NATIONAL HURRICANE CENTER
TROPICAL CYCLONE REPORT

HURRICANE KIKO

(EP112013)

30 August -2 September 2013

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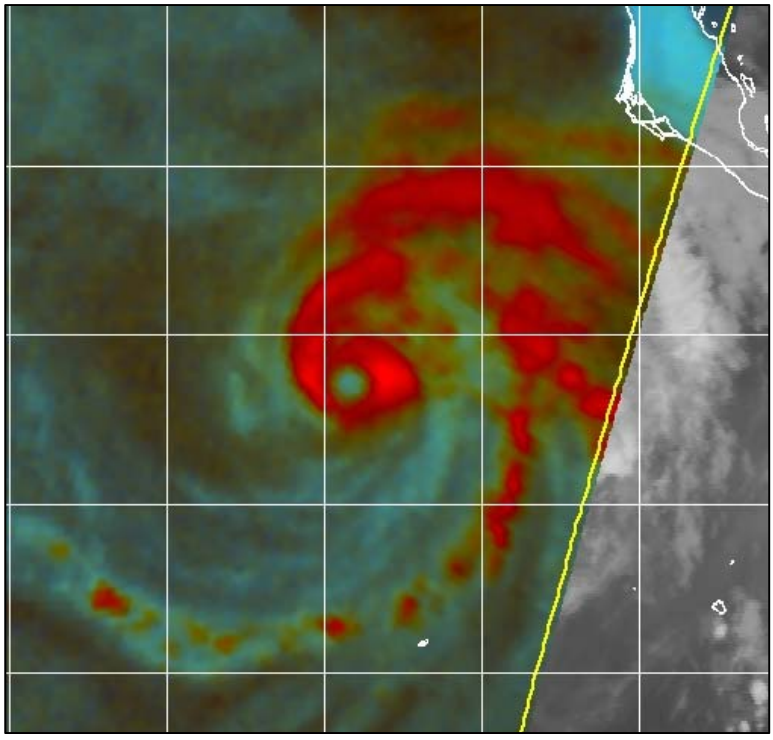

**COMPOSITE 91 GHZ MICROWAVE IMAGE OF KIKO NEAR PEAK INTENSITY.
IMAGE COURTESY OF NAVAL RESEARCH LABORATORY.**

Kiko was a short-lived category 1 hurricane (on the Saffir-Simpson Hurricane Wind Scale) that remained over the open waters of the eastern Pacific.

Hurricane Kiko

30 AUGUST -2 SEPTEMBER 2013

SYNOPTIC HISTORY

Kiko originated from the interaction of an eastern Pacific inter-tropical convergence zone (ITCZ) disturbance and a westward-moving tropical wave. The ITCZ disturbance became apparent on 28 August as a northeast-to-southwest-oriented trough of low pressure that was located about 750 n mi south-southwest of the southern tip of the Baja California peninsula. Later that day, a broad area of low pressure developed along the trough and began moving northeastward. The following day, the southern portion of a prolific tropical wave – one that had already contributed to the genesis of Atlantic Tropical Storms Erin and Fernand, and to the formation of eastern North Pacific Tropical Storm Juliette – approached the broad area of low pressure. When the tropical wave passed the pre-existing low pressure area on 29 August, the low became better defined and convection associated with the system began to increase. Early the next day, the low turned northward around the western portion of a mid-level ridge over Mexico while deep convection associated with the system became better organized. By 1200 UTC 30 August, the convection gained enough organization for the system to be analyzed as a tropical depression about 460 n mi southwest of the southern tip of the Baja California peninsula. The "best track" chart of the tropical cyclone's path is given in Fig. 1, with the wind and pressure histories shown in Figs. 2 and 3, respectively. The best track positions and intensities are listed in Table 1[1].

During the next 24 h, the depression strengthened slowly as it continued north-northwestward to northwestward over warm waters within an environment of moderate northerly vertical wind shear. The depression attained tropical storm strength by 1200 UTC 31 August when it was located about 435 n mi west-southwest of the southern tip of the Baja California peninsula. Around that time, the vertical shear decreased and a period of rapid strengthening began when the system became more symmetric with the center embedded within the small area of deep convection. Kiko turned north-northeastward between an upper-level low to its west and a mid-level ridge to the east, and shortly after 1800 UTC a banded eye briefly appeared in visible satellite imagery. During the next 12 to 18 h, the eye became better defined in microwave imagery (Figs. 4 and 5) and it is estimated that Kiko attained hurricane strength and reached its peak intensity of 65 kt around 0600 UTC 1 September.

