

Research of Path of Typhoons from 2015 to 2016-Factors and Influences

【Motivation】

As we started our mission of being observers, we have collected a large amount of data, due to the equipment and the techniques we aren't capable of using, what we could do for research wasn't precisely enough, but the data still has its reference, therefore we needed to find a weather phenomenon that is attached to Taiwan, to make a better report. This year is different than usual, we have compared a large scale of data from the Central Weather Bureau to our observation, find out reasons and effects of typhoons approaching Taiwan. Moreover, we have found out data observed by the precipitation station close to our school, in order to understand the weather phenomenon the typhoon will bring.

【Hypothesis】

At summer, below the Subtropical High, the monsoon will swirl up together and form a

tropical depression.As it moves along ,it will become larger or smaller depends on the route it goes, we could also look at the satellite images and weather charts of it compare to the disaster it has made, impacts between the high pressure and the low pressure.

【Methods and Results】

Method:Examine the relevance of satellite images to the weather chart ,find out how the typhoons are moving and what the influence factors are ,match the daily cumulative rainfall chart when the typhoons reached Taiwan with the observation we have made.Find out the disaster loss statistics and combine the precipitation station observation data.

Result:We have found that if typhoons made landfall would cause a severe influence to the disasters the typhoons made, but we still have to compare the storm range in order to find out.We have offered some examples to check if it's true.

Case 1:CHAN-HOM.~~生成後向西轉西北緩慢移動，9日5時其中心在琉球東南方海面，暴風圈逐漸接近臺灣東北部及北部海面；20時起其暴風圈逐漸擴大，對臺灣北部及東北部陸地逐漸構成威脅。10日17時，其暴風圈掠過臺灣東北部鼻頭角，23時其強度逐漸減弱，對陸地威脅已解除。11日11時其中心在臺北北方海面，向北北西轉北移動，對臺灣北部海面威脅亦已解除。昌鴻颱風影響臺灣期間（2015/07/09 06:00~2015/07/11 21:00）降雨集中在臺北、桃園、新竹與苗栗等縣市山區，期間最大累積雨量為新竹縣烏嘴山雨量站約412mm。~~

警報期間 ~~2015/07/09 05:30~2015/07/11 11:30~~

Produces backward west transfers northwest slow migration, on 9th 5 o'clock its center in the Ryukyu Islands southeast sea level, the storm solar halo approaches northeast gradually Taiwan and north the sea level; 20 o'clock gets up its storm solar halo to expand gradually, and northeastern part the land poses the threat gradually to Taiwan north. On 10th 17 o'clock, its storm solar passed over gently and swiftly northeast Taiwan the tip of the nose angle, 23 o'clock its intensity is weaken gradually, has relieved to the land threat. North 11th 11 o'clock its center north Taipei the sea level, north west transfers to the north moves, the sea level threat has also relieved to Taiwan north. The prosperous CHAN-HOM typhoon affects Taiwan period (2015/07/09 06:00 ~2015/07/11 21:00) rains concentrates in county city mountainous areas and

**so in Taipei,Taoyuan, Hsinchu and Miaoli, the period
maximum accumulation rainfall of Hsinchu County
烏嘴山precipitation station approximately 412mm.**

