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**Coastal Brazil, Uruguay, and
Extreme Northern Argentina
Marine Climate Study for
SeaDream Yacht Club**

Warning: This study represents the long-term average state of weather and ocean conditions for this region during the period in question and is intended for planning purposes only. Do not use this information as an operational severe weather avoidance, or weather forecasting tool. The prudent mariner always consults the most up to date weather and oceanographic forecasts available.

TABLE OF CONTENTS

1. GEOGRAPHIC OVERVIEW	3
1.1 BRAZIL.....	3
1.2 URUGUAY	4
1.3 ARGENTINA	4
2. GENERAL CLIMATE SUMMARY	5
3. DETAILED NOVEMBER THROUGH MARCH CLIMATE.....	7
3.1 REGION 1 – BELEM TO NATAL	7
3.1.1 General Weather Discussion.....	7
3.1.2 November through March Weather	8
3.1.2.1 November Winds	8
3.1.2.2 November Seas	9
3.1.2.3 January Winds.....	9
3.1.2.4 January Seas.....	10
3.1.2.5 March Winds.....	11
3.1.2.6 March Seas.....	12
3.2 REGION 2 – NATAL TO RIO DE JANEIRO	12
3.2.1 General Weather Discussion.....	12
3.2.2 November through March Weather	13
3.2.2.1 November Winds	13
3.2.2.2 November Seas	14
3.2.2.3 January Winds.....	14
3.2.2.4 January Seas.....	15
3.2.2.5 March Winds.....	16
3.2.2.6 March Seas.....	16
3.3 REGION 3 – RIO DE JANEIRO TO BUENOS AIRES.....	19
3.3.1 General Weather Discussion.....	19
3.3.2 November through March Weather	21
3.3.2.1 November Winds	21
3.3.2.2 November Seas	22
3.3.2.3 January Winds.....	22
3.3.2.4 January Seas.....	23
3.3.2.5 March Winds.....	24
3.3.2.6 March Seas.....	24
4. CONCLUSION	25
5. EAST COAST SOUTH AMERICA MARINE DATA TABLES.....	27
DATA SITE LOCATIONS MAP.....	27
SITE 1: OFFSHORE BELEM; 0.5 S 47.5 W.....	28
SITE 2: OFFSHORE NATAL; 5.5 S 34.5 W	28
SITE 3: SOUTH OF NATAL; 13.5 S 38.5 W	28
SITE 4: SOUTH OF CABO FRIO; 23.5 S 41.5 W	28
SITE 5: SOUTH OF RIO DE JANEIRO; 23.5 S 44.5 W	28

SITE 6: RIO DE LA PLATA; 35.5 S 55.5 W	29
SITE 7: OFFSHORE PORTO ALEGRE; 28.5 S 47.5 W	29
6. STATION CLIMATE SHEETS.....	30
6.1 BELEM, BRAZIL	30
6.2 NATAL, BRAZIL	31
6.3 RECIFE, BRAZIL	32
6.4 SALVADOR, BRAZIL	33
6.5 VITORIA, BRAZIL	34
6.6 RIO DE JANEIRO	35
6.7 PORTO ALEGRE, BRAZIL	36
6.8 BUENOS AIRES.....	37
7. REFERENCES.....	38

Figures

Figure 1: Geography of the Region	3
Figure 2: Amazon River.....	4
Figure 3: Airflow Over the South Atlantic	5
Figure 4: Study Region Overview Map.....	7
Figure 5: Region 1 November Wind Speed.....	8
Figure 6: Region 1 November Wave Height	9
Figure 7: Region 1 January Wind Speed	10
Figure 8: Region 1 January Wave Height.....	10
Figure 9: Region 1 March Wind Speed	11
Figure 10: Region 1 March Wave Height.....	12
Figure 11: Region 2 November Wind Speed.....	13
Figure 12: Region 2 November Wave Height	14
Figure 13: Region 2 January Wind Speed	15
Figure 14: Region 2 January Wave Height.....	15
Figure 15: Region 2 March Wind Speed	16
Figure 16: Region 2 March Wave Height.....	18
Figure 17: Region 3 November Wind Speed.....	21
Figure 18: Region 3 November Wave Height	22
Figure 19: Region 3 January Wind Speed	22
Figure 20: Region 3 January Wave Height.....	23
Figure 21: Region 3 March Wind Speed	24
Figure 22: Region 3 Wave Heights.....	25
Figure 23: Data Site Location Map.....	27

1. Geographic Overview

The region in question for this study, coastal Brazil, Uruguay and the extreme northern area of Argentina, encompasses over 5,000 miles of coastline along the South Atlantic Ocean. The South Atlantic Ocean is bounded by Africa on the east, Antarctica on the South and the eastern coast of South America on the west. Marginal waters of the South Atlantic include the Gulf of Guinea, off Africa, the eastern entrance to the Strait of Magellan, at the southern tip of Argentina, and the Rio de la Plata, between northern Argentina and Uruguay.

Several countries lie along the eastern coast of South America, these include Brazil, Uruguay, Argentina and extreme southern Chile. The continental shelf offshore of these countries extends to a maximum width of 270 miles in the vicinity of the Golfo de San George, near central-coastal Argentina. The shelf decreases in width to a minimum of 6 miles off Salvador, near central-coastal Brazil, and then increases to a width of 150 miles off the mouth of the Amazon River, in the vicinity of Belem, Brazil.



Figure 1: Geography of the Region

1.1 Brazil

Brazil, the largest country in South America, is bounded by French Guiana, Suriname, Guyana, and Venezuela on the north, Columbia, Peru, Bolivia, Paraguay, and Argentina on the west, and Uruguay on the south.

The greater part of Brazil consists of hilly uplands, plateaus and low mountains. Very little of the region can be considered a plain, with the exception of the upper Amazon Basin. The coast from Cabo Orange (4°20'N, 51°27'W) to Fortaleza is low, consisting of almost entirely sandy beaches backed by dunes or forest. Between Fortaleza and Cabo Santa Marta Grande (28°23'SN, 48°49'W) the coast is generally bolder with mountains close to the shore, but occasionally with long stretches of low flat coast. The coast further south to the Uruguayan border consists of a continuous low flat beach, broken occasionally by river mouths and backed by sand dunes.

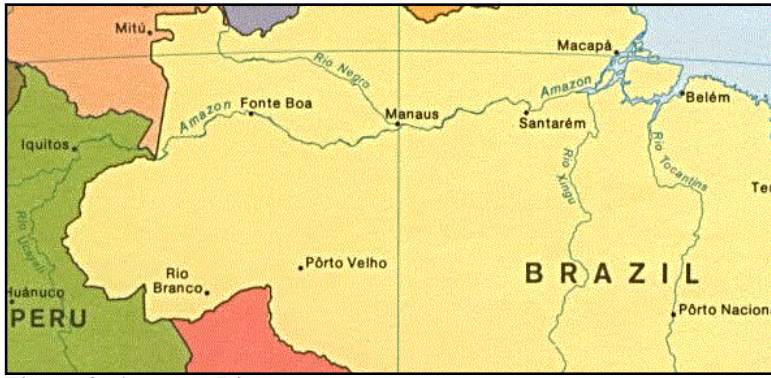


Figure 2: Amazon River

One of the most remarkable features of this region is the Amazon River System located in northern Brazil. The rivers, and its tributaries, form the greatest river systems in the world, with over 13,738 miles of channels that are safe for navigation. The headwaters of the Amazon, at Belém, drain the Andes Mountains from Colombia to Bolivia. On average 4.2 million cubic feet of water per second empties into the

South Atlantic Ocean from the Amazon; this amount increases to 7 million cubic feet per second in the rainy season. The Amazon River proper is about 3,500 miles long, originating in Lago Lauricocha, Peru, about 100 miles north-northeast of Lima.

Numerous other rivers along the Brazilian coast empty into the ocean. In some cases their mouths form good harbors, such as at Salvador and Rio de Janeiro, but the rivers can seldom be navigated.

1.2 Uruguay

Uruguay is bounded on the northeast by Brazil, on the south by the Rio de la Plata, and on the west by Argentina. The country, the smallest country in South American, has a 300-mile coastline, including the Rio de la Plata.

The coast of Uruguay consists of sandy beaches separated by rocky points, some of which have low cliffs. Generally, the country is comprised of low, rolling grassy hills and plains, and rivers flowing west into the Rio Uruguay. The Uruguay River is the country's most important waterway, as it is navigable by ocean-going vessels for over 100 miles above the port of Nuevo Palmira near its mouth. The river also forms the boundary between Uruguay and Argentina, to the south.

Montevideo, the capital of Uruguay, stands on a promontory at the mouth of the Rio de la Plata.

1.3 Argentina

Argentina is bounded on the north by Bolivia and Paraguay, on the east by Brazil and Uruguay and on the south and west by Chile. The country has a coastline of about 2,180 miles, including the Rio de la Plata.

The Atlantic coastline consists of long stretches of low cliffs with occasionally areas of low sandy coasts usually near the mouths of rivers. The coast of the Rio de la Plata is low and featureless.

The Rio de la Plata is a broad estuary comprising an enormous drainage basin which includes the Paraguay, Parana and the Uruguay Rivers and numerous smaller rivers and streams. The river is entered between Punta del Este, Uruguay and Cabo San Antonio, Argentina, about 120 miles to the southwest. The Rio de la Plata extends about 120 miles in a west-northwest direction. Despite the enormous amount of water discharged into the ocean, the estuary is relatively shallow due to a large amount of sediment transport into the estuary from the rivers that drain into it. Seasonal water rate flows, winds and tide have a considerable effect on the depth. A large portion of the river cannot be

used at all, or only be very shallow draft vessels. Navigation in the lower reaches can only be maintained by constant dredging.

2. General Climate Summary

The climate of the coastal region is primarily influenced by the landmass distribution of the South Atlantic Ocean. Since the South Atlantic lacks any significant landmasses, as compared to the North Atlantic, the climate of the region is fairly uniform, with variations mainly driven by changes in latitude.

The chief control of weather from the Equator to about 40° South latitude, the area in question for this study, is a semi-permanent high-pressure cell produced by subsiding air over the region. This air initially rises near the equator due to heating caused by the large amounts of solar radiation received in the tropics throughout the year. The air flows southward in the upper atmosphere, cools and descends near the Tropic of Capricorn. At the surface, this situation produces the large zone of high-pressure that dominates the South Atlantic Ocean. The anti-clockwise airflow around this high-pressure cell drives the climate of the region. Along the eastern side of the South Atlantic, cold and dry polar air is brought northward. This influx of dry air produces clear skies and dry conditions along the low to mid-latitude regions of Africa. Along the eastern coast of South America however, conditions are unstable as warm tropical air is carried southward at the surface by the anti-clockwise wind flow. The moist air flowing from the northeast to east reaches the coasts of South America and produces clouds and convective precipitation in this region.

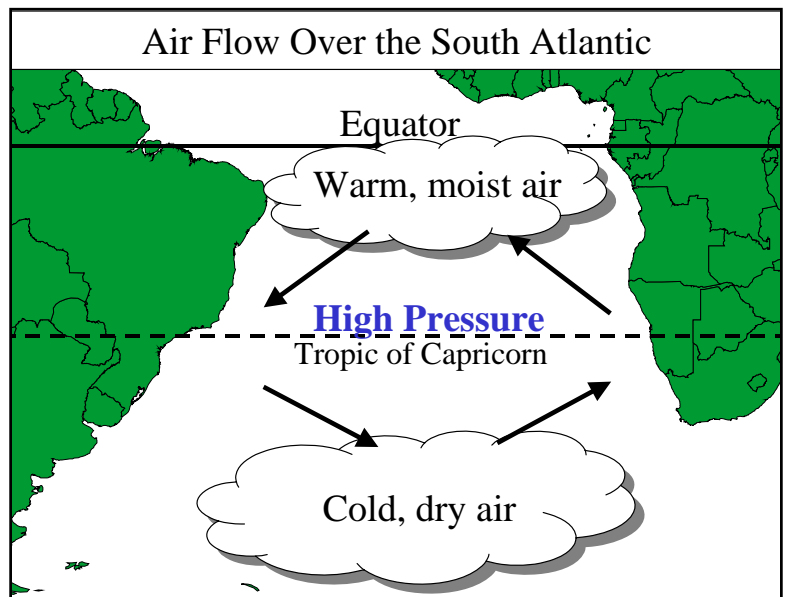


Figure 3: Airflow Over the South Atlantic

The South Atlantic high-pressure zone is farthest north during the southern hemisphere winter, when its axis reaches a mean latitude of 25° south, near the Tropic of Capricorn. The high is strongest during this season. During the southern hemisphere summer months the high moves southward and eastward towards the coast of Africa and weakens.

The position of the high-pressure cell in winter typically blocks the movement of low-pressure storm systems in the region south of Montevideo. Occluded fronts however, crossing the Andes may develop a new low pressure system on the eastern side of the mountains in the vicinity of Rio de la Plata. This is particularly prevalent in the late March through May timeframe when deep lows develop over the Rio de la Plata. Most bad weather in this area of interest however is caused by the intrusion of cold air behind cold fronts moving through the region. These cold fronts are followed by high pressure, and the enhanced atmospheric pressure gradient between the high and low-

pressure systems produces strong southerly winds as far north as 30° south. Offshore, these conditions can produce rough seas, especially in the vicinity of the Rio de la Plata.

To the north of the semi-permanent high-pressure lies the tropical region known as the Intertropical Convergence Zone (ITCZ). From July through October, the hemisphere's winter season; the ITCZ is located in the northern hemisphere, over the tropical North Atlantic Ocean. The area then moves slowly south to the delta region of the Amazon, over Belem Brazil, and reaches São Luis do Maranhão by March. Continental heating in the tropical region during summer produces a semi-permanent low-pressure cell over southern Brazil. This low-pressure cell often brings scattered showers, and thunderstorms to the region during the summer rainy season.

The eastern most coastal regions of Brazil are under the influence of the tropical trade winds during all seasons. The effects of the easterly trade winds are limited during the summer to between 3° South and 13° South latitudes, from the Amazon basin southward to about Salvador. During the Southern Hemisphere winter these trade winds are southeasterly. As summer approaches, the southeasterly winds are replaced by northeasterly winds over northern Brazil as far south as São Luís and Parnaíba as the ITCZ moves southward over the area. Further south along the Brazilian, Uruguayan and Argentine coasts northeasterly winds generally prevail throughout most of the year.

Local wind flow along the coastal region is highly complicated by topography. Exposed coastal ports may be subject to the same influences as open ocean areas, while sheltered ports may never experience high wind conditions. Narrow channels and passages, however can create dangerous squalls due to the funneling of winds through these features. Land and sea breezes are very prevalent in the area during the summer months. As the land rapidly heats up during the day, an onshore sea breeze sets up in the late morning to early afternoon. In the evening and at night, the wind will reverse as the land cools, generating an offshore land breeze.

Gales are rare north of Rio de Janeiro. However, on the east of coast of Brazil around the mouth of the Amazon, local afternoon squalls, known as Squalls of Para, may develop in the dry season from June through the end of September. Wind speeds may reach 20 to 30 knots during these storms. Further south along the Brazilian coast during the wet season from December through June, sudden local storms may blow from the southwest. These storms are known as Reboyo and can last 3 to 4 days with winds reaching gale force.

In the Rio de la Plata area a phenomena occurs similar to a squall line in the Northern Hemisphere. This phenomenon, known as a Pampero, often accompanies a cold frontal passage, and brings strong west to south winds. Shortly before its arrival calm winds may prevail and there is often a roll of cumulus clouds to the southwest, followed by heavy cumulonimbus clouds that gradually cover the entire sky. As the clouds move in, a violent wind squall with winds to 70 knots, forms from the west to south, followed by torrential rainfall and often thunder and lightning. These storms usually only last less than two hours. While the majority of the storm is located inland, the effects may be felt 400 miles offshore. The storms typically form during the winter in the region, however summer Pamperos may develop. The summer Pamperos are shorter in duration, however their onset is much more sudden and just as violent as the winter storms.

3. Detailed November through March Climate

For the purpose of this study, the overall area in question (the coastal region from Belem, Brazil southward to the Buenos Aires, Argentina) will be divided into three sub-regions. The first region will extend from Belem, Brazil southeast to the furthest eastern extent of Brazil near Natal. The second region will extend from Natal southwards to Rio de Janeiro, Brazil. The third region will extend southwards from Rio de Janeiro to the Rio de la Plata at Buenos Aires, Argentina. A detailed analysis of weather that may affect maritime operations will be performed in all of these regions. Detailed conditions in the vicinity of Rio de Janeiro will be mainly discussed in Region 3.



