NATIONAL HURRICANE CENTER ANNUAL SUMMARY

2012 EASTERN NORTH PACIFIC HURRICANE SEASON

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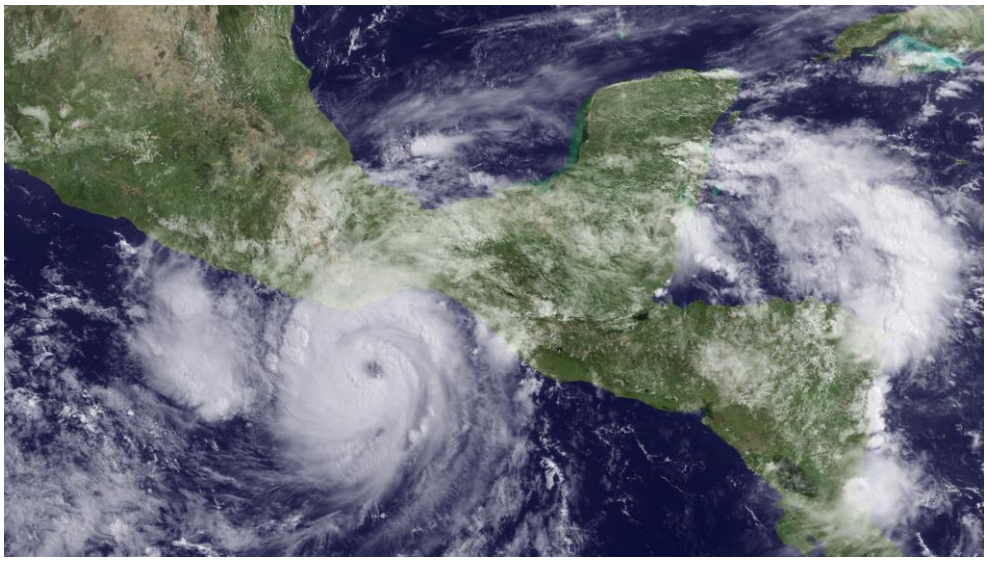

IMAGE OF HURRICANE CARLOTTA AT 1556 UTC 15 JUNE 2012. IMAGE COURTESY OF NASA.

ABSTRACT

Tropical cyclone activity of the eastern North Pacific hurricane season was near average during 2012. Of the seventeen tropical storms that formed, ten became hurricanes and five reached major hurricane strength (category 3 or stronger on the Saffir-Simpson Hurricane Wind Scale). One hurricane, Carlotta, made landfall in Mexico. On average, the National Hurricane Center track and intensity forecasts in the eastern North Pacific for 2012 were very good in comparison to the long-term means.

OVERVIEW

In terms of the overall levels of activity, the 2012 eastern North Pacific hurricane season was similar to that of the previous year. There was a near-average amount of activity and, of the 17 named storms that formed, 10 became hurricanes, and 5 reached major hurricane strength [maximum 1-min 10-m winds greater than 96 kt (1 kt = 0.5144 m s^{-1}) -- corresponding to category 3 or greater on the Saffir-Simpson Hurricane Wind Scale (Saffir 1973, Simpson 1974, National Weather Service 2010)]. For comparison, the 1981-2010 averages are about 15 tropical storms, 8 hurricanes and 4 major hurricanes. In terms of the Accumulated Cyclone Energy (ACE) index (Bell et al. 2000), which accounts for the frequency, intensity, and duration of the season's storms, the value for the 2012 season was 98.4 x 10^4 kt^2, or about 93% of the long-term (1981-2010) median value of 106 x 10^4 kt^2.

