

SUPER TYPHOON KIM (23W)

Super Typhoon Kim was a "midget" tropical cyclone that produced sustained winds of 135 kt (69 m/sec) with gusts to 165 kt (85 m/sec) and attained a minimum sea-level pressure (MSLP) of 905 mb. It was the fourth significant tropical cyclone that began in November, and was the first of four significant tropical cyclones in the month of December. Kim was the third super typhoon of the year and the first December super typhoon in twenty-two years since Super Typhoon Opal (December 1964). Fifty-two warnings were issued on Kim - more than any other tropical cyclone in 1986 except for Typhoons Vera (11W) and Wayne (12W). Thirty aircraft reconnaissance missions were flown on Kim, the most for any tropical cyclone in 1986. Included in these missions were five synoptic tracks and 45 center fixes. The information provided by the aerial reconnaissance platform was quite essential as Kim presented JTWC with track forecast problems at three different times.

Kim began, innocently enough, as a broad poorly organized area of convection near the dateline on the 26th of November. When convection persisted for 24-hours, JTWC first mentioned it on the Significant Tropical Weather Advisory (ABPW PGTW) at 270600Z. Maximum sustained winds were estimated at 10 to 20 kt (5 to 10 m/sec) and the MSLP was estimated at 1006 mb. Over the next 15-hours, outflow and convection increased significantly. Upper-level outflow was unrestricted in all quadrants and an upper-level anticyclone became well-established over the surface circulation center. The MSLP was estimated at 1005 mb. For these reasons JTWC issued a Tropical Cyclone Formation Alert (TCFA) at 272130Z, when the system was located about 360 nm (667 km) east of Pohnpei. Just nine hours later, at 280600Z, JTWC issued the first warning on Tropical Depression 23W based on a (Dvorak) intensity estimate of 35 kt (18 m/sec). At 281200Z, JTWC upgraded Tropical Depression 23W to Tropical Storm Kim based on continued intensification.

At 290126Z, the first aircraft reconnaissance mission closed off the surface circulation center 145 nm (269 km) north-northeast of Pohnpei. The Aerial Reconnaissance Weather Officer reported that an elliptical eye was beginning to form, which was open to the northwest. This first penetration found maximum 700 mb winds of 65 kt (33 m/sec) and a 700 mb height of 2921 meters, which corresponds to an MSLP of about 980 mb. The second penetration, 90 minutes later, reported maximum surface winds of 80 to 85 kt (41 to 44 m/sec). The 290600Z warning upgraded Kim to typhoon status.

From 261800Z through 291200Z (warning number 6), Kim tracked toward the west-northwest following a basic under-the-ridge scenario. At 291800Z, the eastward movement of a mid-latitude trough weakened the subtropical ridge. This caused Kim to move northwestward. The weakness in the ridge was misinterpreted by JTWC as a "break" in the ridge. At 010000Z, JTWC altered Kim's forecast track from an under-the-ridge scenario to a through-the-ridge scenario based on this break. Kim's track changed from anticyclonic to cyclonic, as Kim continued to track toward the northwest. As Kim reached the inflection point, it began to intensify at a rate slightly greater than expected from the normal Dvorak curve of one "T-number" per day. Kim's intensity increased from 85 kt (44 m/sec) at 010000Z to 135 kt (69 m/sec) by 022100Z.

The first, of three, major track forecasting problems arose when aircraft reconnaissance at 021105Z verified prior satellite imagery indications that Kim was moving westward. The mid-level ridge to the north strengthened as the low- to mid-level trough moved off to the east. Because of the significant forecast track change on Kim, an abbreviated warning message was sent out at 022100Z, since Kim immediately became a threat to Saipan.

