

## Supplementary Information

### Air Quality in the Maracanã and Deodoro Zones During the Rio 2016 Olympic Games

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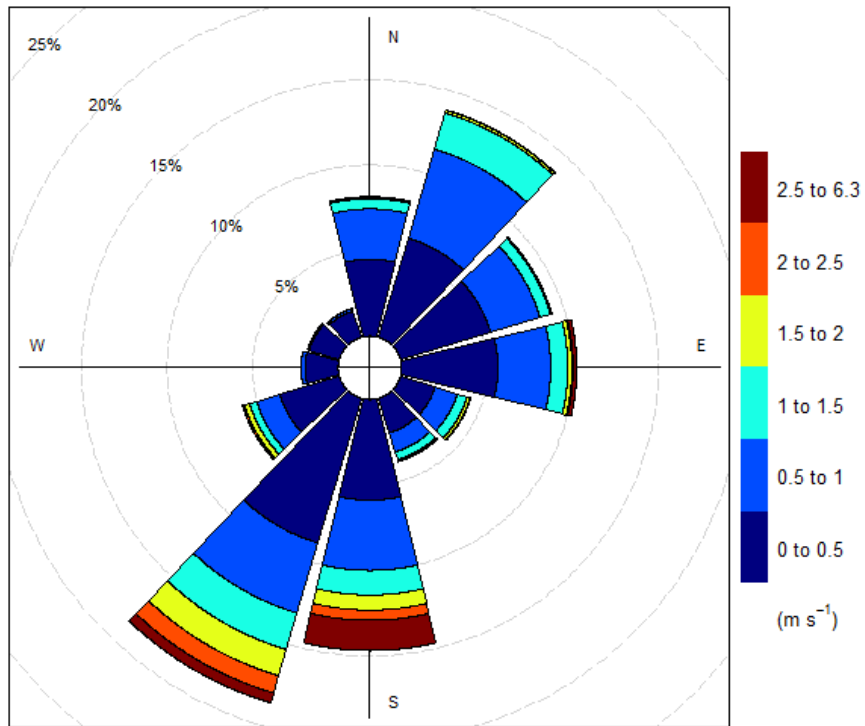
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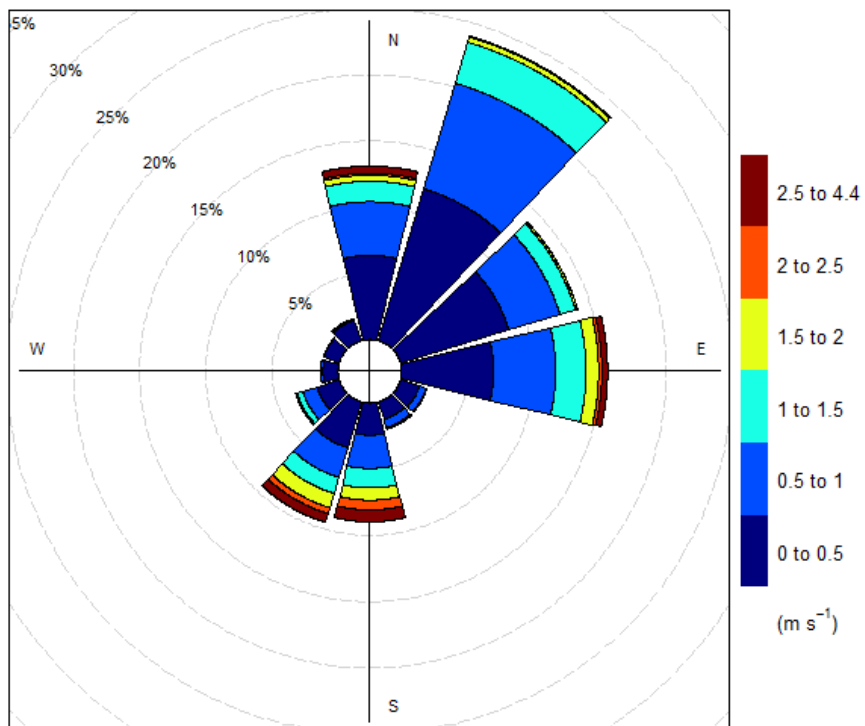


**Figure S1.** Map of the city with the sampling locations: Tijuca (Saens Peña Square), in the Maracanã Olympic zone, and Deodoro District, in Deodoro Olympic zone. The Maracanã and Deodoro Olympic zones are also shown. Source: Google Earth.