Figure 4: Study Region Overview Map

3.1 Region 1 – Belem to Natal

This region comprises the area from the mouth of the Amazon at Belem, Brazil, southeastward to Natal, Brazil. The southern most extent of Region 1 is about 6° South, placing this region entirely within a tropical climatic regime.

3.1.1 General Weather Discussion

The main influence to weather in the region is the seasonal movement of the Intertropical Convergence Zone (ITCZ). During the southern hemisphere’s winter months, the ITCZ is located in the northern hemisphere over the tropical North Atlantic Ocean. This marks what may be termed the “dry season” for the region, although the region does still receive rainfall with amounts averaging between 4 and 6 inches from July through November. Beginning in late November and early December, the region begins to transition to its true rainy season as the ITCZ begins to move slowly southward. Monthly rainfall amounts increase to 8 inches in December, then over 17 inches in March, the height of the rainy season. Cloud cover is extensive during the rainy season, and some form of precipitation, usually as rain and drizzle or showers with thunderstorms, may be experience everyday of the month. Thunderstorms in this area occur on over 100 days per year in the Amazon

Basin, with the majority occurring during the wet season. Torrential downpours of up to 10 inches of rainfall in a 24-hour period often accompany these storms.

Temperatures in this region are uniform through the year, averaging in the low 80's, with daily highs in the upper 80's and daily lows in the mid to low 70's. Extreme temperatures in the upper 90's and lower 100's have been experienced in the area however. Since this is a tropical environment, with a strong maritime influence, relative humidity is high, averaging near 100% in the mornings and 70% to 80% in the afternoon during the rainy season. During the dry season, relative humidity averages only in the low to mid 60% in the afternoons. The combination of high humidity caused by increased rainfall during the rainy season, and high afternoon temperatures, which may reach the upper 90's, produce dangerous heat indices in excess of 110° F. Heat indices in excess of 105° F are likely to produce sunstroke, heat cramps and heat exhaustion in unclimatized individuals. Heat indices in excess of 105° F will produce heat stroke, which may be fatal if not treated promptly.

Winds over the region are predominately out of the east, averaging less than 10 knots throughout the year in sheltered areas near Belem, and increase to 15 knots in exposed waters to the east near Natal. Gusts as high as 56 knots have been experienced in the region however during the period in question. These higher winds are associated with thunderstorm activity that occurs during the rainy season.

3.1.2 November through March Weather

3.1.2.1 November Winds

In November the ITCZ is located over the tropical zone of the North Atlantic, and the semi-permanent high-pressure cell over the South Atlantic extends northward towards this region. Interaction between the high-pressure cell and the ITCZ enhances the easterly wind flow over the region. Winds average 12 to 13 knots along the coast of Brazil from Belem to Natal, with higher winds to the northwest of Natal reaching 14 to 16 knots. Winds may be expected to range between 6 and 17 knots offshore of

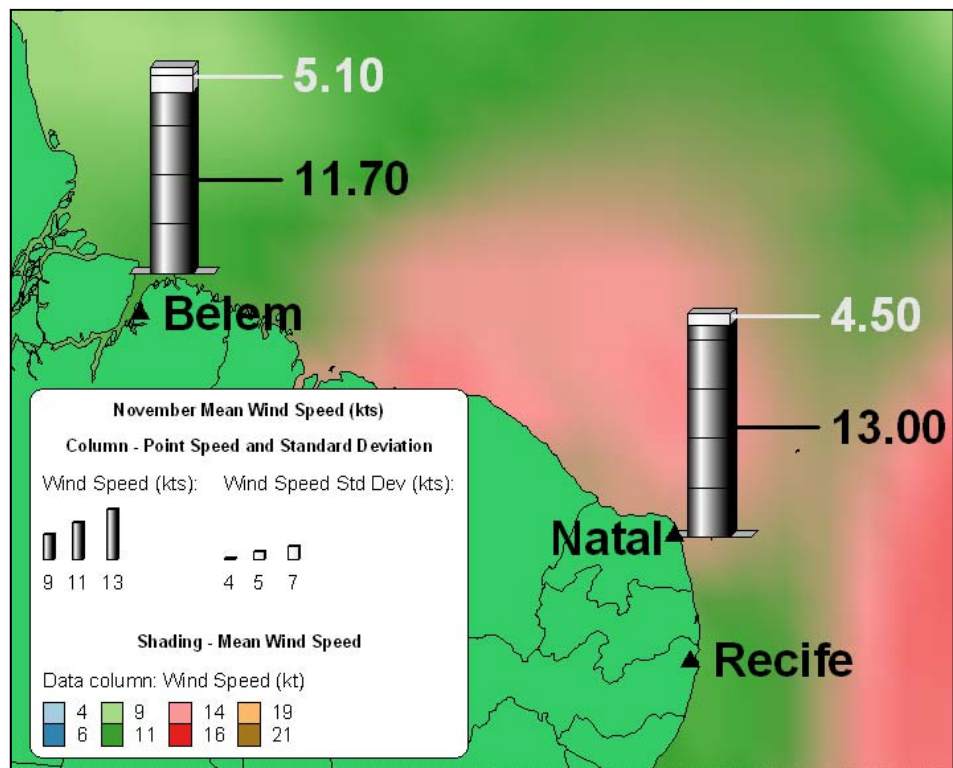


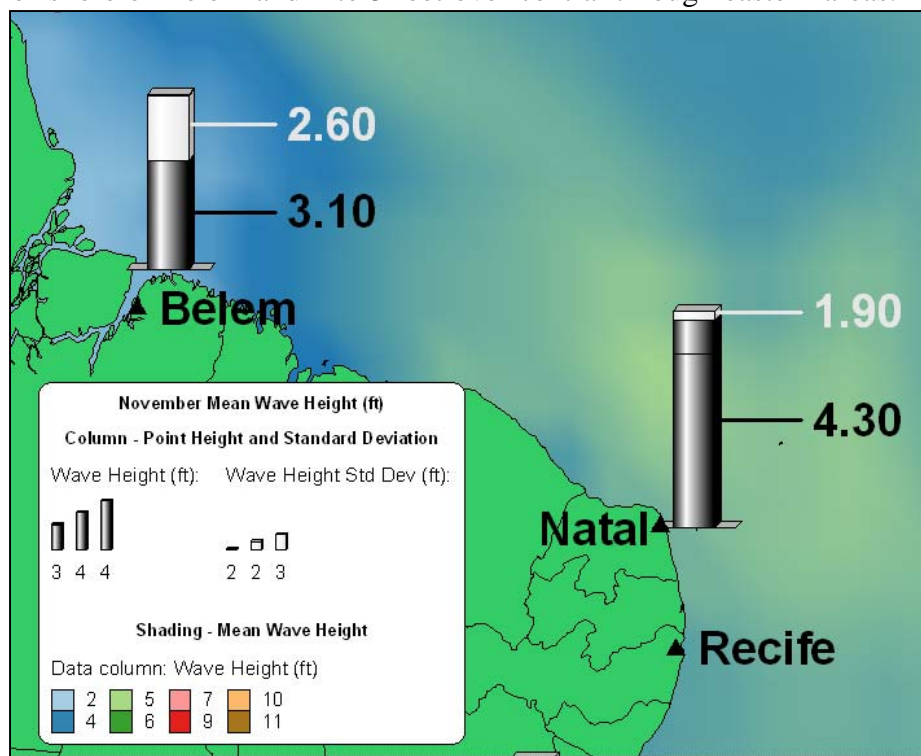
Figure 5: Region 1 November Wind Speed

Belem, 10 to 20 knots in the central portion of the region, and 8 to 18 knots near Natal in November.

Wind gusts associated with thunderstorms in the region may be quite high. Atmospheric conditions in the area of Belem tend to be more unstable due to its higher air temperatures, increased moisture and higher sea surface temperatures. On average, Belem experiences over twenty-five thunderstorms per month from December through March, whereas Natal experiences less than one per month during the same period. Wind gusts over the northern portions of the region may reach over 50 knots, while southern portions may only experience gusts in the low 20's.

3.1.2.2 November Seas

Waves over the region during November are predominately from the east, averaging 3 to 4 feet offshore of Belem and 4 to 5 feet over central through eastern areas. Wave heights in eastern parts



of the region are more uniform, varying on average between 2 to 6 feet, while waves over northern portions of the region are highly variable, averaging between 1 to 6 feet. This increased variability in wave height is due to the higher frequency of thunderstorms experienced in the northern portions of the region. Waves may quickly reach 6 to 9 feet during severe thunderstorms in the area.

Figure 6: Region 1 November Wave Height

3.1.2.3 January Winds

By January the ITCZ has moved south to just north of the mouth of the Amazon River. Over the central portion of the South Atlantic, the semi-permanent high-pressure cell begins to weaken and retreat to the south. Interaction between the ITCZ and the high-pressure cell lessens, slightly decreasing wind speeds over southern portions of the region to an average of 11 to 12 knots. Over northern portions of the region, mean wind speeds maintain at near 11 knots.

Gusty conditions increase over the region as thunderstorm activity becomes more prevalent due to unstable conditions produced by higher temperatures and moisture associated with the onset of the southern hemisphere summer. Gusts as high as 44 knots have been recorded at Belem and 34 knots at Natal in January.

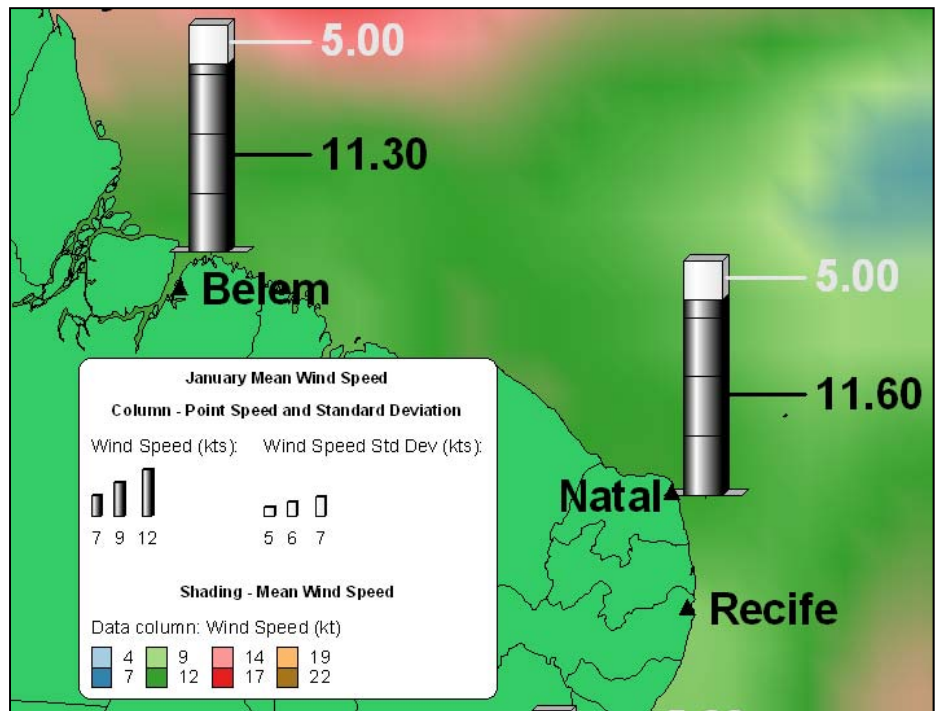


Figure 7: Region 1 January Wind Speed

3.1.2.4 January Seas

Mean wave heights over the northern portion of the region near Belem, have increase to 4 to 5 feet by January, with the strengthening of easterly trade winds as the ITCZ moves into the area. Wave height variability remains high due to gusty conditions produced by thunderstorm activity. Wave heights may be expected to range between 2 to 7 feet in January in northern areas. To the south near Natal, wave heights have lowered due to the decrease in wind speeds in this area caused by the weakening and southward retreat of the South Atlantic's semi-permanent high-pressure cell. Mean waves heights have reduced to 3 to 4 feet by January, and may be expected to range between 2 feet to nearly 6 feet. Higher wave are possible in thunderstorm conditions, with waves as high as 8 to 10 feet likely.

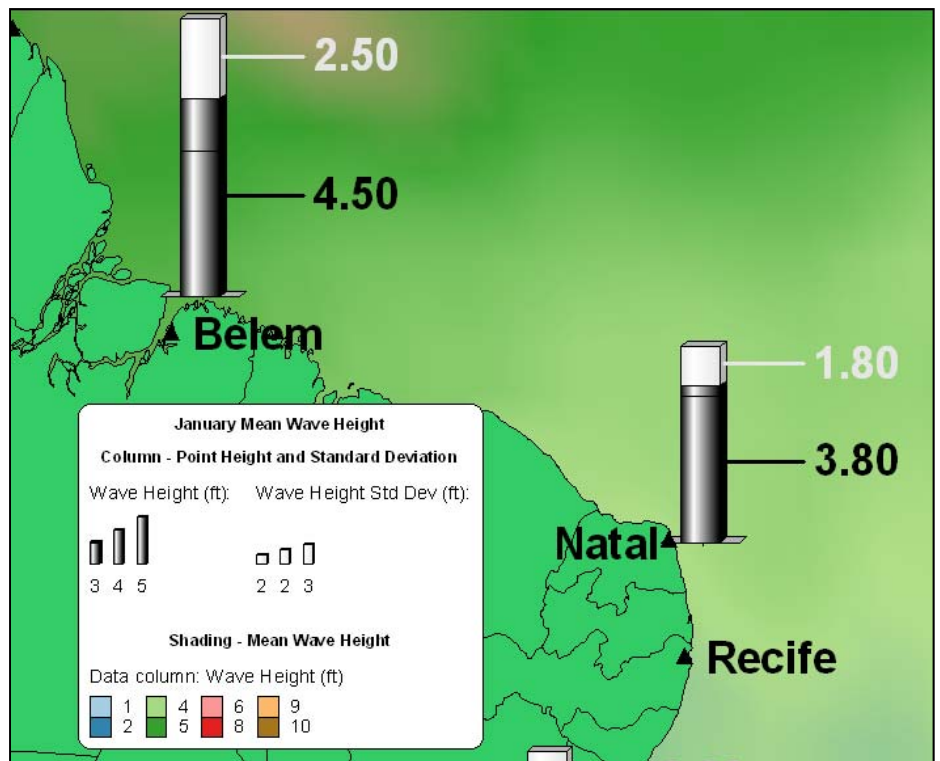
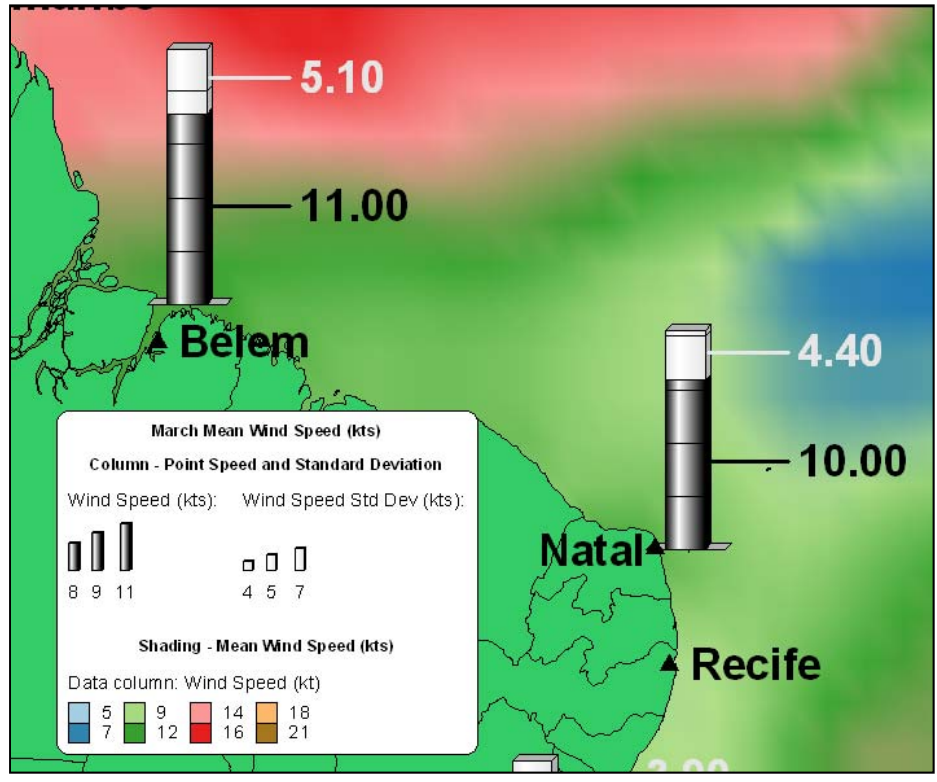


Figure 8: Region 1 January Wave Height

3.1.2.5 March Winds

By March the ITCZ has reached its southern most extent, lying over São Luis do Maranhão, to the south of Belem. Winds over the region are predominately northeasterly to easterly, however they occasionally tend east-southeast to southeast with oscillations in the ITCZ.