Kiko did not maintain hurricane status for very long, as increasing southwesterly shear and cooler waters initiated rapid weakening. Kiko weakened to a tropical storm by 1800 UTC 1 September, and later that day the shear caused the center to become exposed to the southwest of the remaining deep convection. The deep convection continued to decrease in coverage and

[1] A digital record of the complete best track, including wind radii, can be found on line at ftp://ftp.nhc.noaa.gov/atcf. Data for the current year's storms are located in the *btk* directory, while previous years' data are located in the *archive* directory.

separate from the low-level center during the next 12 to 18 h. The decrease in organization resulted in steady weakening and by 0600 UTC 2 September the maximum winds decreased to an estimated 35 kt. The remaining deep convection dissipated shortly thereafter, and the system degenerated into a remnant low about 350 n mi west-southwest of the southern tip of the Baja California peninsula. The remnant low made a small cyclonic loop, then drifted southward before dissipating about 340 n mi west of the southern tip of the Baja California peninsula by 1200 UTC 4 September.

METEOROLOGICAL STATISTICS

Observations in Kiko (Figs. 2 and 3) include subjective satellite-based Dvorak technique intensity estimates from the Tropical Analysis and Forecast Branch (TAFB) and the Satellite Analysis Branch (SAB), and objective Advanced Dvorak Technique (ADT) estimates from the Cooperative Institute for Meteorological Satellite Studies (CIMSS)/University of Wisconsin-Madison. Data and imagery from NOAA polar-orbiting satellites including the Advanced Microwave Sounding Unit (AMSU), the NASA Tropical Rainfall Measuring Mission (TRMM), the European Space Agency's Advanced Scatterometer (ASCAT), and Defense Meteorological Satellite Program (DMSP) satellites, among others, were also useful in constructing the best track of Kiko.

The maximum intensity of Kiko was estimated operationally to be 60 kt. The 0600 UTC 1 September ADT estimate was 53 kt in real time; however, microwave-adjusted ADT estimates that became available several hours later were 63 kt at 0600 UTC and 72 kt at 1200 UTC. A CIMSS AMSU intensity estimate of 73 kt from a 0916 UTC satellite overpass also supports a higher wind speed than the operational assessment. Based on these data, Kiko is estimated in post-analysis to have been a hurricane with a maximum wind speed of 65 kt at 0600 and 1200 UTC 1 September.

There were no ship reports of winds of tropical storm force associated with Kiko.

CASUALTY AND DAMAGE STATISTICS

There were no reports of damage or casualties associated with Kiko.

FORECAST AND WARNING CRITIQUE

The genesis of Kiko was not well anticipated. The disturbance from which Kiko formed was introduced into the Tropical Weather Outlook at 0600 UTC 28 August. At that time, the disturbance was assigned a low chance (<30%) of formation during the next 48 h, and a 30% (medium) chance of formation during the next 120 h. The 0-48 h chance of formation did not

reach the medium category until genesis is estimated to have occurred in the best track. The 0 to 120 h probabilities of genesis were either 20% or 30% the entire time between when the system was introduced into the Outlook and when genesis occurred. The probabilities of formation were not higher because it was thought that the disturbance would reach cooler waters before significant development could occur. The formation of this system was not well forecast by the global models either. These models generally expected any development to be more gradual than what actually took place.

A verification of the relatively few NHC official track forecasts for Kiko is given in Table 2a. Official forecast track errors were slightly larger than the mean official errors for the previous 5-yr period. A homogeneous comparison of the official track errors with selected guidance models is given in Table 2b. The GFS, HWRF, and multi-model consensus TVCE exhibited mean track errors lower than the official forecast (OFCL).

A verification of NHC official intensity forecasts for Kiko is given in Table 3a. Official forecast intensity errors were somewhat higher through 36 h than the mean official errors for the previous 5-yr period. At 48 h, the mean error was lower than the 5-year mean, albeit for only two verifying forecasts. A homogeneous comparison of intensity errors with selected guidance models is given in Table 3b. The NHC forecasts and all of the intensity models did not predict as much intensification of Kiko as what occurred. This led to a significant low bias in the intensity guidance and the NHC forecasts.

