

Preliminary Report  
Hurricane Linda  
9 - 17 September 1997

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Linda is estimated to have been the strongest hurricane on record in the eastern North Pacific Ocean. With the exception of Socorro Island, Linda did not directly affect land, although long-range computer models indicated that the tropical cyclone would approach southern California.

a. Synoptic History

Rawinsonde data from Dakar indicated that a well-defined tropical wave emerged from the west coast of Africa on 24 August. The wave was tracked across the Atlantic and the Caribbean Sea in satellite imagery. Increased cloudiness and convection off the Pacific coast of Panama on 6 September was likely associated with the wave. Evidence of a poorly-defined cloud system center within a broad tropical disturbance appeared in satellite imagery early on 9 September. A banding-type pattern emerged, and the "best track" indicates that a tropical depression formed from the disturbance near 1200 UTC 9 September while centered about 400 n mi south of Manzanillo, Mexico (Fig. 1 and Table 1). The tropical cyclone moved northwestward at 5 to 10 knots, partly in response to a mid- to upper-level low in the vicinity of lower Baja California.

Deep convective banding increased and the depression strengthened into Tropical Storm Linda at 0000 UTC 10 September while centered about 350 n mi south-southwest of Manzanillo. Upper-level outflow became very well established and intermittent hints of an eye appeared by 0000 UTC 11 September, at which time Linda is estimated to have become a hurricane while centered about 475 n mi south-southeast of the southern tip of Baja California. Rapid strengthening occurred and it is estimated that Linda reached its peak intensity with 160 knot winds and 902 mb minimum central pressure near 0600 UTC 12 September while centered about 125 n mi southeast of Socorro Island. A small, well-defined eye embedded within very cold convective tops was visible on satellite imagery at this time.

On 13 September, Linda began moving toward the west-northwest at 10 to 12 knots in response to a building ridge to the north of the tropical cyclone.

Linda moved over cooler water and weakened to a tropical storm by 1200 UTC 15 September while centered about 730 n mi west of the southern tip of Baja California. Steering currents also began weakening about this time, and the forward motion gradually decreased to near 5 knots. Linda weakened to a tropical depression by 0600 UTC 17 September while centered about 960 n mi west of the southern tip of Baja California and dissipated by 0000 UTC 18 September, although a weakening swirl of mostly low clouds persisted for a few more days.

#### b. Meteorological Statistics

Figures 2 and 3 show the curves of minimum central pressure and maximum one-minute wind speed, respectively, versus time along with the observations on which they are based. As usual for an eastern Pacific tropical cyclone, satellites provided the primary source of observational data. Formal Dvorak technique location and intensity estimates from the satellite data were produced by the Air Force Global Weather Center (AFGWC), the NOAA Synoptic Analysis Branch (SAB) and the NOAA Tropical Analysis and Forecast Branch (TAFB). In addition to the formal Dvorak estimates shown in Figs. 2 and 3, objective Dvorak T-numbers (based on the warm spot eye temperature and the coldest surrounding ring temperature at a radius of 30 n mi from the center) were calculated by TAFB at 30 minute intervals. All of these objective Dvorak T-numbers were between 7.5 (155 knots) and 8.0 (170 knots) from 0000 UTC 12 September to 1200 UTC 12 September, and is the justification for overriding some of the intensity constraints of the Dvorak technique. The highest 3-hour average objective T-numbers were 7.8 ending at 0430 UTC and 7.7 ending at 0600 UTC on 12 September. The peak intensity of Linda, estimated to have occurred near 0600 UTC 12 September, is a conservative estimate that is higher than normal Dvorak constraints would allow, but somewhat lower than objective T-numbers would suggest possible. Although maximum sustained winds of 160 knots and minimum central pressure of 902 mb indicated in the best track makes Linda the strongest hurricane on record in the eastern North Pacific to date, one should remember that intensities are almost always *estimated* from satellite interpretations for this basin. Also, the record is quite short, since routine satellite surveillance began in 1966. There could well have been other cyclones as strong as, or stronger than, Linda.

