11A.7 TCS08 MINORITY REPORT: HOW TO PREVENT TYPHOONS IN THE WESTERN NORTH PACIFIC

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Introduction

Between May and December of 2008, The THORPEX Pacific Asian Regional Campaign (T-PARC) was underway. In support of the many activities of T-PARC, several field experiments were carried out in the western North Pacific to study the behavior of tropical cyclones (TC) and the extra-tropical transition of TCs. Against the backdrop of these international field experiments, the U.S. Navy (primarily the Office of Naval Research with funding also from the National Science Foundation) undertook a field experiment to study TC structure: TCS08. Similar to the earlier TC motion experiments in the early 1990s, U.S. military assets were deployed to the western North Pacific during August, September, and October of 2008 for the field phase of TCS08. The objectives of TCS08 addressed mechanisms and predictability of tropical cyclone formation, intensification, and structure change.

The headquarters for TCS08 plans, activities and decisions affecting asset deployments was at the Naval Post Graduate School in Monterey, CA. Linked by interactive internet applications, many individuals and groups provided real-time weather diagnoses and forecasts for TCS08 decision makers. The author of this paper provided such support from Guam in cooperation with personnel from Guam's National Weather Service Forecast Office. Based in the western North Pacific, the Guam team had a unique perspective on the weather and climate of the summer and fall of 2008. Because of the regional differences in the understanding of tropical cyclone behavior, the Guam forecast support team had diagnoses and forecasts that often deviated substantially from the consensus; hence, this "Minority Report" providing the Guam-based understanding of the TC activity, climate and weather during TCS08.

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The climate and weather of 2008

The weather patterns during the summer and fall of 2008 in the tropics of the western North Pacific deviated far from normal. The strength of the low-level easterlies was extraordinary, with a persistent 2 SD easterly anomaly in the deep tropics (EQ to 20 N) for almost the entire period June through November (Fig.1). Other anomalies of note included: Persistent 200 mb west-wind anomalies; a dearth of TC origins from cloud clusters in the "ITCZ" (i.e., relatively few cloud clusters in the deep tropics became the seeds for TC genesis) (Fig. 2); a conspicuous absence of the monsoon trough; and, unusual convective activity in the subtropics that produced some controversial cyclones. The low-level east wind anomalies were so strong that the monsoon trough did not make its usual episodic penetrations eastward into Micronesia.

The year of 2008 both began and ended with La Niña conditions, with ENSO indices remaining neutral for most of the year. But while the prevailing state of the climate was ENSO-neutral, the weather patterns were far from normal. In the western North Pacific basin, climatic effects more typical of La Niña were noted for much of 2008, and included well-known La Niña-related anomalies such as below normal tropical cyclone activity across most of Micronesia, basin tropical cyclone activity shifted well to the west and north of normal (Fig. 2), a weak (or absent) monsoon, and abnormally strong and widespread easterly surface winds in the low latitudes that pushed tropical cyclone activity to the west and raised the sea level to abnormally high levels in western portions of the basin.

During the calendar year 2008, the weather throughout the U.S.-Affiliated Pacific Islands (USAPI) was generally tranquil, with no destructive wind events and few extremes of rainfall. The most dramatic climate extreme of the year occurred during the period December 9-15, 2008, when an unusual pattern of gale-