There were no watches or warnings issued in association with Kiko.

Table 1. Best track for Hurricane Kiko, 30 August – 2 September 2013.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
29 / 1800	15.0	115.1	1008	20	low
30 / 0000	15.7	115.1	1008	25	"
30 / 0600	16.4	115.1	1008	25	"
30 / 1200	17.0	115.2	1007	25	tropical depression
30 / 1800	17.6	115.4	1007	30	"
31 / 0000	18.0	115.9	1005	30	"
31 / 0600	18.4	116.3	1005	30	"
31 / 1200	18.8	116.4	1003	35	tropical storm
31 / 1800	19.2	116.2	1001	45	"
01 / 0000	19.7	115.9	996	55	"
01 / 0600	20.3	115.6	989	65	hurricane
01 / 1200	21.0	115.6	989	65	"
01 / 1800	21.7	115.7	995	55	tropical storm
02 / 0000	22.3	116.0	1000	45	"
02 / 0600	22.6	116.2	1003	35	"
02 / 1200	22.8	116.3	1005	30	low
02 / 1800	22.9	116.5	1005	30	"
03 / 0000	22.8	116.6	1006	25	"
03 / 0600	22.7	116.5	1008	20	"
03 / 1200	22.7	116.4	1008	20	"
03 / 1800	22.7	116.2	1008	20	"
04 / 0000	22.6	116.1	1009	15	"
04 / 0600	22.4	116.1	1010	15	"
04 / 1200					dissipated
01 / 0600	20.3	115.6	989	65	maximum winds and minimum pressure

Table 2a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) track forecast errors (n mi) for Hurricane Kiko. Mean errors for the previous 5-yr period are shown for comparison. Official errors that are smaller than the 5-yr means are shown in boldface type.

	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	28.0	55.8	71.6	84.0			
OCD5	42.6	90.4	140.6	139.0			
Forecasts	8	6	4	2			
OFCL (2008-12)	27.0	43.1	57.8	71.9	101.7	137.2	165.9
OCD5 (2008-12)	37.4	73.0	114.9	158.3	238.4	313.5	389.1

Table 2b. Homogeneous comparison of selected track forecast guidance models (in n mi) for Hurricane Kiko. Errors smaller than the NHC official forecast are shown in boldface type. The number of official forecasts shown here will generally be smaller than that shown in Table 2a due to the homogeneity requirement.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	29.5	55.8	71.6	84.0			
OCD5	43.9	90.4	140.6	139.0			
GFSI	**22.0**	**38.3**	**57.8**	93.7			
GHMI	36.8	56.6	**45.1**	**60.1**			
HWFI	**23.0**	**49.3**	**70.6**	**74.6**			
EMXI	32.9	66.1	85.6	113.8			
NAMI	60.5	113.1	133.9	138.5			
LBAR	40.7	95.4	160.8	186.4			
AEMI	**27.3**	61.2	95.8	117.2			
TVCE	**26.5**	**45.8**	**58.5**	**72.8**			
BAMD	36.0	71.4	105.4	94.9			
BAMM	45.5	86.4	132.2	134.3			
BAMS	60.7	115.9	180.9	213.8			
Forecasts	7	6	4	2			

Table 3a. NHC official (OFCL) and climatology-persistence skill baseline (OCD5) intensity forecast errors (kt) for Hurricane Kiko. Mean errors for the previous 5-yr period are shown for comparison. Official errors that are smaller than the 5-yr means are shown in boldface type.

	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	6.9	18.3	17.5	**7.5**			
OCD5	11.6	23.3	17.8	4.0			
Forecasts	8	6	4	2			
OFCL (2008-12)	6.3	10.5	13.4	14.5	15.3	17.0	17.3
OCD5 (2008-12)	7.6	12.5	16.5	18.8	20.4	20.3	20.6

Table 3b. Homogeneous comparison of selected intensity forecast guidance models (in kt) for Hurricane Kiko. Errors smaller than the NHC official forecast are shown in boldface type. The number of official forecasts shown here will generally be smaller than that shown in Table 3a due to the homogeneity requirement.