Winds to the north, closer to the axis of the ITCZ and the heavier precipitation, are higher however, averaging 14 to 16 knots.

Wind gusts increase in March in the northern portion of the region as more thunderstorm activity associated with the ITCZ is experienced. Wind gusts of 54 knots have been recorded at

Figure 9: Region 1 March Wind Speed

Belem. To the south, near Natal, maximum wind gusts maintain in the low to mid 30's, with 34 knot gusts having been recorded in the area.

3.1.2.6 March Seas

Wave heights over northern parts of the region increase slightly with the enhancement of the ITCZ in the area. Wave heights average about 5 feet near shore and 6 to 7 feet offshore in March. As in January, wave heights may vary by about 2 to 3 feet in the area due to storm activity over the region. Waves may be expected to range from 2 to 7 feet near shore, and 8 to 9 feet offshore in January. Over southern parts of the region, wave heights are marginally lower due to the southward movement

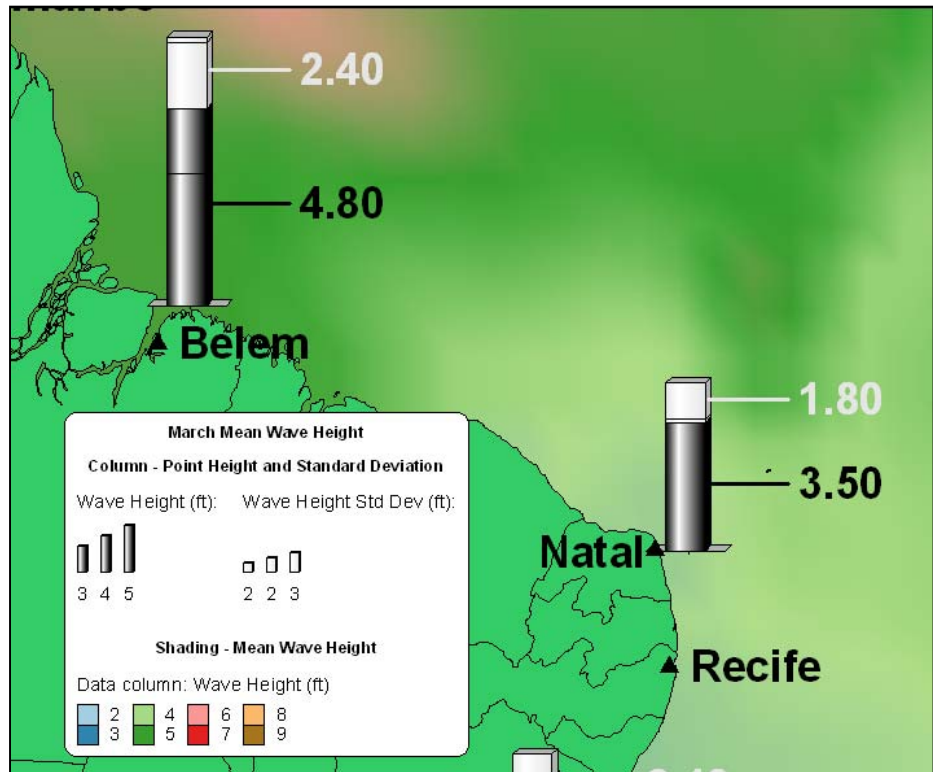


Figure 10: Region 1 March Wave Height

of the semi-permanent high-pressure cell over the South Atlantic and the weakening of the trades. Wave heights near shore at Natal average 3 to 4 feet in March. Wave height variability remains lower than to the north, with waves expected to range from 1 to 5 feet. Higher waves in thunderstorms may be expected to reach 9 to 12 feet.

3.2 Region 2 – Natal to Rio de Janeiro

This region comprises the area from Natal, Brazil southward to Rio de Janeiro, Brazil. The region extends from about 6° to about 23° south, placing this region entirely within a tropical climatic regime.

3.2.1 General Weather Discussion

Although entirely within the tropics, there are two distinct climate regimes along the coast due to the seasonal movement of the ITCZ and the semi-permanent high-pressure cell over the South Atlantic Ocean. From November through March, the ITCZ moves southward into northern Brazil, reaching its southernmost latitude by March. During this time, the South Atlantic high weakens and moves south and eastward towards the coast of Africa. This situation generates a low-pressure trough along the northeast coast of Brazil from March through September. This low-pressure trough causes increased rainfall in the northern sections of Region 2. Monthly rainfall amounts average 5 to 12 inches over Recife and Salvador during this period. Outside of these months, this area is relatively dry, with monthly rainfall amounts of less than 4 to 5 inches typical. With the onset of the hemisphere's winter, the ITCZ moves northward, followed by the South Atlantic High,

which strengthens as it moves north. This causes the trough of low pressure along the coast to dissipate and be replaced by high pressure in September. This high pressure over the area causes the “dry” period in the northern parts of Region 2 from September through February.

In the southern parts of the region however, the maximum rainfall amounts tend to be earlier in the season, from October through January at Vitoria and from November through April at Rio de Janeiro. This section of the coast is not as strongly influenced by the ITCZ and is mainly affected by the South Atlantic High. As the high-pressure moves south and eastward during the summer, conditions become more conducive for rainfall along this section of the coast.

Temperatures in the region are fairly uniform, with mean daily temperatures averaging in the upper 70’s to lower 80’s F from November through April and low to mid 70’s F for the remainder of the year. Daytime highs may reach the lower 90’s F on average, and extreme high temperatures in the upper 90’s to lower 100’s F have been experienced over mid to northern areas of the region, and up to 111° F in Rio de Janeiro. These high temperatures, combined with relative humidity that reaches 60% to 70% in the afternoon may produce dangerous heat indices that can cause sunstroke, heat exhaustion, heat cramps and possibly heat stroke.

Winds are predominately from the northeast to east throughout the year and average less than 11 knots near shore during the period. Winds become southerly from March through September along northern coasts of Region 2 with the establishment of the low-pressure trough in this area however.

3.2.2 November through March Weather

3.2.2.1 November Winds

November marks the transition into the hemisphere’s summer season. The South Atlantic High pressure cell is the main feature affecting weather and winds in Region 2 in November. Winds are predominately northeast to easterly throughout the region and average 8 to 11 knots near the coast, but increase to 14 to 16 knots offshore. Winds near Rio de Janeiro are the lowest in the region, due to its more sheltered location from the northeast to easterly wind flow. Winds may be

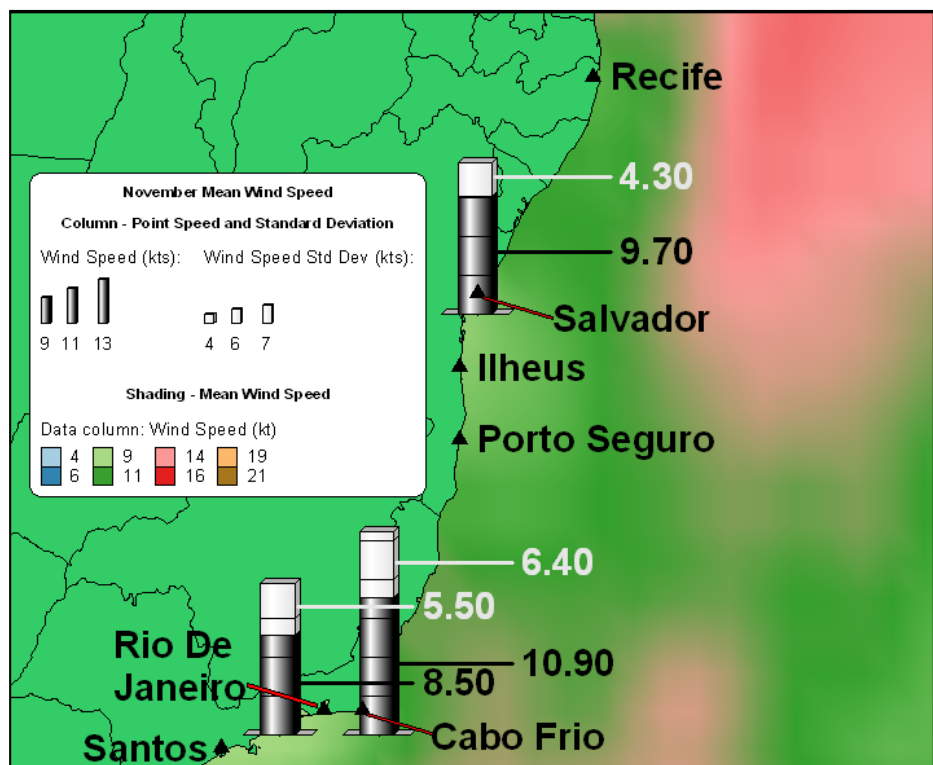


Figure 11: Region 2 November Wind Speed

highly variable during the month, and can be expected to range between 3 to 17 knots near shore, with the higher winds associated with rain that occurs in the region between 14 and 18 days per month in November. Gusts have been reported in the area as high as 28 knots over Salvador and 33 knots over Rio de Janeiro. Offshore winds may be expected to range between 10 and 22 knots.

3.2.2.2 November Seas

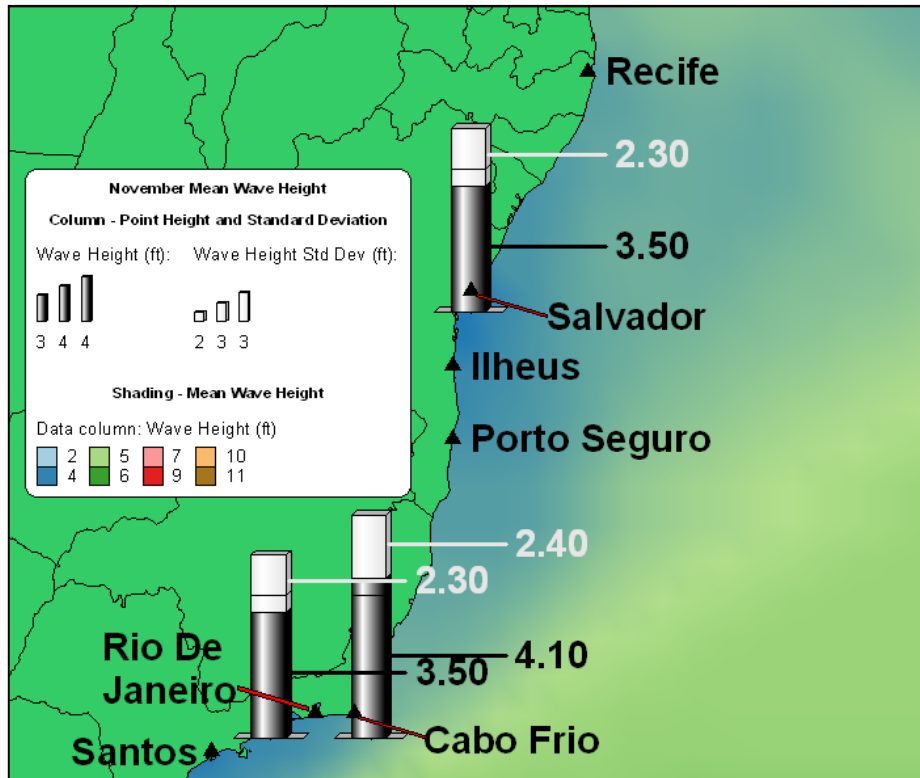


Figure 12: Region 2 November Wave Height

Wave heights over the region in November are low due to little influence from the ITCZ and weak high pressure over the area. Mean wave height averages between 3 to 4 feet near shore, and increase to 5 to 6 feet offshore. Wave height may vary between 2 and 3 feet from the means during the period however due to increased winds associated with rainstorms and thunderstorms. Waves may be expected to range between 1 and 6 feet near shore, and 3 to 8 feet offshore. Waves may reach 8 to 10 feet offshore in thunderstorms.

3.2.2.3 January Winds

By January the South Atlantic High has weakened and moved to the south and east towards Africa. This weakening and movement of the high-pressure cell slightly lowers overall mean wind speeds across the area. Mean wind speeds average 7 to 9 knots over the area close inshore and 9 to 12 knots offshore over a majority of the area, with a region of 14 to 16 knots offshore of Salvador and Recife. Winds south of Rio de Janeiro are lower, averaging 7 knots, due to its sheltered location from the northeast to easterly winds. Increased unstable conditions due to surface heating and the influx of warm, moist tropical air however, cause wind speed variability to be higher in January. Winds may vary by 5 to 6 knots from the means over the region, with wind speeds ranging from 2 to 16 knots during the period near shore, and 5 to 22 knots offshore.

Wind gusts associated with thunderstorms due to the increased unstable conditions may be quite high during January. Wind gusts as high as 63 knots have been recorded over Rio de Janeiro and 33 knots over Salvador. Thunderstorms occur on average of 10 days per month at Rio and 1 day per month at Salvador in January.