Alert 2015/07/09 05:30 ~2015/07/11 11:30

Marine warning issue time 2015/07/09 05:30

Marine all clear time 2015/07/11 11:30

Warning month 7

On land warning issue time 2015/07/09 20:30

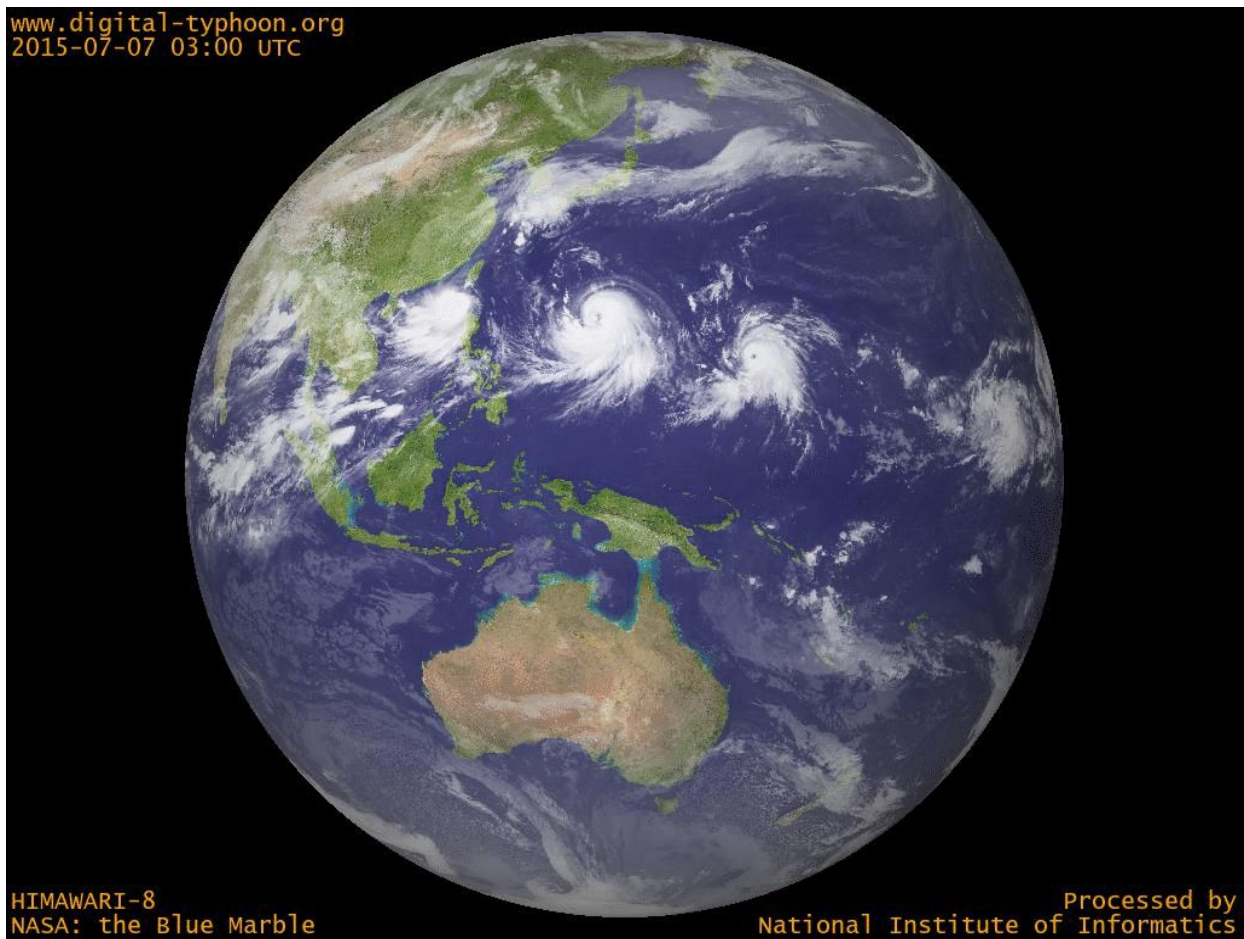
On land all clear time 2015/07/10 23:30

Home station intensity: Moderate

**Home station near center maximum wind speed
(m/s) 48**

**Life time center lowest barometric pressure (hPa)
935**

**Home station 7 level of wind storm radius (km)
280**



Case 2: SOUDELOR.

After the production stabilizes to the west northwest migration and the fast enhancement, although on 4th afternoon slightly has is weaken, but still approached Taiwan by the moderate typhoon upper limit. On 7th 17 o'clock its center southeast Hualian the Eastern sea level, the storm solar contacts the

Taiwan land gradually. On 8th about 4 o'clock 40 minutes the center lands at Hualien County 秀林鄉, 11 o'clock goes to sea in the Yunlin County 臺西鄉, about same date 22 o'clock enters the mainland by Fujian. SOUDELOR typhoon reaches above 12 levels, creates the electric power facility, the air feed facility, the water facilities, the transportation, the communication and other (five minute mountain weather radar) and so on the infrastructure damages, the entire Taiwan approximately 450 ten thousand households power cuts, power cut for the recent years household number most records.

Alert 2015/08/06 11:30 ~2015/08/09 08:30

Warning month 8

Marine warning issue time 2015/08/06 11:30

Marine all clear time 2015/08/09 08:30

On land warning issue time 2015/08/06 20:30

On land all clear time 2015/08/09 08:30

Stroke Taiwan route classification 3

Home station intensity Moderate

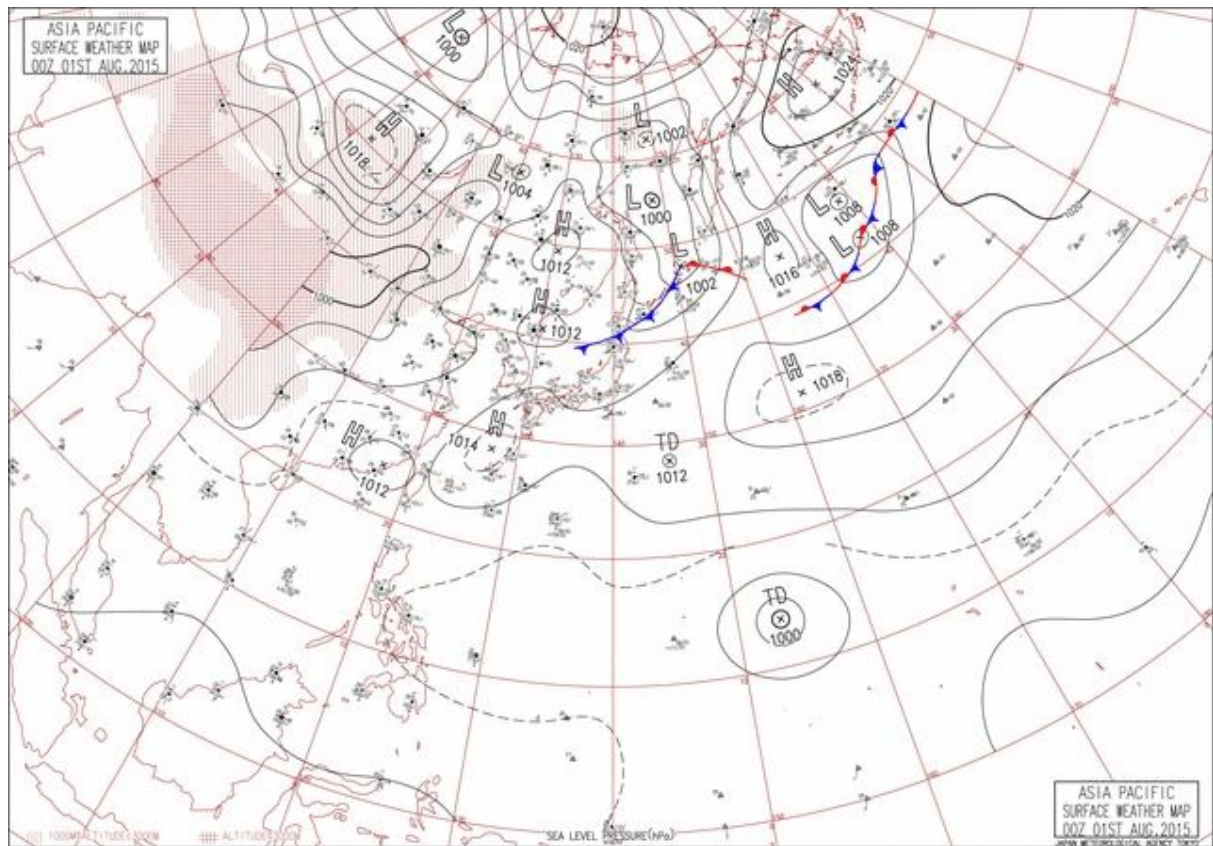
Home station near center maximum wind speed (m/s) 48

