

WEATHER CONDITIONS DURING ATHENS OLYMPIC ROWING AND FLATWATER CANOE-KAYAK REGATTA AT THE OLYMPIC ROWING CENTER IN SCHINIAS

Vassilios Diafas¹, Socratis Kaloupsis¹, Vihren Bachev²,
Eleni Dimakopoulou¹ and Vassiliki Diamanti³

¹National & Kapodistrian University of Athens, Department of PE and Sports Science,
Water Sports Faculty, Athens, Greece

²Vassil Levski National Sports Academy, Sofia, Bulgaria

³PhD student at Vassil Levski National Sports Academy, Sofia, Bulgaria

Preliminary communication
UDC 551.5:796.012:797.122(495)

Abstract:

In water sports like rowing and canoe-kayak weather conditions are important factors to the competition and can probably reduce the performance of athletes. Thus, the aim of this study was to analyze the weather conditions during August and September in the past 10-13 years in the Schinias area where the Olympic Rowing and Canoe-Kayak Regattas were held. A secondary aim was to relate the data with the environmental conditions from previous Olympic Games. Wind speed (m/s), relative humidity (%) and temperature (°C) daily from 8⁰⁰ to 21⁰⁰ were recorded and collected from the National Meteorological Bureau. The results revealed that the wind speed was under 5m/s during races and training hours, temperature and humidity were 29°C and under 60%, respectively. However, there were some exceptions in the weather but during the Olympic Games 2004, the weather conditions were normal and the athletes participated in the competition without problems.

Key words: *wind, air temperature, relative humidity, performance*

WETTERBEDINGUNGEN BEIM OLYMPISCHEN RUDERN UND KANU-KAJAK REGATTA IN ATHEN IM OLYMPISCHEN RUDERN-ZENTRUM IN SCHINIAS

Zusammenfassung:

Beim Wassersport wie Rudern und Kanu-Kajak sind die Wetterbedingungen sehr wichtig für den Wettbewerb und können die Leistungen von Sportlern vermindern. Das Ziel dieser Forschung war, die Wetterbedingungen im August und September in den letzten 10 – 13 Jahren im Bereich von Schinias zu analysieren, wo die olympische Rudern- und Kanu-Kajak-Regatta stattfand. Das zweite Ziel war, die Daten mit den Umgebungsbedingungen bei den vorherigen Olympischen Spielen zu korrelieren. Die Windgeschwindigkeit (m/s), relative Luftfeuchtigkeit (%) und die Temperatur (°C) wurden täglich ab 8 Uhr morgens bis 21 Uhr abends im National Meteorological Bureau niedergeschrieben und gesammelt. Die Ergebnisse zeigten, dass während der Wettbewerbe und Trainingszeit die Windgeschwindigkeit weniger als 5 m/s, die Temperatur 29°C und der Luftfeuchtigkeit weniger als 60% waren. Es gab einige Ausnahmen im Bezug auf das Wetter, aber während der Olympischen Spielen im Jahre 2004 waren die Wetterbedingungen normal und die Sportler hatten keine Probleme während der Wettbewerbe.

Schlüsselwörter: *Wind, Lufttemperatur, relative Luftfeuchtigkeit, Leistung*

Introduction

The relationships between the environment and sports are well recorded (Peiser & Reilly, 2004). The physical environment influences the perform-

ance of athletes in many ways. Daily or hourly fluctuations in temperature and humidity, wind speed or changes in wind direction are unpredictable factors and can easily wreck any well planned preparations. Moreover, in many important competitions

