

[WMO VLab Regional Focus Group meeting]

Satellite Analysis for Tropical Cyclone over KMA

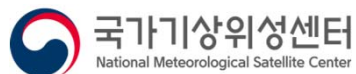
August 13, 2020

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Satellite Analysis Division

National Meteorological Satellite Center

Korea Meteorological Administration





Contents

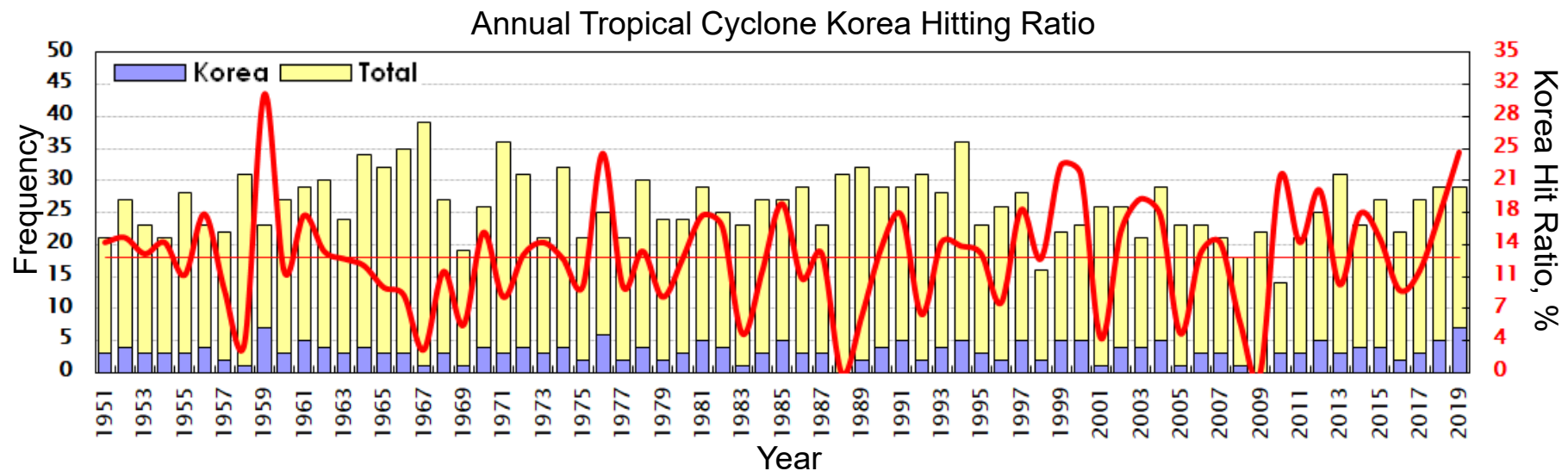
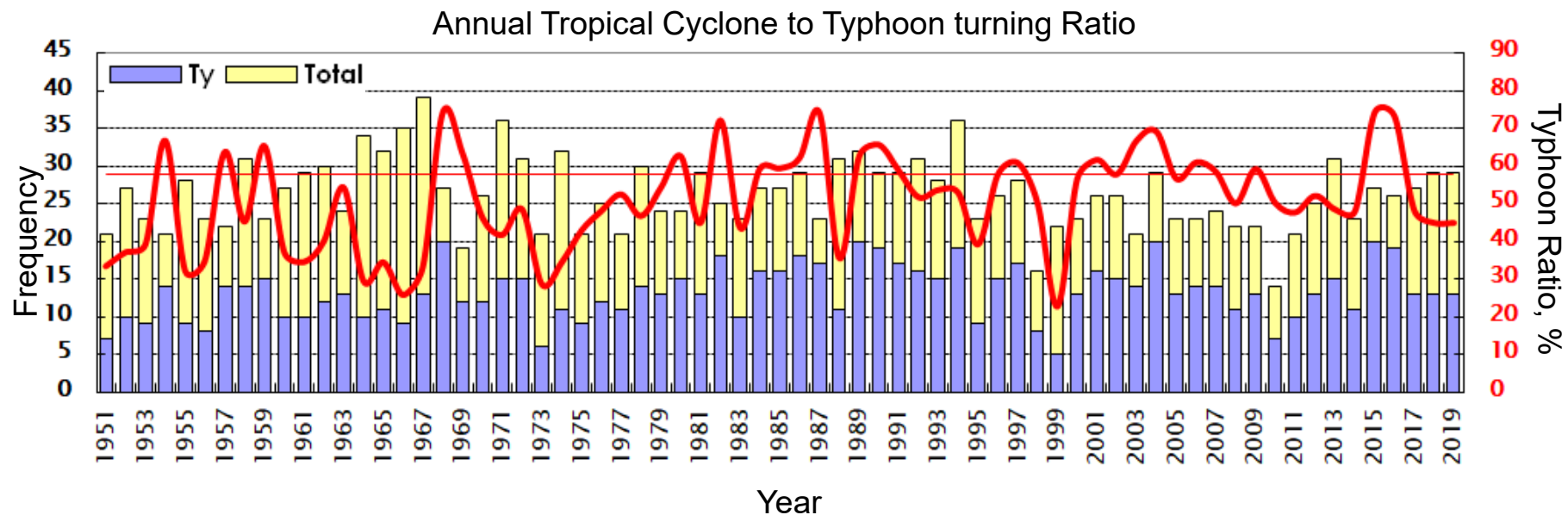
New GK-2A web-based analysis system