Life time approaching center lowest barometric pressure (hPa) 930

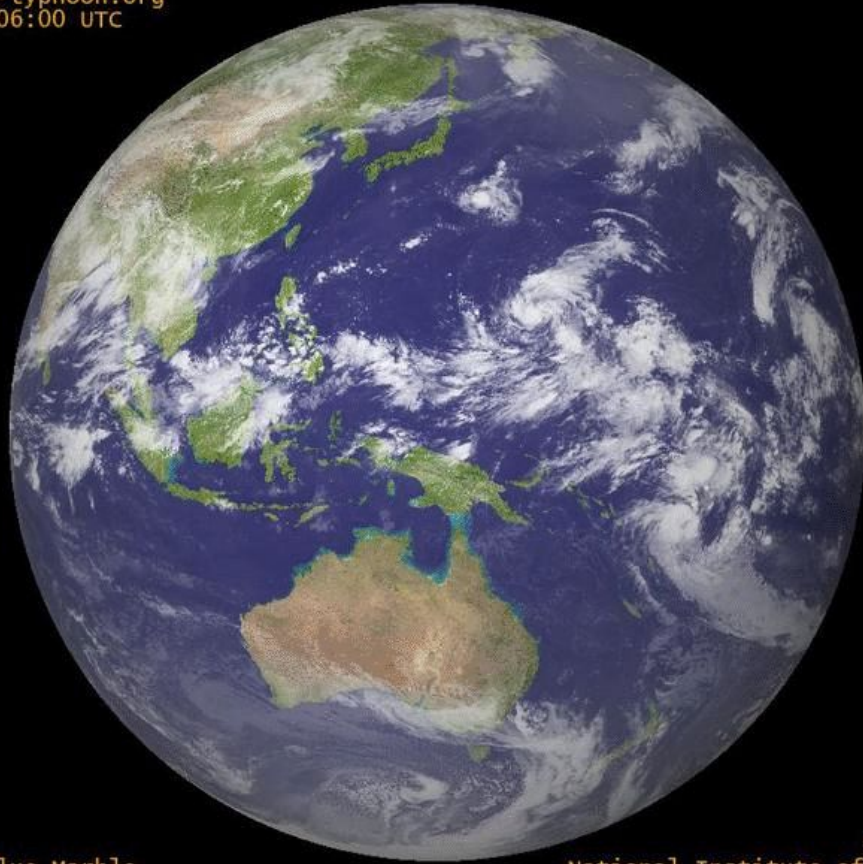
Home station 7 level of wind storm radius (km) 300

Landing Taiwan Yes

Landing Area 花蓮縣秀林鄉



www.digital-typhoon.org
2015-08-01 06:00 UTC



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Case3:DUJUAN.

After the production changes the west northwest traverse.On 28th 17 o'clock 40 minute its center by Yilan 南澳 township debarkation, on 29th 1 o'clock goes to sea in the 彰化芳苑 township.The main rainfall area concentrates in new county city mountainous areas and so on north the north market, Taoyuan, Yilan County, Hualien County, 嘉義 County as well as Kaohsiung, the typhoon creates the entire Taiwan to surpass 2,200,000 households power cuts.Stops to September 29, the DUJUAN typhoon altogether causes 3 deaths, 376 injured; Stops to October 5, 2015, the farming and forestry fishing animal husbandry product and the folk facility estimated the loss counts 1,000,000,000 7,603 ten thousand dollars.Speaking of the Taoyuan area, these three rain amount reaches as high as 150mm, in 28th, all day precipitation reaches as high as especially 130mm.