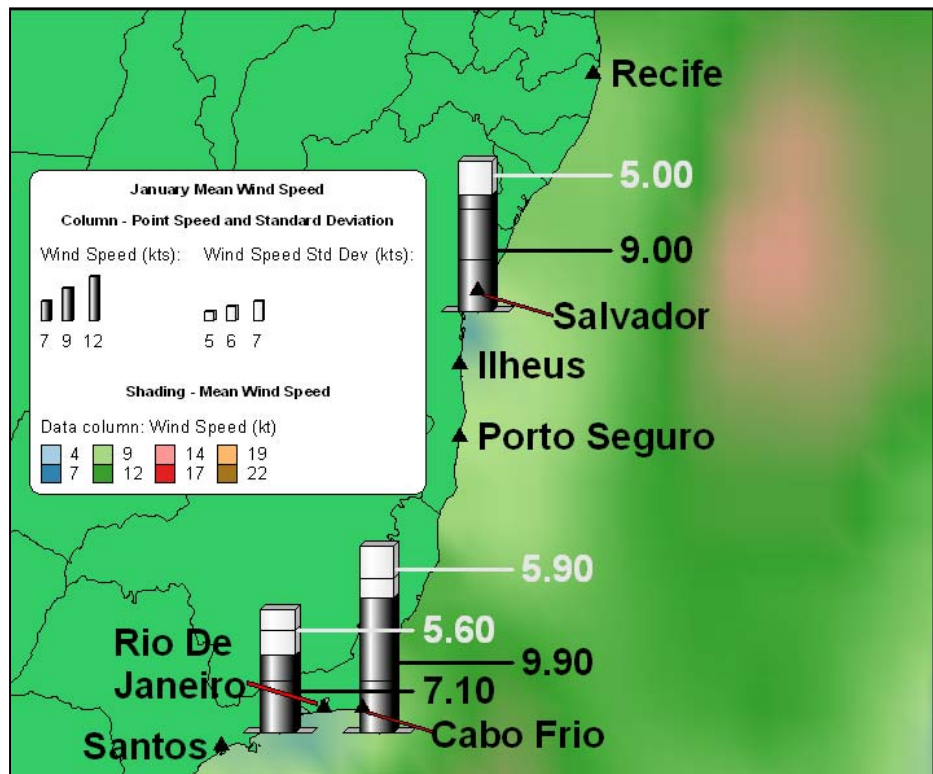


Figure 13: Region 2 January Wind Speed

3.2.2.4 January Seas

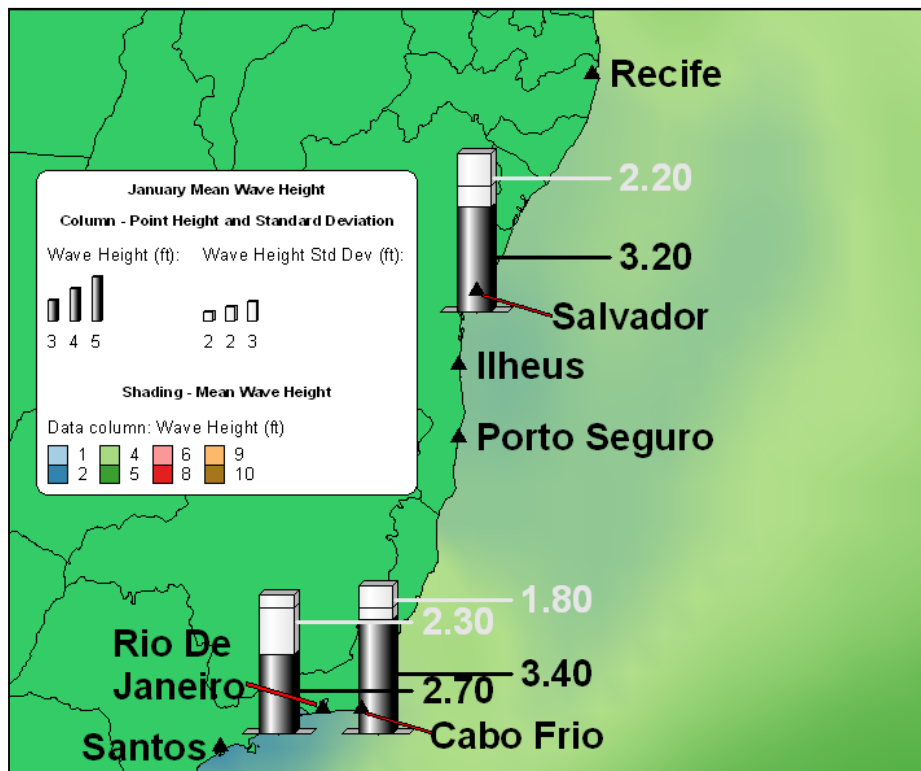


Figure 14: Region 2 January Wave Height

With the reduction in mean wind speeds over the area, there is also a slight reduction in mean wave heights. Mean wave heights average about 2 to 4 feet near shore in January, and build to 4 to 5 feet offshore. Wave height viability does not change appreciably from November, with waves varying by about 2 feet from the means across the region. Waves may be expected to range between 1 to about 6 feet near shore, and 2 to 7 feet offshore in January.

Waves may build as high as 8 to 10 feet in thunderstorms in offshore areas during this period.

3.2.2.5 March Winds

By March the South Atlantic High has reached its weakest intensity and its furthest southeastern location near the African coast. Overall wind speeds over Region 2 have decreased. Mean wind speeds inshore now range from 7 to 9 knots, with areas south of Salvador ranging between 5 and 7 knots. The 14 to 16 knot area of high winds east of Salvador in January has decreased in extent and wind speeds off the coast range, for the most part, between 9 and 12 knots. Winds continue to remain highly variable over southern areas of the region, near Rio de Janeiro and Cabo Frio, and may vary by 5 to 6 knots from the means.

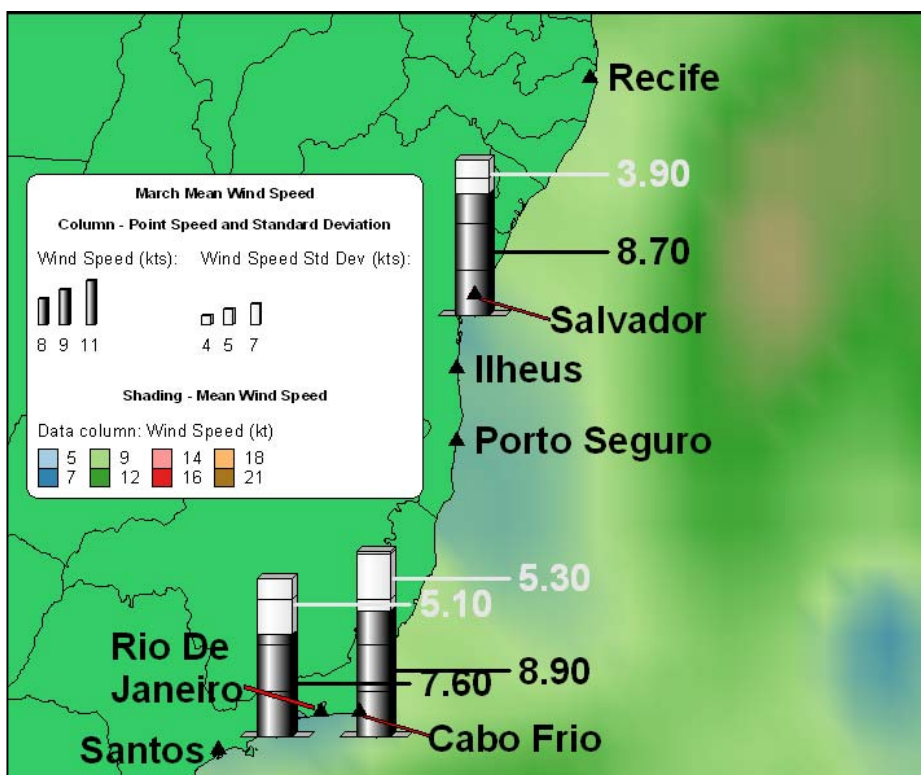


Figure 15: Region 2 March Wind Speed

Winds may be expected to range from 2 to 14 knots in this area. To the north near Salvador winds may be expected to range from 5 to 12 knots. Gusty conditions may continue to be experienced in the region, however maximum gusts have decreased. Wind gusts as high as 46 knots have been recorded in March at Rio de Janeiro and 26 knots at Salvador in March. Thunderstorm activity has decreased to 7 days per month at Rio and maintains at 1 day per month at Salvador in March.

3.2.2.6 March Seas

With the reduction of overall wind speeds across the area, comes an associated reduction in overall wave heights. In March mean wave heights average 4 to 5 feet across the region, with a large expanse of lower seas, with wave heights averaging 2 to 3 feet, south and just east of Salvador along the coast. Wave height variability also decreased during the month of January, with waves only varying by about 2 feet from the mean. Waves may be expected to range between 1 to 6 feet near shore off of Salvador, Cabo Frio and Rio de Janeiro. Further offshore, wave may be expected range between 2 to 7 feet. Waves associated with offshore thunderstorms may be expected to increase to 7 to 10 feet in March.

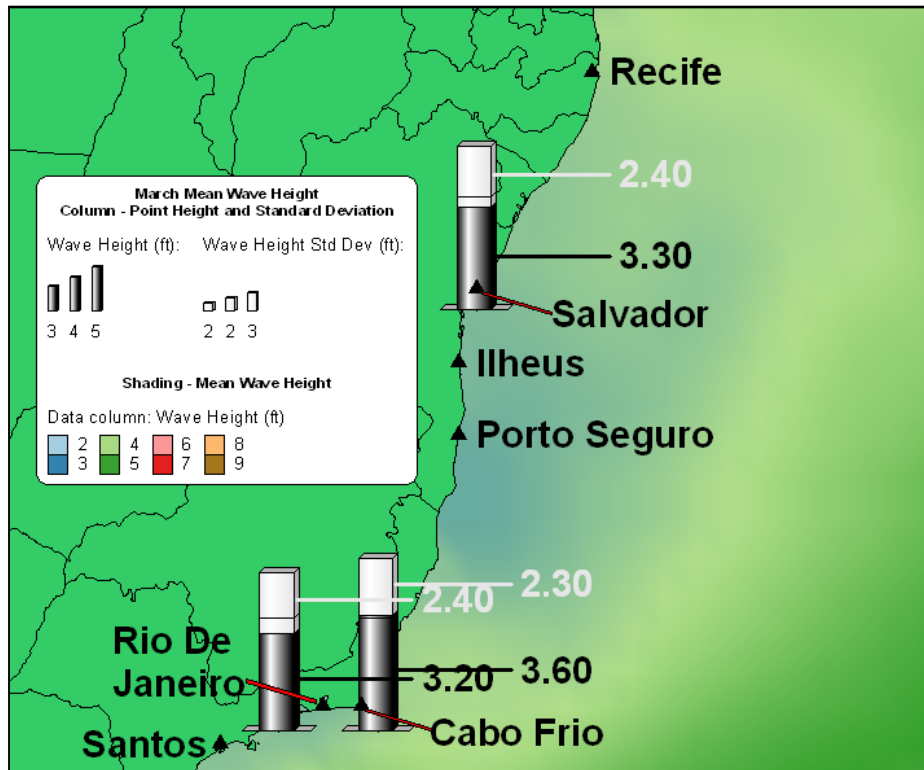


Figure 16: Region 2 March Wave Height

3.3 Region 3 – Rio de Janeiro to Buenos Aires

This region comprises the area from Rio de Janeiro, Brazil, to Buenos Aires, Argentina. The region extends from about 23° to about 35° south, placing this region entirely within what is classified as a sub-tropical environment.

3.3.1 General Weather Discussion

This section of the coast of South America lies in a climatic region known as a humid sub-tropical environment. The region is far enough south to not be affected by the ITCZ. The principal element that determines the climate of the region is the movement of the South Atlantic High Pressure cell. From April through October, the Southern Hemisphere winter, the high pressure-cell is located over the northern regions of the South Atlantic and at its strongest intensity. High pressure builds over Region 3, bringing easterly to northeasterly wind flow and reducing the amount of rainfall in the region. From November through March, the Southern Hemisphere summer, however, the high-pressure cell weakens and moves southeast towards the coast of Africa. This weakening and movement of the cell allows warm tropical air to move southward along the east coast of South America into the region, bringing moisture, higher temperatures and rainy conditions to the area. Monthly rainfall amounts average 3 to 5 inches over the region during the period. Thunderstorms are also frequently experienced in the region during the summer period. The area between Rio de Janeiro and Montevideo experiences about 35 days of thunderstorms per year, most of which occur during the summer months. Near the mouth of the Rio de la Plata thunderstorms occur on about 50 days per year, and average from 6 to 8 per month during the summer months.

Temperatures in the region are fairly moderate throughout the summer period, with daily temperatures averaging in the upper 70's to low 80's F. Daily high temperatures average in the mid 80's F at Porto Alegre and the upper 60's to low 70's at Buenos Aires. Daily low temperatures average in the upper 60's to lower 70's F at Porto Alegre and upper 50's to lower 60's F at Buenos Aires. Relative humidity is also quite comfortable in the region, with afternoon relative humidities only in the low to upper 50%.

Winds are predominately from the northeast to east throughout the year and average less than 10 knots near shore during the period. Winds however may be quite gusty. Along the Brazilian coast during the wet season from December through June, sudden local storms may blow from the southwest. These storms are known as Reboynos and can last 3 to 4 days with winds reaching gale force.

The most significant weather feature of the region occurs in the Rio de la Plata area. A feature similar to a squall line in the Northern Hemisphere, known as a Pampero, often accompanies a cold frontal passage, bringing strong west to south winds. Shortly before its arrival calm winds may prevail and there is often a roll of cumulus clouds to the southwest, followed by heavy cumulonimbus clouds that gradually cover the entire sky. As the clouds move in, a violent wind squall, with winds to 70 knots, forms from the west to south, followed by torrential rainfall and often thunder and lightning. These storms usually only last less than two hours. While the majority of the storm's effects are experienced inland, the effects may be felt 400 miles offshore. These storms typically form during the winter in the region, however summer Pamperos may develop. The summer Pamperos are shorter in duration, however their onset is much more sudden and just as violent as the winter storms.

3.3.2 November through March Weather

3.3.2.1 November Winds

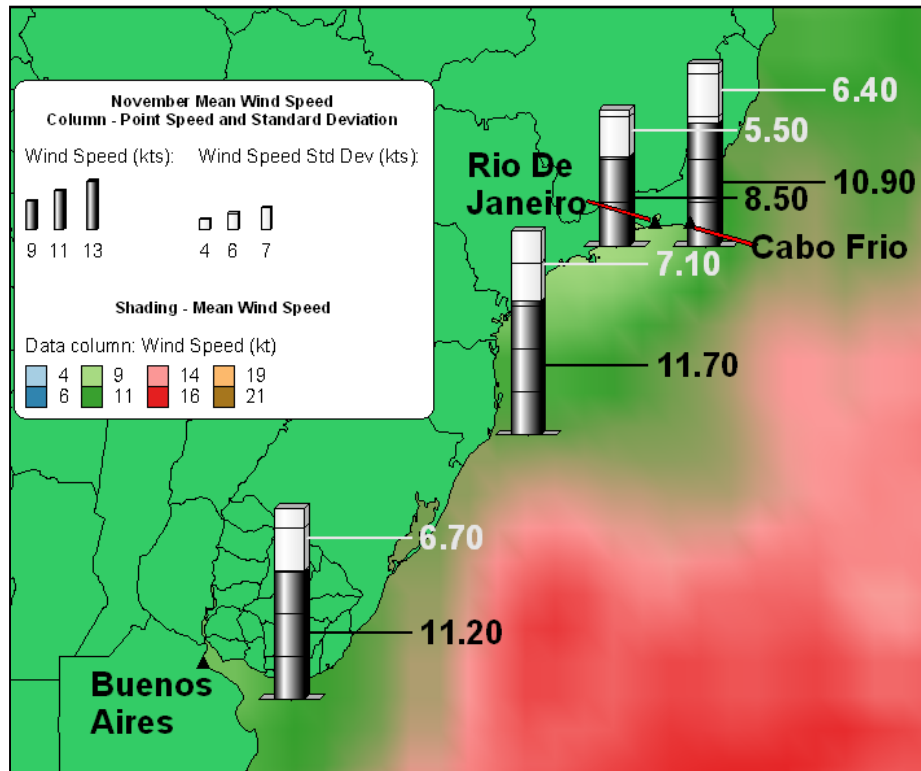


Figure 17: Region 3 November Wind Speed

This region is the southern most region in this climate study, and is unlike Region 1 and 2 in that it lies within a sub-tropical climate regime, rather than a tropical climate region like Regions 1 and 2. As such, the region is not influenced by the ITCZ, but is mainly affected by the South Atlantic High Pressure Cell. During the month of November the high pressure cell is at its furthest northern location and at its strongest intensity. Winds over the region reflect this situation, with mean winds out of the northeast to east with speeds

averaging 14 to 16 knots offshore. In areas of the region that are sheltered from these northeasterly to easterly winds, wind speeds are lower. Near shore winds in the vicinity of Rio de Janeiro average 8 to 11 knots and winds in the mouth of the Rio de la Plata average about 11 knots. Wind speeds during November are highly variable due to surges in the high-pressure cell and thunderstorm activity, which averages 5 days per month at Rio de Janeiro and Buenos Aires. Wind speeds may vary by 5 to 7 knots from the means over the region, with winds expected to range from 3 to 14 knots near Rio de Janeiro and 5 to 18 knots in the Rio de la Plata. Gusts in the region may be very high, especially in the vicinity of the Rio de la Plata. Wind gusts of 33 knots have been recorded at Rio de Janeiro and 61 knots at Buenos Aires. Higher winds speeds in the Rio de la Plata, near Buenos Aires, are associated with the Pamperos that occur in this area (see general weather for this region, above).

3.3.2.2 November Seas

Due to topographic sheltering from the higher northeasterly winds offshore, wave heights over the region are consistently low close near shore than offshore in November. Near shore mean wave height averages 2 to 4 feet in the vicinity of Rio de Janeiro, southward over the Baía de Paranaguá and south of Uruguay, into the Rio de la Plata. Close offshore; waves build to 5 to 6 feet. Wave heights over the region may be expected to vary by about 2 to 3 feet from the means, with waves near shore expected to range between flat-calm to 7 feet and close offshore 3 to 9 feet. During severe thunderstorm over the area and Pamperos events over the Rio de la Plata, waves may be expected to build to 9 to 12 feet.

