



MINISTÉRIO DA CIÊNCIA E TECNOLOGIA
INSTITUTO NACIONAL DE PESQUISAS ESPACIAIS

Products, weather and sea state forecasts provided by the CPTEC / INPE for 2016 Olympics

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**15th Workshop on Meteorological Operational Systems
ECMWF, Reading-UK**



Topics

- Web site “<http://esportes.cptec.inpe.br>”
- Data Assimilation (on going development)
- Numerical Weather Forecast
- Sea State Forecast
- Forecast Service
- Concluding Remarks



Sports Web Site

<http://esportes.cptec.inpe.br> (prototype)

CPTEC/INPE Dados observados Figuras dos modelos - Boias FURG - Meteogramas

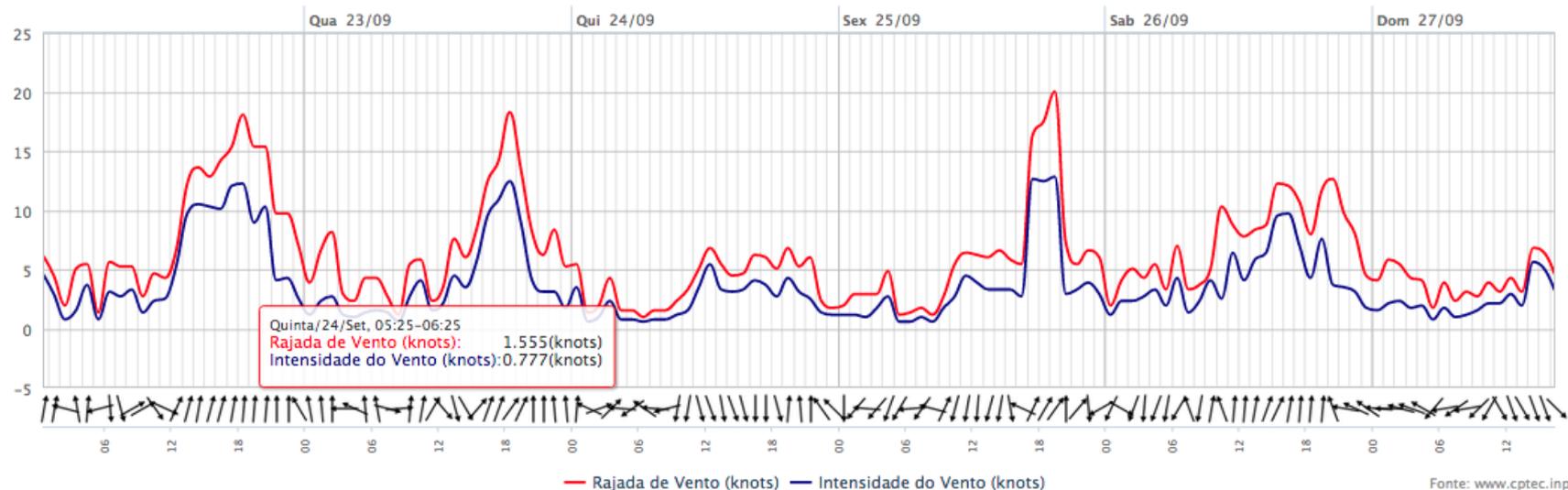
Boia SiMCosta RJ 1 - instalada na entrada da Baía da Guanabara

Aviso importante

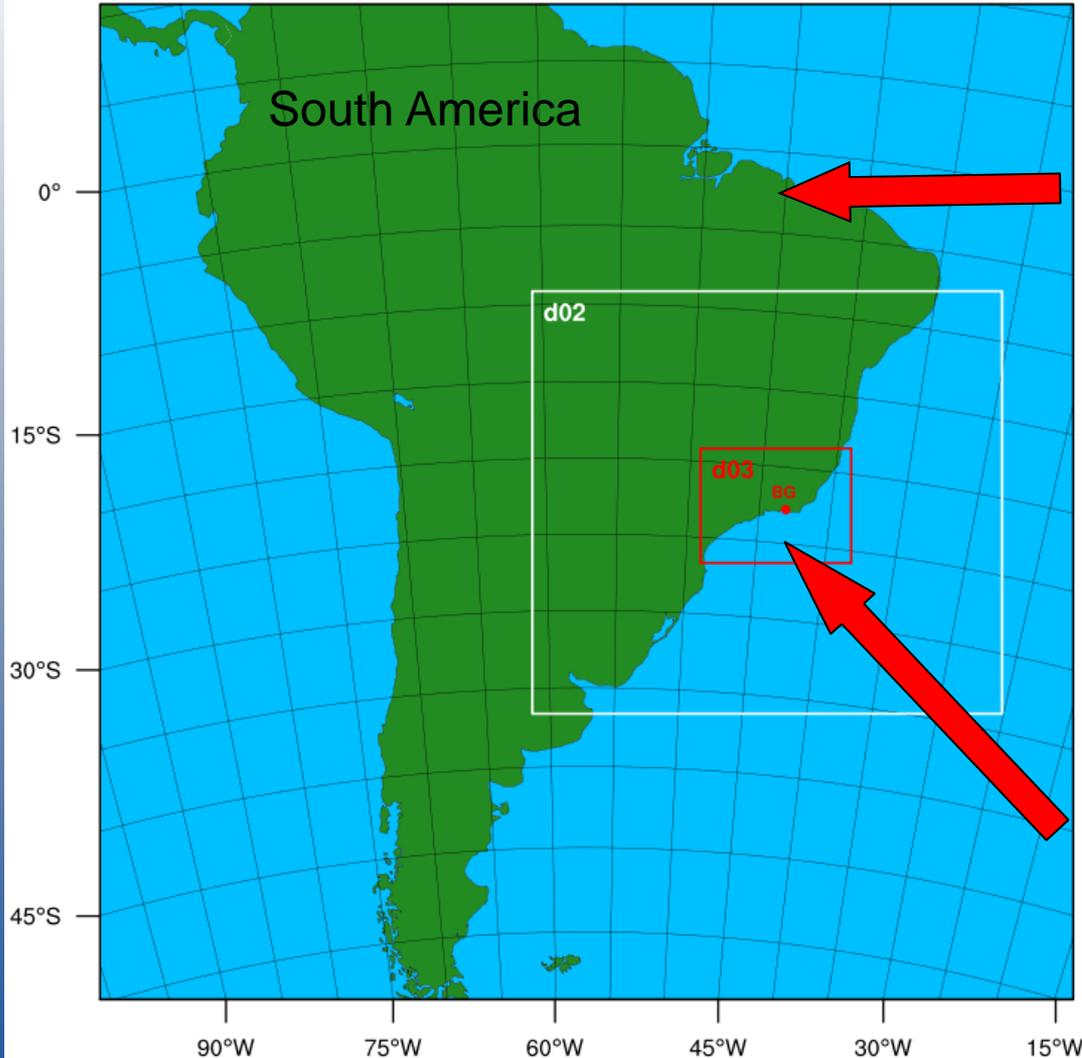
Informamos, que a bóia RJ01 parou de enviar dados desde 04/09, pois ela sofreu um choque e teve seus sensores danificados, não ha previsão de quando ela estará novamente em operação.