Alert 2015/09/27 08:30 ~2015/09/29 17:30

Warning month 9

Marine warning issue time 2015/09/27 08:30

Marine all clear time 2015/09/29 17:30

On land warning issue time 2015/09/27 17:30

On land all clear time 2015/09/29 17:30

Stroke Taiwan route classification 2

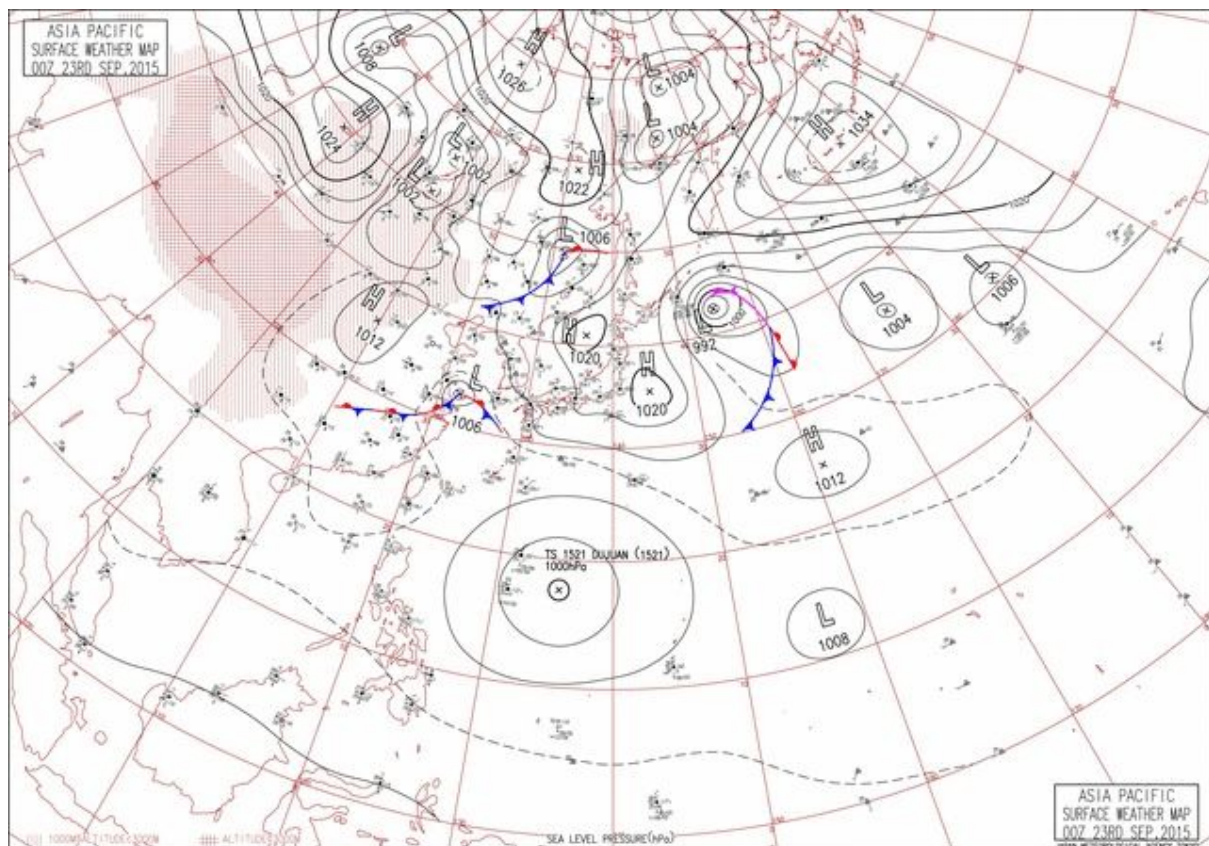
Home station intensity Intense

Home station near center maximum wind speed
(m/s) 51

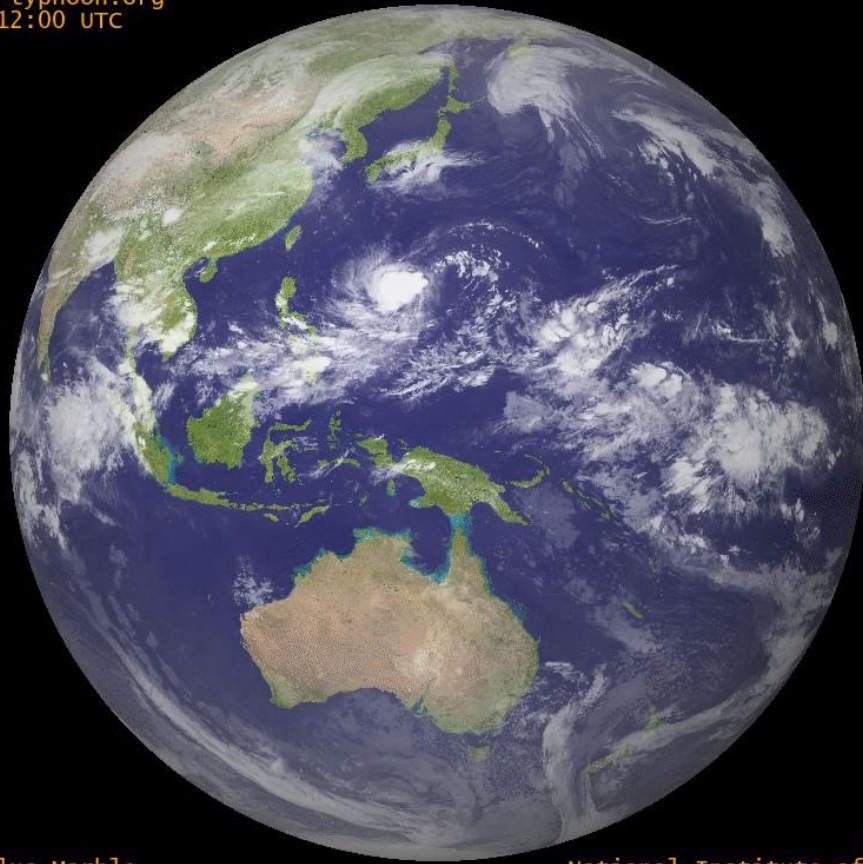
Life time approaching center lowest barometric
pressure (hPa) 925

Home station 7 level of wind storm radius (km)
220

Landing area Yilan County 南澳 township



www.digital-typhoon.org
2015-09-22 12:00 UTC



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Case4:NEPARTEK.

The typhoon formed at the south of Guam, and then toward the west northwest traverse, on 7th 8 o'clock its center in the Hualian southeast sea level, the storm solar approaches the Taiwan southeast gradually offshore, the same date evening gets up its storm solar to enter southeast sea gradually Taiwan. The center of a typhoon on 8th about 5 o'clock 50 minutes in the Taitung County Taimali township debarkation, 14 o'clock 30 minutes enters by Taina the military region the Taiwan Straits, and about 13 o'clock enters Fujian on 9th northeast Jinmen. On July 8 early morning 5 o'clock 50 minutes landed in the Taitung Taimali, smuggle the formidable circumstances to pass over gently and swiftly the Taitung urban district, the Nepali Bert typhoon invaded Taiwan period (2016/07/06 14:30 ~2016/07/09 14:30) the Taitung survey station once have appeared the maximum Rafale wind speed to reach as high as 57.2m/s (17 levels of strong Rafale).