Percentile analysis on Rain and Wind

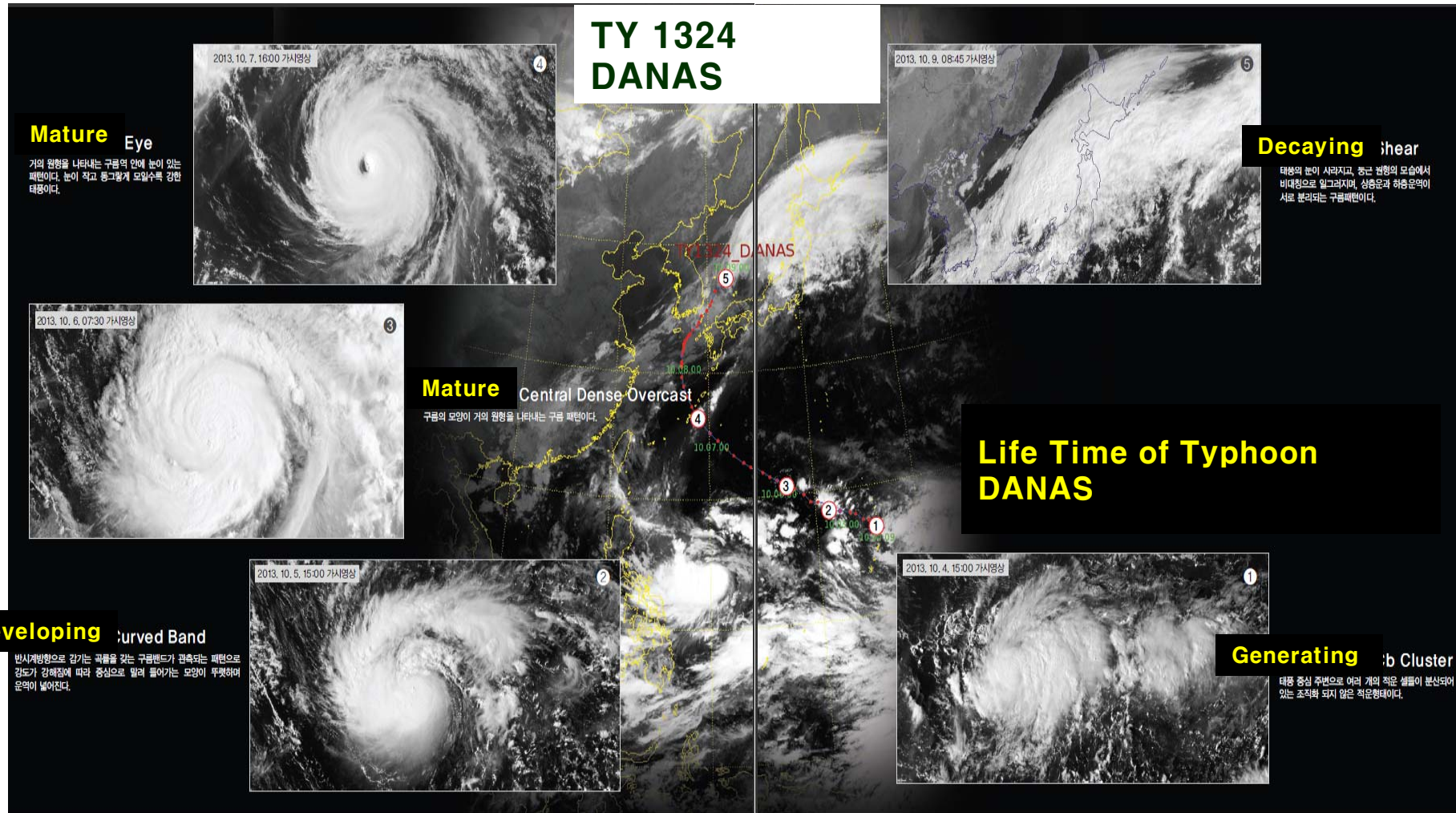
Application of Lower level Winds

COMPASS

Last 69 years Typhoon over Northwest Pacific (1951~2019)