Pressão Atmosférica (mb) | Temperatura do Ar (C) | URL do Ar média (%) | Intensidade da Corrente (m/s) | Direção da Corrente (graus) | Temperatura da Água (C) |
Rajada de Vento (knots), Intensidade do Vento (knots) e Direção do vento (graus) | Altura da Onda (m) | Altura Máxima da Onda (m) | Período de Pico(s) | Direção Média da Onda (graus) | Espalhamento Médio (graus)

Rajada de Vento (knots), Intensidade do Vento (knots) e Direção do vento (graus)



Data Assimilation and Weather Forecast



● Conventional and satellite data assimilation using the Gridpoint Statistical Interpolation System (GSI) on domain d01 (9km).

● Domain d01 provides Initial and Boundary conditions to d02 (3km) and d03 (1km).

● Radar Data Assimilation using the WRF Data Assimilation System (WRFDA).

BG = Baía de Guanabara
Guanabara Bay



Radar Data Assimilation and Weather Forecast



- S-band Doppler Radar
- Observations:
 - Reflectivity
 - Radial Velocity

- Cycle:
 - Radar data assimilation will cycle hourly and restart each 6 hour using initial condition from domain d02 (from regional cycle)

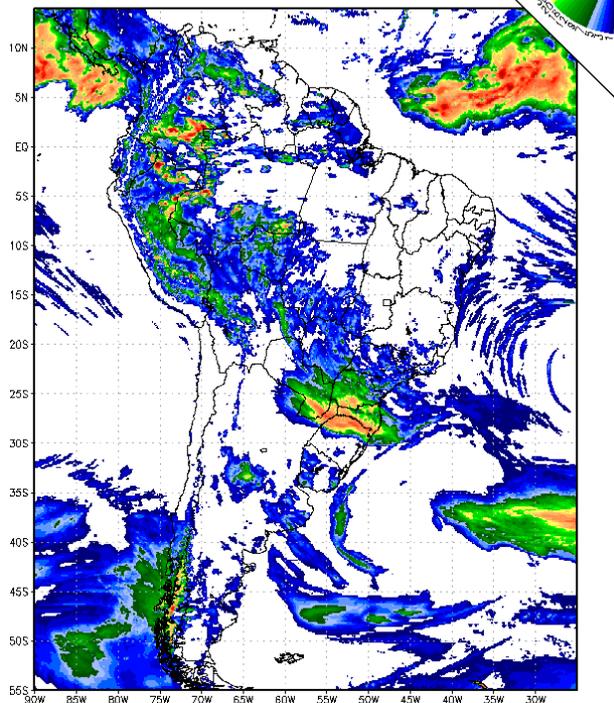
Pico do Couto Radar
(Rio de Janeiro)

São Roque Radar
(São Paulo)



Radar Data Assimilation and Weather Forecast

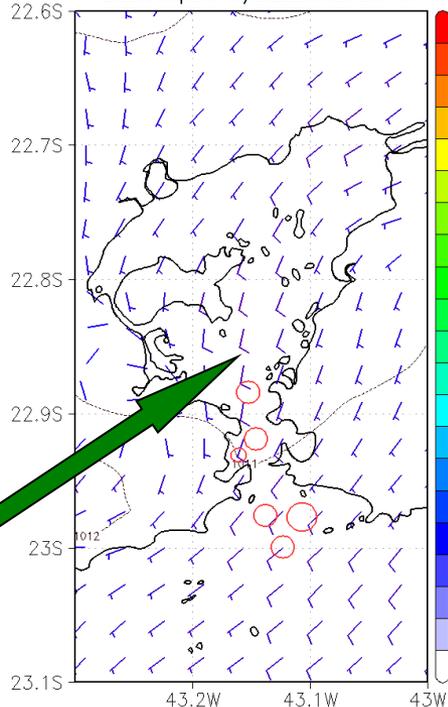
PREC. ACUM. [mm/24h]
03Z26SEP2015 - 00Z27SEP2015



Some Products :
Regional, Meso-scale
and Local Area

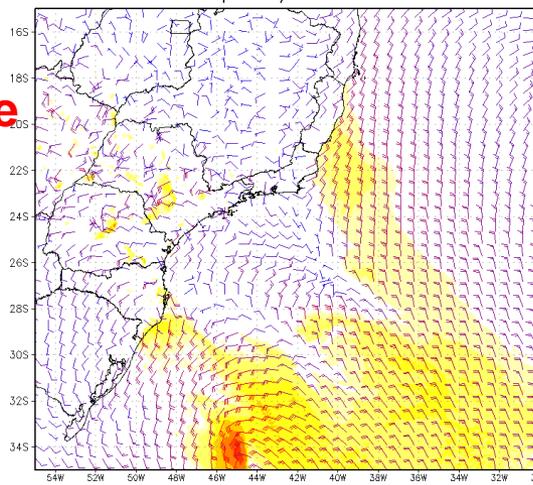
Precipitation

PSLM [hPa] + PREC [mm/h]
12Z25Sep2015/22Z25SEP2015



Guanabara bay
Sailing venue

10m Wind [kt] + Wind Gust [kt]
12Z25Sep2015/18Z25SEP2015

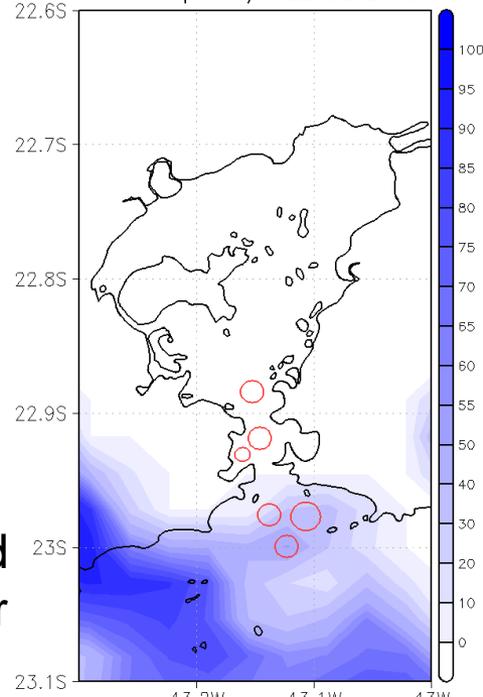


Wind and
Gust

ud Cover [%]
5/08Z28SEP2015

Wind
Precipitation
Pressure

Total Cloud
Cover





Sea State Forecast

Hydrodynamics Delft3D numerical model

Delft3D is a development of Deltares, a fully integrated modeling framework for a multi-disciplinary approach and 3D computations for coastal, river, lake and estuarine areas.