millions of visitors watch the world's finest athletes compete for a medal and adapt or overcome difficult weather conditions. It is well known from literature that a high air temperature, wind speed and its direction, the waves produced and relative humidity may affect an athletic performance. Several authors have suggested that the environmental conditions could threaten the performance of sport efficiency (Tziortzis, Gelada, & Paradisis, 1992; Gallow & Maughan 1997). Many publications have shown that the increase of environmental temperature has a negative influence on stroke volume, on cardiovascular function, and also results in hyponatremia (Marino, Kay, Connan, Serwach, & Hilder, 2002; Gonzalez-Alonso, Rodriguez, Bellow, & Coyle, 1997; Armstrong et al., 1993). However, in outdoor sports like rowing and canoe-kayak weather conditions are important factors to the competition as waves or winds, and the heat, could effect the performance or even postpone the competition. According to FISA, rule 69 (1.3 wind) reports that the starter should consider the wind's ability to disrupt the rowing functionality "... the starter may cancel the start." Also rule 72 reports that "... the umpire will monitor the wind conditions, rain and temperature levels." Hydrodynamics is also closely related to weather conditions and even the water temperature, deep or shallow water, the upstream or downstream currents cause different movements or technique. The water condition is connected to the performance. The hulls of modern rowing and canoes-kayaks are light and strong and the boat racks are close to the water surface, so it is not surprising that water has a dramatic effect on racing time where the wind is strong. Also, water density and water viscosity indexes are closely related to water temperature (Han & Zheng, 1998). Thus, the aim of this study was: a) to compare the weather condition during the Olympic Games in Athens and during the World Juniors Championship 2003 with the average weather conditions according to the period 1990-2000, b) to compare the weather conditions during the Olympic Games in Athens with those in Atlanta and Sydney during the previous Games and c) to compare the weather conditions in August and September to see which period is more suitable for competitions.

Methods

Average and maximum wind speed (m/s), prevailing wind direction, maximum and minimum and average temperature (°C), average relative humidity (%) data, in August and September over the past 11 years (1990-2000), were collected from the Greek National Meteorological Bureau and this data concerns the Marathon area and especially the Olympic Rowing and Flat-water Canoe-Kayak Center. These meteorological parameters are mean hourly data (8⁰⁰-21⁰⁰) recorded daily. Also, the average

temperature, relative humidity and average wind speed (m/s) in September and August of 2003 and 2004 were collected from the same Meteorological Bureau. The methodology for the determination of each previous parameter is according to the technology used by the Greek National Meteorological Bureau and the Ministry of Environment. In this study the most important day period to be examined is between 8⁰⁰ and 14⁰⁰, when usually the competition program takes place, and the training hours in the afternoon between 18⁰⁰ and 20⁰⁰.

Results

The average wind speed (m/s) recorded in August and September over the past 11 years and the years 2003, 2004 is presented in Figures 1 and 2, respectively. Maximum wind speed (m/s) during the last decade did not exceed 12.5-15 m/s, however, during August 2003 a value of 19.1m/s was reported but this wind speed was an exception.

The average temperature (°C) recorded for the same periods is showed in Figures 3 and 4. The highest temperature recorded was 39.6 (3rd period of August 1990-2000 at 15⁰⁰) and the lowest was 11.6 (3rd period of September 1990-2000 at 8⁰⁰).

The average relative humidity (%) is shown in Figures 5 and 6. Our data revealed that maximum relative humidity approached the value of 96% in the 2nd period of August of 1990-2000 at 8⁰⁰.

The collected data point out the prevailing northern and north-eastern wind direction. The days with rain are not frequent with some exceptions during the first and second ten-day period of September.

Discussion and conclusion

The analysis of the data showed that average wind speed (m/s) during the period 1990-2000 was higher in August than in September. Especially, in the second ten-day period of August the wind speed was from 2.9m/s (at 8⁰⁰) and was increasing constantly up to 6.5 m/s. During the afternoon (at 18⁰⁰-21⁰⁰) the wind speed decreased. The highest value of wind speed (19m/s) was reported in the first period of August 2003 during the World Juniors Championship (Test Event 6-9/8). Due to the strong northerly wind during the race, FISA and competition Manager changed the time of the races and the athletes raced over a distance of 1,000m (Rule 64, FISA's Rules of Racing). During August 2004 the wind speed was less than 5m/s during races and training hours. The low wind speed in combination with wind direction created the best weather conditions for the Olympic Regatta. The temperature ranged from 22.5 °C at 8⁰⁰ to 29.8 °C at 13⁰⁰. Relative humidity which could affect an athletic performance was relatively low (60%). During the 1996 Atlanta Olympic Games the air tem-