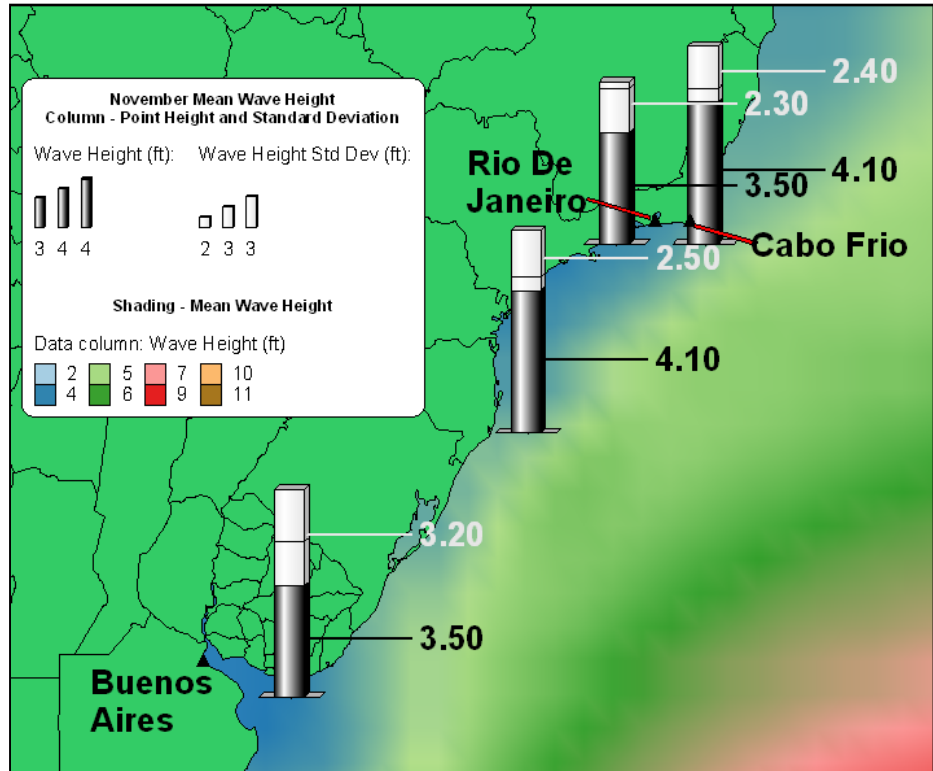


Figure 18: Region 3 November Wave Height

3.3.2.3 January Winds

Winds decrease over the region in January as the South Atlantic High Pressure Cell continues moving to the south and weakens over the South Atlantic. Overall mean wind speed averages 10 to 15 knots over the region in January. As the

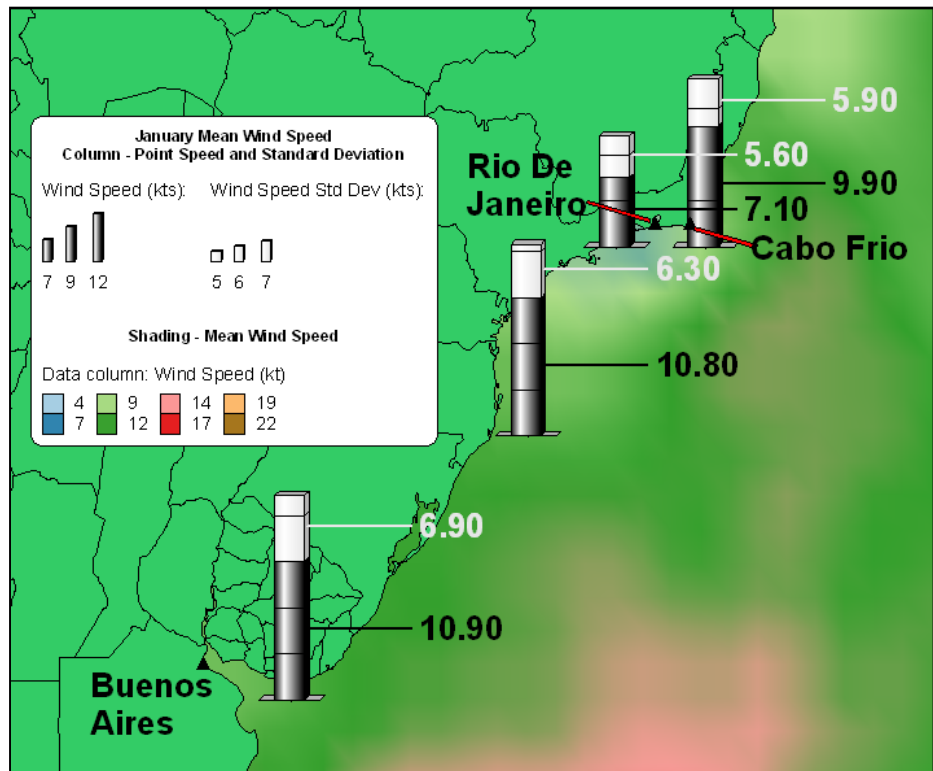


Figure 19: Region 3 January Wind Speed

high-pressure cell moves south however, wind direction becomes more easterly in the area, causing the wind shadow effect on the southern exposures of the coast to be greatly reduced. A small area of low winds, averaging 4 to 7 knots, maintains south of Rio de Janeiro, however all other areas that had been sheltered in November are now exposed to the higher winds. Winds near shore along the coast increase to 9 to 12 knots in January. The area of higher wind speeds that were off the coast in November has diminished and is prevalent only over southern areas of the region where wind speeds average 14 to 16 knots. Wind speeds remain highly variable and may vary by 5 to 7 knots from the means. Winds near shore Rio de Janeiro may range from 2 to nearly 13 knots, winds near the exposed areas of Cabo Frio may range between 4 and 16 knots, and winds over the mouth of the Rio de la Plata may range from 4 to 18 knots. Offshore winds in the region may reach 20 to 24 knots during this period. Maximum gusts over the area continue to remain high due to surges in the high-pressure cell and thunderstorms that may be experienced on average 10 days per month at Rio de Janeiro and 6 days per month at Buenos Aires. Wind gusts as high as 63 knots have been experienced at Rio de Janeiro and Buenos Aires during this month.

3.3.2.4 January Seas

Wave heights in January lower across the region with the associated reduction of wind speeds in the area. Mean wave heights average 4 to 5 feet across the area. Near shore, waves have built due to the increased exposure to offshore winds however. Waves near Cabo Frio and at the mouth of the Rio de la Plata average 3 to 4 feet. The only area that remains semi-sheltered is to the south of Rio de Janeiro where wave heights average less than 3 feet. An area of higher waves is located offshore eastward of the Rio de la Plata, with wave heights averaging 6 to 8 feet. Wave height variability ranges from about 2 to 3 feet from the means. Waves may be expected to range from about 2 to 5 feet near Cabo Frio, 1 to 6 feet at the Rio de la Plata, flat-calm to 5 feet near Rio de Janeiro and 4 to 11 feet offshore. Wave heights to 12 feet offshore and at the Rio de la Plata may be experienced during severe thunderstorm events in the area.

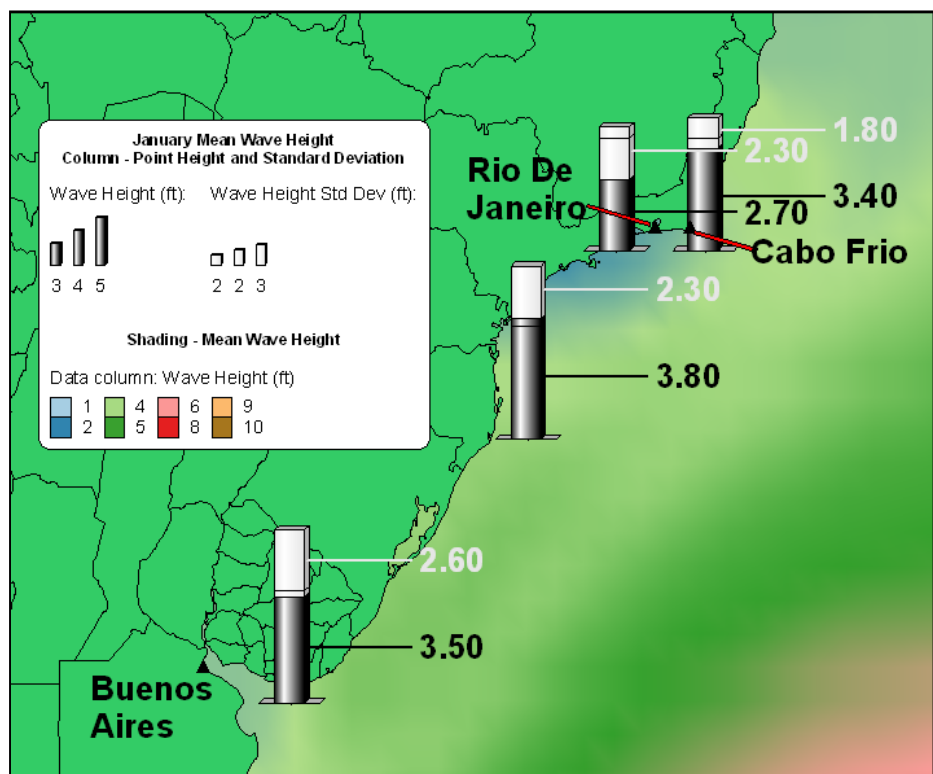
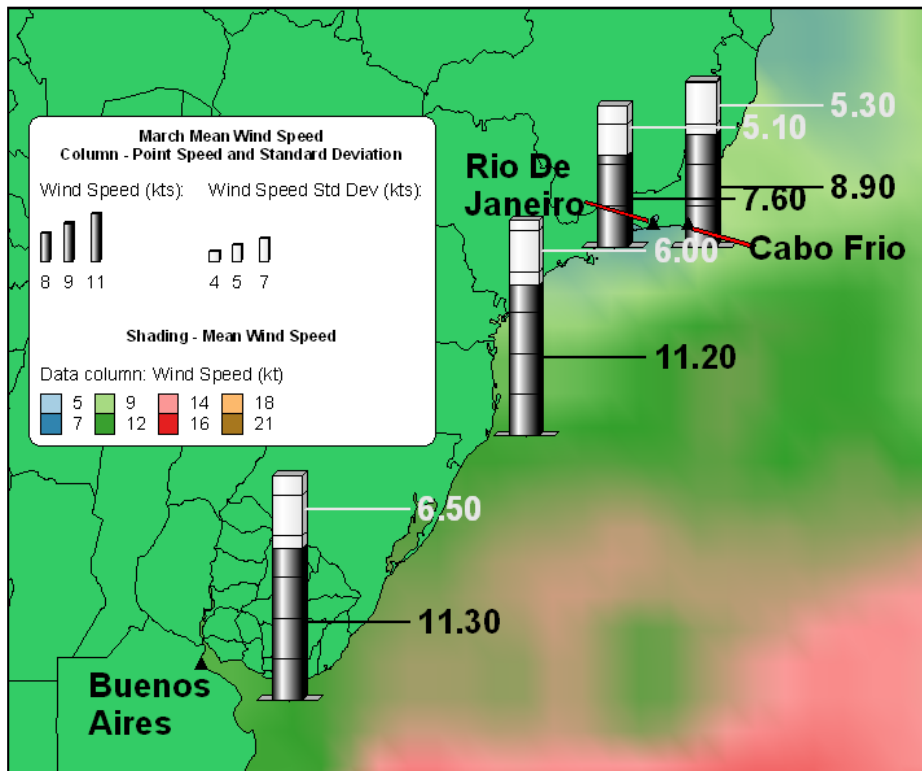


Figure 20: Region 3 January Wave Height

3.3.2.5 March Winds



Winds in March have not appreciably increased from those experienced in January over coastal areas of the region. Winds maintain at about 8 to 11 knots near the coast, with the lower winds in close coastal areas that are sheltered from the predominately northeast to easterly winds. Offshore however winds average 10 to 15 knots through most of the southern areas, lowering to 9 to 12 knots over northern offshore areas. Winds at Cabo Frio average about 9 knots, in the mouth of the Rio de la Plata 11 knots and along the southern side of Rio

Figure 21: Region 3 March Wind Speed

de Janeiro in sheltered waters 7 to 8 knots. As in January, wind speed variability remains at 5 to 7 knots from the means through the region. Winds may be expected to range from 5 to 22 knots offshore, 4 to 14 knots near Cabo Frio and 5 to 18 knots at Buenos Aires. At Rio de Janeiro winds may expected to be calm to 13 knots.

Gales associated with thunderstorms over the area may be quite high, with gusts as high as 63 knots having been recorded at Rio de Janeiro in March. As the season ends in these southerly regions, the chance of experiencing a Pamperos storm becomes more likely. These storms can be extremely violent, and wind gusts up to 88 knots have been experienced at Buenos Aires during this month.

3.3.2.6 March Seas

Waves heights along coastal regions in March are very similar to heights experienced in January. Offshore wave heights however increase in March, averaging 12 to 16 feet over a majority of these areas during the month as the expanse of higher winds offshore has increased. Higher waves are to be expected in southerly areas of the region. Waves close inshore average 3 to 4 feet, with lower wave heights found south of Rio de Janeiro where the area is sheltered form the northeast to easterly winds. On average, wave height may be expected to vary by 2 to 3 feet from the means in March, with offshore waves expected to be 9 to 19 feet over the area, and near shore waves 1 to 6 feet in the vicinity of Cabo Frio and the mouth of the Rio de la Plata, and flat-calm to 6 feet south of Rio de Janeiro. Over the Rio de la Plata however, gusts associated with Pamperos storms may reach close to 90 knots, and seas can quickly become extremely rough.

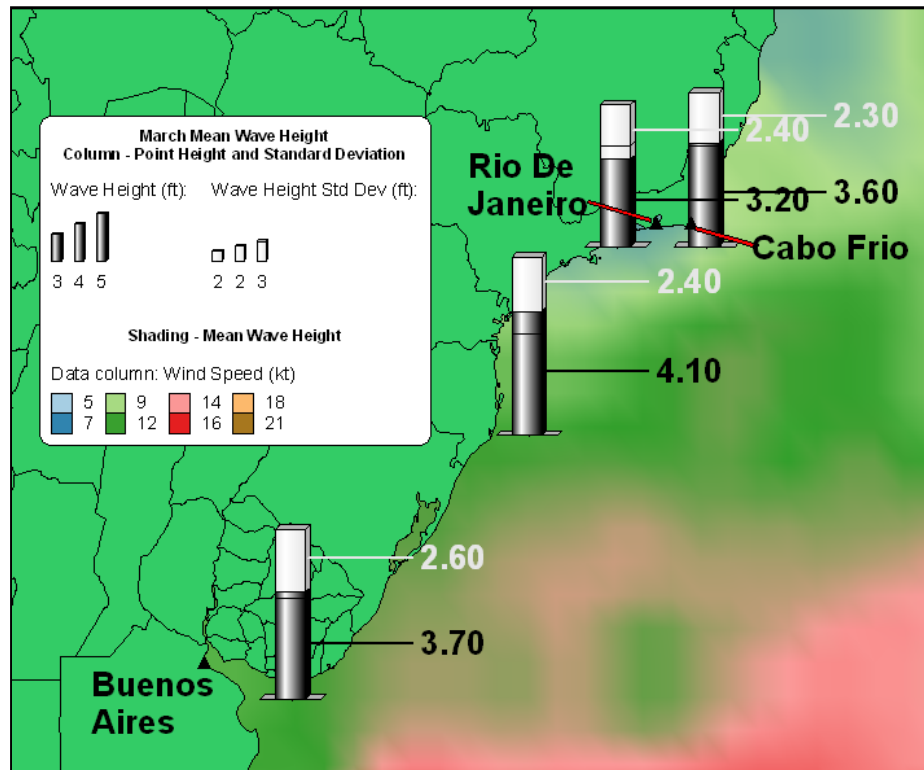


Figure 22: Region 3 Wave Heights

4. Conclusion

During the November through March period, weather over the region is predominately controlled by the movement of the ITCZ and the South Atlantic High Pressure cell. Over northern areas, especially near the Amazon Basin, cloud cover is extensive and trade winds are typically light, and seas low. The area however is prone to thunderstorms, especially during this period of the year. Torrential downpours of up to 10 inches of rainfall in a 24-hour period often accompany these storms. Additionally, high temperatures combined with high afternoon relative humidity can produce extreme heat indices that may create dangerous heat illnesses such as heat exhaustion and heat stroke.