Figures 1 and 2 show the tracks of the 2012 eastern North Pacific tropical storms and hurricanes, and Table 1 lists the basic statistics of the season. It is of interest to note that, aside from Daniel and Emilia, the tropical cyclones of 2012 moved along predominantly meridional tracks. This is consistent with the anomalous deep-layer (1000-200 mb) mean flow for July through October of 2012, which was dominated by a large cyclonic gyre over the basin centered near 20°N 125°W (Fig. 3). As is the case with most years in the east Pacific basin, most of the 2012 cyclone activity remained offshore of the coasts of Mexico and Central America. However, Carlotta made landfall in eastern Mexico as a category 2 hurricane. A total of 3 deaths, all due to Carlotta, are directly attributed to the tropical cyclone activity from this hurricane season.

The 2012 season began early with Aletta, which was only the third eastern North Pacific tropical storm in the reliable record (since satellite imagery became available in 1966) to form prior to the May 15 official starting date. Aletta did not affect land. Bud, an early-season major hurricane, brought tropical storm conditions to portions of southwestern Mexico near and over Manzanillo before dissipating just offshore. Norman made landfall as a tropical depression near Topolobampo, Mexico. Paul was a category 3 hurricane that rapidly intensified near Clarion Island and then rapidly weakened as it approached the Baja California peninsula. Paul made landfall along the west coast of Baja California Sur as a post-tropical cyclone and then dissipated northwest of Punta Eugenia. All of the other eastern North Pacific tropical storms and hurricanes of 2012 remained at sea throughout their lifetimes.

The following section describes Hurricane Carlotta, the most significant tropical cyclone of the season. More detailed information on the eastern North Pacific tropical cyclones of 2012 can be found at http://www.nhc.noaa.gov/2012epac.shtml.

SELECTED STORM SUMMARY

Hurricane Carlotta

The genesis of Carlotta can be traced back to an area of disturbed weather that moved westward from Colombia to near and just south of Panama on 11 June. Extrapolation and analyses from the National Centers for Environmental Prediction's Global Forecast System suggest that this system was associated with a tropical wave that departed Africa in early June, although this is uncertain since the wave became ill defined over the central Atlantic. An eastward-moving Kelvin wave that passed over Central America during the second week of June was also a likely contributor to development. The disturbance continued westward, and by 1800 UTC 13 June it spawned a well-defined low-level circulation several hundred n mi south of Guatemala. By 0000 UTC 14 June, the associated deep convection became better organized and it is estimated that a tropical depression formed at this time, centered about 460 n mi south-southeast of Huatulco, Mexico. The cyclone was situated on the southwestern periphery of a mid-tropospheric ridge and shortly after genesis, it turned from a west-northwestward to a northwestward heading. Vertical shear was quite weak over the area, which allowed the system to strengthen into a tropical storm by 0600 UTC 14 June. Carlotta continued to gradually intensify over the next day or so, and it became a hurricane at about 1200 UTC 15 June, while centered about 170 n mi south-southeast of Puerto Escondido, Mexico. Not long after becoming a hurricane, Carlotta underwent a period of rapid intensification, with its maximum winds increasing to 95 kt by 2100 UTC 15 June. As it neared the coast, the hurricane turned toward the north-northwest, and the forward speed increased from around 10 kt to 16 kt. Carlotta made landfall in the Mexican state of Oaxaca, about 10 n mi east-southeast of Puerto Escondido, around 0100 UTC 16 June (Fig.4). Satellite imagery showed that the eye became less well-defined just before landfall, suggesting that the hurricane had weakened slightly to an intensity of 90 kt, likely due to the partial interaction of the circulation with the rugged terrain of Mexico. After the center crossed the coast, it turned toward the northwest and moved over the southern portion of Oaxaca and, later on 16 June, over the state of Guerrero. Carlotta weakened very rapidly while it traversed the mountainous terrain of southern Mexico, and by 1200 UTC 16 June the cyclone was reduced to a tropical depression, centered about 60 n mi northeast of Acapulco, Mexico. The system turned to the west-northwest while decelerating and degenerated into a remnant low around 0000 UTC 17 June. Later that day, the low dissipated over the western part of Guerrero, Mexico.