It can carry out numerical modeling of flows, sediment transport, waves, water quality, morphological developments and ecology.

The Delft3D framework is composed of several modules, grouped around a mutual interface, while being capable to interact each one with another.

(Font: Delft3d: Functional Specification, 2014)

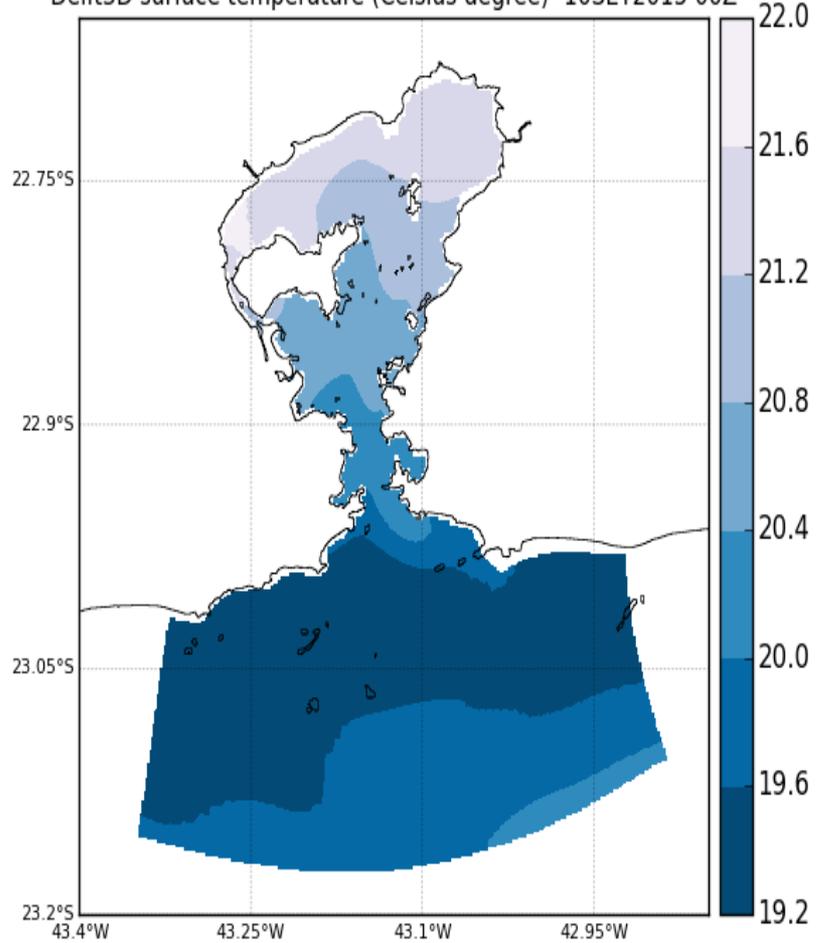
At CPTEC/INPE, SWAN, Delft3D-FLOW and Delft3d-WAVE modules are being implemented for Guanabara Bay.



