



## Introduction

Golf returned to the Olympics in 2016 for the first time in 112 years. The PGA Tour, LPGA, and other golf organizations were heavily involved with the International Golf Federation (IGF) in the planning and organization of golf at the 2016 Olympics. The IGF implemented their own weather action plan at the Olympic Golf Course, independent of the other outdoor venues in Rio de Janeiro. While the Instituto Nacional de Meteorologica (INMET) was assigned to provide remote weather support for the outdoor Olympic Games in Rio de Janeiro, the IGF was the only sports federation to privately contract a meteorologist to work on-site at the Olympic Golf Course with the organizers of the event.

The IGF took extraordinary steps to mitigate the risks associated with lighting and inclement weather to their players, spectators, and staff at the 2016 Olympic Games in Rio de Janeiro. This poster will explain the weather action plan implemented by the IGF and also provide an overview of the lightning and severe weather management system that was put together by the Schneider Electric on-site meteorologist to assess the localized lightning threats and other impactful weather hazards.



Areal photograph of the Olympic Golf Course in Rio de Janeiro, Brazil.



Spectator grandstands at the Olympic Golf Course during the final round of the men's competition.

## Olympic Golf Course Weather Action Plan

### Pre-Tournament

- Weather action plan is created by the tournament. An on-site meteorologist is contracted.
- Evacuation vehicles are rented and strategically staged across the golf course.
- Weather message graphics are loaded into the electronic scoreboard database.
- Evacuation committee practices evacuation scenarios to ensure the staff is prepared.
- Course evacuation instructions are provided to all players, officials, and tournament staff.

Plan of action during a thunderstorm event Thunderstorm Arrival Thunderstorm Arrival Thunderstorm Arrival < 40 min < 1 hour

- Weather policy messages will run on the scoreboards.
- All committees are notified of approaching storms.
- Evacuation committee will dispatch drivers to wait at the evacuation vehicles.
- Approaching thunderstorn messages will run on the scoreboards for spectators.
- All tournament committees will prepare for a possible suspension of play and course evacuation.

## Tournament Week

- On-site meteorologist creates custom forecasts for the venue and distributes to tournament staff and organizers.
- On-site meteorologist provides daily staff briefings for tournament organizers, operations staff, and golf course maintenance regarding current and forecast weather conditions.
- On-site meteorologist will continuously monitor weather conditions at the venue and alert organizers to approaching hazardous conditions.

#### • Tournament Director will make the decision to suspend play and air horns will sound throughout the golf course Players & caddies

< 30 min

- are driven back to the clubhouse.
- Spectators, volunteers, and workers are advised to seek safe shelter.

# Weather Action Plan for the Olympic Golf Course at the 2016 Olympic Games in Rio de Janeiro

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Thunderstorms have ended

 On-site meteorologist will advise the Tournament Director when the threat o lightning has ended. • The golf course will reoper and play will resume.



# Tools used to monitor the lightning threat at the Olympic Games

# Campbell Scientific CS–110 Electric Field Meter





# WeatherSentry<sup>®</sup> Online – lightning layer map



- CS110 Electric Field Mete and Young Wind Monitor are assembled on-site.
- The CS110 Electric Field Meter measures the electric field at the venue and has a range of 15-20 miles.
- Data is transmitted wirelessly and displayed on a laptop using the LoggerNet software.
- WeatherSentry Online is a subscription weather package from Schneider Electric that includes high resolution layered mapping.
- Real-time lightning data from Vaisala and Earth Networks are integrated into a single product for the most comprehensive lightning package on the market with world-wide lightning coverage.
- Real-time lightning data is also available on the WxSentry App available on iPhone and Android. Custom alerts, texts, and emails can be generated when lightning occurs within a defined area.

Strong winds were the main weather hazard at the 2016 Olympic Games and a total of 4 damaging wind events occurred during the 2 week period. The strong wind events preceded synoptic cold fronts and would develop abruptly with the highest gusts occurring at the onset. The strongest wind event occurred on the afternoon of Aug 21 where a peak gust of 58mph was recorded. The women's competition finished up on Aug 20 and was not affected by these damaging winds. Aug 21 was the final day of the Olympic games and the closing ceremonies were held that evening.





# Official Weather Summary for the 2016 Olympic Games



## Damaging wind events during the Olympics

Minor damage to the spectator grandstands after the Aug 15 wind event. Mesh was ripped from the scaffolding and the grandstand flags were ripped and tattered.



Rain develops 1 hour after the closing ceremonies of the Women's Competition on Aug 20, 2016.

SE F	eatł	<u>ner</u>	<u>Summary</u>		Golf Golfe / Golf
	Low	High	Wind	Rain	Remarks
	(C) 18	(C) 36	(mph) N 6-12mph	(inch)	
ng	25	33	N 10-20mph before 10:40, then SW 20-30mph, peak gust of 43mph.		Strong winds between 10:40 – 13:40. Peak wind gust of 43mph was recorded at 10:54.
	21	26	SE 12-22mph		
	17	27	NE 4-8mph before 12:00, then S 9-15mph		
	17	22	W 12-22mph	0.15"	Periods of light rain occurred throughout the day along with gusty west winds.
	15	24	SW 15-25mph		Peak wind gust of 29mph was recorded.
	15	23	W 9-15mph	0.12″	Rain squalls produced periods of moderate rain at times between 09:00-11:00.
	15	26	N 4-8mph before 12:00, then SE 12-20mph		
	16	29	N 4-8mph before 12:00, then SE 9-15mph		
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Rio	CAMPO OLÍMPIC	MPIOUE DE GOLF	eath	ner	Summary		Golf Golfe / Golf
	: Golf Course I's competition						
Date: 1	5 Aug - 21 Aug, 201	6					
Date	Weat	her	Low	High	Wind	Rain	Remarks
Mon 15 Aug	Mostly sunny with strong winds after 15:40.		(C) 16	(C) 34	(mph) S 5-10mph before 15:40, then SW 20-40mph with peak gust 50mph	(inch)	Strong winds between 15:40- 22:00. Southwest winds increased to 20-40mph with a peak gust of 50mph.
Tue 16 Aug	Partly cloudy early. mostly cloudy after afternoon sprinkles	18	28	S 6-12mph	Trace		
Wed 17 Aug	Sunny		19	33	SE 9-15mph		
Thu 18 Aug	Strong winds from a 05:00. Skies were p during the day. Rai developed betweer	21	28	Strong winds before sunrise. Winds were S 6-12mph during the day.	0.02"	Strong winds between midnight and 05:00. Winds were southwest at 20-30mph with a peak gust of 37mph.	
Fri 19 Aug	Partly cloudy and b	21	30	E/SE 10-20mph before 13:00, then E/SE 20-30mph		East/southeast winds increased between 10:00-13:00. Winds peaked between 13:00-16:00 with gusts to 30mph.	
Sat 20 Aug	Mostly Cloudy with at 16:00. Rain show between 16:00-20:0	21	26	SW 10-20mph early, winds subsided in the afternoon.	0.10"	A brief period of gusty winds developed between 08:00-09:00 with gusts to 27mph. Winds subsided between 09:00-14:00.	
Sun 21 Aug	Mostly cloudy with periods of light rain throughout the day. Very strong winds developed after 15:30 and continued into the evening.			26	Variable 5-10mph before 15:30, then SW 30-50mph	0.20"	Damaging winds developed after 15:30 with a peak gust of 58mph recorded.
Climate	logy 15-21 Aug						
	e maximum temp	25C					
	e minimum temp	19C					
Average	e weekly rainfall	0.40"					
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