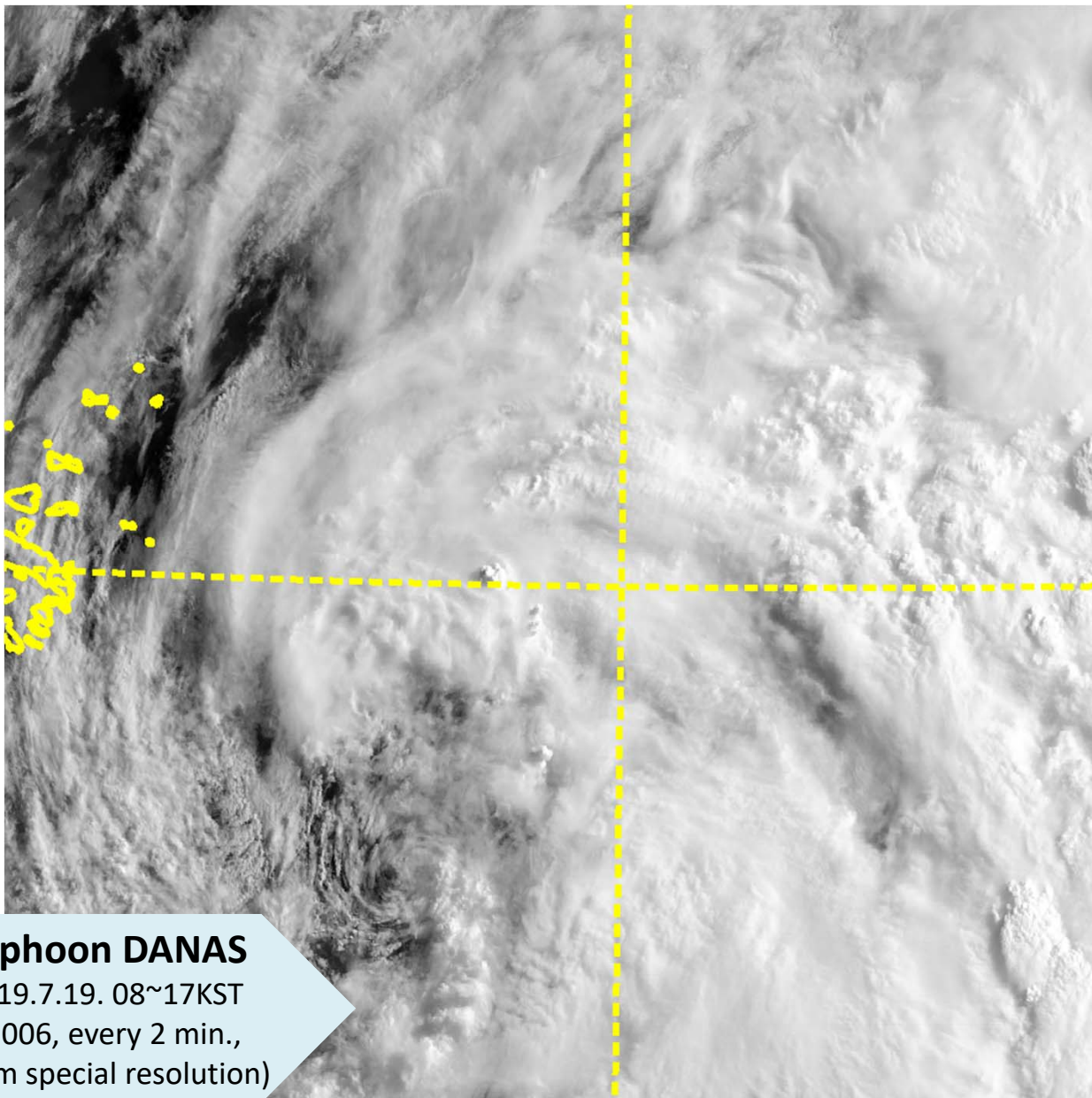
Typical pattern of Typhoon near Korea



Generating -> Developing -> Mature -> Weaking

①Cb Cluster -> ②Curved Band -> ③CDO -> ④EYE -> ⑤SHEAR

GK2A is now operational!