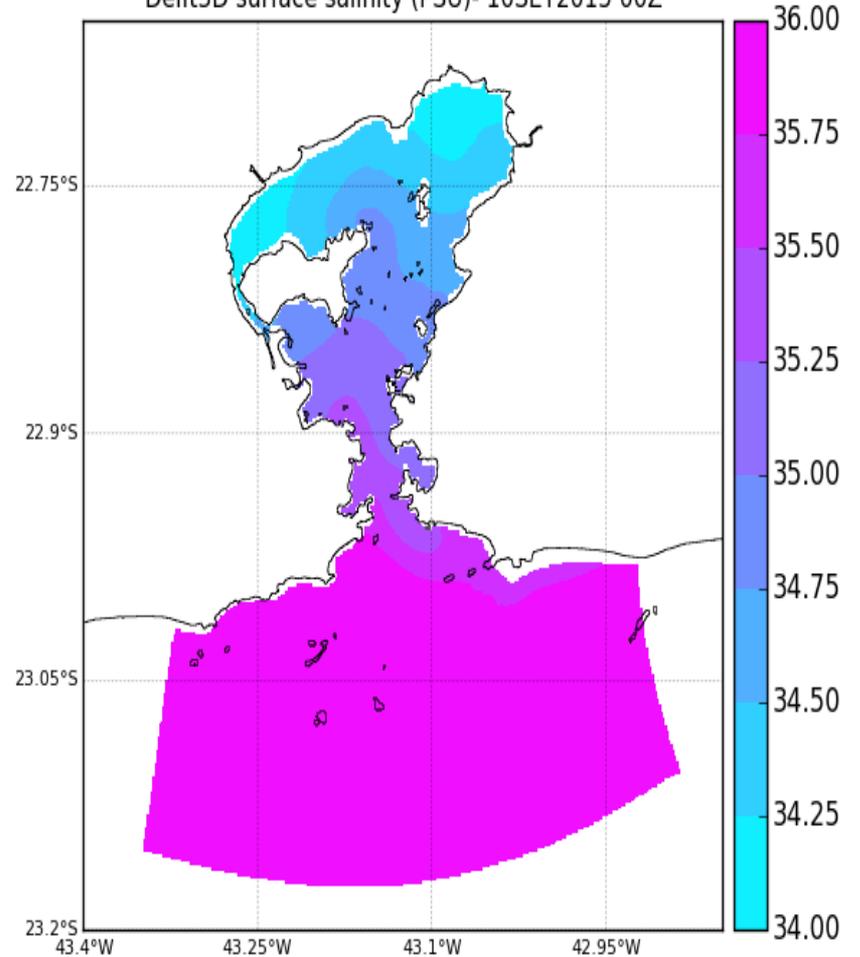
Surface temperature and Salinity

Delft3D - Guanabara Bay

Delft3D surface temperature (Celsius degree)- 10SET2015 00Z



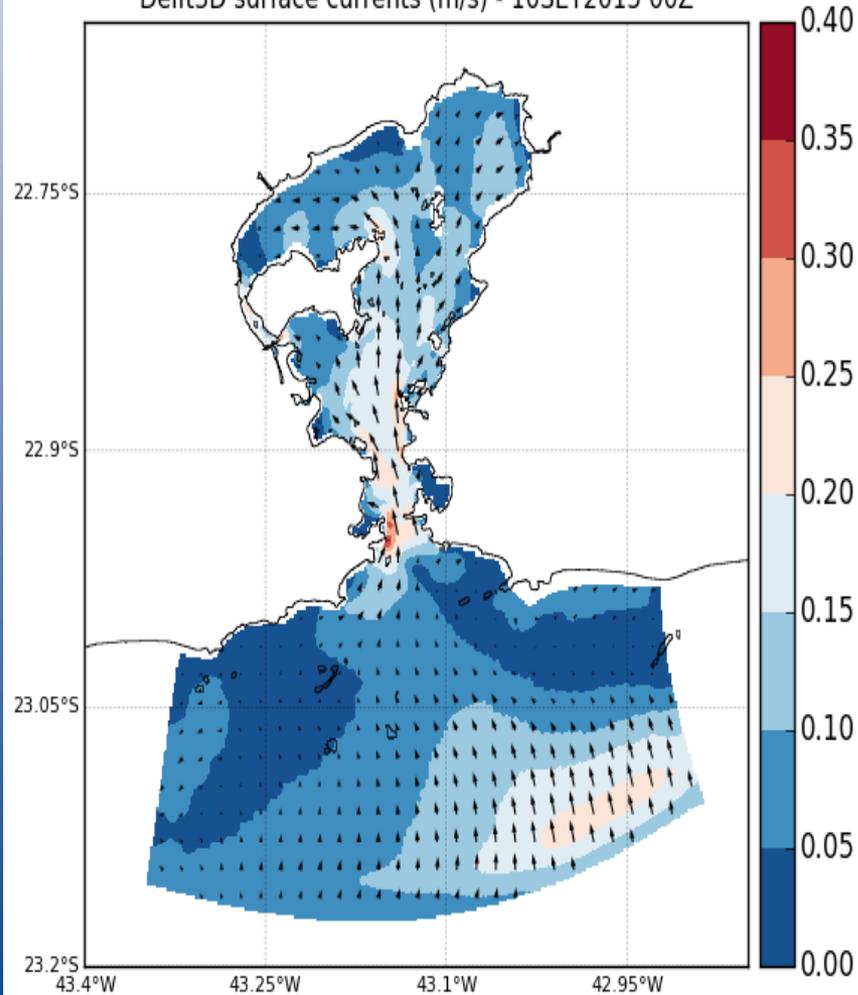
Delft3D surface salinity (PSU)- 10SET2015 00Z



