



The heat is on: Bracing for impacts in Tokyo

The Tokyo Olympic and Paralympic Games are just over 6 months away. A mere glance at the statistical climatology of Tokyo from late July to early September gives certainty of high temperatures, but more importantly, high levels of moisture in the air, curbing evaporative cooling for athletes and spectators alike. Lessons learned from the extreme heat at the Athens, Atlanta, and Los Angeles Games may help in the preparedness efforts of the organizers and the International Olympic Committee, acclimatization protocols for athletes, and also support the shifting of start times or locations of events (e.g. moving marathon and racewalk events to Sapporo); even so, human health risks due to the expected heat in Tokyo remain high.

Eighty years of data from the Japan Meteorological Agency give high confidence that maximum daily air temperatures in Tokyo will reach an *average* of 31°C in August, coinciding with relative humidity levels just above 60% and high radiative loads [1]. Warm water temperatures (averaging 25.7°C in August), while also a concern for water sports, help maintain the city's high humidity and overnight temperatures, with average minimum air temperatures of ~24°C (in conjunction with a relative humidity just over 80%) providing little relief from the oppressive August conditions [1]. Concerns from climatologists, physiologists, public health officials, athletic trainers, sports scientists, athletes, and organizers have put Tokyo in the spotlight, with new research examples emphasizing Tokyo's oppressive conditions in their acclimation protocols [2], heat illness prevention strategies [3], urban micrometeorology assessments [4], and Tokyo-specific climatology focused on heat stress indices [5].

To build upon this literature, and in anticipation of Tokyo 2020, *Temperature* solicited original review and research articles from the international scientific community to highlight research surrounding high ambient levels of radiation, air

temperature, and moisture in the city, and specific risks to athletes at the submolecular to the biospheric levels. The first special issue in anticipation of the 2020 Tokyo Games highlights important safety considerations related to classical and exertional heat exposures across diverse populations, including Paralympic athletes and their unique challenges faced in the heat [6].

Recent events have acted as litmus tests in preparation for Tokyo's heat (e.g. 2019 World Track and Field Championships in Doha; 2019 Summer test triathlon in Tokyo; 2019 World Junior Rowing Championships in Tokyo), and indeed have presented challenges to some of the fittest athletes in the world. While preparations, predictions, and practices continue with an eye toward coping with extreme heat, questions arise: How hot could it actually be in downtown Tokyo? Could outdoor sporting records still be broken? Are the city and the International Olympic Committee prepared to deal with increased heat illness in spectators, and potentially heat mortality? How are athletes mentally and physically preparing? Is this the *new normal*?

With Paris 2024 and Los Angeles 2028 also likely to bring hot conditions, these conditions indeed could be the new normal for elite athletes at the Olympics without additional considerations of extreme heat. Yet insights in this new special issue, as well as future work, can also inform proactive decision-making using multi-scalar climate data for Tokyo as well as further international competitions, including the Fédération Internationale de Football Association World Cup events in Qatar (2022) and the USA/Mexico/Canada (2026). Although Tokyo may be presented with challenges in coping with extreme heat during the Games, they also have an opportunity to adequately prepare for extreme heat and further leave a legacy to enhance Tokyo's heat mitigation strategies, public health, and urban sustainability long after the Olympics culminate.

References

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