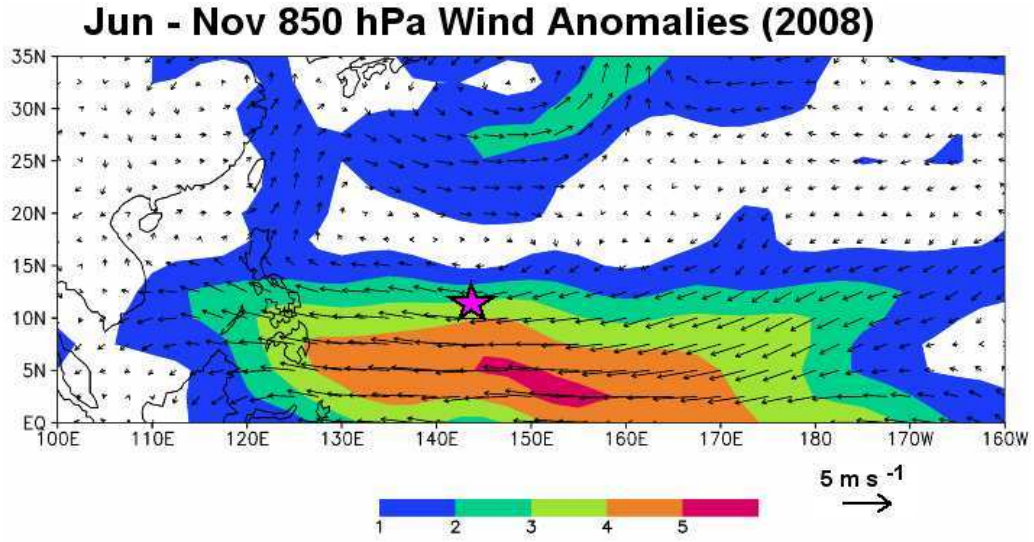

Figure 1. Wind anomaly at 850 hPa for the 6-month period June through November 2008. This vast easterly wind anomaly in the deep tropics of the western North Pacific was of sufficient magnitude to eliminate the normal monsoon trough of the region, and to stifle the normal development of tropical cyclones eastward of the longitude of Guam (Purple star). The magnitude of the wind anomaly approaches two units of standard vector deviation in the orange region. (Figure adapted and used with the permission of J –C.L. Chan, City University of Hong Kong)

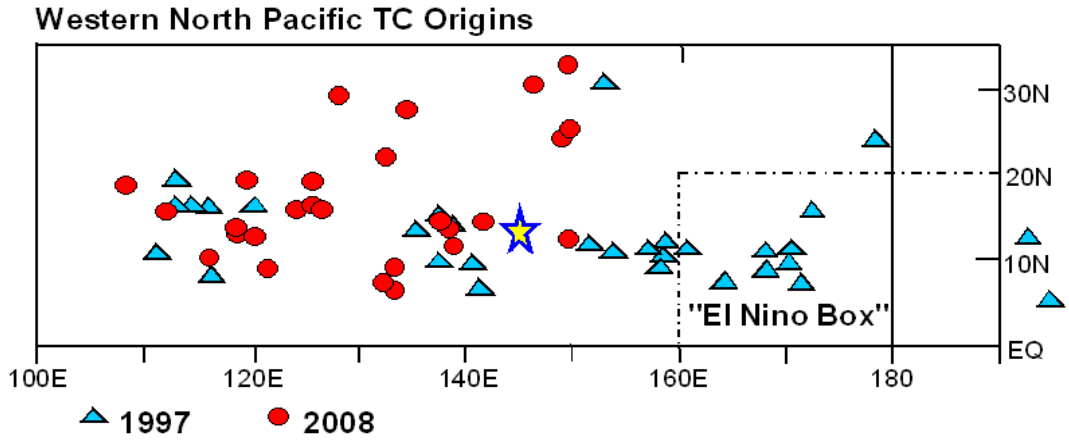

Figure 2. Tropical cyclone origin locations during 1997 (blue triangles) and during 2008 (red dots). The yellow star with blue outline is the location of the island of Guam (13.4 N ; 144.8 E). The origin location of each tropical cyclone is assigned to the location where the wind speed first attains 25 kt on the JTWC best track. Note the substantial difference between TC origins during 1997 (an El Niño year) verus 2008 (an ENSO-neutral year that acted in many ways as if it were La Niña). Only one tropical cyclone, Dolphin (originating in the location of the red dot just to the east of Guam), required a watch and warning anywhere in Micronesia during 2008.

force winds located in the subtropics of the western North Pacific near the International Date Line generated an oceanic swell that traveled to the south and caused phenomenal surf throughout eastern Micronesia, and all the way south to the northern coast of Papua New Guinea. Massive inundation was experienced in many locations, with damage to infrastructure, personal property, and crops.