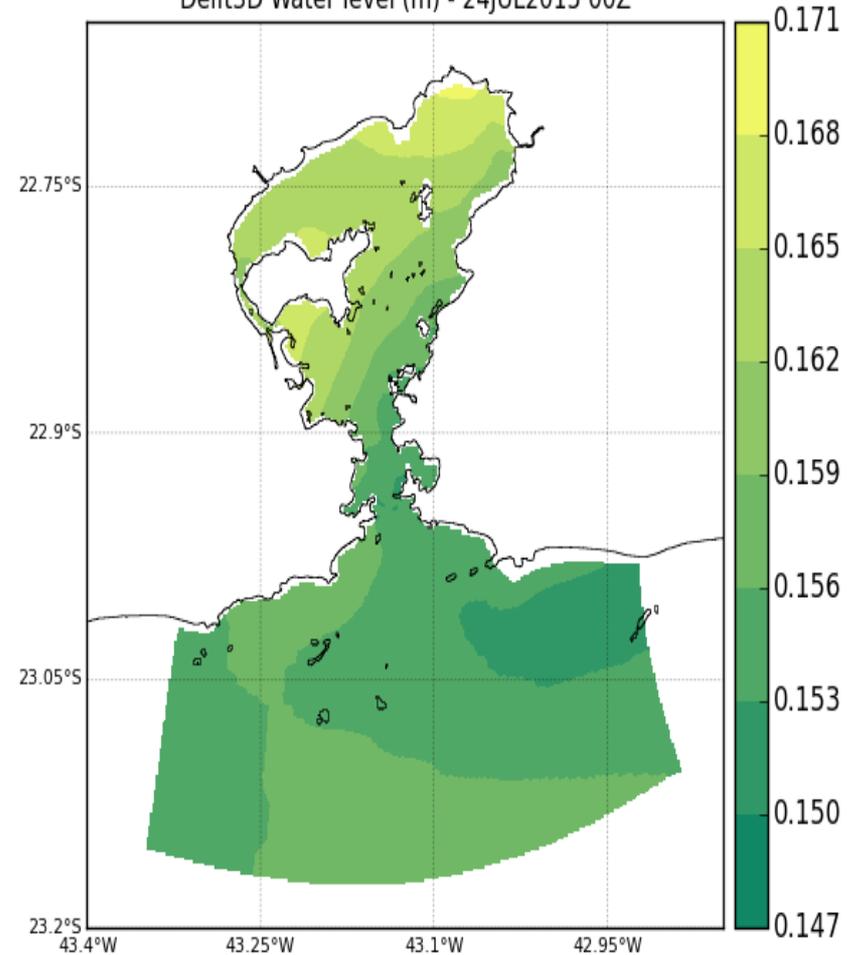
Surface currents and Water level

Delft3D - Guanabara Bay

Delft3D surface currents (m/s) - 10SET2015 00Z



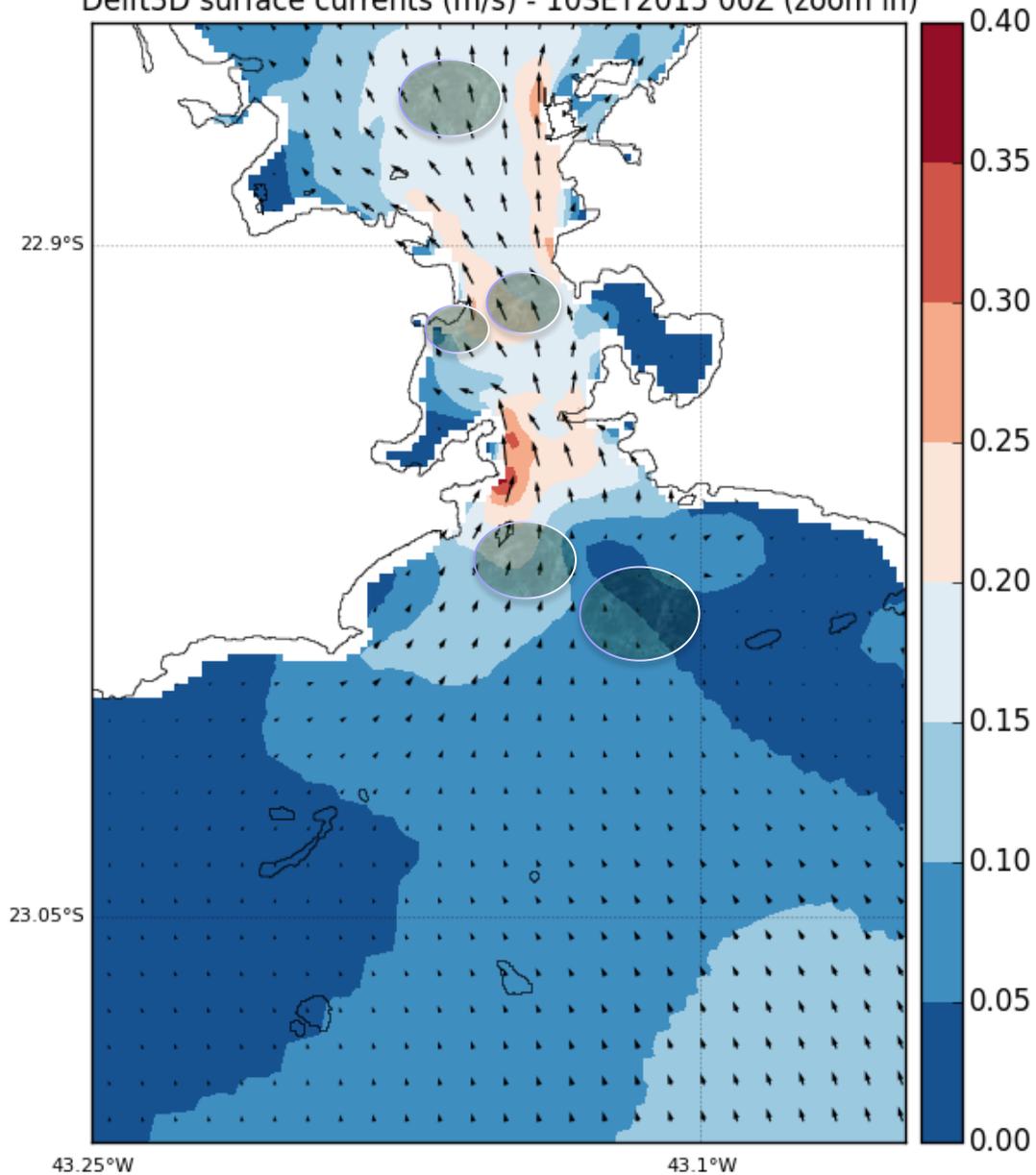
Delft3D Water level (m) - 24JUL2015 00Z





Sailing area

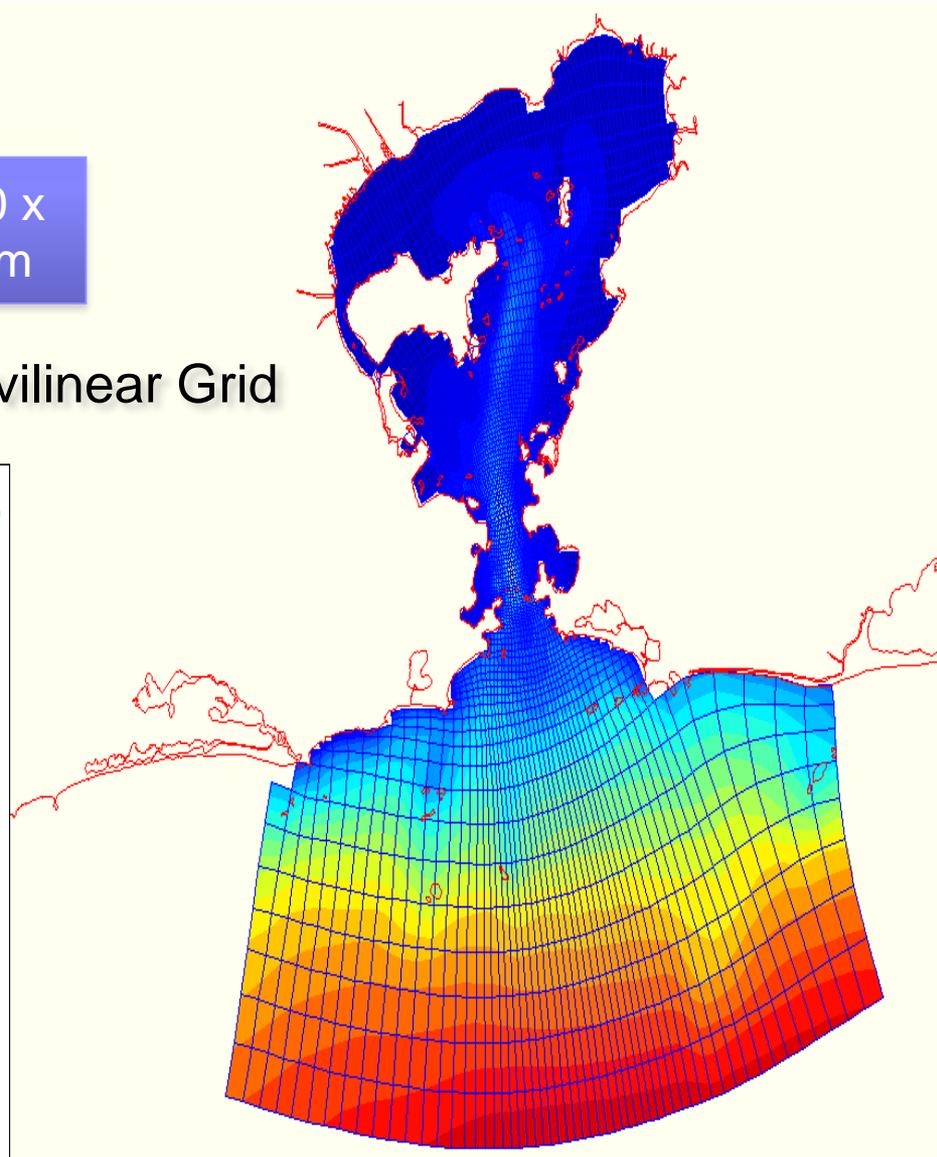
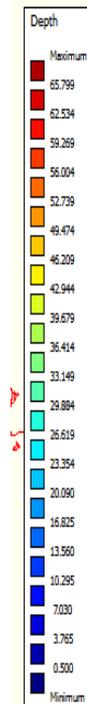
Delft3D surface currents (m/s) - 10SET2015 00Z (zoom in)