Launched on
December 5, 2018

Public release on
July 25, 2019

Typhoon DANAS

2019.7.19. 08~17KST
(VI006, every 2 min.,
0.5km special resolution)

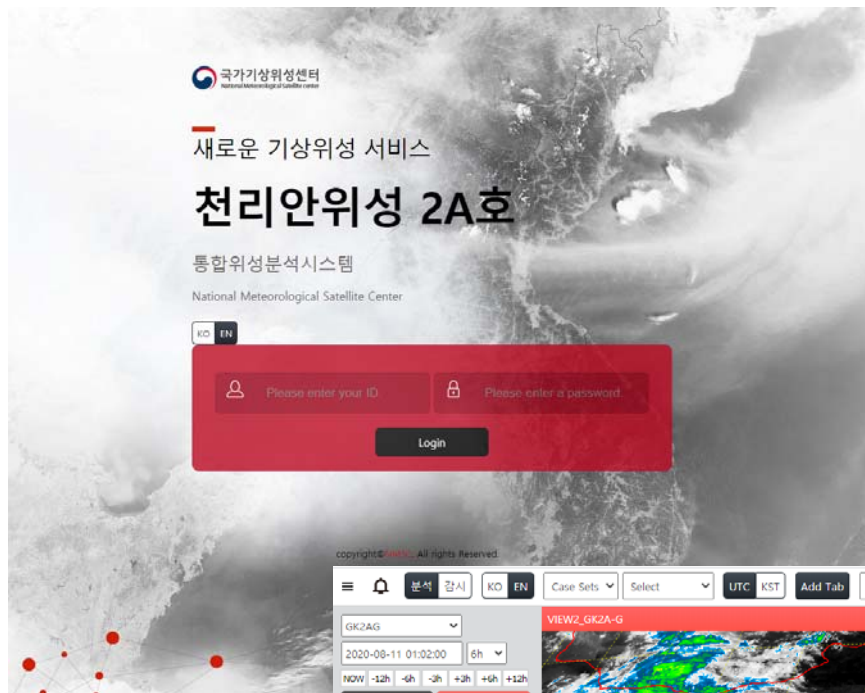
New GK-2A web-based analysis system



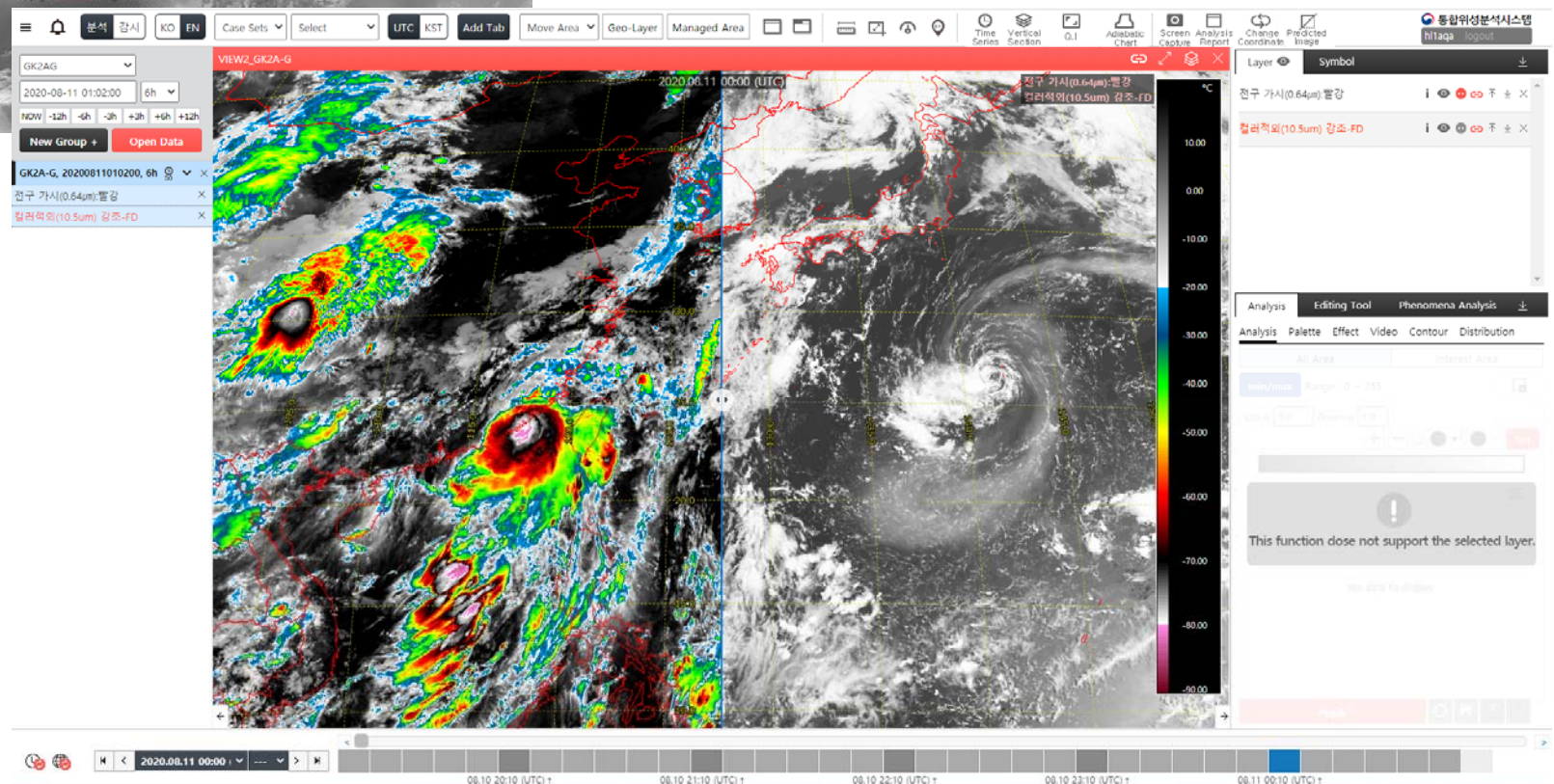
Web-based Satellite Image Analysis System