Wind Rose August 2016

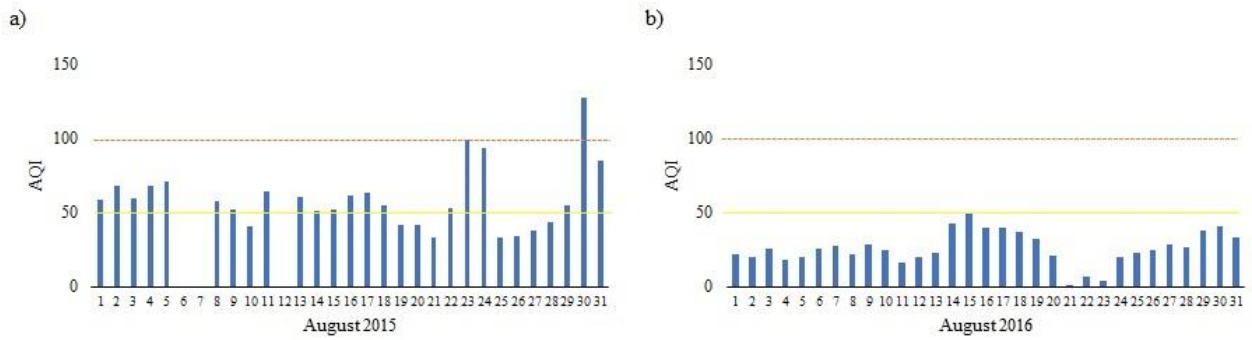


Wind Rose September 2016

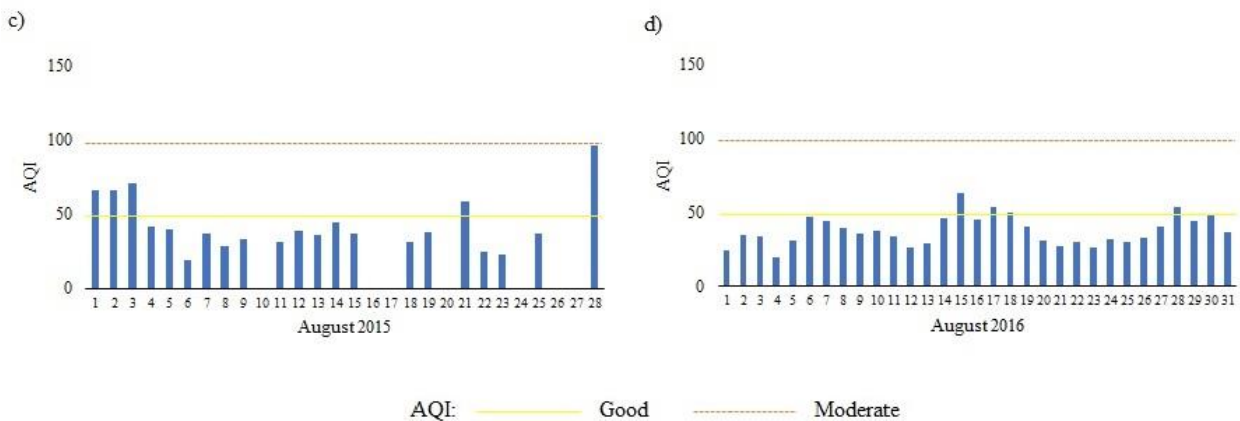


**Figure S2.** Wind roses calculated for August and September 2016, in Tijuca (Rio de Janeiro).

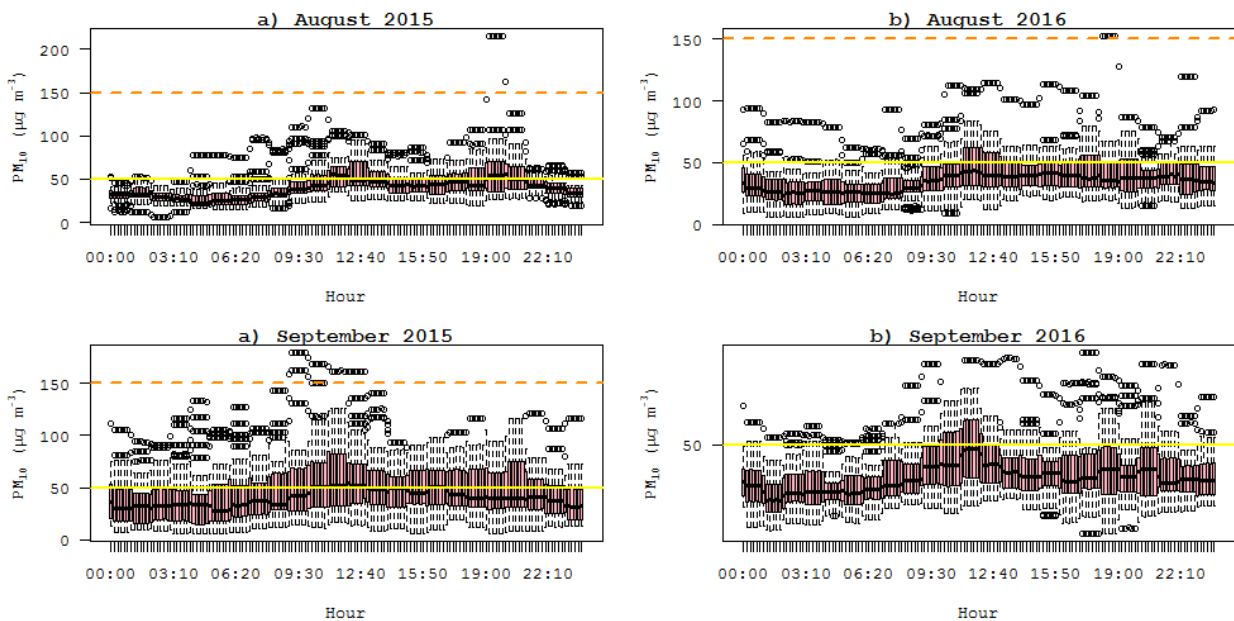
Campos dos Afonsos Monitoring Station



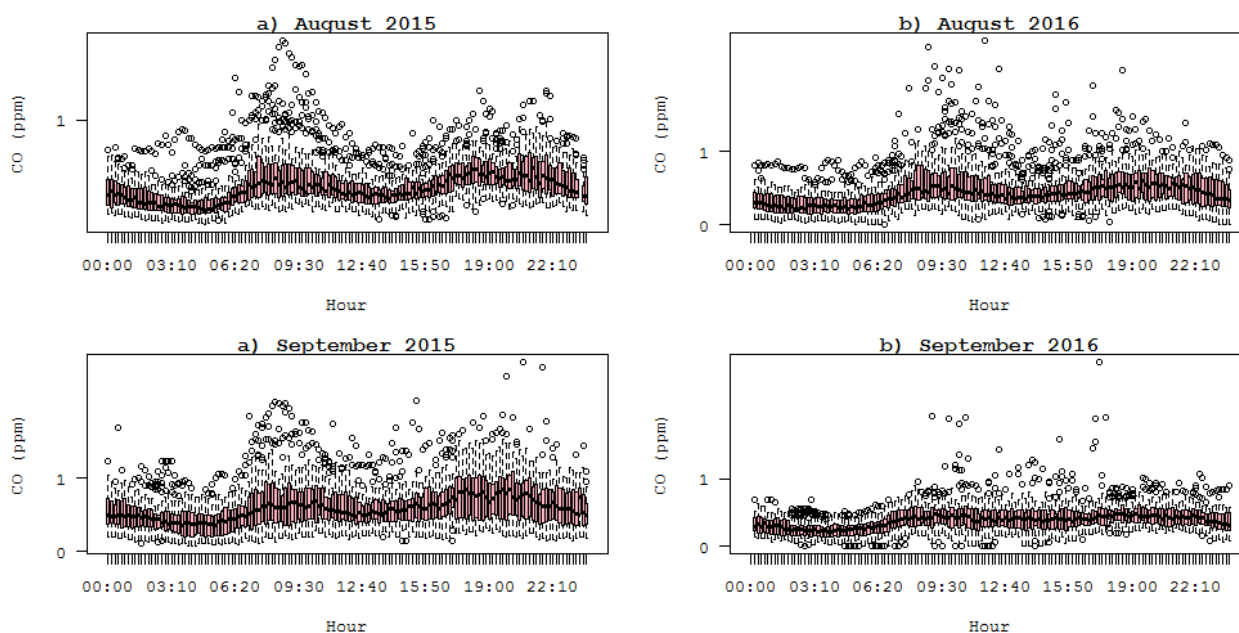
Maracanã Monitoring Station



**Figure S3.** Daily air quality indexes determined in the Olympic monitoring stations Campo dos Afonsos in: (a) August 2015; (b) August 2016; and Maracanã: (c) August 2015 and (d) August 2016.<sup>1</sup> The AQIs were calculated using only ozone as the criteria pollutant. Lines indicating good (0-50) and moderate (51-100) values (CETESB)<sup>2</sup> are included.



**Figure S4.** PM<sub>10</sub> concentrations determined at the Tijuca monitoring station in August and September of 2015 and 2016.