Alert 2016/07/06 14:30 ~2016/07/09 14:30

Warning month 7

Marine warning issue time 2016/07/06 14:30

Marine all clear time 2016/07/09 14:30

On land warning issue time 2016/07/06 20:30

On land all clear time 2016/07/09 14:30

Stroke Taiwan route classification 4

Home station intensities Intense

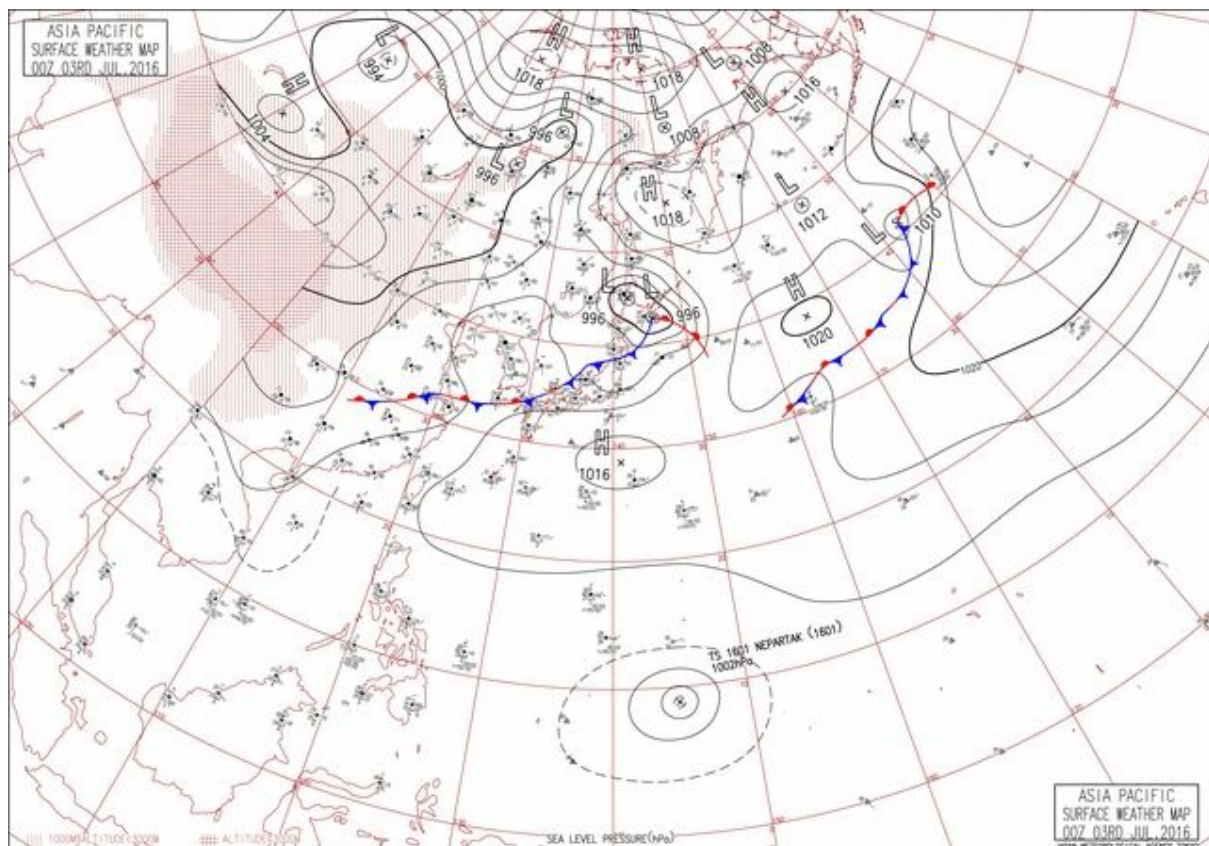
**Home station near center maximum wind speed
(m/s) 58**

**Life time approaching center lowest barometric
pressure (hPa) 905**

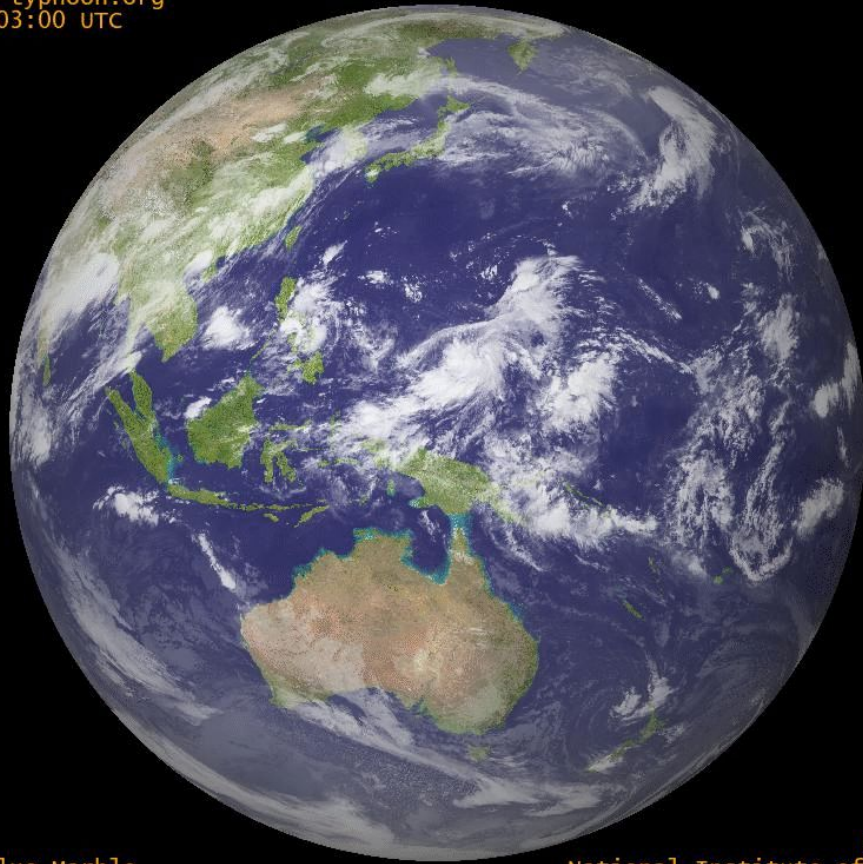
**Home station 7 level of wind storm radius (km)
200**