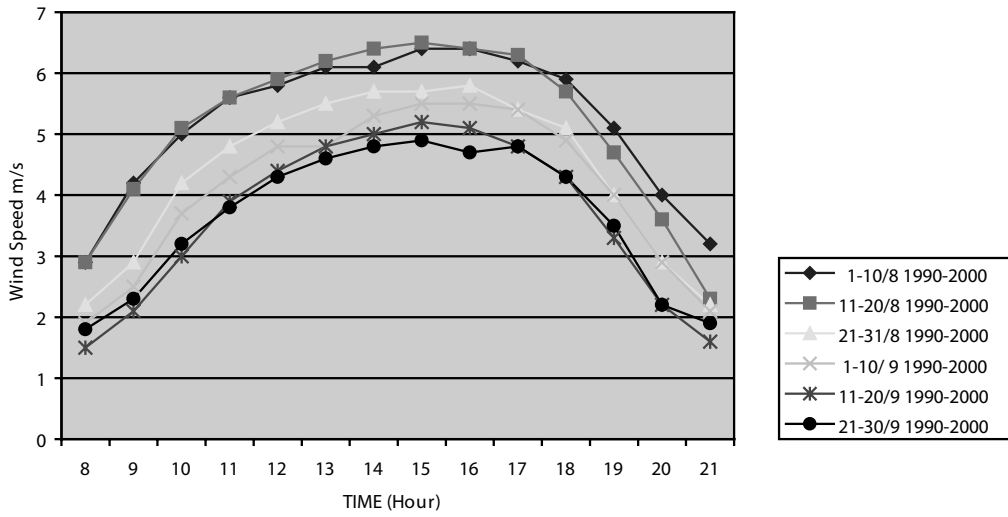


Figure 1. Average wind speed (m/s) during August & September 1990-2000.

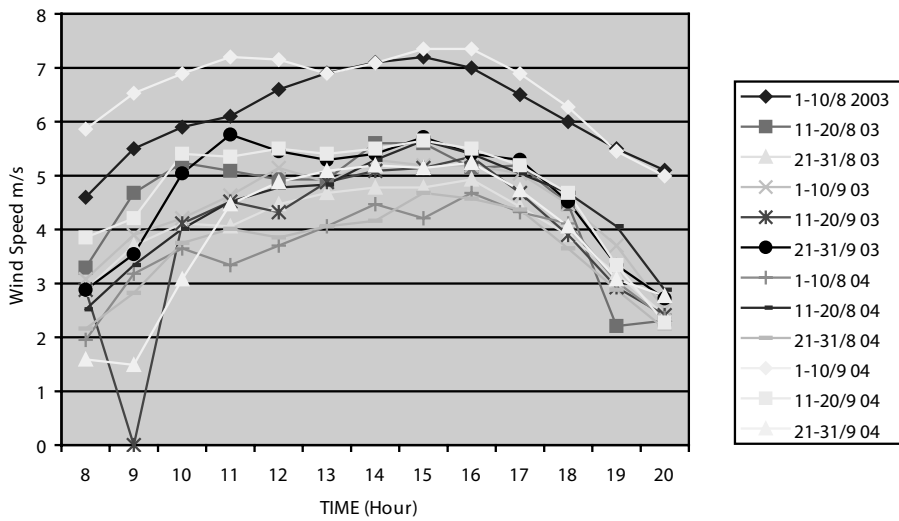


Figure 2. Average wind speed (m/s) during August & September 2003 and 2004.