- New user friendly web-based system for COMS-2A
- Using Dvorak Technique from SSEC/CIMSS
- Create own UI, DB, and intensity algorithm for ADT/SDT
- Including all available observation data
- Automated tools including finding center position, intensity, wind radii beside subjected analysis by human
- Comparisons with other agencies report and best track

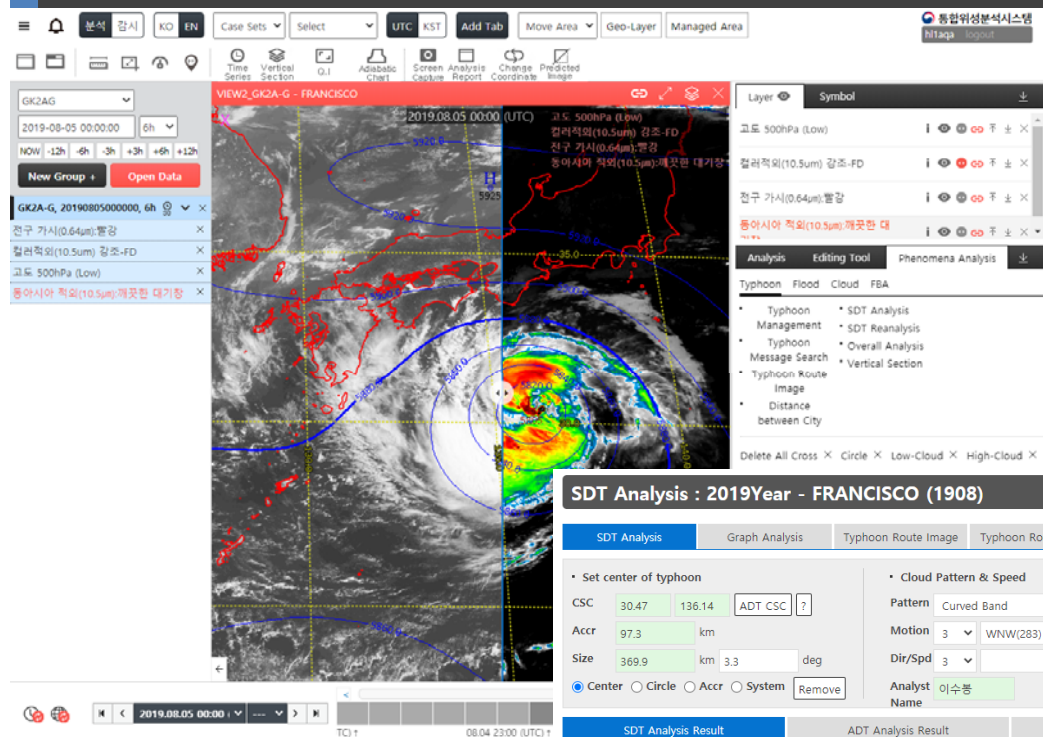




Web based Satellite image Analysis System



Tropical Cyclone Analysis



Main Window

- Data selection(time, area, type, etc)
- Layer display
- Analysis tools(palette, effect, video, contour, distribution, editing, etc)
- Phenomena(Typhoon, Flood, Cloud, Fire/Volcanic ash/Fog etc)

SDT Analysis : 2019Year - FRANCISCO (1908)