At about 030400Z, Super Typhoon Kim, with its peak winds of 135 kt (69 m/sec), passed about 18 nm (33 km) to the north of Saipan. Kim inflicted

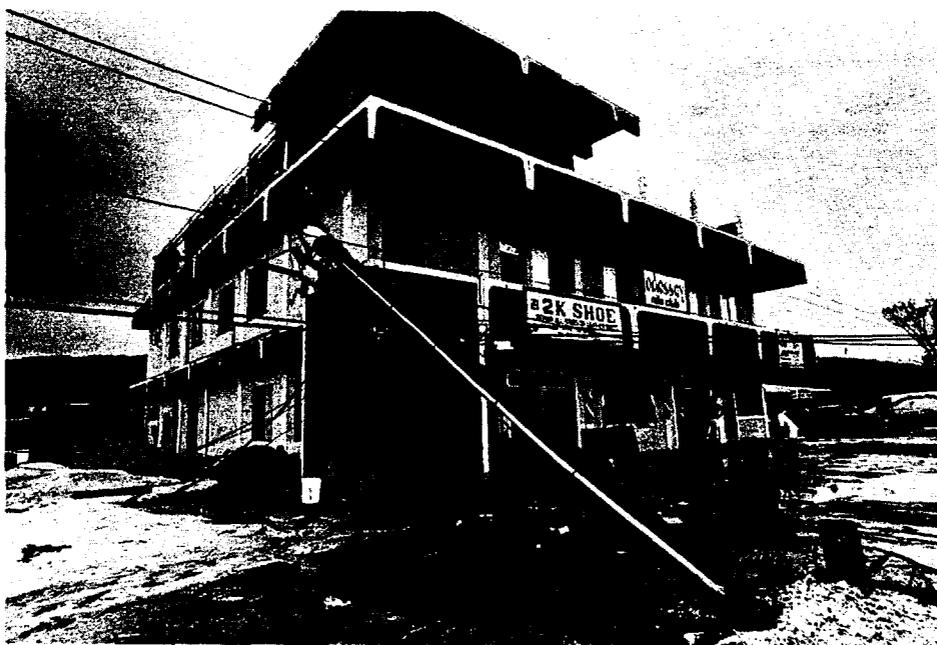


Figure 3-23-1. One of the many downed telephone poles leans against a shoe store in Garapan, the major city of Saipan, in the aftermath of Kim (Photo provided courtesy of Guam Publications, Inc.).

substantial damage to Saipan, leaving the entire island without electricity and water. An estimated one-third of all power poles were down (see Figure 3-23-1), hundreds of people were left homeless, 14 people were injured, mainly due to flying glass, and one (heart attack) fatality was reported. Damages (Figure 3-23-2) were estimated at about 15 million dollars by the Governor of Saipan. A team of U.S. Navy Construction Battalion personnel (Seabees), engineers from the U.S. Navy Public Works Center (Guam) and electrical generators were sent to Saipan to get the island's essential power system back on-line.

Kim continued tracking westward until 040000Z (Figure 3-23-3). Afterward, it began moving northwestward. This presented the second major forecasting problem with Kim. JTWC had followed the One-Way Interactive Tropical Cyclone Model (OTCM) guidance and repeatedly forecast recurvature. A synoptic track flow between 040500Z and 041200Z indicated a "break" in the subtropical ridge approximately 135 nm (250 km) southwest of Iwo Jima. The forecast looked good, but for the second time an unforecasted major directional change in the track

occurred. Once again, this was not a "break" in the ridge, but merely a weakness that would cause the tropical cyclone to take a "step" toward the northwest and then return to a the westward track; as the mid-latitude trough moved north and then east of the system.

At 071200Z, Kim abruptly changed track and began moving toward the south along the leading edge of a modifying polar air mass moving off the Asian landmass. At the same time, the entrainment of cold air and increased vertical shear started to weaken the tropical cyclone. Aircraft reconnaissance at 081542Z, 082130Z and 090000Z documented this trend and Kim was subsequently downgraded to tropical storm intensity at 090000Z. By 090600Z, Kim's intensity was down to 55 kt (28 m/sec), and forty-two hours later, at 110000Z, to 30 kt (15 m/sec). After three days of erratic movement, Kim was further downgraded to a tropical depression. The final warning was issued at 110000Z as the system dissipated over water. The remains of Kim tracked west-northwestward and dissipated over the Philippine Sea 300 nm (556 km) east of the island of Luzon.