In addition to the satellite information on Linda, the NOAA high-altitude jet

flew synoptic-flow dropwindsonde missions which resulted in data being available for the 0000 UTC NCEP global model runs on the 14th and 15th. The intent of these missions was to provide the most accurate description of the steering flow in the environment around Linda during the period just prior to potential recurvature. Evaluations of the impact of these missions will be made by NCEP.

Four vortex messages were provided from a U.S. Air Force Reserve (Hurricane Hunter) aircraft on 14 September, after Linda had peaked in intensity.

The eye of Linda passed very near Socorro Island near 1800 UTC 12 September, but unfortunately power was cut off to all wind and pressure recording instruments.

#### c. Casualty and Damage Statistics

There were no reports of casualties or damage from Linda received at the National Hurricane Center. CNN reported five men swept off a jetty in Newport Beach, California by large waves related to Linda. All were rescued.

#### d. Forecast and Warning Critique

NHC average official track forecast errors (excluding the tropical depression stage) were 32 (27 cases), 73 (25 cases), 117 (23 cases), 163 (21 cases) and 247 n. mi. (17 cases), respectively, for the 12-, 24-, 36-, 48- and 72-hour forecast periods. These average errors were higher than the 1988-1996 average errors at the 36-, 48- and 72-hour forecast periods and were about the same at other times. The NHC average official track forecast errors were higher than the averages from the operationally available GFDL, UKMI, BAMD and BAMM track guidance models at the 48 and 72 hour time periods.

Some of the models initialized after 0000 UTC 13 September indicated recurvature toward Baja California or southern California. In fact, an experimental five-day GFDL model forecast indicated a weakening tropical cyclone centered just off the southern California coast at the verifying time of 0000 UTC 18 September. A few of the official forecasts also indicated recurvature on 13 and 14 September. The best track shows that recurvature did not occur. State forecast discussions, public information statements and special weather statements discussing the possible impact of Linda on southern California were issued by the Oxnard, California, NWS office.

Some of these products specifically mentioned the uncertainties in forecasting Linda and asked the media not to overdramatize the storm.

The NHC official intensity forecasts showed a large negative bias (i.e., intensity was underestimated) while Linda was strengthening and a distinct positive bias (i.e., intensity was overestimated) when the cyclone was weakening. These biases are not uncommon for a tropical cyclone that changes intensity as rapidly as Linda did.

Watches and warnings were neither issued nor necessary for Linda.

Table 1. Best track, Hurricane Linda, 9 - 17 September, 1997.

Date/Time (UTC)	Position		Pressure (mb)	Wind Speed (kt)	Stage
	Lat. (°N)	Lon. (°W)			
09/1200	12.4	104.7	1007	25	tropical depression
1800	13.0	105.5	1006	30	“
10/0000	13.5	106.1	1005	35	tropical storm
0600	14.1	106.5	1002	40	“
1200	14.5	106.8	998	50	“
1800	14.9	107.1	994	55	“
11/0000	15.4	107.4	987	65	hurricane
0600	15.7	107.8	974	80	“
1200	15.9	108.2	960	100	“
1800	16.1	108.6	935	125	“
12/0000	16.6	109.1	906	155	“
0600	17.1	109.6	902	160	“
1200	17.7	110.3	903	155	“
1800	18.4	111.0	905	150	“
13/0000	19.1	111.9	906	145	“
0600	19.7	113.0	910	145	“
1200	20.2	114.1	915	140	“
1800	20.6	115.3	921	135	“
14/0000	21.0	116.5	935	125	“
0600	21.3	117.8	946	110	“
1200	21.6	119.0	950	95	“
1800	21.9	120.1	959	80	“
15/0000	22.2	121.1	962	75	“
0600	22.5	122.1	980	65	“
1200	22.7	123.1	994	55	tropical storm
1800	22.8	124.0	997	50	“
16/0000	22.8	124.7	999	45	“
0600	22.8	125.3	1000	40	“
1200	22.8	125.9	1001	35	“
1800	22.9	126.4	1001	35	“
17/0000	22.9	126.8	1002	35	“
0600	23.0	127.2	1003	30	tropical depression
1200	23.2	127.6	1004	30	“
1800	23.5	128.0	1006	30	“
18/0000					dissipating
12/0600	17.1	109.6	902	160	minimum pressure