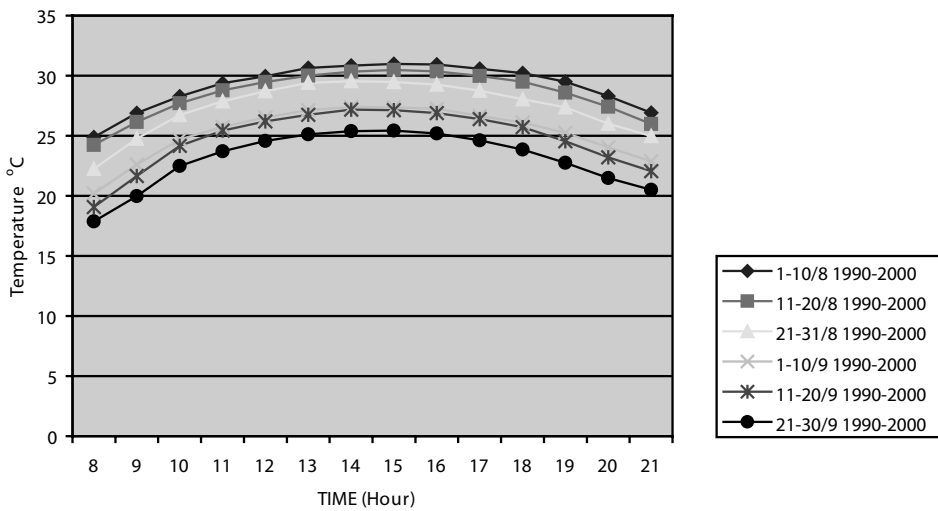


Figure 3. Average temperature during August & September 1990-2000.

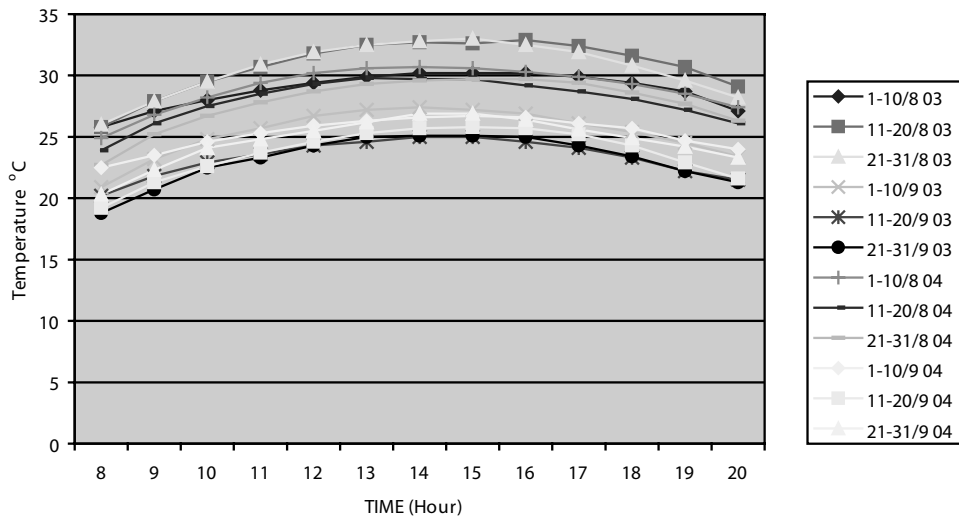
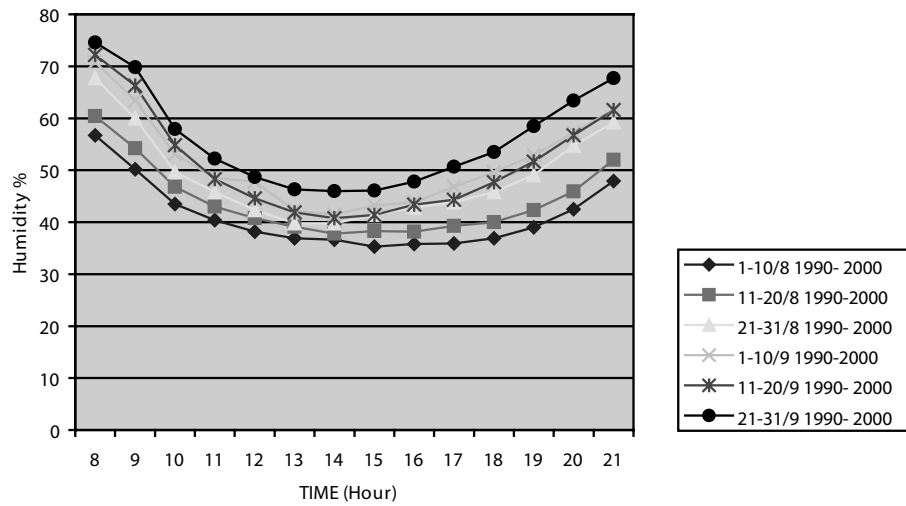