Horizontal Resolution and Model Grid



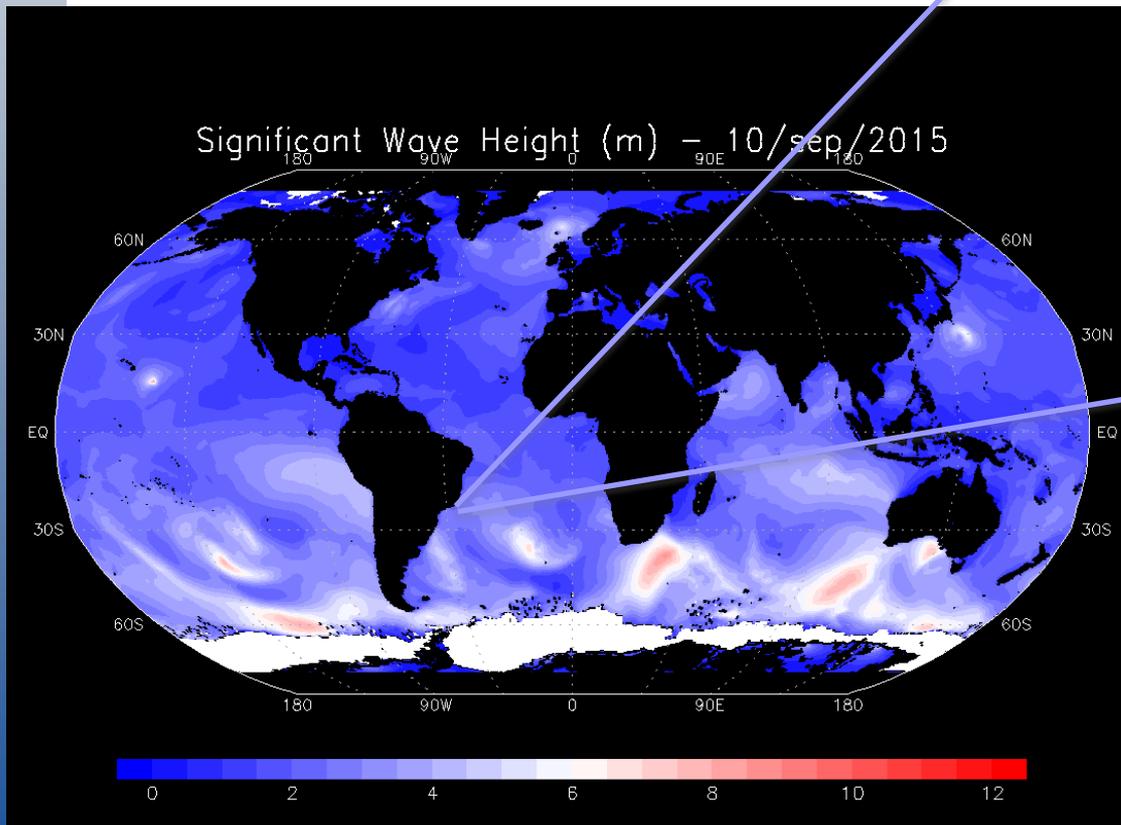
Guanabara Bay Curvilinear Grid



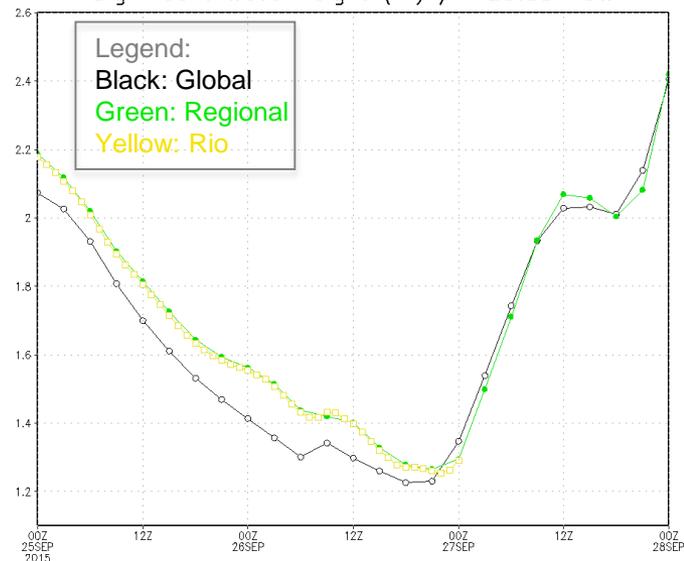


Wave Watch 3 v4.18 model

Significant Wave Height (m) - 10/sep/2015



Significant Wave Height (m) / -23.5S 43W



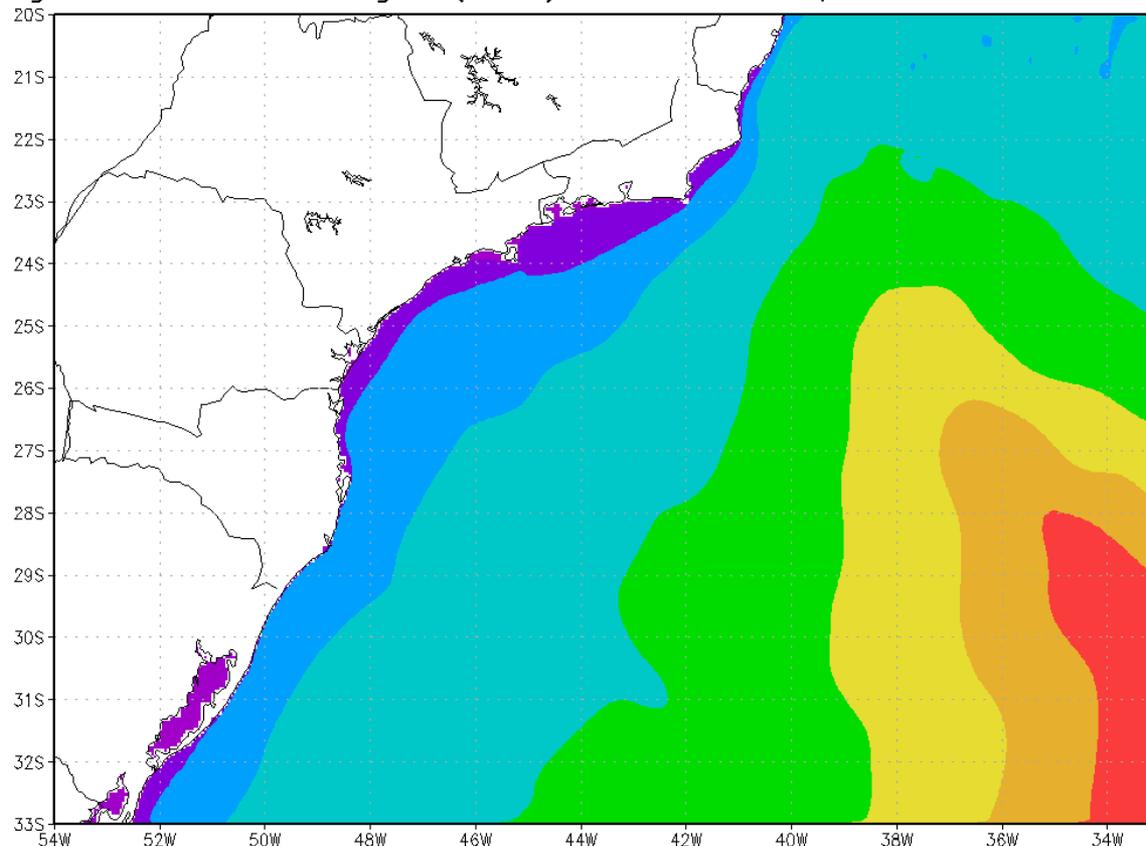
Forecast up to 72h
Output each 3h
Space resolution: $0.5^\circ \times 0.5^\circ$



Wave Watch 3 v4.18

Regional Domain – Brasil S-SE

Significant Wave Height (SWH) for 10 - Sep - 2015 00:00 BRT



Forecast range: 0 - 48h