Model ID	Forecast Period (h)						
	12	24	36	48	72	96	120
OFCL	6.9	18.3	17.5	7.5			
OCD5	11.6	23.3	17.8	**4.0**			
GHMI	13.5	23.0	21.0	11.0			
HWFI	9.3	**17.5**	**17.0**	14.0			
DSHP	10.8	21.5	**16.0**	**1.0**			
LGEM	11.5	23.5	20.0	7.5			
ICON	11.1	20.8	**16.3**	8.0			
IVCN	11.1	20.8	**16.3**	8.0			
Forecasts	8	6	4	2			

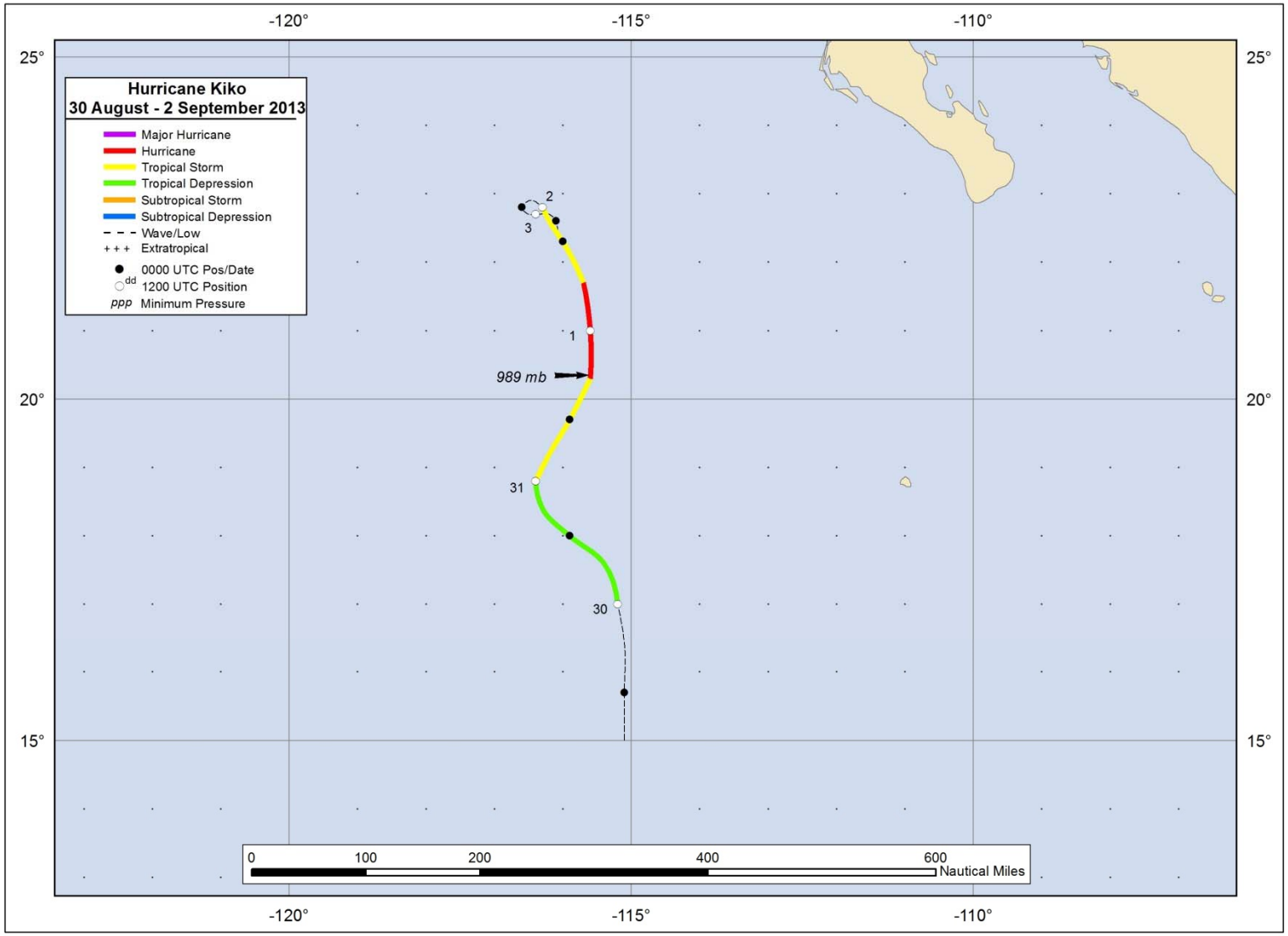

Figure 1. Best track positions for Hurricane Kiko, 30 August – 2 September 2013.