For the second year in a row, the tropical cyclone season of the western North Pacific basin was below normal in almost every category of activity (e.g., number of typhoons). The JTWC numbered 27 tropical cyclones in the western North Pacific basin during 2008. This was 4 below average. Of these 27 cyclones, 2 were tropical depressions, 14 were tropical storms, 11 were typhoons, and 2 of the typhoons were super typhoons. This corresponds to normal values of 3, 10, 18, and 4 for these statistics, respectively. The JMA named 22 of the cyclones that JTWC numbered. The JMA named one cyclone, Phanfone, which the JTWC did not number. Tropical cyclone activity in the western North Pacific basin was also shifted far westward and northward, which is typical during La Niña. Because of this major shift of basin cyclone activity, no area of Micronesia was severely impacted by a tropical cyclone during 2008. The Guam Weather Forecast Office almost made it through the entire calendar year of 2008 without issuing a single tropical cyclone watch or warning for any of the islands of Micronesia. This unprecedented tranquility was briefly interrupted by Typhoon Dolphin during December.

The suppression of typhoons

The anomalously easterly winds of 2008 were so strong that the typical monsoon trough of the western North Pacific was absent in its normal location across Micronesia. Thus, the circulation of the deep tropics of the western North Pacific looked much like a typical tropical Atlantic low-level wind circulation dominated by easterly winds and deep convection concentrated in a narrow "ITCZ" cloud band. This was a recipe for a very quiet typhoon season. Many of the early arrivals of U.S. mainland personnel for TCS08 flight operations out of Andersen Air Force Base, Guam, were excited to see the extensive easterly wind flow across the region, and fully expected many of the cloud clusters in the ITCZ to be the seeds for TC genesis. The Guam-based forecast support team, however, recognized this wind pattern as highly detrimental for TC genesis. To much of the group, their forecasts seemed unduly pessimistic. Interesting TC action was taking place in the subtropics, but in their excitement to explore the systems in this region, the Guam forecast team seemed to the group to be overly optimistic.

TC activity in the subtropics

While the deep tropics of the western North Pacific failed to provide much TC development, the subtropics had an unusual abundance of controversial cyclones that were (for the most part) ignored. First and foremost, the action in the subtropics was generally out of the range of experiment assets. Also, many of these systems were not considered to be genuine tropical cyclones by a majority of participants (hence, this Minority Report). Much of the focus of the field experiment was devoted to what were thought to be "easterly waves" moving rapidly westward in the anomalous easterly flow in the deep tropics (5° to 15° N). These had extreme difficulty forming tropical cyclones. In early August, a spate of small cyclones formed along the western periphery of the subtropical high, and moved northward along the East Asia coastline (Fig. 3). All but one of these (TD 11W) was ignored by the TCS08 group and the TC warning agencies (e.g., JMA and JTWC).

TD 11W

The tropical disturbance that became TD 11W formed near Okinawa. From there it moved north toward Korea, and then passed into the Sea of Japan. This one cyclone alone illustrated the great divide between the Guam TC forecast support personnel philosophy and the external TC community. TD 11W was a typical "midget" tropical cyclone that most probably was a tropical storm. The JTWC begrudgingly called it a TD with 30 kt wind, and the JMA never named it. There were few in-situ reports within its circulation. One ship observation of 37 kt was found on the northwest side of the TC when it was located just to the south of Cheju Do (middle image in Fig. 4). Quickscat showed a well-defined vortex with peak winds of gale force. Satellite imagery could have been interpreted as that of a tropical storm.