There were three direct deaths associated with Carlotta. A mud-brick house collapsed in the town of Pluma Hidalgo, Oaxaca, killing a 13-year-old girl and her 7-year-old sister. A 56-year-old woman from the coastal city of San Jose Manialtepec, Oaxaca was killed when the vehicle she was driving was flipped over by the wind. Some sources indicate that at least seven people died in Mexico due to Carlotta. However, other than the three casualties listed above, it cannot be confirmed whether these deaths were direct. At least 29,000 homes and 2,500 businesses in Mexico were affected by flooding and high winds, primarily in the state of Oaxaca, although structural damage did not appear to be very severe. While monetary damage totals

are incomplete, it is worth noting that the state of Oaxaca requested 1.444 billion pesos ($113 million US) for repairs to public infrastructure.

FORECAST VERIFICATION

There were 310 official forecasts issued in the eastern North Pacific basin in 2012, although only 39 of these verified at 120 h. This level of forecast activity was near normal. NHC official track forecast errors set a new record for accuracy at the 12-, 24 -, 48-, 96-, and 120-h forecast times, and track forecast skill was at or near all-time highs. The official forecast outperformed all of the guidance except for dynamical model consensus, TVCE, which beat the official forecast at the 12-, 72-, and 96-h periods. Among the guidance models with sufficient availability, EMXI was the best individual model, and GFSI and HWFI performed fairly well. The skill of FSSE was close to that of TVCE, but it trailed TVCE by 5-10 % at 96 and 120 h.

For intensity, the official forecast errors in the eastern North Pacific basin were lower than the 5-yr means at all times. The climatology and persistence (Decay-SHIFOR) model errors in 2012 were slightly lower than their 5-yr means at all forecast times, indicating the season's storms were a little easier to forecast than normal. The official forecasts, in general, performed as well as or better than all of the eastern Pacific guidance throughout the forecast period. The ICON and DSHP were the best performers from 12 to 72 h. The LGEM was the best individual model and beat the official forecast at 96 and 120 h. HWFI struggled late in the forecast period and was the worst performer at the longer forecast times.

Quantitative probabilistic forecasts of tropical cyclogenesis (i.e., the likelihood of tropical cyclone formation from a particular disturbance within 48 h) were made public for the first time in 2010. Forecasts were expressed in 10% increments and in terms of categories ("low", "medium", or "high"). There was an under-forecast bias in the eastern North Pacific basin at the middle probabilities with an over-forecast (high) bias at the high probabilities. Additional details on the forecast verification for 2012 may be found in Cangialosi and Franklin (2013).

REFERENCES

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Table 1. 2012 eastern North Pacific hurricane season statistics.

Name	Class[a]	Dates[b]	Maximum 1-min wind (kt)	Minimum sea level pressure (mb)	Direct deaths
Aletta	TS	May 14-19	45	1000	
Bud	MH	May 20-26	100	961	
Carlotta	H	June 14-16	95	973	3
Daniel	MH	July 4-12	100	961	
Emilia	MH	July 7-15	120	945	
Fabio	H	July 12-18	95	966	
Gilma	H	August 7-11	70	984	
Hector	TS	August 11-16	45	995	
Ileana	H	August 27-September 2	75	978	
John	TS	September 2-4	40	1000	
Kristy	TS	September 12-17	50	998	
Lane	H	September 15-19	75	985	
Miriam	MH	September 22-27	105	959	
Norman	TS	September 28-29	45	997	
Olivia	TS	October 6-8	50	997	
Paul	MH	October 13-17	105	959	
Rosa	TS	October 30-November 3	45	1001	

[a] TS = tropical storm, wind speed 34-63 kt (17-32 m s^{-1}); H = hurricane, wind speed 64 kt (33 m s^{-1}) or higher; MH – major hurricane, hurricane with maximum winds 96 kt (49 m s^{-1}) or higher.