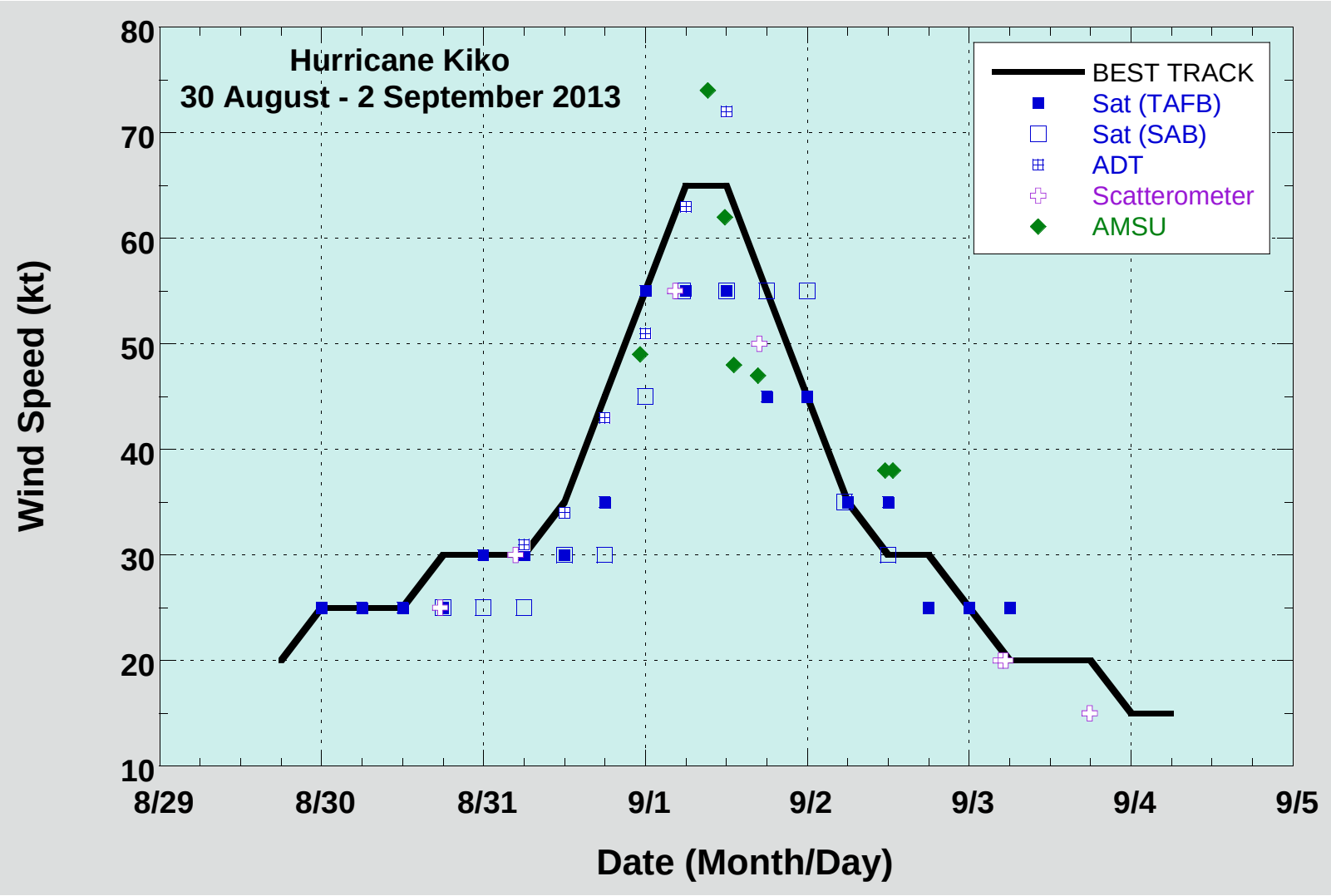

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Hurricane Kiko, 30 August – 2 September 2013. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. Dashed vertical lines correspond to 0000 UTC.