Figure 4. Average temperature during August & September 2003 and 2004.



5. Average humidity (%) during August & September 1990-2000.

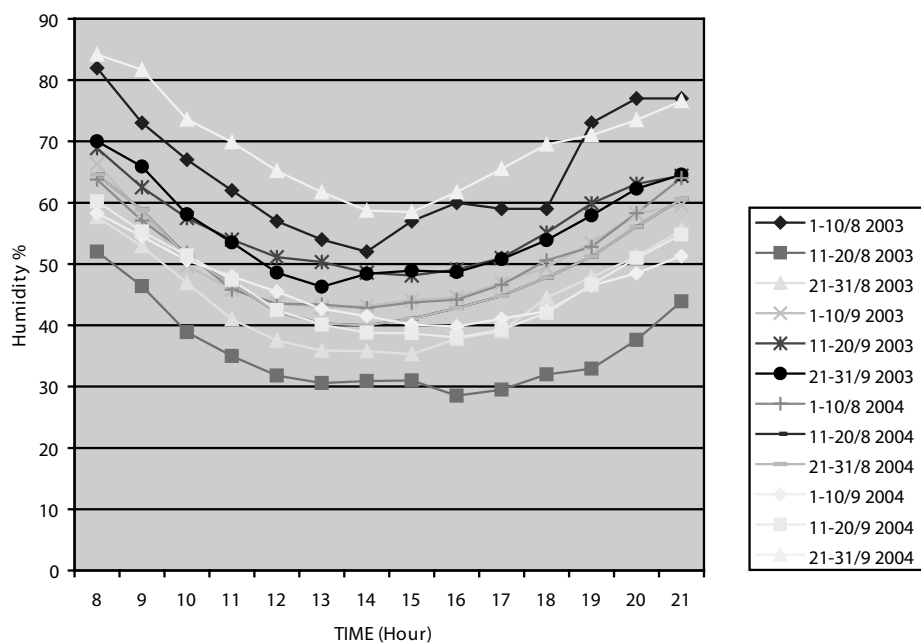


Figure 6. Average humidity (%) during August & September 2003 and 2004.

perature ranged from 30 °C to 38 °C and the relative humidity from 40% to 80% (Nielsen, 1996). In Sydney, the respective values ranged from 14.4 °C to 33.8 °C and from 18% to 90% (Nassis & Geladas, 2002). Galloway and Maughan (1997) examined the effect of high temperature on performance. The results of their study revealed a 37% lower performance time at 30°C compared with 21°C (55 vs. 81 min, respectively). Also, it is known that dehydration and hyperthermia affect the cardiovascular and thermoregulatory system function (Nassis & Geladas, 2002). It must be noted according to another study that the superimposition of dehydration on hyperthermia during exercise in the heat causes a greater reduction in stroke volume and cardiovascular function that make the athlete less able to cope with hyperthermia. Nielsen (1996) suggested that in certain extreme environmental conditions, sporting events and especially outdoors endurance type of competitions should be cancelled if the air temperature is above 35 °C combined with humidity over 60% to protect the athletes from injuries resulting from heat. Existing studies have recognized that prolonged exercise in a hot environment typically results in decreased physical performance and an increase in risk of heat stroke (Costill, Kammer, & Fisher, 1970; Hiller, 1989).

