 pm)	36.3°C	34.5 – 37.3°C	103%
June			
Feels Like Temperature	Average	Range	Percent of Tokyo
Morning (9 am – 12 pm)	35.7°C	33.5 – 37.4°C	104%
Afternoon (1 pm – 3 pm)	37.0°C	34.9- 39.5°C	103%
Evening (4 pm – 7 pm)	35.3°C	34.1 – 36.2°C	101%
July			
Feels Like Temperature	Average	Range	Percent of Tokyo
Morning (9 am – 12 pm)	34.8°C	33.9 – 36.3°C	101%
Afternoon (1 pm – 3 pm)	36.1°C	35.2 – 37.2°C	101%
Evening (4 pm – 7 pm)	35.0°C	34.7 – 35.3°C	100%
August			
Feels Like Temperature	Average	Range	Percent of Tokyo
Morning (9 am – 12 pm)	35.1°C	27.8 – 39.4°C	102%
Afternoon (1 pm – 3 pm)	36.7°C	30.0 – 39.7°C	103%
Evening (4 pm – 7 pm)	34.6°C	27.5 – 38.6°C	99%

Suva, Fiji

Only May is presented as June and July are more than likely not hot enough to provide an adequate acclimatisation.

May			
Feels Like Temperature	Average	Range	Percent of Tokyo
Morning (9 am – 12 pm)	27.6°C	26.0 – 28.9°C	80%
Afternoon (1 pm – 3 pm)	29.6°C	28.8 – 30.8°C	83%
Evening (4 pm – 7 pm)	27.8°C	26.9 – 29.1°C	79%

Port Villa, Vanuatu

Only May is presented as June and July are more than likely not hot enough to provide an adequate acclimatisation.

May			
Feels Like Temperature	Average	Range	Percent of Tokyo
Morning (9 am – 12 pm)	29.6°C	27.9 – 30.7°C	86%
Afternoon (1 pm – 3 pm)	29.7°C	28.3 – 30.6°C	83%
Evening (4 pm – 7 pm)	26.4°C	24.7 – 27.5°C	75%

Appendix B: Heat Chamber and Hot Yoga Facilities

Prior to booking any of the below facilities please contact your heat lead or one of the HPSNZ heat team members ([see here](#)). All chambers will be closed if in COVID-19 alert level 3 or 4, in level 2 most will require special permission to use but all are open at level 1.

Heat chamber facility	Hourly cost	Booking details	Temp & Humidity	Number of people	Number of Supervisors
Otago University, Dunedin	\$80	Contact: nigel.barrett@otago.ac.nz	10-55°C 10-90% RH	7	2 (1 must have a first aid certificate)
Otago University, Wellington	\$85-100	Contact: rachael.mason@otago.ac.nz	-10-50°C 10-95% RH	8	2 (1 must have a first aid certificate)
Waikato University, Mount Maunganui	\$100	Contact: steven.finlayson@waikato.ac.nz	10-40°C 20-99% RH	8	At least 1
Wintec, Hamilton	\$50 + GST	Contact: nik.whitfield@wintec.ac.nz	4-39°C 40-100% RH	2-4	2
AUT, Auckland	\$100	Contact: allan.carman@aut.ac.nz	4 to 50°C 10-90% RH	3-4	2

Hot yoga studio	Booking details	Temp & Humidity	Price per session	Private class with studio teacher	Hire studio, without studio teacher
Sweat, New Market, Auckland	Contact: info@sweatyoga.co.nz	30-40°C Variable humidity	\$12 (\$30 usually for the public)	\$200 (≥20 people, but negotiable)	\$100
Breathe, Albany, Auckland.	Contact: anita@breatheyoga.nz	38-40°C, ~30% RH Max of 55 people per class.	From \$30 for single class but can purchase concession cards.	-	-

Appendix C: D.I.Y. Heat Chamber Instructions

Target environmental range:

Temperature: 30-35°C

Relative Humidity: 60-80%

Equipment:

- Bathroom or small room
- Heater (Wattage is room dependent, use the second calculator on this [page](#))
- Humidifier (if not in bathroom, otherwise intermittent use of the shower will increase humidity)
- Bike + trainer
- Temperature and humidity gauge
- Kettle(s)

Health and Safety First:

- Consult your physiologist/heat lead or one of the HPSNZ heat team prior to planning or embarking on a DIY heat chamber approach.
- Be careful with the operation of electrical appliances in wet and humid areas such as bathrooms.
- Make sure someone else is in the house and is regularly checking on you.
- Do not perform these sessions if you are ill or think you are becoming ill.
- Sanitize/disinfect and air the room and equipment after use to avoid spreading germs.

Tips and tricks:

- Set up the room and have the heater running at least 30-45 min (room size dependent) before the session.
- Perform a trial run to make sure you can create the required environment.
- If you cannot achieve the humidity required, then try to increase the room temperature further (e.g., >35°C) or wear additional layers of clothing.
- Use a towel to block heat loss under the door, or through windows.
- If using a bathroom then turn the shower on intermittently (with hot water) to increase the humidity (i.e., steam) in the room.
- Perform a normal heat acclimation session and protocol as directed by your physiologist/heat lead.
- A humidifier or a kettle (or multiple) could be useful to add some humidity to the room particularly if not using a bathroom.