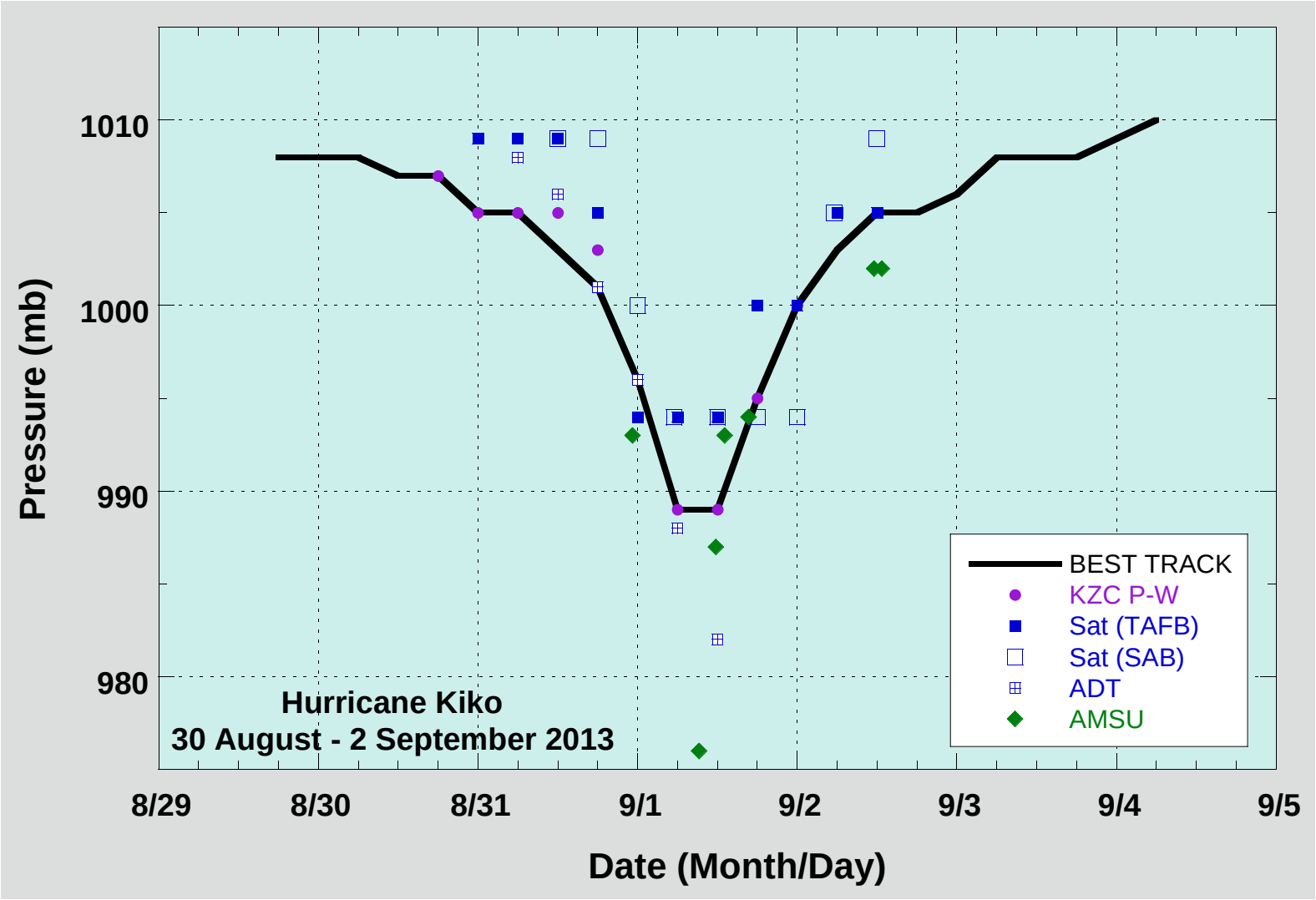

Figure 3. Selected pressure observations and best track minimum central pressure curve for Hurricane Kiko, 30 August – 2 September 2013. Advanced Dvorak Technique estimates represent the Current Intensity at the nominal observation time. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. KZC P-W refers to pressure estimates derived using the Knaff-Zehr-Courtney pressure-wind relationship. Dashed vertical lines correspond to 0000 UTC