Analysis Date : 2019-08-05 00:00:00 UTC

SDT Analysis	Graph Analysis	Typhoon Route Image	Typhoon Route Video	IR Radius of Gail	Verify Radius of Gail	MW Radius of Gail	MW Typhoon Image	GTS text	PCT / TDI
<p>• Set center of typhoon</p> <p>CSC: 30.47, 136.14, ADT CSC: ?</p> <p>Accr: 97.3 km</p> <p>Size: 369.9 km, 3.3 deg</p> <p>Center Circle Accr System Remove</p> <p>Analyst Name: 이수봉</p>									
<p>• Cloud Pattern & Speed</p> <p>Pattern: Curved Band</p> <p>Motion: 3 WNW(283) 33.8 km/h</p> <p>Dir/Spd: 3</p>									
<p>• Intensity</p> <p>DT: BAND, 2.5</p> <p>MET: +0.5, 3.5, -24</p> <p>PT: B, 3.5, W, Set Strength</p> <p>T: PT, 3.5, CI, 3.5, 981.0 hpa, 29.3 m/s</p>									

SDT Analysis Result ADT Analysis Result GTS Text Archer Analysis Result KADT-ARCHER2

No	typhoon.analydate.utc.w	Latitude	Longitude	typhoon.pr	typhoon.3hr	typhoon.6hr	CI	MSLP (hPa)	MWS (m/s)	Cloud Pattern	T SELECT	DT	DT Pattern	MET	MET TENDENCY	PT	PT TYPE	ACCR	SIZE	typhoon.savetime.kst.w
11	2019-08-06 02:00:00	33.61	130.38	49	NW / 31.5	NW / 28.9	3.5	981.0	29.3	Curved Band	DT	0.0			-	0.0	A	1.0	1.0	2019-12-07 04:53:4
12	2019-08-06 01:00:00	33.30	130.74	49	NNW / 33.7	NNW / 20.9	3.5	981.0	29.3	Curved Band	DT	0.0			-	0.0	A	1.0	1.0	2019-12-07 04:52:5
13	2019-08-06 00:00:00	33.07	130.88	49	NNW / 31.5	NNW / 28.2	3.5	981.0	29.3	Curved Band	PT	3.0	BAND	3.0	-0.5	3.5	A	22.7	333.3	2019-08-06 09:27:0
14	2019-08-05 23:00:00	32.96	131.02	40	NNW / 26.4	NNW / 25.6	4.0	973.0	32.9	Banding Eye	DT	0.0			-	0.0	A	1.0	1.0	2019-12-07 04:51:5
15	2019-08-05 22:00:00	32.50	131.23	40	NW / 8.1	NW / 16.5	4.0	973.0	32.9	Banding Eye	DT	0.0			-	0.0	A	1.0	1.0	2019-12-07 04:50:1
16	2019-08-05 21:00:00	32.35	131.42	40	NNW / 24.9	NW / 24.5	4.0	973.0	32.9	Banding Eye	PT	4.0	B-EYE	4.0	0.5	4.0	A	48.0	507.4	2019-08-06 06:14:2
17	2019-08-05 18:00:00	31.78	131.84	40	NW / 24.0	WNW / 23.1	4.0	973.0	32.9	Banding Eye	PT	4.0	B-EYE	4.0	1.0	4.0	A	50.9	303.0	2019-08-06 03:10:5
18	2019-08-05 15:00:00	31.37	132.43	40	WNW / 22.2	WNW / 25.5	4.0	973.0	32.9	Banding Eye	PT	4.0	B-EYE	3.5	1.0	4.0	A	45.5	311.7	2019-08-06 00:12:5
19	2019-08-05 12:00:00	31.20	133.10	40	W / 28.8	WNW / 25.5	4.0	973.0	32.9	Banding Eye	PT	4.0	EYE	4.0	1.0	4.0	A	42.8	388.0	2019-08-05 21:37:0
20	2019-08-05 09:00:00	31.10	134.00	49	WNW / 22.1	WNW / 22.4	3.5	981.0	29.3	Curved Band	PT	3.5	BAND	4.0	1.0	3.5	B	38.4	395.1	2019-08-05 18:44:4
21	2019-08-05 06:00:00	30.80	134.60	49	W / 22.6	WNW / 25.4	3.5	981.0	29.3	Curved Band	PT	3.0	BAND	3.5	0.5	3.5	B	68.9	335.3	2019-08-05 15:50:1
22	2019-08-05 03:00:00	30.70	135.30	49	WNW / 28.2	WNW / 31.0	3.5	981.0	29.3	Curved Band	PT	2.5	BAND	3.5	0.5	3.5	B	104.5	224.2	2019-08-05 12:25:3
23	2019-08-05 00:00:00	30.47	136.14	49	WNW / 33.8	WNW / 38.7	3.5	981.0	29.3	Curved Band	PT	2.5	BAND	3.5	0.5	3.5	B	97.3	369.9	2019-08-05 09:09:3
24	2019-08-04 21:00:00	30.27	137.17	49	WNW / 43.7	WNW / 32.8	3.5	981.0	29.3	Curved Band	PT	3.0	BAND	3.5	0.5	3.5	B	76.8	384.2	2019-08-05 06:19:2
25	2019-08-04 18:00:00	29.77	138.40	54	WNW / 21.9	W / 28.1	3.0	987.0	25.7	Curved Band	PT	2.5	BAND	3.5	0.5	3.0	B	107.2	254.4	2019-08-05 03:14:2
26	2019-08-04 15:00:00	29.57	139.04	54	W / 34.3	WNW / 29.6	3.0	987.0	25.7	Curved Band	PT	2.5	BAND	2.5	0.0	2.5	B	83.8	469.4	2019-08-05 00:14:3
27	2019-08-04 12:00:00	29.51	140.10																	