Lands Taiwan Yes

Landing area Taitong County Taimali



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2016-07-03 03:00 UTC



HIMAWARI-8
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Case5:MERANTI.The typhoon forms the west sea of Guam, then transferred northwest traverse toward the west northwest, on 13th 14 o'clock its center in the temperate southeast Eastern sea level, the storm solar halo starts to enter the Bashi Channel, the same date 23 o'clock its storm solar halos enter southeast gradually Taiwan the land and the temperate peninsula, to Taiwan east, south central and Penghu, the Jinmen area poses the threat.The center of a typhoon about 2 o'clock enters on 15th by Jinmen to福建, 11 o'clock Jinmen is separated from the storm solar halo, the blue alert relieves.On September 12, 2016 MERANTI (MERANTI) and MALAKAS (MALAKAS) typhoon continues attacking Taiwan.Among them, the MERANTI typhoon is in 2016 northwest Pacific Ocean invades in the Taiwan typhoon strongest, falls the downlap big torrential rain east Taiwan, also south its gale direct attack The Islands areas and so on the Taiwan and Penghu, Jinmen, create the roadside tree, the advertisement iron sheet, the agriculture and the water and electricity maintain livelihood the pipeline damage, even the Gaoxiong port has many ships to break the cable drift, creates the port area facility damage and the oil leak pollution.The farming and forestry fishing animal husbandry product and the folk facility estimated lost 21億9,876萬dollars.

Alert 2016/09/12 23:30~2016/09/15 11:30

Warning month 9

Marine warning issue time 2016/09/12 23:30

Marine all clear time 2016/09/15 11:30

On land warning issue time 2016/09/13 08:30

On land all clear time 2016/09/15 11:30

Stroke Taiwan route classification 7

Home station intensities intense

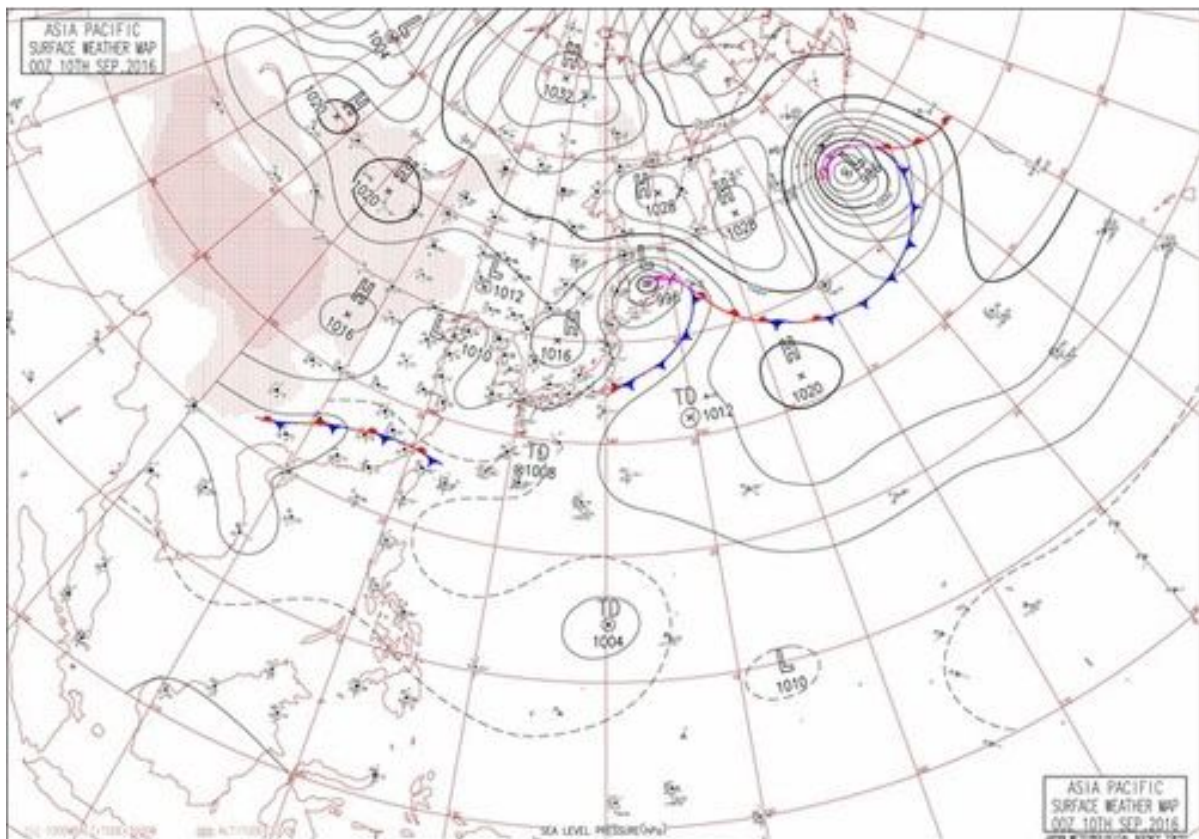
**Home station near center maximum wind speed
(m/s) 60**