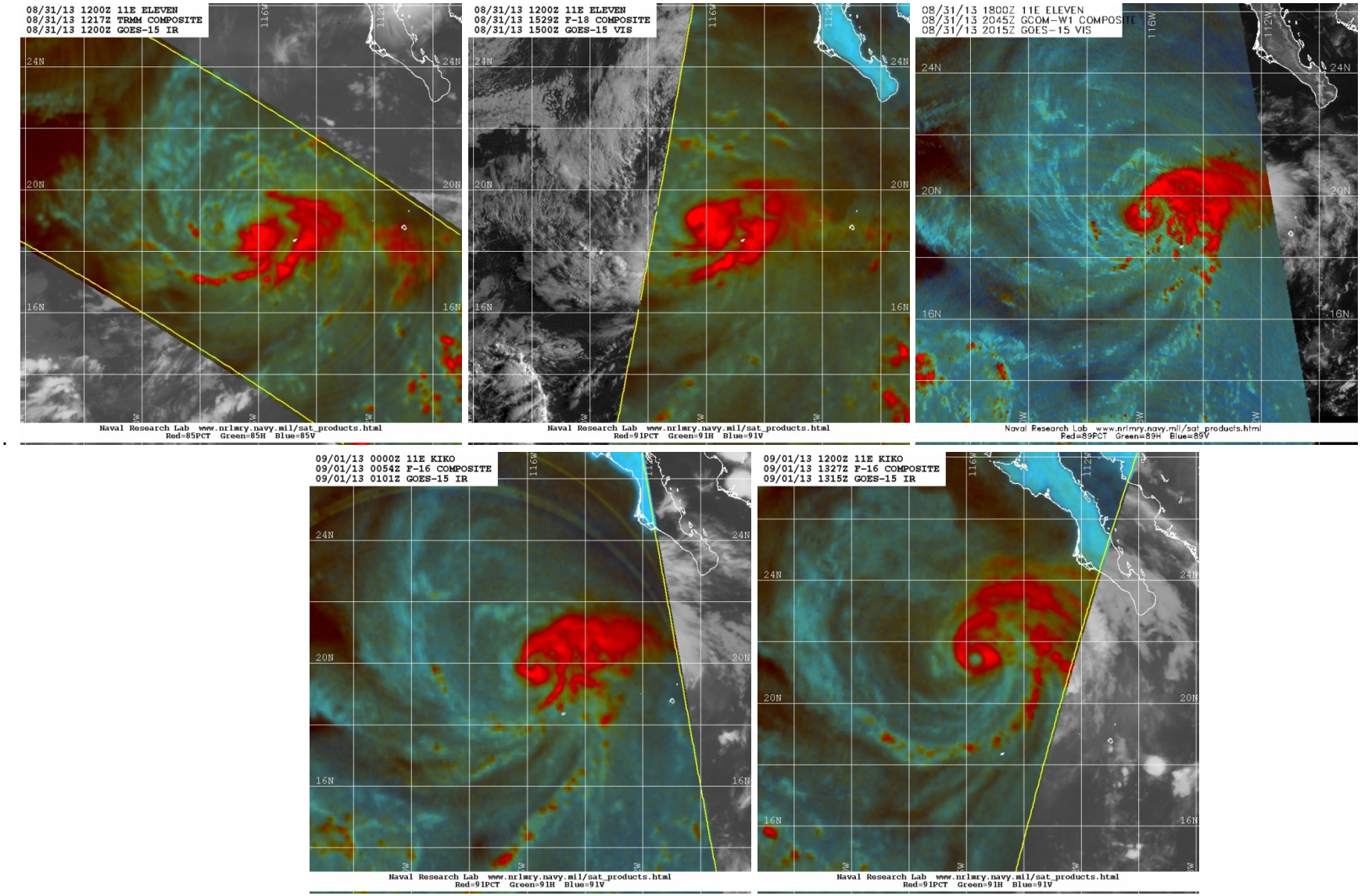

Figure 4. Composite 85 to 91 GHz microwave images showing the increasing organization of the convection associated with Kiko from 1217 UTC 31 August (top left) to 1327 UTC 1 September (bottom right). Note the formation of the well-defined eye in the 1327 UTC 1 September image. Images courtesy of the Naval Research Laboratory (NRL).