Save & Transmit Save Re-Create Typhoon Route Typhoon End Draw Route Remove Route Save as Excel Close

Secondary Window

- SDT Analysis (intensity, center position, etc)
- Automated analysis (ADT, KADT, GTS, Archer, etc)

Comparisons

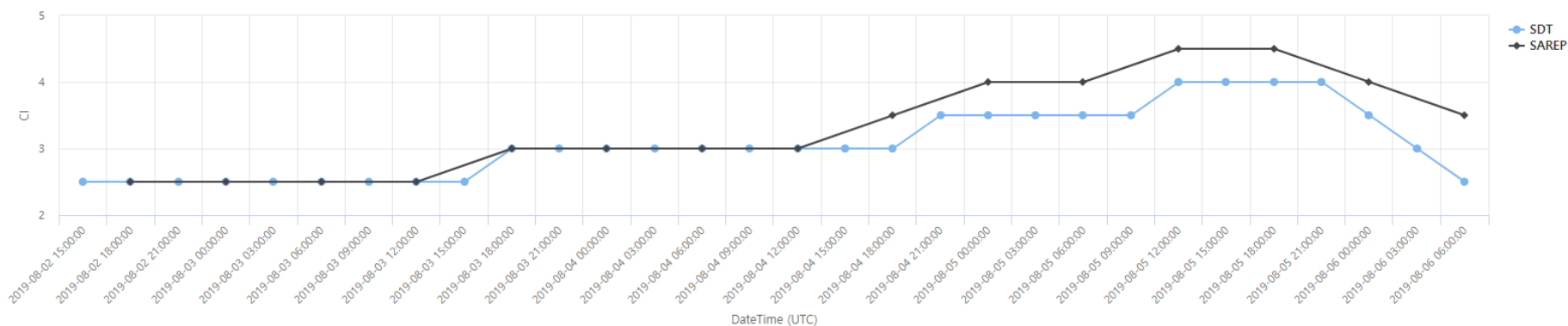
SDT Analysis : 2019Year - FRANCISCO (1908)

Analysis Date : 2019-08-05 00:00:00 UTC

SDT Analysis **Graph Analysis** Typhoon Route Image Typhoon Route Video IR Radius of Gail Verify Radius of Gail MW Radius of Gail MW Typhoon Image GTS text PCT / TDI

• Start Year 2019 • Typhoon FRANCISCO (1908) • Classification CI • Interval 3hour • Period 2019-08-02 00:00 ~ 2019-08-06 12:00

• Typhoon
Analysis Result ☒ SDT ☐ Automatic ADT 8.2.1 ☐ KADT-IR ☐ KADT-NRT ☒ SAREP ☐ KMA ☐ JMA ☐ JTWC ☐ CMA