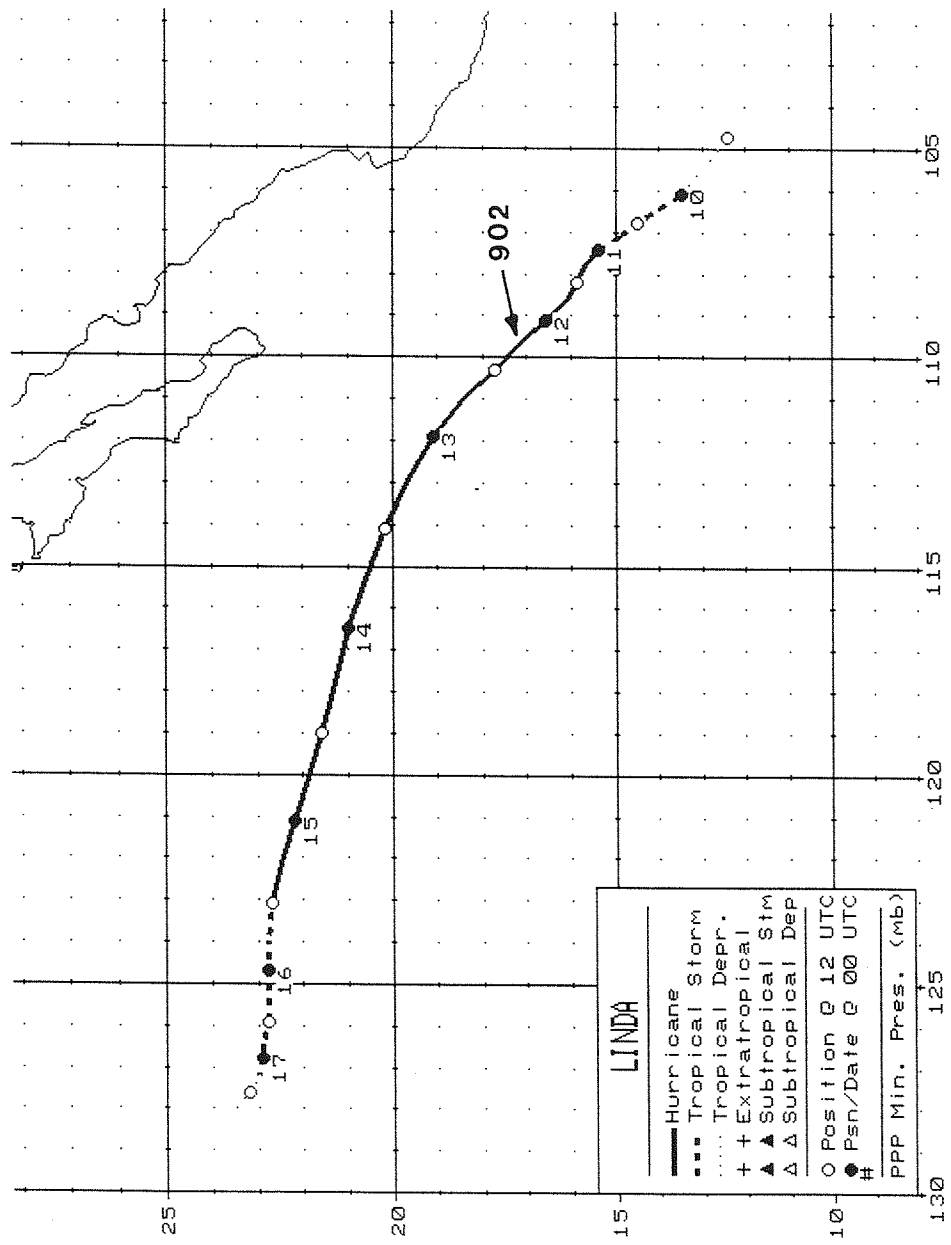


Figure 1. Best track positions for Hurricane Linda, 9 - 17 September 1997.