[b] Dates are based on UTC and include the tropical depression stage but exclude the post-tropical stage.

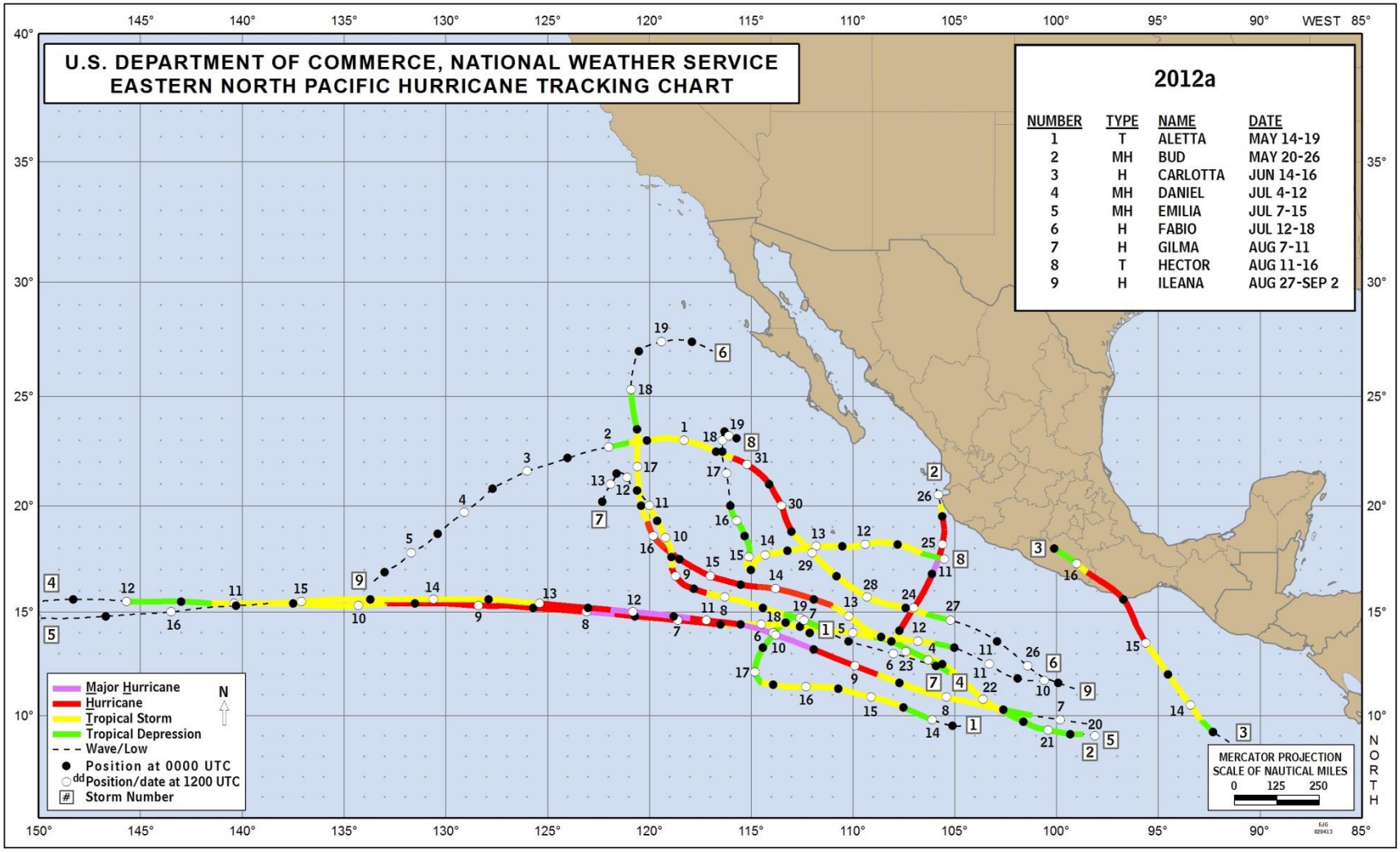

Figure 1. Tracks of the first nine eastern North Pacific tropical storms and hurricanes of 2012.

