5B.3 THE URGENT NEED FOR A RE-ANALYSIS OF WESTERN NORTH PACIFIC TROPICAL CYCLONES

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1. INTRODUCTION

The U.S. Hurricane Research Division (HRD) is well underway in a project to revise the Atlantic basin hurricane database (or HURDAT). HURDAT is the official record of tropical storms and hurricanes for the Atlantic Ocean, Gulf of Mexico and Caribbean Sea, including those that have made landfall in the United States. This database is utilized for a wide variety of purposes: setting of appropriate building codes for coastal zones, risk assessment for emergency managers, analysis of potential losses for insurance and business interests, intensity forecasting techniques, verification of official and model predictions of track and intensity, seasonal forecasting, and climate change studies. There are many reasons why a re-analysis of the HURDAT dataset was both needed and timely. HURDAT contained many systematic and random errors that needed correction. Additionally, as our understanding of tropical cyclones developed, analysis techniques at the. National Hurricane Center changed over the years, and led to biases in the historical database. Recent efforts led by the late Jose Fernandez-Partagas uncovered previously undocumented historical tropical cyclones in the mid-1800's to early 1900's.

In the western North Pacific, there are several institutions that archive statistics of the tropical cyclones. The Joint Typhoon Warning Center (now located in Pearl Harbor, Hawaii) has nearly 50-year record of tropical storms and typhoons for the western North Pacific Basin. The Tokyo Typhoon Center is the Regional Specialized Meteorological Center (RSMC) for the analysis, tracking and forecasting of western North Pacific tropical cyclones within the framework of the World Weather Watch Programme of the World Meteorological Organization (WMO). The Tokyo Typhoon Center was established at the Headquarters of the Japan Meteorological Agency (JMA) in July 1989, following the designation by the WMO Executive Council at its 40th session held in Geneva in June 1988. It has a record of tropical storms and typhoons in western North Pacific that extends back to 1951.

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This presentation examines differences in the best track archives of these two institutions and documents the many substantial differences in the locations, intensities, and wind distributions of tropical cyclones. Intensities are sometimes found to vary by two Saffir-Simpson Categories. The archived distribution of gales and typhoon-force winds can vary by hundreds of kilometers. The objective of the work reported in this paper is to examine and summarize the differences that are found in the best track archives, and to attempt to explain some of them. The ultimate goal is to establish a working group of tropical cyclone diagnostic experts to undertake a project similar to the HRD Hurricane Re-Analysis Project for the historical record of the tropical cyclones of the western North Pacific. The historical record of tropical cyclones has become important in the scientific and political challenges of climate change, and the risks of the ever-increasing human habitation in cyclone-prone regions. It is of the utmost importance to make the record as accurate as possible. Real-time validation data are often not available.

Despite efforts to minimize conflicting information, the JMA and the JTWC are often quite far from each other in their assessments of tropical cyclone intensity and wind distribution. Part of this conflict results from the use of different wind averaging periods for the warning intensity. The JMA warnings give 10-minute sustained values whereas the JTWC provides a 1-minute sustained wind on its advisories. The relationship between the 10-minute sustained wind and the 1-minute sustained wind is such that the 1-minute wind is approximately 112% of the 10-minute sustained wind speed. Other agencies use slightly different conversions such as the Hong Kong Observatory, which uses a factor of approximately 114%. This is not the only source of conflict, however. The basic scale used to assign wind speeds to tropical cyclones based on their characteristics as seen on meteorological satellite imagery is quite different between the JMA and the JTWC. Dvorak's techniques for estimating tropical cyclone intensity from visible and infrared satellite imagery (Dvorak, 1975, and Dvorak 1984) provide a "T" number that is related to the cyclone's intensity. The differences

in the intensities given by the JMA and by the JTWC to specific "T" numbers (Table 1) cannot be entirely accounted for by the 10-minute/1-minute conversion. The JMA wind speeds are lower than those of the JTWC for the higher wind speeds even when a correction is made for the different averaging intervals. This has led to some complaints that the JTWC typhoon intensities are too high, or conversely, that the JMA typhoon intensities are too low.