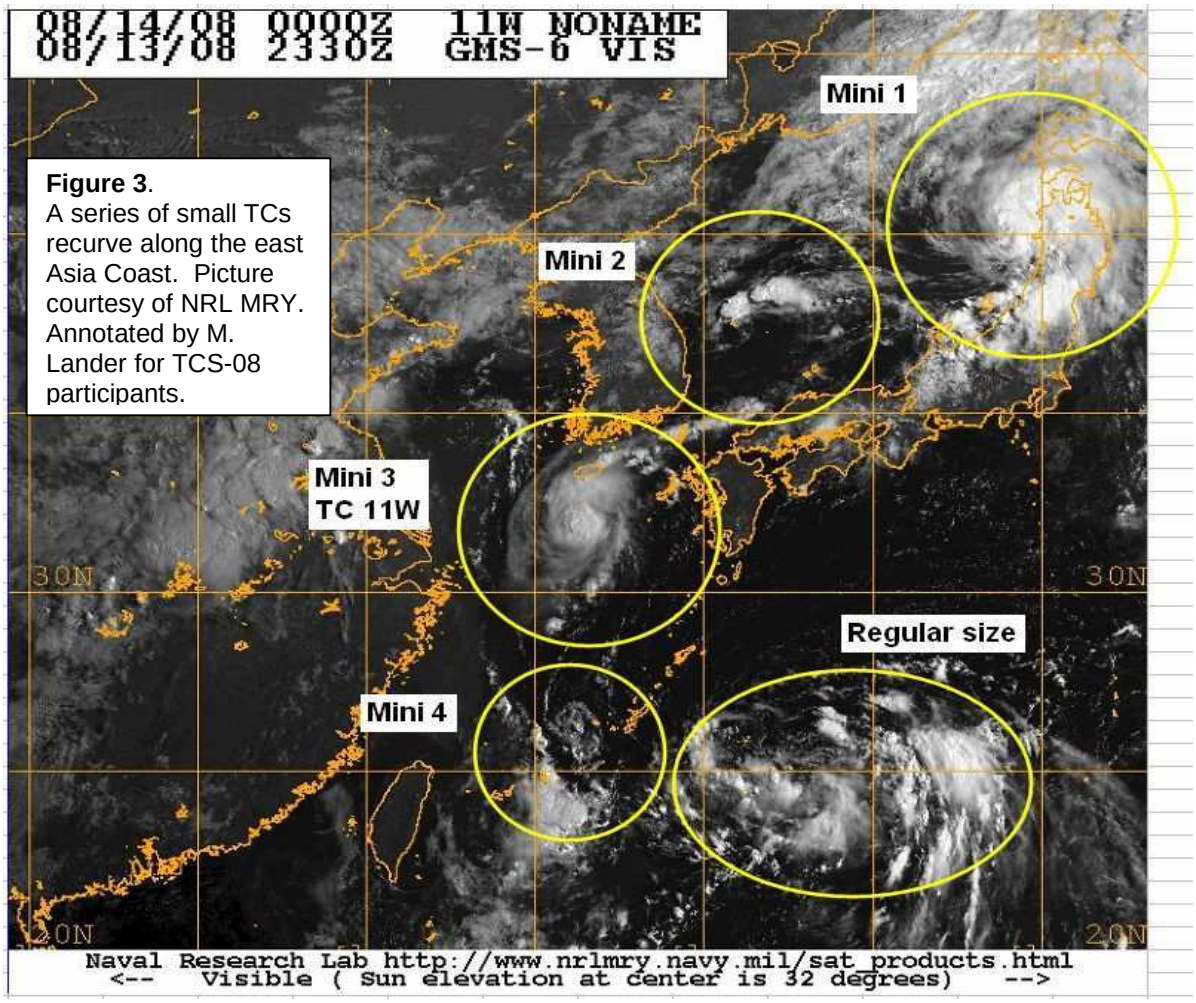

Figure 3.
A series of small TCs recurve along the east Asia Coast. Picture courtesy of NRL MRY. Annotated by M. Lander for TCS-08 participants.