**Life time approaching center lowest barometric
pressure (hPa) 900**

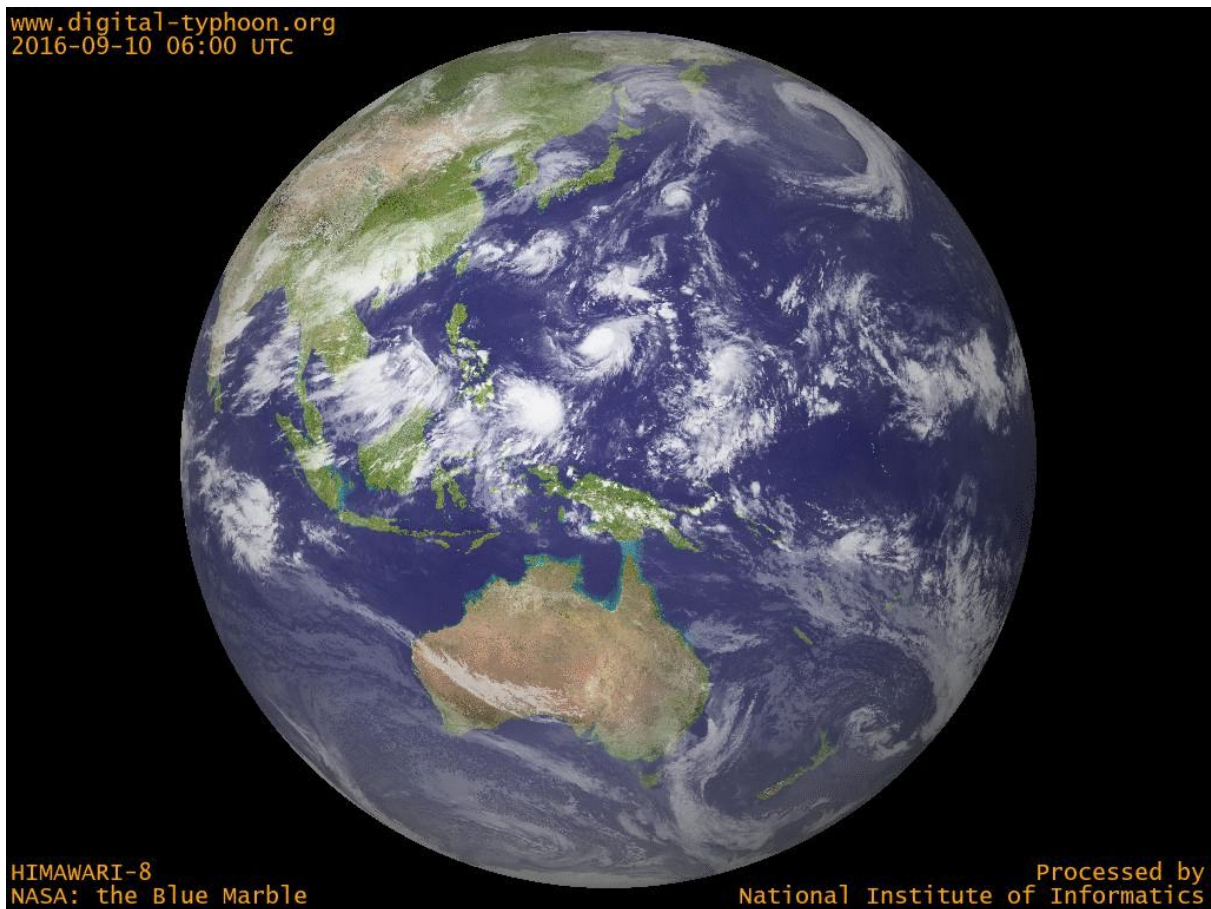
**Home station 7 level of wind storm radius (km)
220**

Lands Taiwan Yes

Landing area Kinmen



www.digital-typhoon.org
2016-09-10 06:00 UTC



颱風名稱	人命傷亡(單位：人)			維生管線影響數目(單位：戶、處)					農林漁牧產物及設施損失金額(單位：仟元)							水利設施損害(單位：處)		
	死亡	失蹤	受傷	自來水	電力	瓦斯	電信(市話)	電信(基地台)	農產(農作物)	漁產	畜產(畜禽)	林產	農田及農業設施	漁民漁業設施	畜禽設施	河堤	海堤	其他
昌鴻201509	0	0	6	0	27336	0	0	108	0	0	0	0	0	0	0	0	0	0
蘇迪勒201513	8	4	437	429248	4492832	34	65844	12820	2677056	86008	22663	56362	277660	367490	97000	13	4	0
杜鵬201521	3	0	376	324415	2255824	0	21735	6879	774068	109465	3685	3453	27270	148620	9480	0	1	3
尼伯特201601	3	0	311	24829	545696	0	11273	2113	963801	4555	4983	979	111020	37800	21400	3	0	0
莫蘭蒂201614	1	0	62	722699	1096823	0	18793	3354	712530	44352	9857	750	0	0	0	0	0	0