To the south, from Natal to Recife, conditions are typically favorable for maritime operations. While this area is in the tropics, the region from Natal to Recife does not experience its heaviest rainfall until the March through September timeframe due to the interaction between the ITCZ and the South Atlantic High. The period from October through April is relatively dry in this area. Winds are typically light and seas low in this area during the period.

From Recife south to Rio de Janeiro, conditions are only moderately less favorable for maritime operations, primarily due to heavier rainfall and possible thunderstorm activity. Winds and seas overall remain light to moderate during the period in near shore areas. Conditions in exposed offshore areas of Rio de Janeiro and Cabo Frio however, do degrade by March, with heavier winds and seas building 9 to 12 feet in this area. The area inshore, just south of Rio de Janeiro however, is

typically sheltered from the predominately northeast to easterly winds and experiences much low sea conditions.

South of Rio de Janeiro conditions quickly become less favorable for operations, primarily due to higher winds experienced in these areas, and the associated higher seas. Wave heights in exposed areas just south of Rio de Janeiro may reach 11 feet by January and up to 19 feet in March. The most hazardous area in this region is the Rio de la Plata due to the occasional Pamperos storms that may affect this area early and late in the period. Gusty winds associated with these events may reach 90 knots and rough seas may build extremely quickly.

5. East Coast South America Marine Data Tables

Data Site Locations Map

Site	Latitude	Longitude
1: Offshore Belem	0.5 S	47.5 W
2: Offshore Natal	5.5 S	34.5 W
3: South of Natal	13.5 S	38.5 W
4: South of Cabo Frio	23.5 S	41.5 W
5: South of Rio de Janeiro	23.5 S	44.5 W
6: Rio de la Plata	35.5 S	55.5 W
7: Offshore Porto Alegre	28.5 S	47.5 W

Note: All sites are marine locations

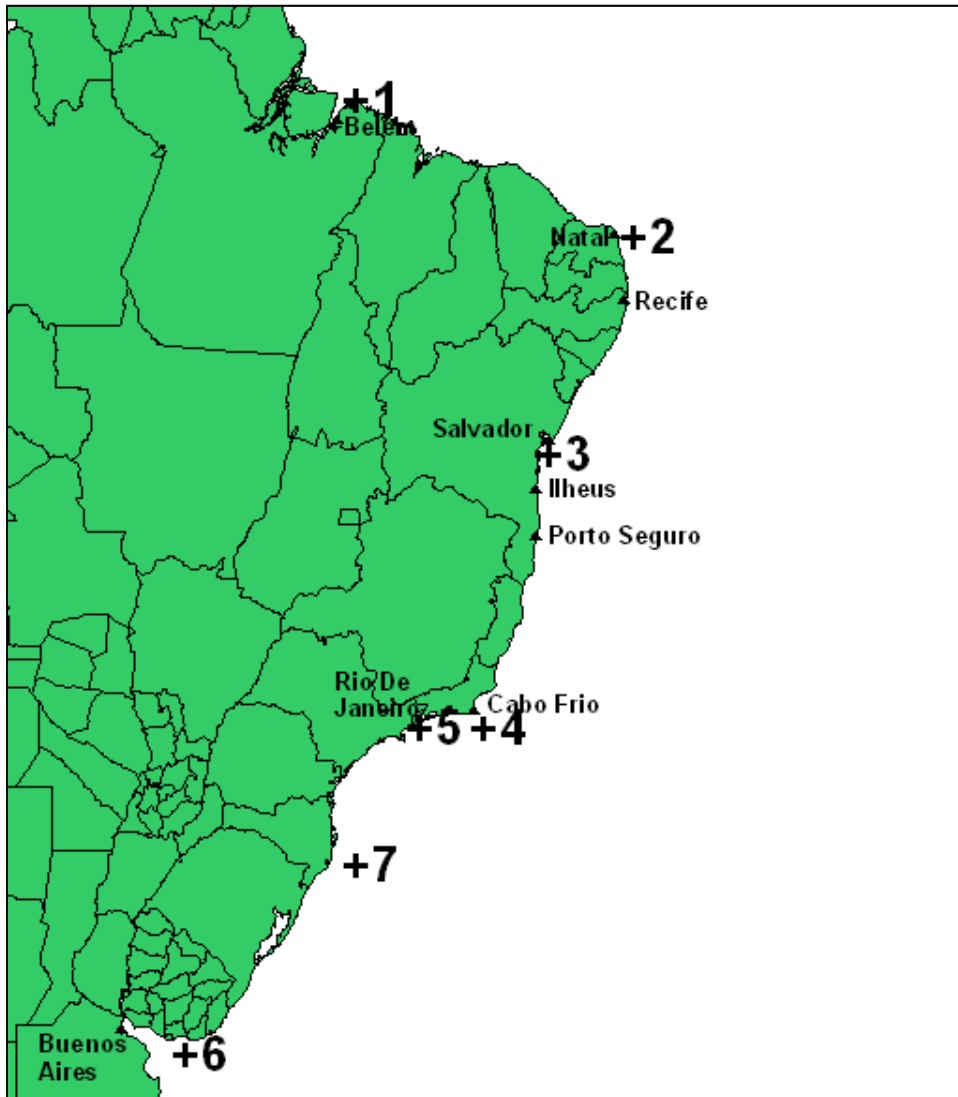


Figure 23: Data Site Location Map

Site 1: Offshore Belem; 0.5 S 47.5 W

	November	December	January	February	March
Wave Height (ft)	3.1	4.8	4.5	4.9	4.8
Wave Height (ft) Standard Deviation	2.6	2.6	2.5	2.6	2.4
Wind Speed (kts)	11.7	11	11.3	11.6	11
Wind Speed (kts) Standard Deviation	5.1	4.3	5	5.3	5.1
Sea Temperature (F)	81.6	83.1	80.7	80.4	82
Air Temperature (F)	81.8	80.7	80.4	80.1	79.2

Site 2: Offshore Natal; 5.5 S 34.5 W

	November	December	January	February	March
Wave Height (ft)	4.3	4.3	3.8	3.8	3.5
Wave Height (ft) Standard Deviation	1.9	1.8	1.8	1.9	1.8
Wind Speed (kts)	13	12.3	11.6	10.4	10
Wind Speed (kts) Standard Deviation	4.5	4.1	5	4.3	4.4
Sea Temperature (F)	79.7	79.1	80.8	81.5	82.2
Air Temperature (F)	79.8	80.5	80.7	81.4	81.7

Site 3: South of Natal; 13.5 S 38.5 W

	November	December	January	February	March
Wave Height (ft)	3.5	4.2	3.2	4.4	3.3
Wave Height (ft) Standard Deviation	2.3	2.3	2.2	2.3	2.4
Wind Speed (kts)	9.7	9.3	9	8.7	8.7
Wind Speed (kts) Standard Deviation	4.3	4.4	5	3.7	3.9
Sea Temperature (F)	78.2	78.6	79.9	80.5	81.2
Air Temperature (F)	78.6	79.5	80.3	80.8	80.9

Site 4: South of Cabo Frio; 23.5 S 41.5 W

	November	December	January	February	March
Wave Height (ft)	4.1	4.1	3.4	3.5	3.6
Wave Height (ft) Standard Deviation	2.4	2.2	1.8	2.2	2.3
Wind Speed (kts)	10.9	10.3	9.9	9.5	8.9
Wind Speed (kts) Standard Deviation	6.4	6	5.9	5.5	5.3
Sea Temperature (F)	72.4	75.2	74.6	75.6	76.6
Air Temperature (F)	73.4	75.1	76.1	77	77.6

Site 5: South of Rio de Janeiro; 23.5 S 44.5 W

	November	December	January	February	March
Wave Height (ft)	3.5	4	2.7	4.2	3.2
Wave Height (ft) Standard Deviation	2.3	2.4	2.3	2.4	2.4
Wind Speed (kts)	8.5	8	7.1	7	7.6
Wind Speed (kts) Standard Deviation	5.5	5.5	5.6	4.9	5.1
Sea Temperature (F)	71.4	74.6	76.6	77.3	77.2
Air Temperature (F)	72.4	74.4	77.4	77.8	77.5

Site 6: Rio de la Plata; 35.5 S 55.5 W

	November	December	January	February	March
Wave Height (ft)	3.5	4.7	3.5	3.7	3.7
Wave Height (ft) Standard Deviation	3.2	2.5	2.6	2.6	2.6
Wind Speed (kts)	11.2	10.9	10.9	10.7	11.3
Wind Speed (kts) Standard Deviation	6.7	6.6	6.9	6.2	6.5
Sea Temperature (F)	62.6	67.4	70.3	71.2	70.3
Air Temperature (F)	63.1	67.6	70.6	71.3	69.8

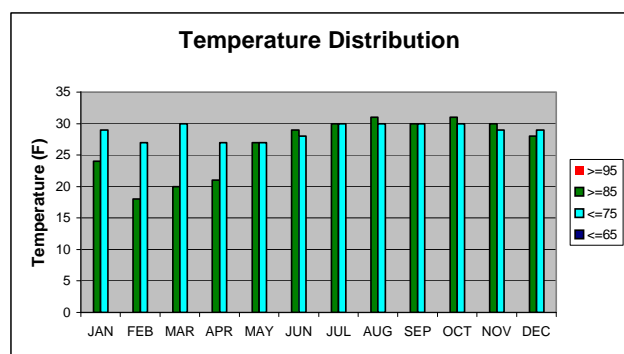
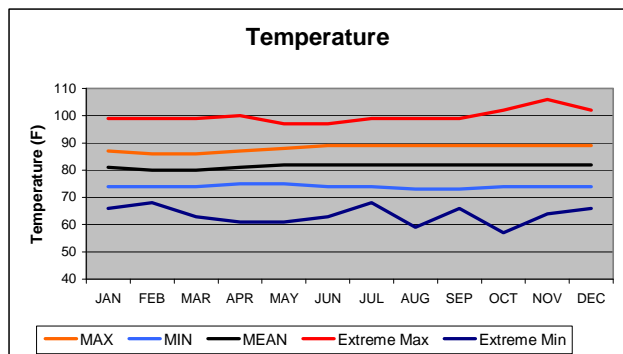
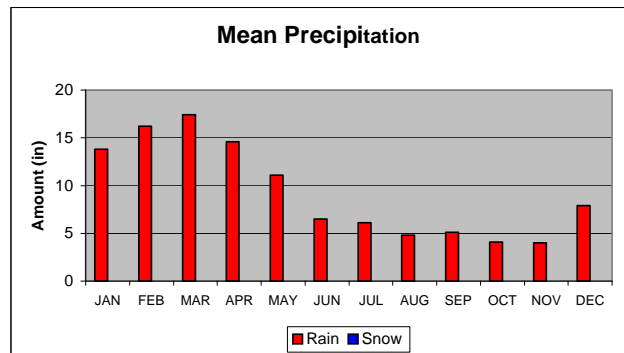
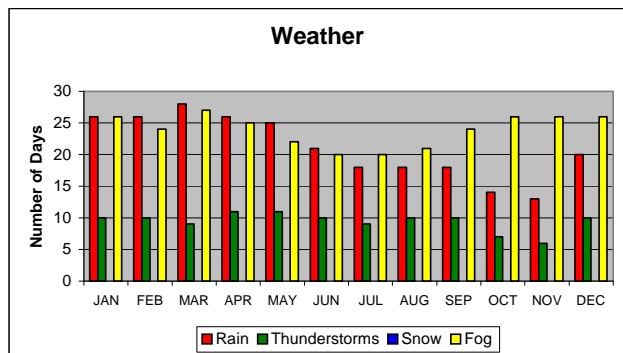
Site 7: Offshore Porto Alegre; 28.5 S 47.5 W

	November	December	January	February	March
Wave Height (ft)	4.1	4.1	3.8	4	4.1
Wave Height (ft) Standard Deviation	2.5	2.2	2.3	2.3	2.4
Wind Speed (kts)	11.7	11	10.8	10.4	11.2
Wind Speed (kts) Standard Deviation	7.1	6	6.3	5.7	6
Sea Temperature (F)	70.6	71.8	76.4	77.5	76.9
Air Temperature (F)	71	74.4	77.4	77.4	76.7

6. Station Climate Sheets

6.1 Belem, Brazil

STATION: BELEM, BRAZIL														Red Sky Weather Service LLC www.redskyweather.com		
LATITUDE: 1-23S				LONGITUDE: 48-29W				ELEVATION: 53(ft)								
	TEMPERATURE (DEG F)						PRECIPITATION (INCHES)					WIND (KTS)			REL HUMIDITY PERCENT (LST)	
	AVERAGE			EXTREME			RAINFALL			24HR MAX	PREVAILING		MAX GST	AM 6	PM 3	
	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	DIR		SPD	DIR				SPD
JAN	87	74	81	99	66	13.8	26.9	7	***	E	7	44	96	80		
FEB	86	74	80	99	68	16.2	30.6	8.1	***	E	6	54	97	81		
MAR	86	74	80	99	63	17.4	31.6	9.3	***	E	6	48	97	82		
APR	87	75	81	100	61	14.6	22.9	7.5	***	E	6	62	97	81		
MAY	88	75	82	97	61	11.1	21.5	4.7	***	E	7	58	96	73		
JUN	89	74	82	97	63	6.5	13	3.2	***	E	7	56	95	65		
JUL	89	74	82	99	68	6.1	11.6	1.6	***	E	7	60	95	64		
AUG	89	73	82	99	59	4.8	11.3	0.6	***	E	7	50	95	66		
SEP	89	73	82	99	66	5.1	10	1.8	***	E	7	58	95	70		
OCT	89	74	82	102	57	4.1	11	0.7	***	E	7	56	95	70		
NOV	89	74	82	106	64	4	11.9	0.6	***	E	7	56	94	70		
DEC	89	74	82	102	66	7.9	14.9	1.6	***	E	7	40	95	74		
ANN	88	74	81	106	57	110	136	86	***	E	7	62	96	73		

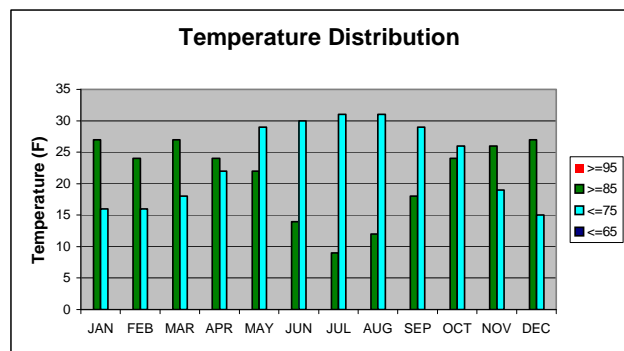
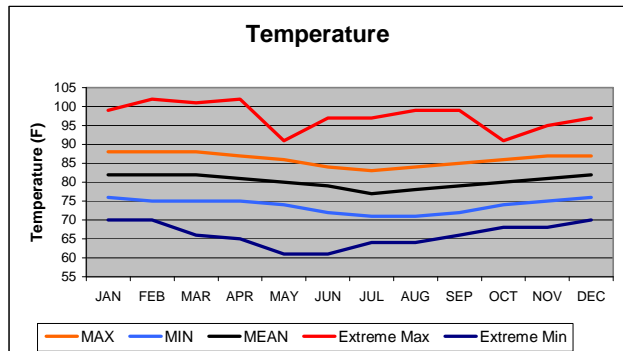
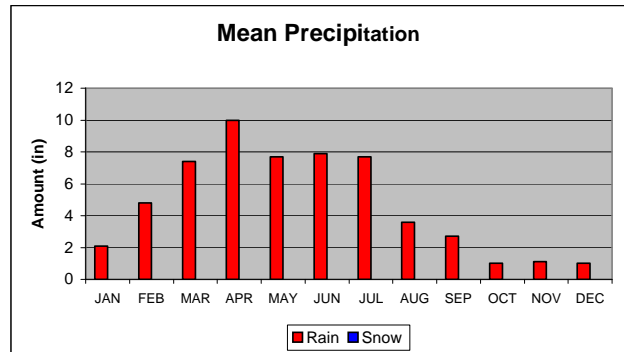
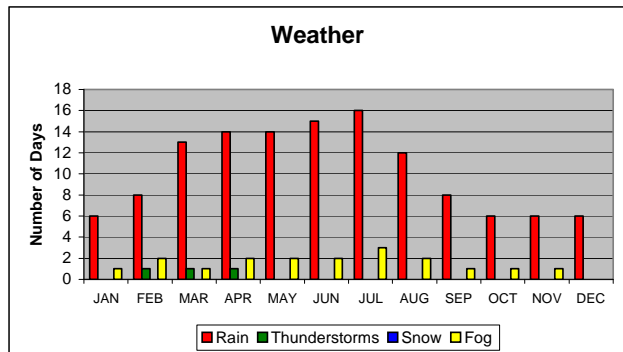