Output every 3h

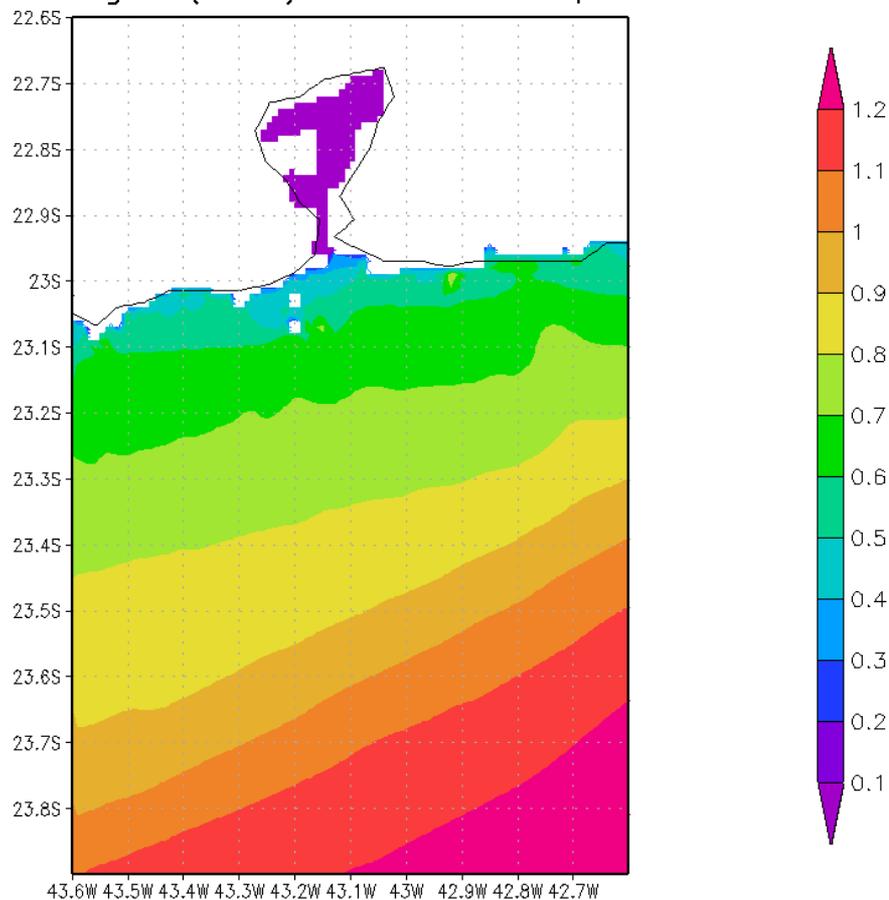
Horizontal Resolution :
9 km x 9 km



Wave Watch 3 v4.18

Local Domain – Rio de Janeiro City Coast

Significant Wave Height (SWH) for 10 – Sep – 2015 00:00 BRT



WRF Forcing
- 10m Wind

Forecast Range:
0 - 48h

Output each: 1h

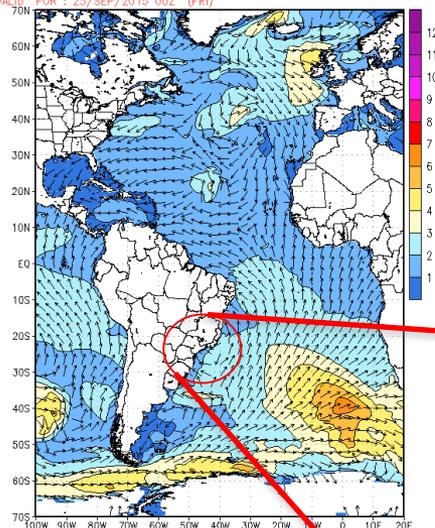
Horizontal
Resolution :
3km x 3km



Wave forecast operational products

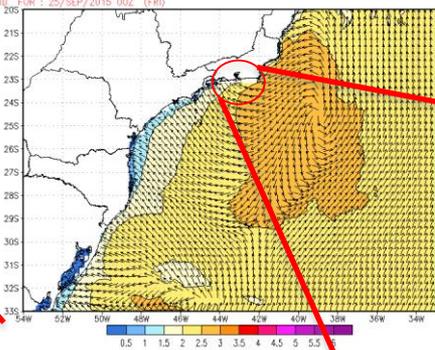
MODEL WIII ST4 global
ANALISE : 25/SEP/2015 00Z (FRI) + 0HR
VALID FOR : 25/SEP/2015 00Z (FRI)