Table 1. Wind speed conversions for Dvorak "T" numbers. Note that a CAT 5 TC is not possible in the JMA relationships until T8 is reached.

T Number	JTWC	JMA	10 to 1
2	30	30	33.6
2.5	35	35	39.2
3	45	45	50.4
3.5	55	55	61.6
4	65	65	72.8
4.5	77	70	78.4
5	90	77	86.24
5.5	102	85	95.2
6	115	93	104.16
6.5	127	100	112
7	140	107	119.84
7.5	155	115	128.8
8	170	122	136.64

2. TWO EXAMPLES OF LARGE DIFFERENCES AMONG TC BEST-TRACK STATISTICS.

TYPHOON VAMEI

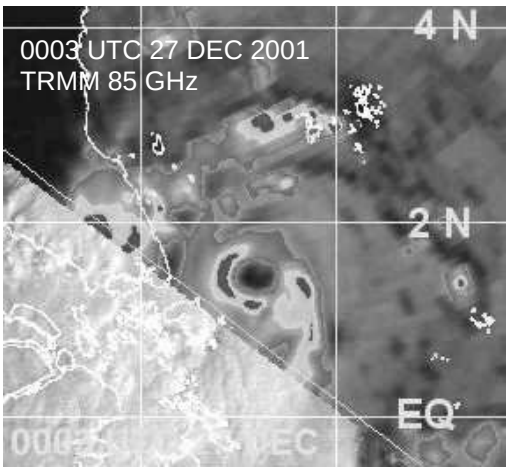

Figure 1. "Typhoon (?)" Vamei. Microwave image courtesy of NRL Monterey: (http://www.nrlmry.navy.mil/tc_pages/tc_home

Typhoon Vamei is a more striking example of the differences among warning agencies. This record-breaking low-latitude TC was carried by the JTWC as a typhoon with a maximum intensity of 75 kt, while the JMA records a maximum intensity of 45 kt.

The following is a quote from the JTWC Annual Tropical Cyclone report for 2001:

"… AT 270000Z, JTWC classified the system as a typhoon based on naval ship observations indicating sustained winds within the small eyewall of 75 knots with gusts to 105 knots." …

In this case, the ship observations corroborated what one might have expected given the MI signature (Figure 1).

TYPHOON MARK

A comparison of JTWC and JMA best track Data for Typhoon Mark (JTWC 1995). Note intensity differences of 45 kt! Positive values in JTWC-JMA columns indicate JTWC higher.

	JTWC				
Lat.	Lon.	Int.	JTWC - JMA		
28.3 N	151.9 E	30	**D Lat**	**D Lon**	**D Int**
29.1	152.8	35			
29.6	153.5	40			
30.1	154.2	55	0.1	-0.6	20
30.5	155.1	60	0	-0.4	20
31	156.1	65	-0.1	0	20
31.5	157.1	65	-0.1	0.3	15
32.4	158	70	0.3	0.6	15
33.4	159	80	0.1	0.2	15
34.9	160.8	95	0.1	0.1	30
36.4	163.4	95	0	0.2	30
37.9	166	95	-0.1	-0.8	45
39.3	169.1	80	-0.1	-0.2	40
40.3	172.6	65	-0.2	0.3	30
40.7	176	45			
41	179.2	45			

3. RECOMMENDATIONS.

(1) Establish a working group of tropical cyclone diagnostic experts to undertake a project similar to the HRD Hurricane Re-Analysis Project for the historical record of the tropical cyclones of the western North Pacific

(2) Undertake a comprehensive project to archive all satellite data (on the order of completeness as the COADS project for ship observations) and make it readily available to the working group.

REFERENCES

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JTWC: Annual Tropical cyclone report archive, https://metoc.npmoc.navy.mil/jtwc/atcr/atcr_archive.html