Key: Extreme temperature is the highest or lowest temperature recorded at the site
 Rainfall: T = < 0.05 in Snowfall: T = < 0.5 in ***: Missing Data

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6.2 Natal, Brazil

STATION: NATAL/AUGUSTO, BRAZIL														Red Sky	
LATITUDE: 5-55S														Weather Service LLC	
LONGITUDE: 35-15W														www.redskyweather.com	
ELEVATION: 171(ft)															
	TEMPERATURE (DEG F)					PRECIPITATION (INCHES)					WIND (KTS)			REL HUMIDITY PERCENT (LST)	
	AVERAGE			EXTREME		RAINFALL			24HR MAX	PREVAILING		MAX GST	AM 6	PM 3	
	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN		DIR	SPD				
JAN	88	76	82	99	70	2.1	6.7	T	***	E	9	34	89	63	
FEB	88	75	82	102	70	4.8	12.5	0.4	***	E	9	33	91	65	
MAR	88	75	82	101	66	7.4	13.9	1.6	***	E	8	34	92	67	
APR	87	75	81	102	65	10	18.9	3.3	***	ESE	8	33	93	69	
MAY	86	74	80	91	61	7.7	14.1	2.6	***	S	6	35	94	70	
JUN	84	72	79	97	61	7.9	16.8	2.4	***	S	7	36	94	71	
JUL	83	71	77	97	64	7.7	16.9	3.7	***	S	7	30	93	70	
AUG	84	71	78	99	64	3.6	9.5	0.6	***	ESE	10	26	93	67	
SEP	85	72	79	99	66	2.7	6.5	0.1	***	ESE	10	33	91	64	
OCT	86	74	80	91	68	1	5.4	T	***	E	9	32	87	63	
NOV	87	75	81	95	68	1.1	4.6	0	***	E	9	22	86	63	
DEC	87	76	82	97	70	1	4.3	0	***	E	9	24	87	64	
ANN	86	74	80	102	61	54	69	37	***	ESE	8	36	91	67	

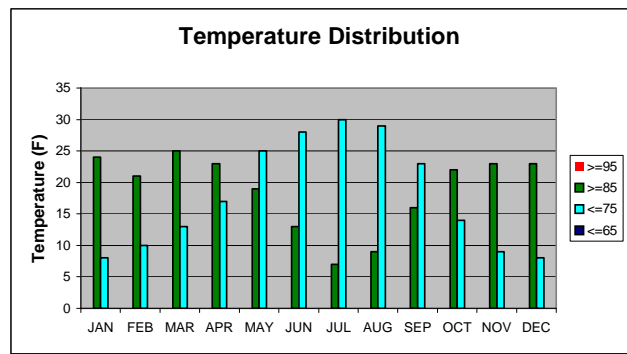
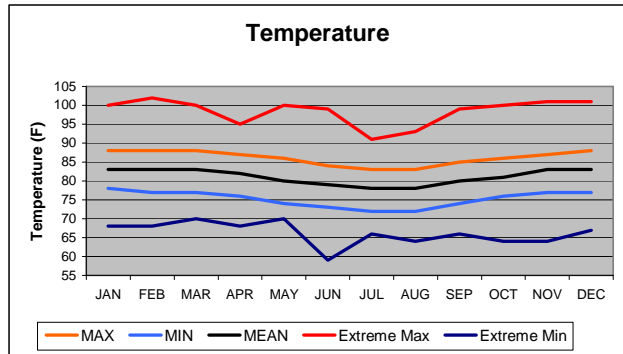
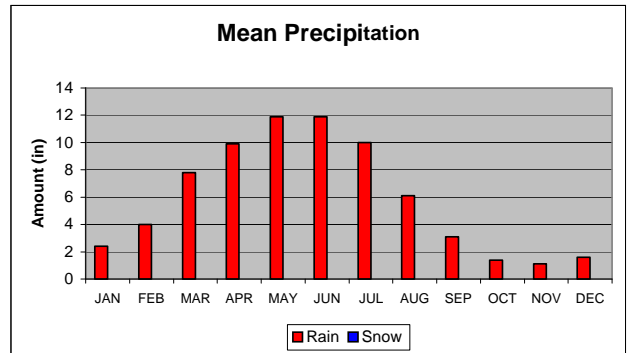
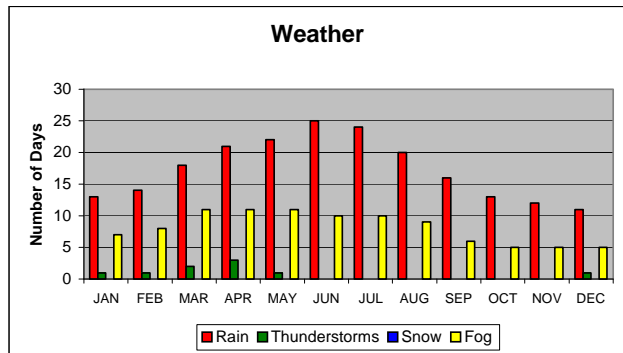


Key: Extreme temperature is the highest or lowest temperature recorded at the site
 Rainfall: T = < 0.05 in Snowfall: T = < 0.5 in ***: Missing Data

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6.3 Recife, Brazil

STATION: RECIFE, BRAZIL														Red Sky			
LATITUDE: 8-04S														Weather Service LLC			
LONGITUDE: 34-51W														www.redskyweather.com			
ELEVATION: 62(ft)																	
	TEMPERATURE (DEG F)						PRECIPITATION (INCHES)					WIND (KTS)			REL HUMIDITY PERCENT (LST)		
	AVERAGE			EXTREME			RAINFALL					PREVAILING		MAX	AM		PM
	MAX	MIN	MEAN	MAX	MIN		MEAN	MAX	MIN	24HR MAX	DIR	SPD	GST	6	3		
JAN	88	78	83	100	68		2.4	10.9	0	0	***	E	7	60	82	64	
FEB	88	77	83	102	68		4	20.7	T	***	ESE	7	50	85	66		
MAR	88	77	83	100	70		7.8	26.6	0.2	***	E	7	60	88	68		
APR	87	76	82	95	68		9.9	32.6	1.2	***	ESE	7	46	90	70		
MAY	86	74	80	100	70		11.9	32	0.9	***	S	7	50	91	71		
JUN	84	73	79	99	59		11.9	29.3	1.8	***	S	7	40	91	73		
JUL	83	72	78	91	66		10	25.6	1.3	***	S	8	54	90	73		
AUG	83	72	78	93	64		6.1	24.6	0.6	***	S	8	60	87	69		
SEP	85	74	80	99	66		3.1	14.9	0.1	***	SSE	9	54	84	67		
OCT	86	76	81	100	64		1.4	11.7	0	***	E	8	56	81	65		
NOV	87	77	83	101	64		1.1	8.7	0	***	E	8	54	79	64		
DEC	88	77	83	101	67		1.6	7.2	0.2	***	E	8	56	81	64		
ANN	86	75	81	102	59		7.1	151.9	24	***	ESE	8	60	86	68		

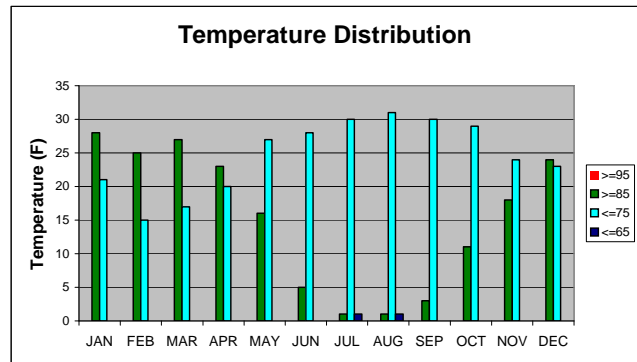
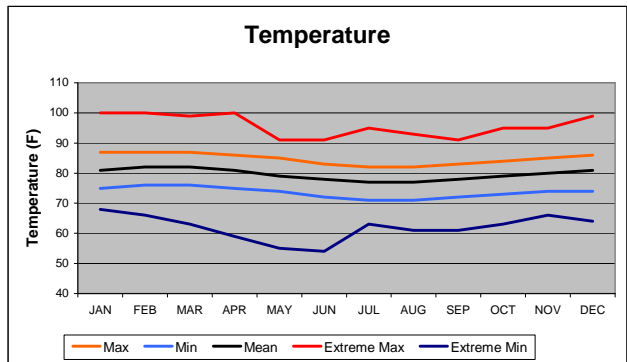
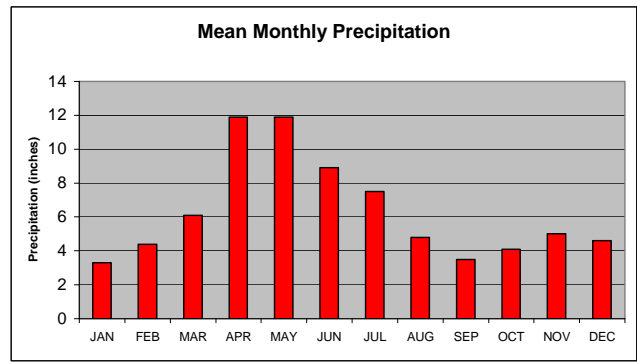
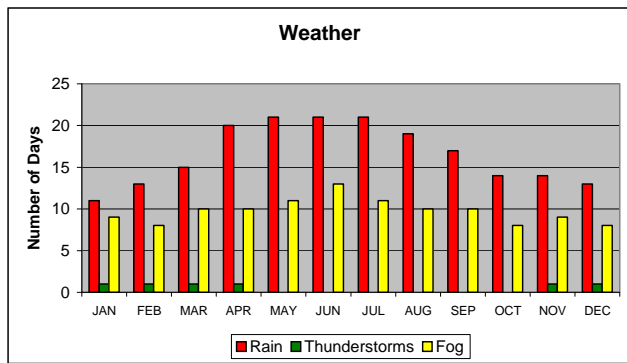


Key: Extreme temperature is the highest or lowest temperature recorded at the site
 Rainfall: T = < 0.05 in Snowfall: T = < 0.5 in ***: Missing Data

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6.4 Salvador, Brazil

STATION: SALVADOR/DOIS, JULHO BRAZIL														Red Sky Weather Service LLC www.redskyweather.com			
LATITUDE: 12-54S														LONGITUDE: 38-20W			
ELEVATION: 20(ft)																	
	TEMPERATURE (DEG F)						PRECIPITATION						WIND (KTS)			REL HUMIDITY PERCENT (LST)	
	AVERAGE			EXTREME			MEAN MONTHLY (INCHES)	MEAN NO. OF DAYS WITH			TH STM	PREVAILING		MAX GST	AM 6	PM 3	
	MAX	MIN	MEAN	MAX	MIN			FRZ R/DZ	HAIL SLEET	PRECIP		DIR	SPD				
JAN	87	75	81	100	68	3.3	11	0	#	11	1	E	10	33	89	67	
FEB	87	76	82	100	66	4.4	13	0	0	13	1	E	10	33	88	66	
MAR	87	76	82	99	63	6.1	15	0	0	15	1	E	10	26	89	67	
APR	86	75	81	100	59	11.9	20	0	0	20	1	E	9	33	89	71	
MAY	85	74	79	91	55	11.9	21	0	0	21	#	E	9	24	90	71	
JUN	83	72	78	91	54	8.9	21	0	0	21	#	SE	10	26	88	72	
JUL	82	71	77	95	63	7.5	21	0	0	21	#	SE	10	33	87	71	
AUG	82	71	77	93	61	4.8	19	0	#	19	#	E	9	29	87	70	
SEP	83	72	78	91	61	3.5	17	0	0	17	#	E	10	26	86	69	
OCT	84	73	79	95	63	4.1	14	0	0	14	#	E	10	28	88	69	
NOV	85	74	80	95	66	5	14	0	0	14	1	E	10	28	88	70	
DEC	86	74	81	99	64	4.6	13	0	0	13	1	ENE	11	22	89	69	
ANN	85	74	79	100	54	76	199	0	#	199	6	E	10	33	88	69	



Key: Extreme temperature is the highest or lowest temperature recorded at the site
 Rainfall: T = < 0.05 in Snowfall: T = < 0.5 in ***: Missing Data

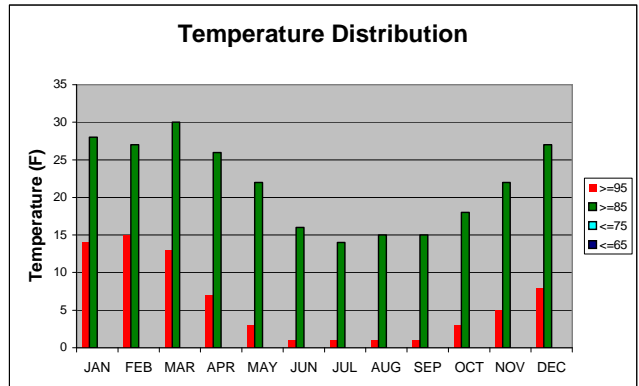
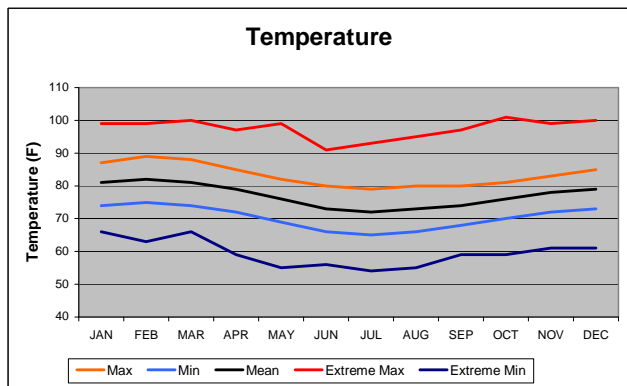
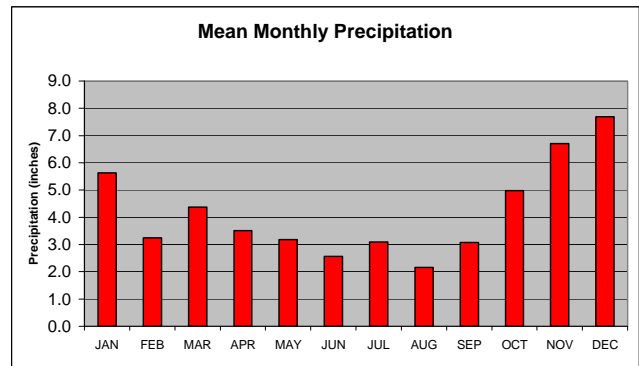
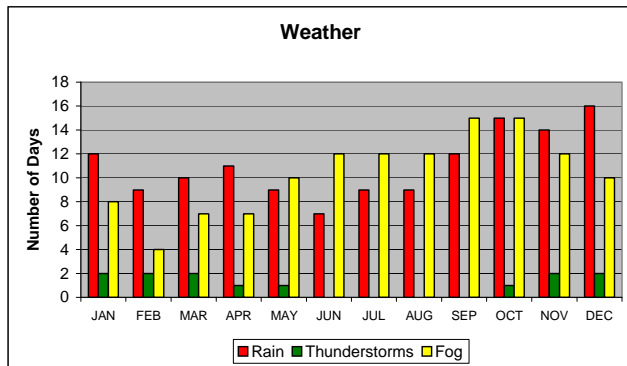
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6.5 Vitoria, Brazil

STATION: VITORIA/GOIABEIRAS, BRAZIL
 LATITUDE: 20-16S LONGITUDE: 40-17W
 ELEVATION: 13(ft)