2015-2017年颱風期間中央氣象局平鎮測站 (Pinghon (COC650) (121.214636 E 24.897503 N)海拔高度：208m)觀測資料																				
颱風名稱	觀測時間 (LST)	測站風速 (hPa)	最高風速 (hPa)	測站最低風速 (LST)	最高風速 (hPa)	測站最低風速 (LST)	最高風速 (hPa)	最高風速時間 (LST)	最低風速 (hPa)	最低風速時間 (LST)	相對濕度 (%)	最小相對濕度 (%)	最小相對濕度時間 (LST)	風速 (m/s)	風向 (degree)	最大陣風 (m/s)	陣風風向 (degree)	最大陣風 (LST)	陣風 (mm)	
昌鴻201509	9	977.4	979.1	2015-07-09 07:51	975.6	2015-07-09 23:59	27.1	30.3	2015-07-09 13:22	25.0	2015-07-09 04:51	85	89	2015-07-09 07:35	1.9	19	10.4	11	2015-07-09 23:45	14.5
	10	973.0	975.7	2015-07-10 00:04	970.2	2015-07-10 23:58	24.8	25.7	2015-07-10 00:08	24.0	2015-07-10 14:16	93	84	2015-07-10 23:57	2.4	326	12.5	345	2015-07-10 00:46	31.0
	11	971.7	975.2	2015-07-11 22:40	969.0	2015-07-11 02:04	28.6	30.9	2015-07-11 16:25	25.3	2015-07-12 00:00	73	63	2015-07-11 20:51	4.9	228	16.2	233	2015-07-11 01:47	0.0
蘇迪勒201513	8月6日	982.1	983.5	2015-08-06 07:49	980.6	2015-08-06 16:23	27.2	32.5	2015-08-06 12:29	21.8	2015-08-06 04:26	76	54	2015-08-06 12:24	2.3	27	12.5	13	2015-08-06 16:23	5.5
	7	976.3	981.3	2015-08-07 00:02	967.6	2015-08-07 23:57	26.8	29.0	2015-08-07 13:15	25.0	2015-08-07 01:04	84	74	2015-08-07 13:18	5.3	28	19.6	26	2015-08-07 20:07	6.0
	8	966.9	970.5	2015-08-08 23:59	947.2	2015-08-08 09:16	25.8	29.3	2015-08-08 15:19	22.9	2015-08-08 07:32	88	70	2015-08-08 15:04	5.3	56	32.3	19	2015-08-08 03:14	140.0
杜鰲201521	9	977.5	982.2	2015-08-09 23:26	970.4	2015-08-09 02:04	26.0	29.5	2015-08-09 11:52	23.9	2015-08-09 01:31	88	70	2015-08-09 12:28	0.5	95	3.9	227	2015-08-09 13:32	0.0
	9月27日	984.3	986.0	2015-09-27 08:19	982.3	2015-09-27 23:59	22.4	23.9	2015-09-27 12:47	21.0	2015-09-27 04:36	91	79	2015-09-27 12:48	X	X	0.0	0	2015-09-28 00:00	23.0
	28	972.5	982.3	2015-09-28 00:01	961.0	2015-09-28 23:23	24.6	27.3	2015-09-29 00:00	22.8	2015-09-28 00:37	95	81	2015-09-28 23:59	X	X	0.0	0	2015-09-29 00:00	137.5
尼伯特201601	29	980.5	989.1	2015-09-29 23:27	961.4	2015-09-29 00:10	26.1	28.1	2015-09-29 12:54	24.6	2015-09-29 07:46	89	78	2015-09-29 00:56	X	X	0.0	0	2015-09-30 00:00	3.0
	7月6日	986.4	987.7	2016-06-06 22:00	985.4	2016-06-06 16:51	25.3	27.4	2016-06-06 07:33	23.3	2016-06-06 03:31	88	78	2016-06-06 16:09	1.0	213	5.8	230	2016-06-06 12:46	12.5
	7	985.8	987.5	2016-06-07 08:33	983.8	2016-06-07 16:17	25.9	30.5	2016-06-07 12:17	23.0	2016-06-07 06:43	85	67	2016-06-07 12:20	0.7	213	5.5	18	2016-06-07 16:24	10.5
莫蘭蒂201614	8	984.2	985.6	2016-06-08 00:08	981.8	2016-06-08 16:45	26.6	30.9	2016-06-08 11:14	23.1	2016-06-08 02:39	81	61	2016-06-08 11:25	1.0	207	7.4	15	2016-06-08 14:00	0.5
	9	984.4	985.6	2016-06-09 07:43	982.9	2016-06-09 13:43	26.3	30.4	2016-06-09 09:53	24.1	2016-06-09 05:33	84	66	2016-06-09 09:26	0.7	57	6.7	4	2016-06-09 13:10	0.0
	9月12日	988.5	990.4	2016-09-12 21:24	986.9	2016-09-12 02:36	25.3	28.0	2016-09-12 09:32	23.7	2016-09-12 23:46	91	78	2016-09-12 10:16	1.7	7	10.1	31	2016-09-12 14:52	5.0
	13	985.9					26.5					82			2.9	55			3.5	
	14	977.1					27.0					76			4.3	55			5.5	
	15	982.1					26.0					89			0.6	215			0.5	

【Conclusion】

1. Qualitative observation of the five typhoons, the impact influences Taiwan the most is SOUDELOR (201513). Investigating its cause, it has carried

Southwest airflow and it's a Category 3 typhoon. Although it's not the strongest, and the center pressure is the second highest of all, but it's storm range is higher than the other four, packing fierce winds and torrential rain. 2015/8/8, daily rainfall is observed up to 140mm.

2. Pingzhen precipitation station, Central Weather Bureau observed the daily rainfall of 140mm at 2015/8/8 (During SOUDELOR stroke Taiwan) and 137.5mm at 2015/9/27 {During DUJUAN (201521) stroke Taiwan}. We found out that both of them stroke the center of Taiwan, when Pingzhen weather station observed it's biggest rainfall, it was at the last half of the warning issued, when the typhoon rotate anticlockwise with current from Taipei basin to Taoyuan plateau. Therefore, NEPARTAK, as a typhoon that also passed the center of Taiwan (201601), didn't have a large amount of rainfall. We assumed it's reason is the route inclined south, the airflow is blocked by Xueshan Range and the Central Mountain Range, could not get into Taoyuan.

【List of references】

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<http://e-service.cwb.gov.tw/HistoryDataQuery/index.jsp>

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<https://docs.google.com/document/d/1muZRCkU2mfqjoiJL2ECRLqiTRHwxjUyD1yYCCR3u2ws/edit?usp=sharing>

https://docs.google.com/document/d/1EGAzNRCEaJP7Ra317I_6d1VFaNkrwhTNQiqfLLABYuY/edit?usp=sharing

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<https://docs.google.com/document/d/10o8MG44TSGuchJJnlCsfaQzx3ql6vW9-ygmXll7nhpE/edit?usp=sharing>

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