Although high temperatures and humidity have a negative effect on athletes' performances,

the negative effects can be reduced using a period of acclimatization. There is no doubt that regular exposure to hot humid conditions results in adaptations. Expansion of the plasma volume, reduced heart rate and body core temperature are some of the adaptations. Full adaptation may take 14 days or even more for some individuals (Terrados & Maughan, 1995).

In conclusion, the analysis of this study showed that the temperature and the humidity varied within the limits that athletes could withstand and the athletic performance could not be threatened by the environmental conditions. The wind speed also was low and the races could be conducted without any problems. This study revealed also that probably the best period for competitions is during the 2nd ten-day period of September when the wind speed and the temperature are low. Probably we should consider organizing the Juniors Championship during that period and not in August as usual or it would be interesting in the future to analyze the weather conditions in July and to see if competitions can be held during that month. Although Greece has been hit particularly often by severe heat waves during the last 30 years (Balafoutis & Makrogiannis, 2002) and even though in 2003 the wind was strong, during the Athens Olympic Games the weather conditions did not differ very much from the average conditions in the period 1990-2000.

References

- Armstrong, L.E., Curtis W.C., Hubbard, R., W., Francesconi R., P., Moore R., P., & Askew E.W. (1993). Symptomatic hyponatremia during prolonged exercise in heat. *Medicine and Science in Sports and Exercise*, 25(5), 543-549.
- Balafoutis, Ch.J., & Makrogiannis, T.J (2002). Analysis of a heat wave phenomenon over Greece and its implications for tourism and recreation. (Available at: http://www.mif.unifreiburg.de/ISB/ws/papers/09_balafoutis.pdf accessed 28 July, 2003).
- Costill, D.L., Kammer, W.E., & Fisher, A. (1970). Fluid ingestion during distance running. *Archives of Environmental Health*, 21, 520-525.
- Galloway, S.D.R., & Maughan, R.J. (1997). Effects of ambient temperature on the capacity to perform prolonged cycle exercise in man. *Medicine and Science in Sports and Exercise*, 29, 1240-1249.
- Gonzalez-Alonso, J., Rodriguez, R.M., Below, P.R., Coyle, E.F. (1997). Dehydration markedly impairs cardiovascular function in hyperthermic endurance athletes during exercise. *Journal of Applied Physiology*, 82 (4), 1229-1236.
- Han, Yi.M., & Zheng J., W.(1998). The influence of the water temperature on the boat speed: the equal-watt boat speed conversion. *Journal Wuhan Institute of Physical Education*, (Wuhan), 3, 83-85.
- Hiller, W.D.B (1989). Dehydration and hyponatremia during triathlons. *Medicine and Science in Sport and Exercise*, 21 (Suppl): S219-S221.
- Marino, F.E., Kay, D., Cannon, J., Serwach, N., & Hilder, M. (2002). A reproducible and variable intensity cycling performance protocol for warm conditions. *Journal of Science and Medicine in Sport*, 5(2), 95-107.
- Nassis, P.G., & Geladas, D.N. (2002). *Journal of the Human Environmental System*, 6(1), 39-45.
- Nielsen, B. (1996). Olympics in Atlanta: A fight against physics. *Medicine and Science in Sports and Exercise*, 28 (6), 665-668.
- Peiser, B., & Reilly, T. (2004). Environmental factors in the summer Olympics in historical perspective. *Journal of Sports Sciences*, 22, 981-1002.
- Terrados, N., & Maughan, J.R. (1995). Exercise in the heat: Strategies to minimize the adverse effects on performance. *Journal of Sports Sciences*, 13, S55-S62.
- Tziortzis, S., Geladas, N., & Paradisis, G. (1992). Polluted atmosphere and training in Olympic Athletics Center of Athens. *Sport Science - Theory and Practice*, 7, 155-167.