Red Sky
Weather Service LLC
 www.redskyweather.com

	TEMPERATURE (DEG F)						PRECIPITATION						WIND (KTS)				REL HUMIDITY PERCENT (LST)	
	AVERAGE			EXTREME			MEAN MONTHLY (INCHES)	MEAN NO. OF DAYS WITH			TH STM	PREVAILING		MAX GST	AM 6	PM 3		
	MAX	MIN	MEAN	MAX	MIN	R/DZ		FRZ R/DZ	HAIL SLEET	PRECIP		DIR	SPD					
JAN	87	74	81	99	66	66	5.6	12	0	0	12	2	NNE	9	32	90	66	
FEB	89	75	82	99	63	63	3.2	9	0	0	9	2	NNE	9	33	90	64	
MAR	88	74	81	100	66	66	4.4	10	0	0	10	2	ENE	10	33	91	65	
APR	85	72	79	97	59	59	3.5	11	0	0	11	1	S	9	33	92	66	
MAY	82	69	76	99	55	55	3.2	9	0	#	9	1	S	8	33	92	67	
JUN	80	66	73	91	56	56	2.6	7	0	0	7	#	S	8	24	93	66	
JUL	79	65	72	93	54	54	3.1	9	0	0	9	#	S	9	30	92	65	
AUG	80	66	73	95	55	55	2.2	9	0	0	9	#	NNE	9	33	91	65	
SEP	80	68	74	97	59	59	3.1	12	0	0	12	#	NNE	9	32	90	68	
OCT	81	70	76	101	59	59	5.0	15	0	0	15	1	S	9	33	90	70	
NOV	83	72	78	99	61	61	6.7	14	0	0	14	2	NNE	9	36	88	70	
DEC	85	73	79	100	61	61	7.7	16	0	0	16	2	NNE	9	32	89	70	
ANN	83	70	77	101	54	54	50.2	133	0	#	133	13	NNE	9	36	91	67	

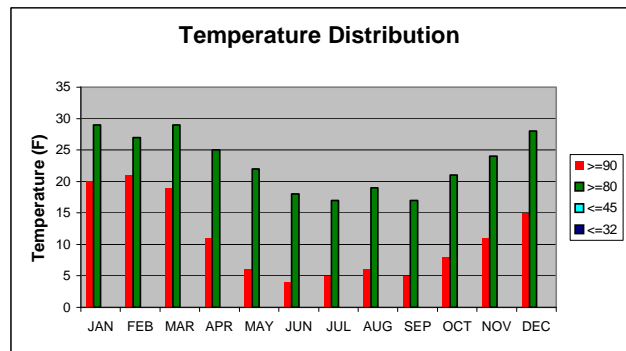
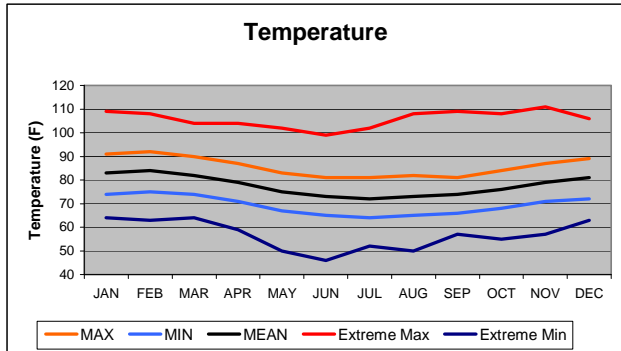
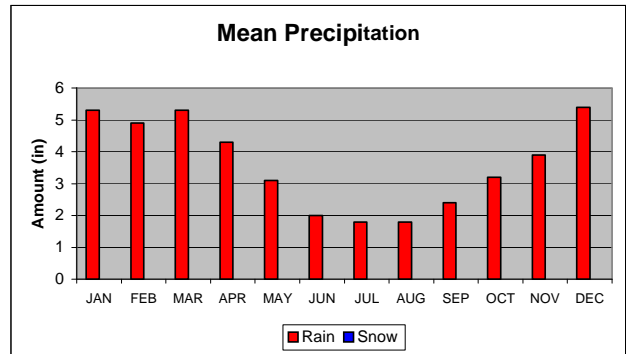
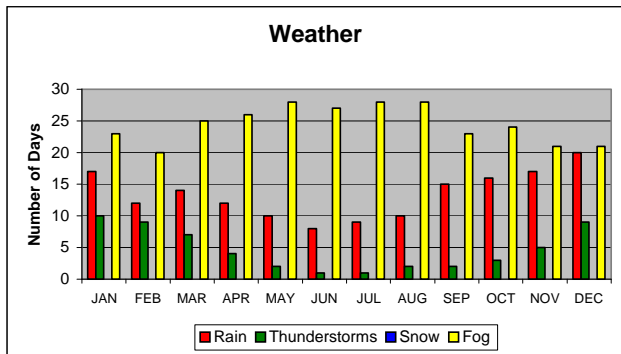


Key: Extreme temperature is the highest or lowest temperature recorded at the site
 Rainfall: T = < 0.05 in Snowfall: T = < 0.5 in ***: Missing Data

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6.6 Rio de Janeiro

STATION: RIO DE JANEIRO BRAZIL											Red Sky Weather Service LLC www.redskyweather.com				
LATITUDE: 22-49S			LONGITUDE: 43-15W			ELEVATION: 20(ft)									
	TEMPERATURE (DEG F)					PRECIPITATION (INCHES)				WIND (KTS)			REL HUMIDITY PERCENT (LST)		
	AVERAGE			EXTREME		RAINFALL			24HR MAX	PREVAILING		MAX GST	AM 6	PM 3	
	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN		DIR	SPD				
JAN	91	74	83	109	64	5.3	24.3	0.2	***	SE	9	63	87	58	
FEB	92	75	84	108	63	4.9	18.6	0	***	E	6	33	88	56	
MAR	90	74	82	104	64	5.3	18.5	0.4	***	E	6	46	90	59	
APR	87	71	79	104	59	4.3	17.9	0.3	***	SE	8	50	92	61	
MAY	83	67	75	102	50	3.1	16.1	0	***	E	5	33	92	60	
JUN	81	65	73	99	46	2	12.2	0	***	E	5	53	91	57	
JUL	81	64	72	102	52	1.8	6.6	0.1	***	E	5	55	91	55	
AUG	82	65	73	108	50	1.8	11.3	0	***	E	6	50	90	56	
SEP	81	66	74	109	57	2.4	8.8	T	***	E	6	33	89	61	
OCT	84	68	76	108	55	3.2	8.1	0.2	***	ESE	7	55	87	60	
NOV	87	71	79	111	57	3.9	16.3	0.5	***	SE	9	33	85	60	
DEC	89	72	81	106	63	5.4	12.5	1.3	***	SSE	10	50	86	61	
ANN	86	69	78	111	46	43.3	71.8	14.3	***	E	7	63	89	59	

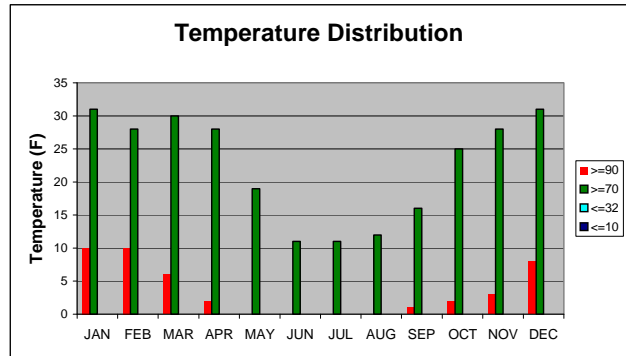
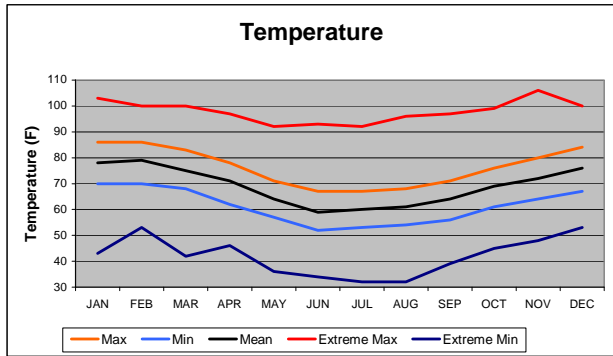
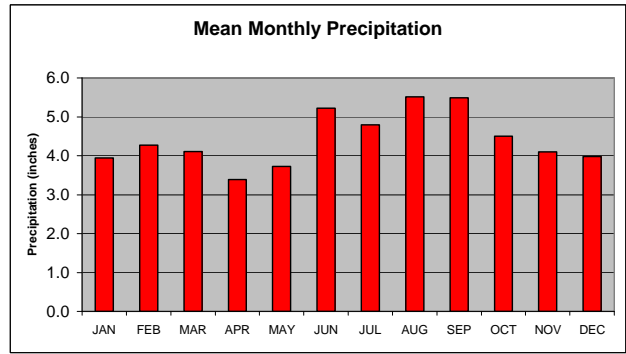
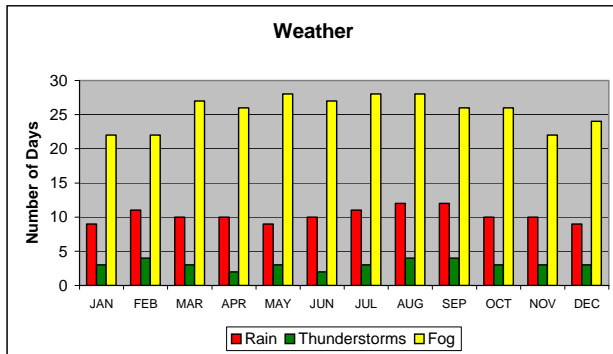


Key: Extreme temperature is the highest or lowest temperature recorded at the site
 Rainfall: T = < 0.05 in Snowfall: T = < 0.5 in ***: Missing Data

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6.7 Porto Alegre, Brazil

STATION: PORTO ALEGRE, BRAZIL															Red Sky	
LATITUDE: 30-00S															LONGITUDE: 51-11W	
ELEVATION: 10(ft)															Weather Service LLC	
															www.redskyweather.com	
	TEMPERATURE (DEG F)						PRECIPITATION					WIND (KTS)			REL HUMIDITY PERCENT (LST)	
	AVERAGE			EXTREME			MEAN MONTHLY (INCHES)	MEAN NO. OF DAYS WITH			TH STM	PREVAILING		MAX GST	AM 6	PM 3
	MAX	MIN	MEAN	MAX	MIN			R/DZ	FRZ R/DZ	HAIL SLEET		PRECIP	DIR			
JAN	86	70	78	103	43	3.9	9	0	0	9	3	E	8	33	89	53
FEB	86	70	79	100	53	4.3	11	0	0	11	4	E	8	26	90	58
MAR	83	68	75	100	42	4.1	10	0	0	10	3	E	8	33	91	58
APR	78	62	71	97	46	3.4	10	0	0	10	2	E	7	30	92	60
MAY	71	57	64	92	36	3.7	9	0	#	9	3	E	6	33	93	63
JUN	67	52	59	93	34	5.2	10	0	#	10	2	W	8	30	93	65
JUL	67	53	60	92	32	4.8	11	0	#	11	3	E	6	35	92	66
AUG	68	54	61	96	32	5.5	12	0	0	12	4	E	7	33	92	64
SEP	71	56	64	97	39	5.5	12	0	0	12	4	E	8	34	92	61
OCT	76	61	69	99	45	4.5	10	0	0	10	3	E	8	30	91	57
NOV	80	64	72	106	48	4.1	10	0	0	10	3	E	8	32	89	55
DEC	84	67	76	100	53	4.0	9	0	#	9	3	E	8	30	89	54
ANN	76	61	69	106	32	53.0	123	0	#	123	37	E	8	35	91	60

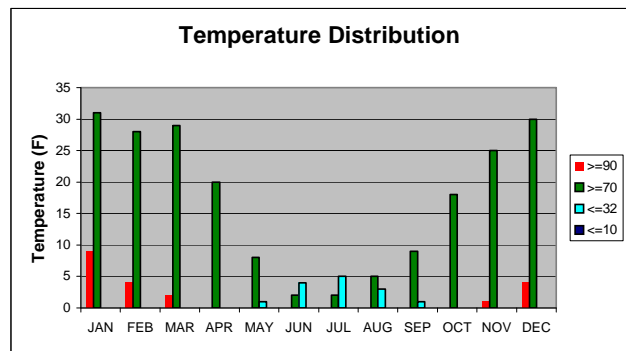
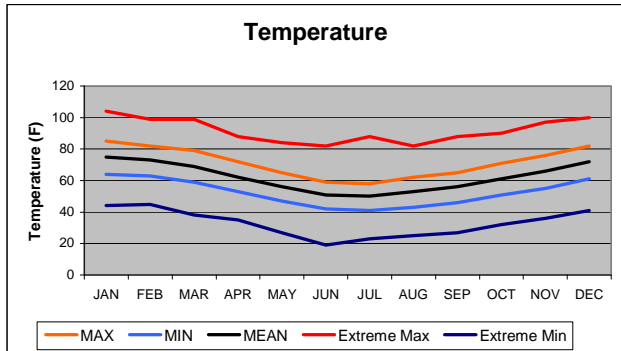
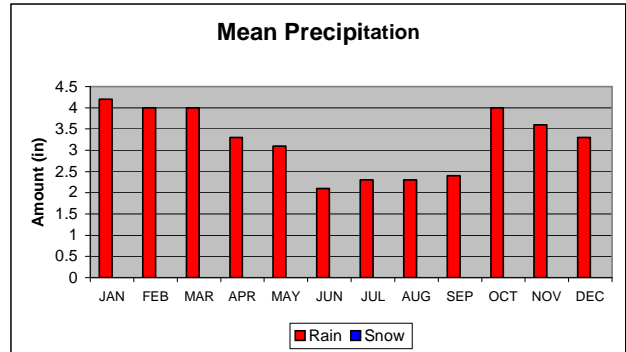
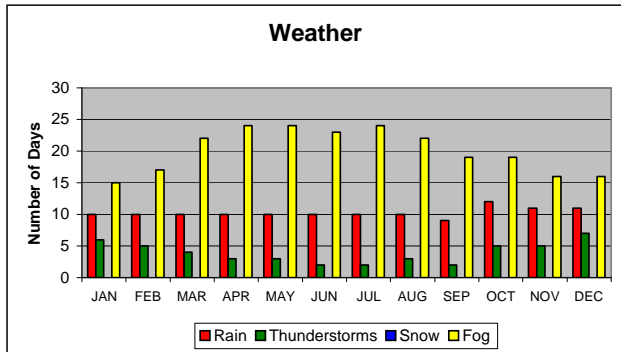


Key: Extreme temperature is the highest or lowest temperature recorded at the site
 Rainfall: T = < 0.05 in Snowfall: T = < 0.5 in ***: Missing Data

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6.8 Buenos Aires

STATION: BUENOS, AIRES ARGENTINA													Red Sky		
LATITUDE: 34-49S													LONGITUDE: 58-32W		
ELEVATION: 66(ft)													Weather Service LLC		
													www.redskyweather.com		
	TEMPERATURE (DEG F)					PRECIPITATION (INCHES)				WIND (KTS)			REL HUMIDITY PERCENT (LST)		
	AVERAGE			EXTREME		RAINFALL			24HR MAX	PREVAILING		MAX GST	AM 6	PM 3	
	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN		DIR	SPD				
JAN	85	64	75	104	44	4.2	9.9	0.2	***	NE	8	61	86	47	
FEB	82	63	73	99	45	4	10	0.7	***	NE	8	61	89	52	
MAR	79	59	69	99	38	4	18	0.2	***	NE	7	88	90	54	
APR	72	53	62	88	35	3.3	12.7	0.1	***	NE	6	58	91	59	
MAY	65	47	56	84	27	3.1	10.9	T	***	NE	6	65	89	60	
JUN	59	42	51	82	19	2.1	5.7	T	***	NW	7	60	89	62	
JUL	58	41	50	88	23	2.3	6.7	0.1	***	NE	7	63	89	62	
AUG	62	43	53	82	25	2.3	6	0	***	NE	7	63	88	57	
SEP	65	46	56	88	27	2.4	7.2	0.2	***	NE	9	51	87	53	
OCT	71	51	61	90	32	4	14.3	0.1	***	NE	8	71	88	56	
NOV	76	55	66	97	36	3.6	8.4	0.3	***	NE	8	61	86	53	
DEC	82	61	72	100	41	3.3	11.3	0.5	***	NE	8	53	86	48	
ANN	71	52	62	104	19	38.5	62.7	24.8	***	NE	7	88	88	55	



Key: Extreme temperature is the highest or lowest temperature recorded at the site
 Rainfall: T = < 0.05 in Snowfall: T = < 0.5 in ***: Missing Data

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