**Figure S5.** CO concentrations determined at the Tijuca monitoring station in August and September of 2015 and 2016.

**Table S1.** Comparison of current air quality limits in the Brazilian, EU, US and WHO guidelines<sup>3-7</sup>

Pollutant	Averaging time	Brazil (CONAMA) <sup>3</sup>	US (NAAQS) <sup>7</sup>	EU (AQS) <sup>6</sup>	WHO <sup>4</sup>
SO <sub>2</sub> / ppb	1 hour mean	–	75	134	–
	3 hour mean	–	500	–	–
	24 hour mean	53	140	48	8
	annual mean	15	30	–	–
NO <sub>2</sub> / ppb	1 hour mean	–	100	106	106
	24 hour mean	101	–	–	–
	annual mean	53	53	21	21
PM <sub>10</sub> / (µg m <sup>-3</sup> )	24 hour mean	150	150	50	50
	annual mean	50	–	40	20
PM <sub>2.5</sub> / (µg m <sup>-3</sup> )	24 hour mean	–	35	–	25
	annual mean	–	15	25	10
CO / ppm	8 hour mean	9	9	10	–
	1 hour mean	35	35	–	–
Ozone / ppb	8 hour mean	80	70	60	50
	1 hour mean	–	–	–	–

US NAAQS: United States National Air Quality Standards; EU AQS: European Union Air Quality Standards. Adapted from reference 8.

**Table S2.** PM<sub>2.5</sub> and PM<sub>10</sub> mean anual values previously reported in the literature (2012-2015)

Local	June 2012-June 2013	2013	2014	2015	Reference
PM <sub>2.5</sub> / (µg m <sup>-3</sup> )					
Urca, RJ		6	11	10	Ventura <i>et al.</i> <sup>9</sup>
Lagoa, RJ		10	20	14	Ventura <i>et al.</i> <sup>9</sup>
INEA, RJ		13	16	11	Ventura <i>et al.</i> <sup>9</sup>
Engenhão, RJ		<sup>a</sup>	17	12	Ventura <i>et al.</i> <sup>9</sup>
Maracanã, RJ		6	13	11	Ventura <i>et al.</i> <sup>9</sup>
Duque de Caxias, RJ	12				Godoy <i>et al.</i> <sup>10</sup>
Tijuca, RJ	10				Godoy <i>et al.</i> <sup>10</sup>
Taquara, RJ	10				Godoy <i>et al.</i> <sup>10</sup>
Barra da Tijuca, RJ	8				Godoy <i>et al.</i> <sup>10</sup>
PM <sub>10</sub> / (µg m <sup>-3</sup> )					
Campo dos Afonsos, RJ		21	36	36	Ventura <i>et al.</i> <sup>9</sup>
Gericinó, RJ		23	35	35	Ventura <i>et al.</i> <sup>9</sup>
Leblon, RJ		22	41	41	Ventura <i>et al.</i> <sup>9</sup>
Maracanã, RJ		43	58	58	Ventura <i>et al.</i> <sup>9</sup>
Duque de Caxias, RJ	54				Godoy <i>et al.</i> <sup>10</sup>
Tijuca, RJ	29				Godoy <i>et al.</i> <sup>10</sup>
Taquara, RJ	66				Godoy <i>et al.</i> <sup>10</sup>
Barra da Tijuca, RJ	25				Godoy <i>et al.</i> <sup>10</sup>

<sup>a</sup>Not reported. 24 hour means in Copacabana, Maracanã and Deodoro were in the range of 6-96 µg m<sup>-3</sup>.

**Table S3.** Air quality indexes (AQI) adopted in Brazil (CETESB, 2017)<sup>2</sup>

SO <sub>2</sub> <sup>a,b</sup> / (µg m <sup>-3</sup> )	CO <sup>a,c</sup> / ppm	PM <sub>10</sub> <sup>a,b</sup> / (µg m <sup>-3</sup> )	O <sub>3</sub> <sup>a,d</sup> / (µg m <sup>-3</sup> )	NO <sub>2</sub> <sup>a,d</sup> / (µg m <sup>-3</sup> )	AQI	Air pollution level	Health implications
0-80	0-4	0-50	0-80	0-100	0-50	good	air quality is considered satisfactory, and air pollution poses little or no risk for the population
81-365	4.1-9	51-150	81-160	101-320	51-100	moderate	air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution
366-800	9.1-15	151-250	161-200	321-1130	101-199	unhealthy	everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects
801-1600	15.1-30	251-420	201-800	1131-2260	200-299	very unhealthy	health warnings of emergency conditions. The entire population is more likely to be affected
1601-2100	30.1-40	421-500	801-1000	2261-3000	> 300	hazardous	health alert: everyone may experience more serious health effects. There is risk of premature deaths

<sup>a</sup>Calculations are performed for the last 24 hours; <sup>b</sup>24 hour maximum mean; <sup>c</sup>8 hour maximum mean; <sup>d</sup>1 hour maximum mean.

## References

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