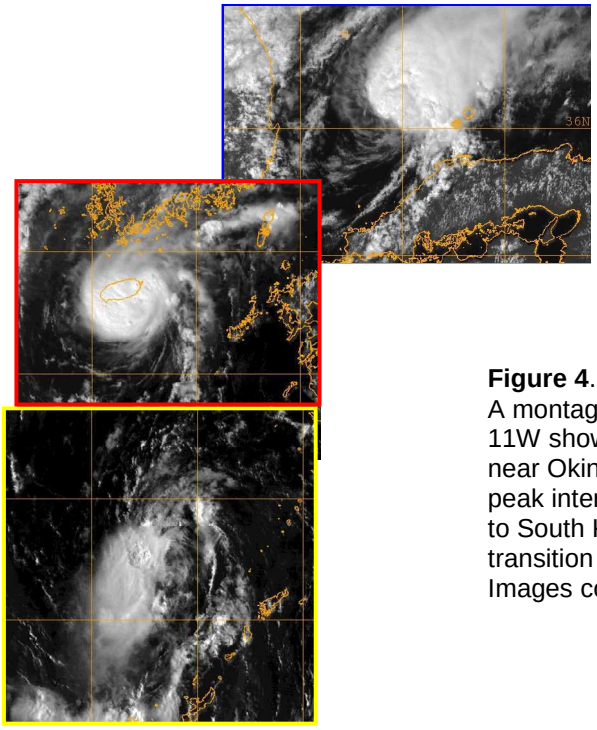

Figure 4.
A montage of images of TD 11W showing its formation near Okinawa, its probable peak intensity on its approach to South Korea, and its ET transition in the Sea of Japan. Images courtesy of NRL MRY.

TD 11W and TS Marco

In October of 2008, a midget tropical storm (Marco) (Fig.5) formed in the southwest Gulf of Mexico. This tiny TC was one of the smallest ever observed in the Atlantic, and its size was given special mention in the following prognostic reasoning message from the Miami Hurricane Center (Fig. 5 and text below).

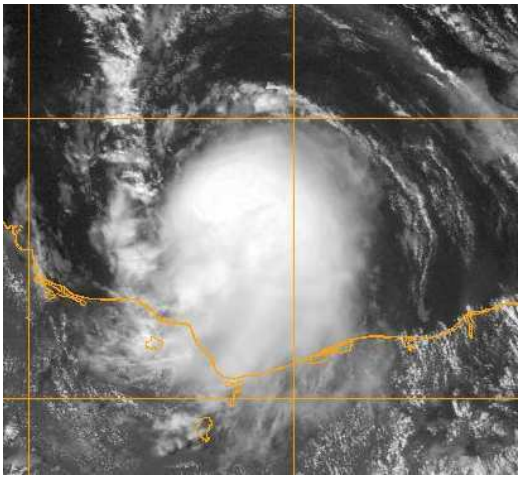

Figure 5.
TROPICAL STORM MARCO

THE DEPRESSION QUICKLY STRENGTHENED TO A TROPICAL STORM...AND ITS WINDS REACHED 65 MPH EARLY ON 7 OCTOBER AS IT MOVED TO THE WEST-NORTHWEST. MARCO DID NOT STRENGTHEN FURTHER...AND MADE LANDFALL BETWEEN TUXPAN AND VERACRUZ ON THE MORNING OF 7 OCTOBER. THE CYCLONE WEAKENED RAPIDLY AFTER MAKING LANDFALL AND DISSIPATED LATER THAT DAY. IT IS ESTIMATED THAT AT TIMES THE TROPICAL STORM FORCE WINDS EXTENDED NO MORE THAN ABOUT 12 MILES FROM THE CENTER. ALTHOUGH THE HISTORICAL RECORD ON STORM SIZE IS VERY SHORT...DATING BACK ONLY TO 1988...MARCO'S 12 MILE EXTENT OF TROPICAL STORM FORCE WINDS MAKES IT THE SMALLEST TROPICAL STORM ON RECORD IN THE ATLANTIC BASIN.

Whereas Tropical Storm Marco had aircraft reconnaissance to “prove” that it was a tropical storm, satellite imagery, one ship report of gales, Quikscat support of gale-force winds, and a fairly well-defined eye on Korean radar imagery was insufficient to bestow upon TD 11W the status of a tropical storm (except by the Guam TCS08 forecast support team). TD 11W had a striking resemblance to Tropical Storm Marco (Fig. 6).