Figure 3-23-2. Many structures were extensively damaged by wind and water (Photo courtesy of Guam Publications, Inc.).

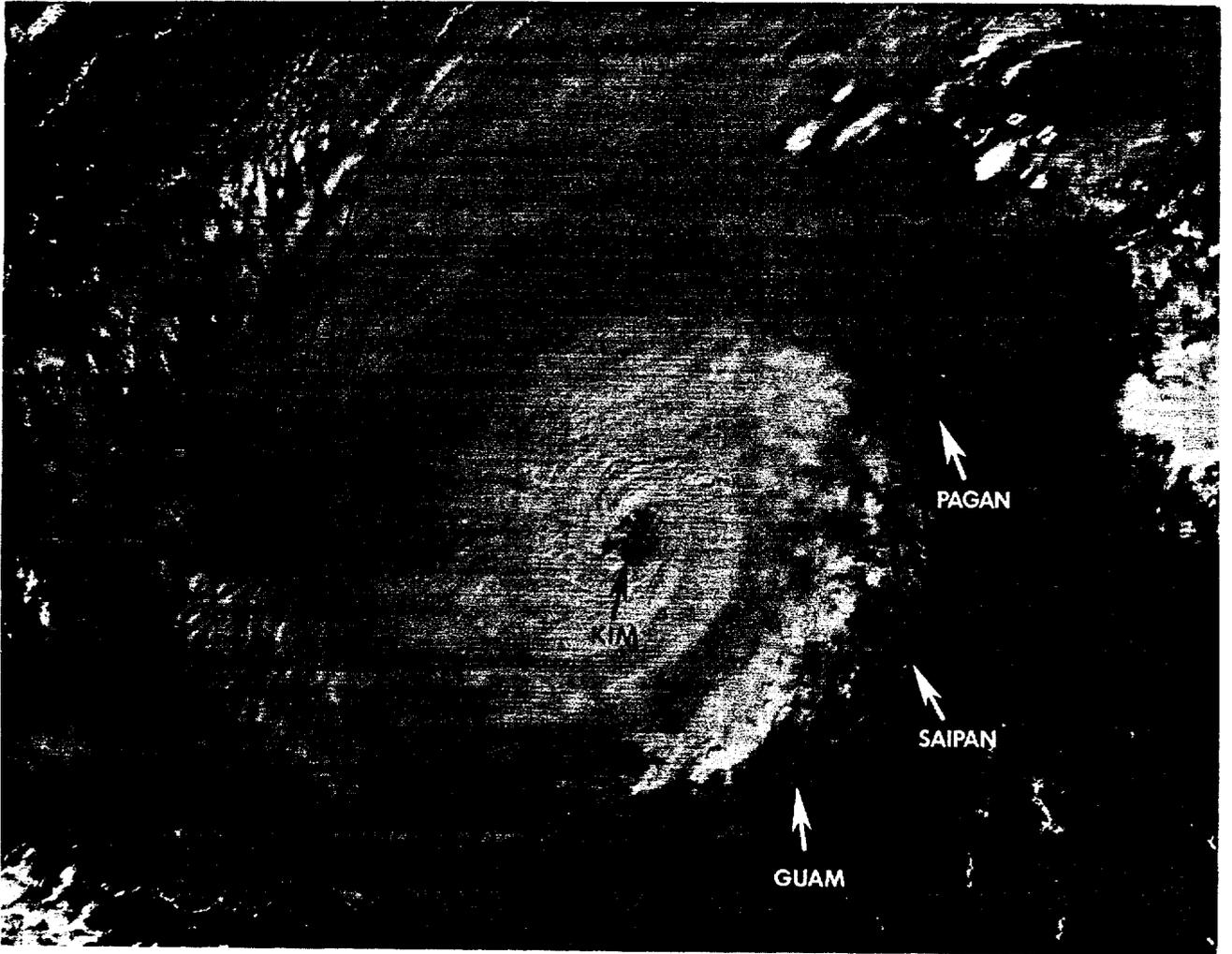


Figure 3-23-3. A day after damaging Saipan, Super Typhoon Kim was still on a westward track (040004Z December DMSP visual imagery).