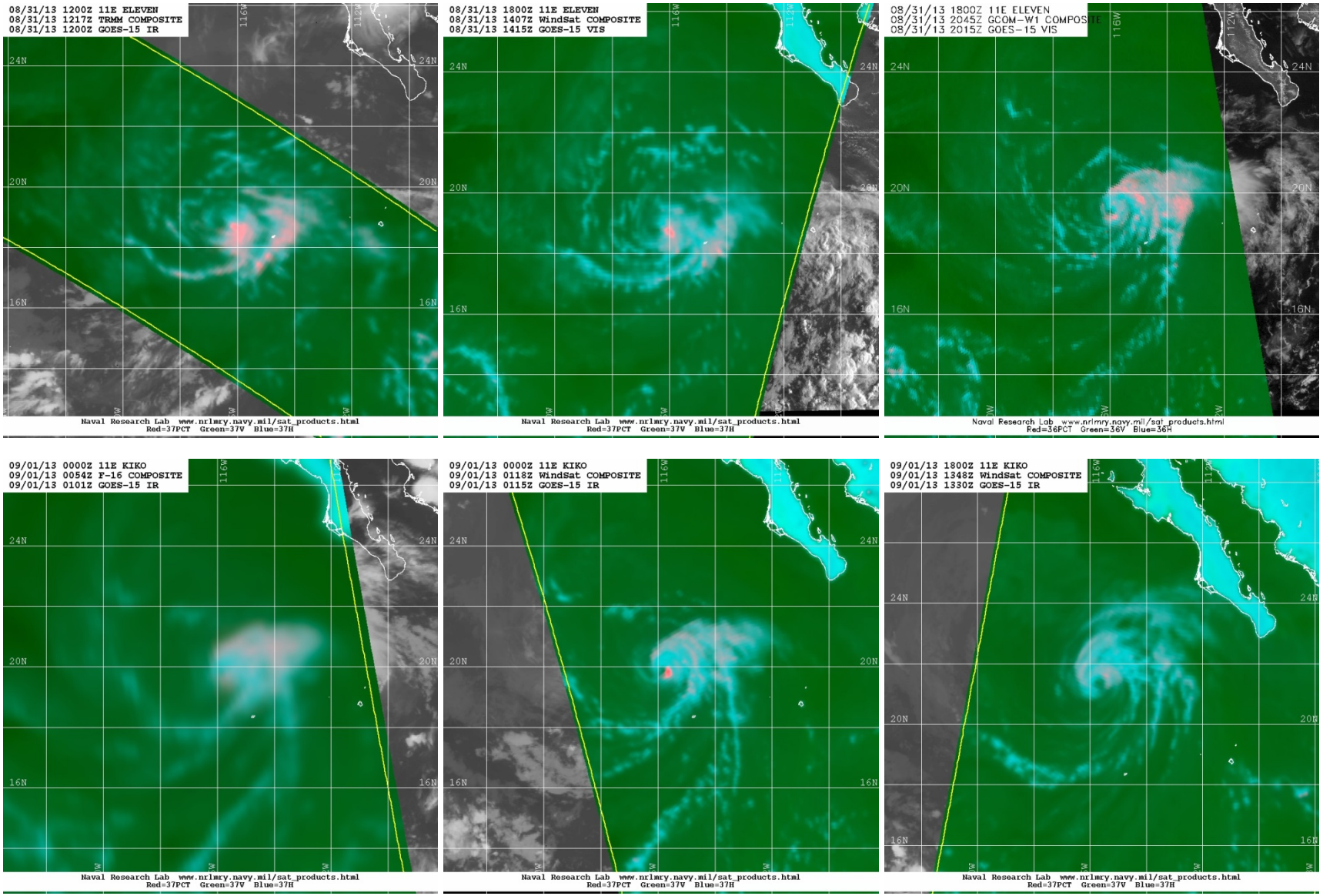

Figure 5. Composite 37 GHz microwave images showing the increasing organization of the low-level inner core of Kiko from 1217 UTC 31 August (top left) to 1348 UTC 1 September (bottom right). Images courtesy of the NRL.