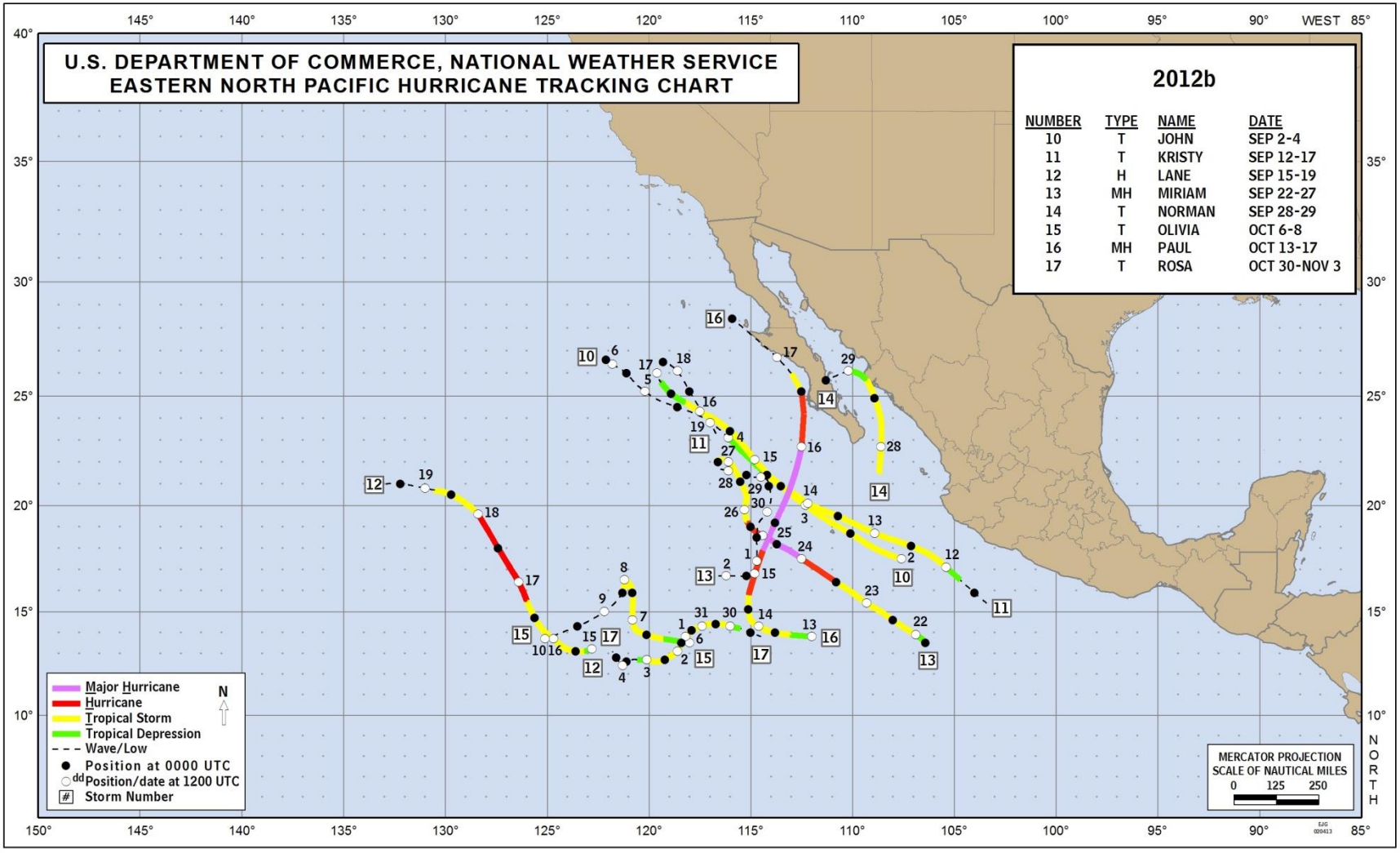

Figure 2. Tracks of the last eight eastern North Pacific tropical storms and hurricanes of 2012.