SIG.HEIGH_(m)_&_DIRECTION
Oceano_Atlantico



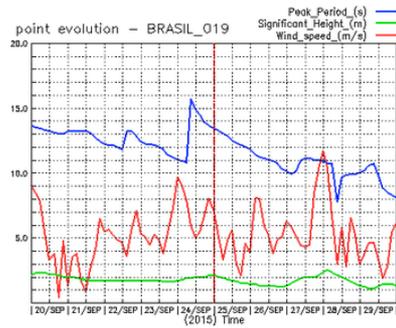
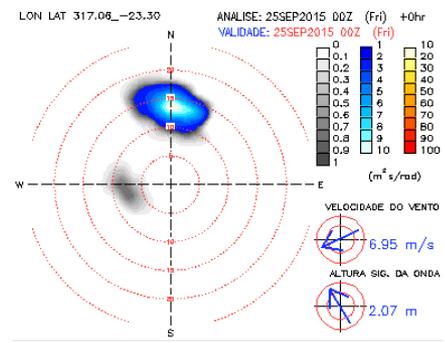
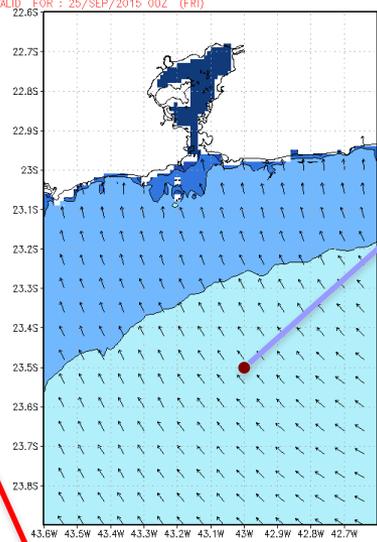
MODEL WIII SUDESTE
ANALISE : 25/SEP/2015 00Z (FRI) + 0HR
VALID FOR : 25/SEP/2015 00Z (FRI)

SIG.HEIGH_(m)_&_DIRECTION
Brasil_Sudeste



MODEL WIII RIO
ANALISE : 25/SEP/2015 00Z (FRI) + 0HR
VALID FOR : 25/SEP/2015 00Z (FRI)

SIG.HEIGH_(m)_&_DIRECTION
Brasil_Rio





The Forecast Service

- CPTEC's forecasters team is participating of "On Site" office for Weather and Sea Forecasts with focus on the management of the games
- 3 briefings per day will be delivered:
 - Two for the Organizing Commission: **9AM local time** with today and next day forecast; and **6PM local time** with **next two days** forecast;
 - One open section forecast (technical coaches and sailors): **10AM local time**;
- Disclosure of forecast products on the Bulletin Board of the competition for public consultation;



Bulletin Board

Weather Forecast for Guanabara Bay Friday, August 21, 2015 All times are local (L)

Aquece Rio
EVENTOS-TESTE

	0800 – 1100L	1100 – 1400L	1400 – 1800L
WEATHER	Partly Cloudy occasionally Cloudy	Partly Cloudy becoming Clear later	Partly Cloudy
VISIBILITY	08/10 km	08/10 km	08/10 km
AIR TEMP.	24°C – 25°C	26°C – 28°C	26°C - 22°C
SURFACE WIND	300°/270° becoming 250°/210° at 11h00 03/06 kts inside	230°/180° 05/10 kts inside	230°/180° becoming 180°/160° 05/10 kts inside
	260°/240° 03/08 kts outside	230°/180° 03/07 kts outside	230°/180° 03/07 kts becoming 170°/135° 05/10 kts at 16h00 outside
WAVES	225°/180° 0.4/0.9 m inside; 2.0/2.5 m outside.	225°/180° 0.7/1.2 m inside; 2.2/2.8 m outside.	200°/170° 0.7/1.2 m inside; 2.5/3.0 m outside

WARNINGS/REMARKS: High surf along the day.



Bulletin Board – Hourly Condition Table

Hourly Weather Forecast for Sailing - Niterói

Valid for Friday 18 September 2015

Issued on Friday 18 September 2015 at 8:39 (local time)

Time	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100
Weather																
Mean wind direction 16 point Compass	NE	NE	NE	ESE	ESE	ESE	SE	SE	SE	SSE	SSE	SSE	SSW	SE	W	NNE
Mean wind direction Degrees True	34	35	41	106	98	108	123	131	134	138	143	143	181	121	252	18
Mean wind speed (m/s)	3	2	2	2	3	4	3	4	3	3	2	2	2	1	1	1
Mean wind speed (knot)	5,82	3,88	3,88	3,88	5,82	7,76	5,82	7,76	5,82	5,82	3,88	3,88	3,88	1,94	1,94	1,94
Maximum wind gust (m/s)	3	2	2	2	3	4	3	4	3	3	2	2	2	1	1	1
Maximum wind gust (knot)	5,82	3,88	3,88	3,88	5,82	7,76	5,82	7,76	5,82	5,82	3,88	3,88	3,88	1,94	1,94	1,94
Current Direction (degrees)	111	115	123	128	126	124	112	80	23	13	162	159	156	162	160	NO-DATA
Current Speed (knot)	0,24	0,24	0,25	0,29	0,27	0,2	0,13	0,05	0,03	0,01	0,03	0,05	0,07	0,09	0,11	NO-DATA
Sea Surface Temperature (°C)	19,7	19,7	19,7	19,8	19,8	19,8	19,8	19,8	19,7	19,7	19,7	19,6	19,6	19,6	19,6	NO-DATA
Wave Height (m)	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,65	0,66	0,66	0,67	0,69	0,7	0,73	0,75	NO-DATA
TPEAK (s)	12,41	12,49	12,64	12,95	13,12	13,14	13,13	13,08	12,99	12,82	12,56	12,4	12,28	12,2	12,13	NO-DATA
Wave Direction (degrees)	105,41	104,8	104,24	103,77	103,38	103,01	102,63	102,2	101,68	101,05	100,41	99,73	99,05	98,48	97,89	NO-DATA
Temperature (°C)	25	25	25	25	25	25	24	25	25	25	25	25	24	25	25	25
Humidity (%)	68	69	69	76	75	75	77	76	77	78	79	80	81	79	78	74



Concluding Remarks

- The Olympic test events that happened in Rio de Janeiro August 2015 was an excellent opportunity to test the system
- However more work still need to be done
- ECMWF-MARS will be used to manage all the data on this system
- CPTEC plays an important role by providing customized meteorological products for major events in Brazil