During the summer of 2008, there were several cyclones in the subtropics of the western North Pacific that were alleged to be tropical storms (and even minimal typhoons) by the Guam forecast team (cf. Edson 2010, paper 10A.3 this conference). They were ignored by the general community for one or more of the following reasons (to list a few commonly used):

(1) the cyclone did not possess gales,
(2) the cyclone was not tropical,
(3) the cyclone was not literally in the tropics,
(4) the cyclone structure was extratropical, or at best, some sort of hybrid cyclone,
(5) the cyclone was “cold core”,
(6) the cyclone did not have enough deep convection (amount and cloud-top heights),
(7) Quikscat gales were unreliable.

Summary Statement

The mechanisms of TC genesis and intensification are not well-understood. Genesis and intensity changes are hard to anticipate, and improvements in forecasting these parameters have lagged the extraordinary improvements in TC motion forecasting. TCS08 provided an opportunity to examine TC genesis and structure changes with in-situ assets that are not normally available in the western North Pacific. Much valuable data was gathered during the field phase of this project. The data from TCS08 must be placed in its context of a very unusual circulation anomaly during the summer of 2008. The easterly low-level wind anomaly in the deep tropics was almost unprecedented in strength and duration. Also, while TC genesis was impeded in the deep tropics, several TCs formed in the subtropics. These garnered little interest from the TCS08 group and were generally ignored or under-reported by the warning agencies (JTWC and JMA).

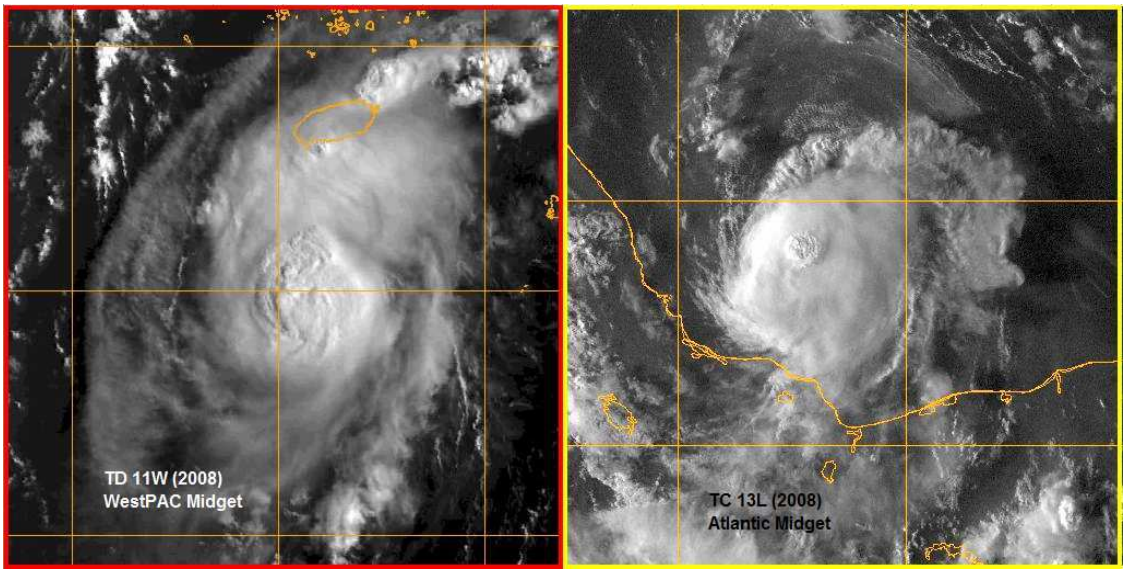

Figure 6. Which one is a 55 kt tropical storm, and which one is a 30 kt TD? Images of TD 11W (left) and TS Marco (right) at the same size scale. Images courtesy of NRL MRY.