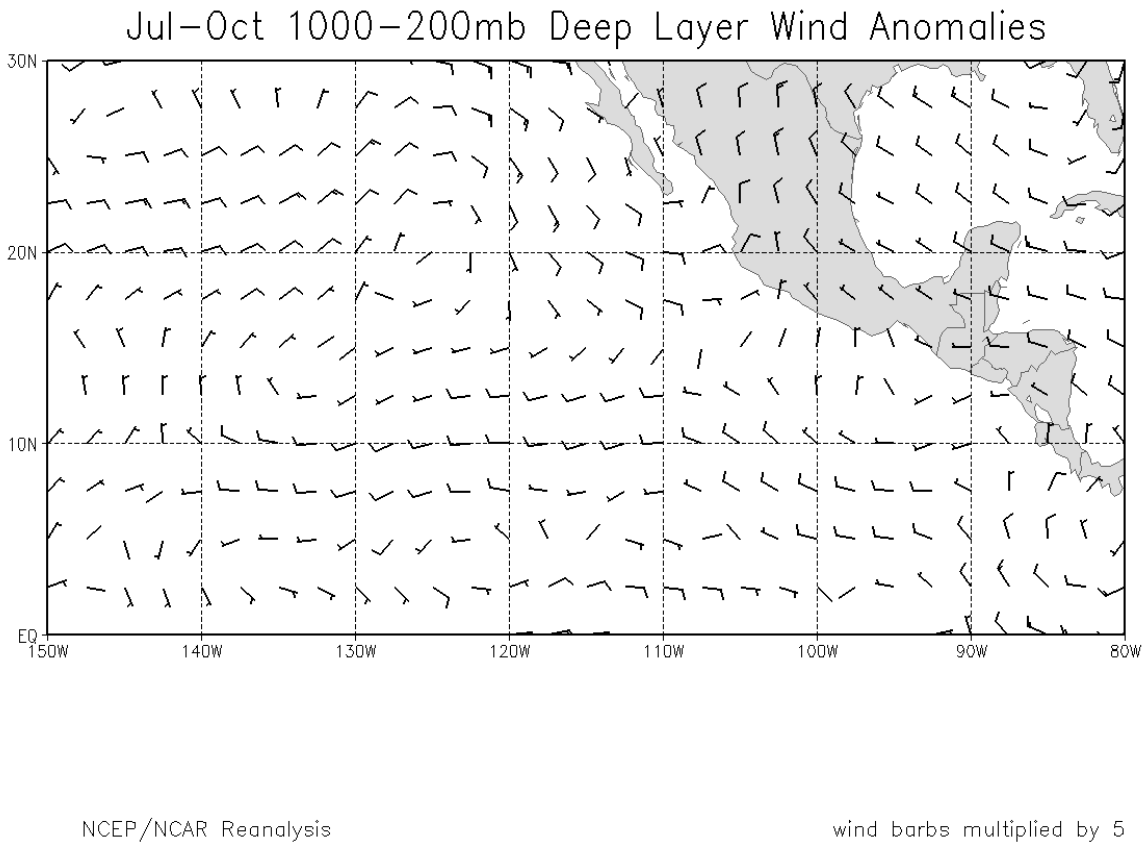

Figure 3. July through October deep (1000-200 mb) layer wind anomalies for 2012. Note that the wind barbs correspond to the actual wind anomalies multiplied by 5. Anomalies are computed from the 1981-2010 mean.