VREMENSKI UVJETI TIJEKOM ATENSKE OLIMPIJSKE VESLAČKE REGATE KANUA I KAJAKA NA MIRNIM VODAMA U OLIMPIJSKOM VESLAČKOM CENTRU U SCHINIASU

Sažetak

Uvod

Vremenski uvjeti mogu utjecati na uspješnost sportaša, osobito u sportovima koji se održavaju na otvorenom, kao što su veslanje i kanu-kajak - visoke temperature, visoka relativna vlažnost i velika brzina vjetra lako mogu odgoditi ili čak uništiti dobro planirano natjecanje. Interakcija između vremenskih uvjeta i sportske uspješnosti uočena je ne samo na olimpijskim natjecanjima, već i na natjecanjima nacionalnog ili internacionalnog ranga. Brojna su istraživanja pokazala da dugotrajno vježbanje u vrlo toplim i vlažnim uvjetima dovodi do dehidracije i hemokoncentracije, da opterećuje kardiovaskularni sustav i, konačno, narušava sportsku/fizičku uspješnost. Nadalje, brzina i smjer vjetra, koji su značajni faktori vremenskih uvjeta u veslanju, mogu bitno utjecati na hidrodinamiku i tehniku. Stoga je cilj ovog istraživanja bio analizirati vremenske uvjete u kolovozu i rujnu u proteklih 10 do 13 godina u regiji Schinias (Marathon, Grčka) gdje se održavala olimpijska veslačka regata u kanuu i kajaku na mirnim vodama. Cilj je bio i usporediti podatke o vremenskim uvjetima s onima s prošlih olimpijskih igara.

Metode rada

Podaci o prosječnoj minimalnoj i maksimalnoj brzini vjetra (m/s), prosječnoj temperaturi (°C) i re-

lativnoj vlažnosti (%) za područje Marathona, osobito za područje Veslačkog olimpijskog centra, prikupljani svakodnevno svakog sata (od 8⁰⁰-21⁰⁰) tijekom kolovoza i rujna tijekom proteklih jedanaest godina (1990-2000), preuzeti su iz statistike Grčkog državnog meteorološkog zavoda.

Rezultati

Dobiveni rezultati pokazuju da je brzina vjetra (m/s) u razdoblju od 1990. do 2000. godine bila viša u kolovozu nego u rujnu, a popimala je vrijednosti od 2,9 m/s u jutarnjim satima do 6,5 m/s te se smanjivala u vrijeme popodnevnih treninga (18⁰⁰-20⁰⁰). Brzina vjetra bila je prilično velika; dosegla je do 19 m/s za vrijeme Svjetskog juniorskog prvenstva 2003, što je bio izuzetak u odnosu na ostala mjerenja. Brzina vjetra za vrijeme Olimpijskih igara 2004. godine varirala je manje od 5m/s. Osim toga, temperaturne vrijednosti kretale su se između 22,5 i 29,8°C, a vlažnost zraka bila je uglavnom ispod 60%. Konačno, smjer vjetra bio je uglavnom sjever- sjeverozapad, a kišni dani bili su rijetkost.

Rasprava i zaključak

Vremenski uvjeti za vrijeme Olimpijskih igara 2004. u Grčkoj bili su takvi da nisu ugrozili izvedbu ni uspješnost sportaša. Na temelju usporedbe prikupljenih meteoroloških podataka za vrijeme Olimpijskih igara u Ateni s onima iz Atlante i Sydneyja, može se zaključiti da su vremenski uvjeti za vrijeme Olimpijskih igara u Ateni bili najbolji za natjecanje.

Submitted: June 15, 2005

Accepted: June 7, 2006

Correspondence to:
Prof. Vassilios Diafas, PhD
National & Kapodistrian University of Athens,
Department of Physical
Education and Sports Science, Water Sports Faculty
Ethn.Antistasis 41, Dafni, 172 37 Greece
Phone: + 30 210 727 61 27
Mobile: + 30 69 48 110540
E-mail: diafasv@ yahoo.com