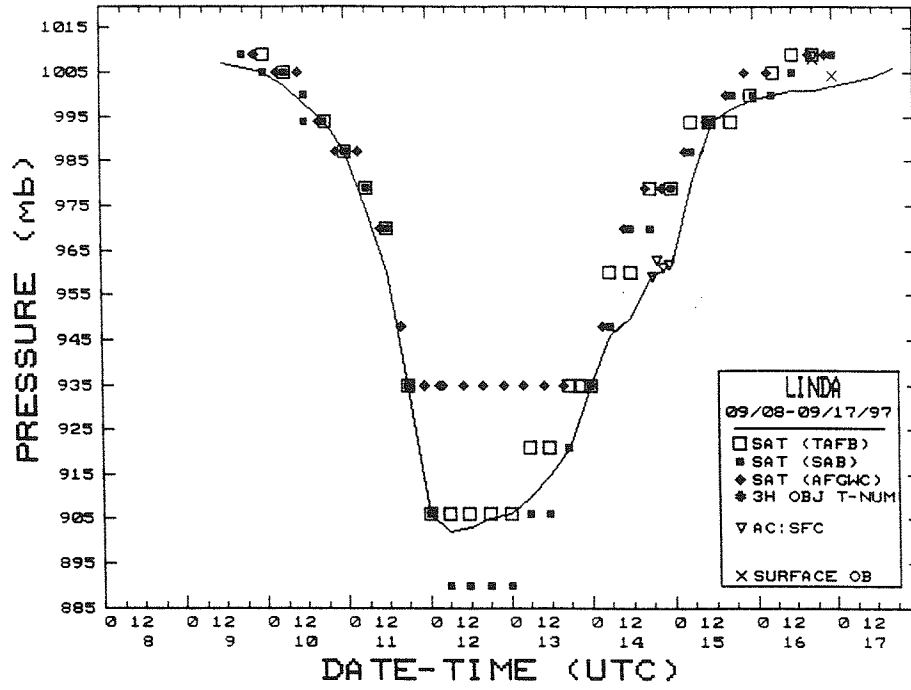


Figure 2. Best track minimum central pressure curve for Hurricane Linda.

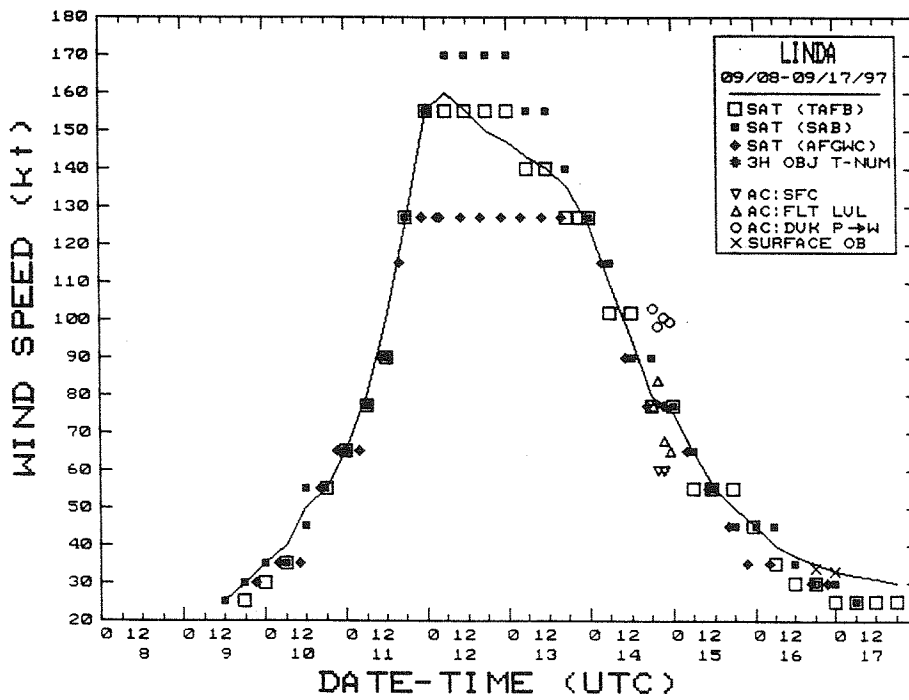


Figure 3. Best track maximum sustained wind speed curve for Hurricane Linda.