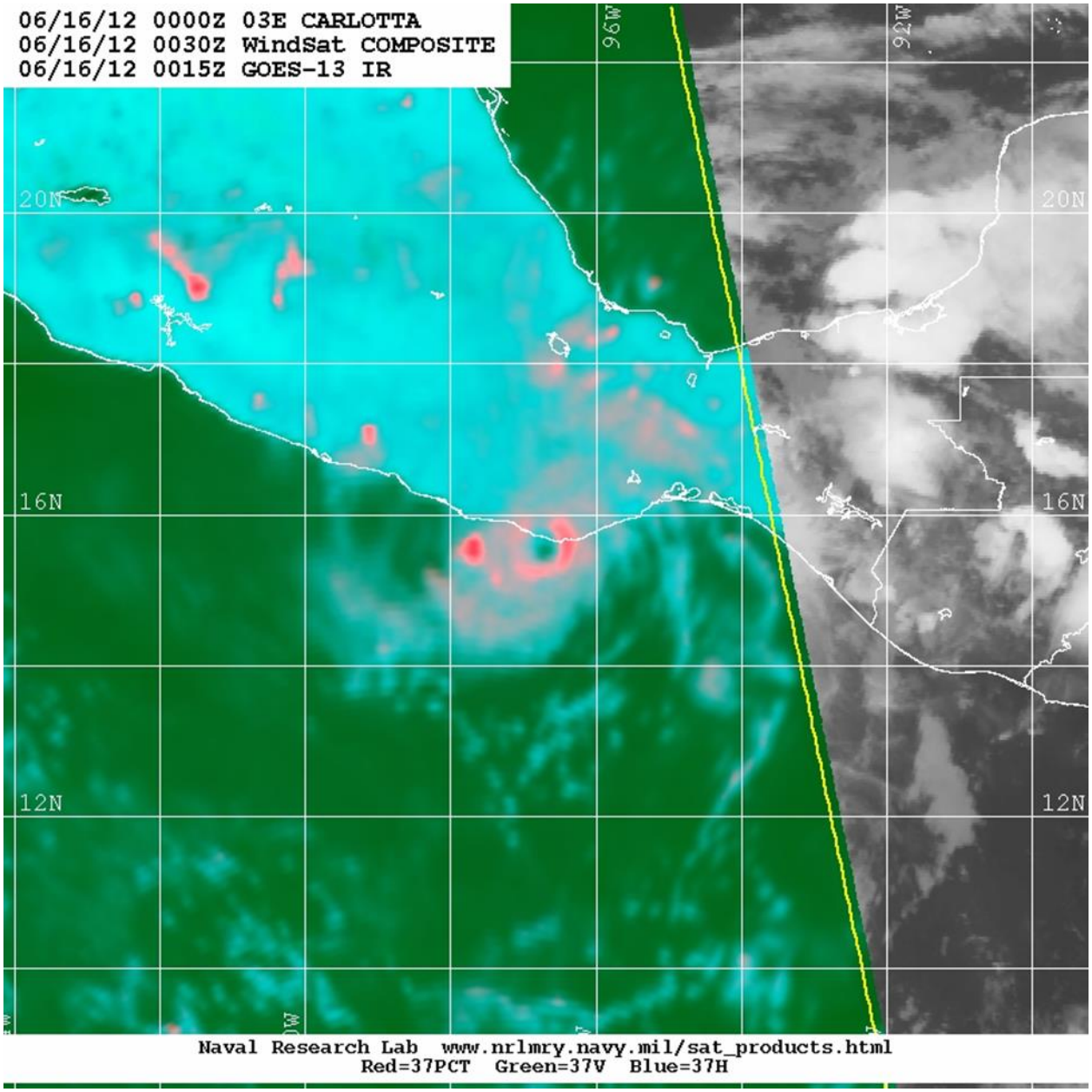

Figure 4. WindSat 37-GHz color composite image of Hurricane Carlotta at 0030 UTC 16 June 2012, very near the time of landfall. Image courtesy of the Naval Research Laboratory.