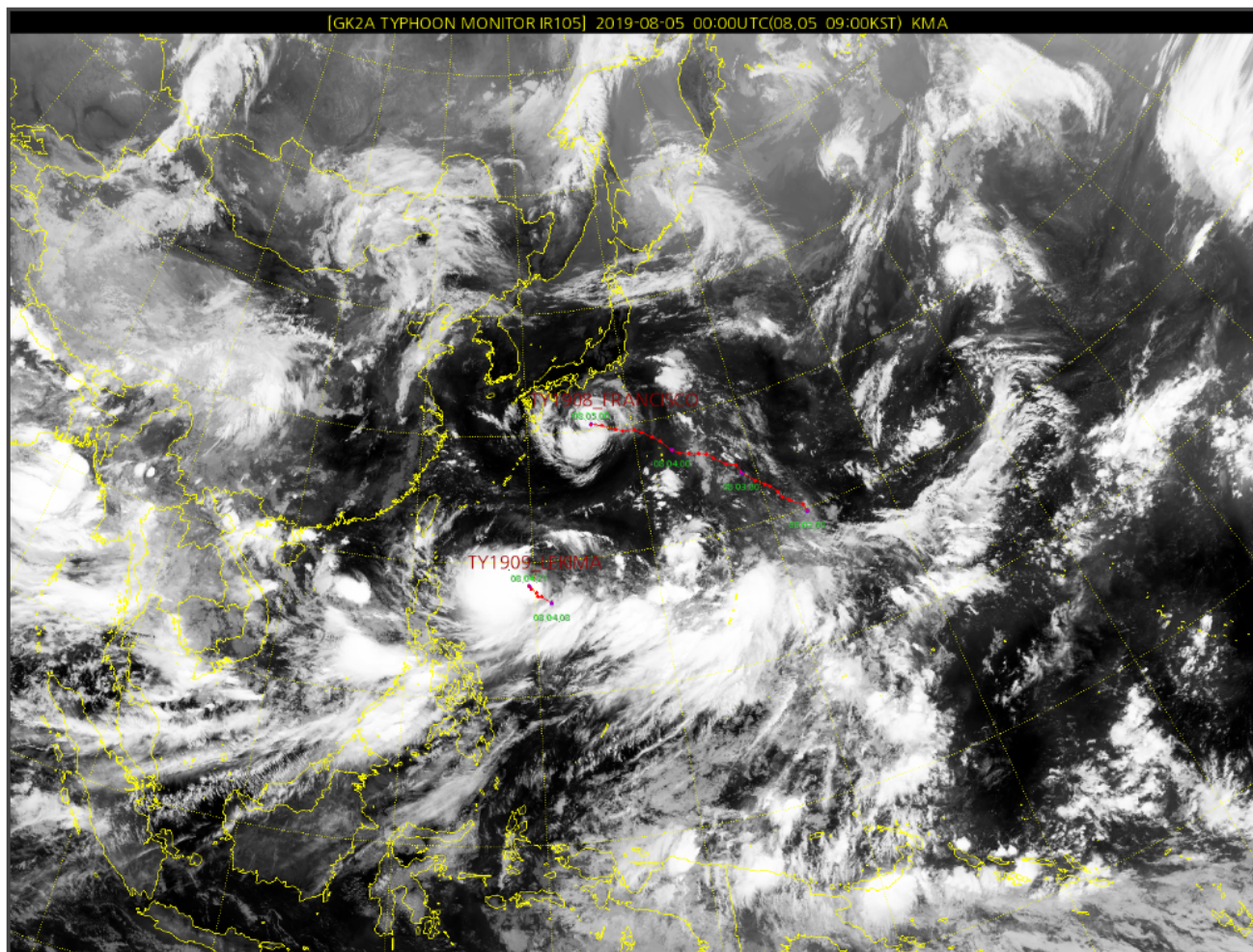


Route image

SDT Analysis : 2019Year - FRANCISCO (1908)

SDT Analysis Graph Analysis **Typhoon Route Image** Typhoon Route Video IR Radius of Gail Verify Radius of Gail MW Radius of Ga

2019-08-05 00:00:00 UTC

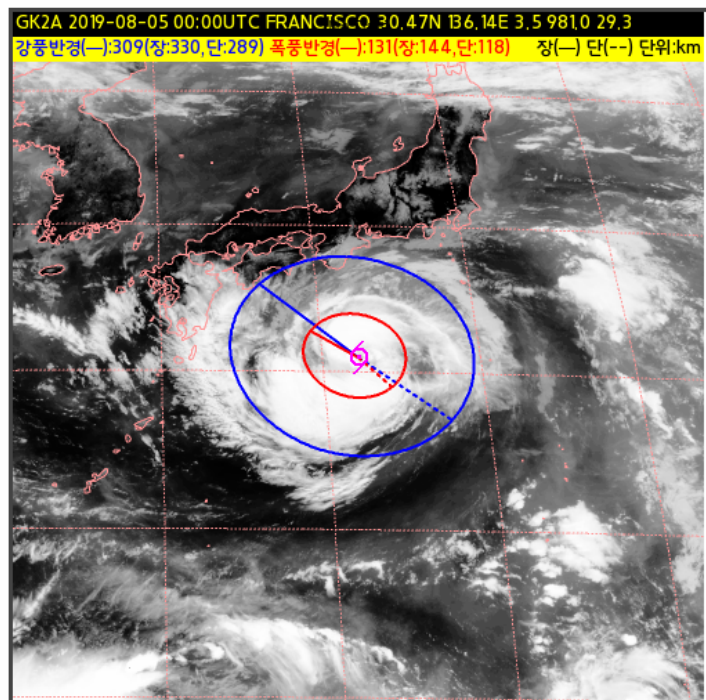


IR based Wind Radii (15 and 25 m/s)

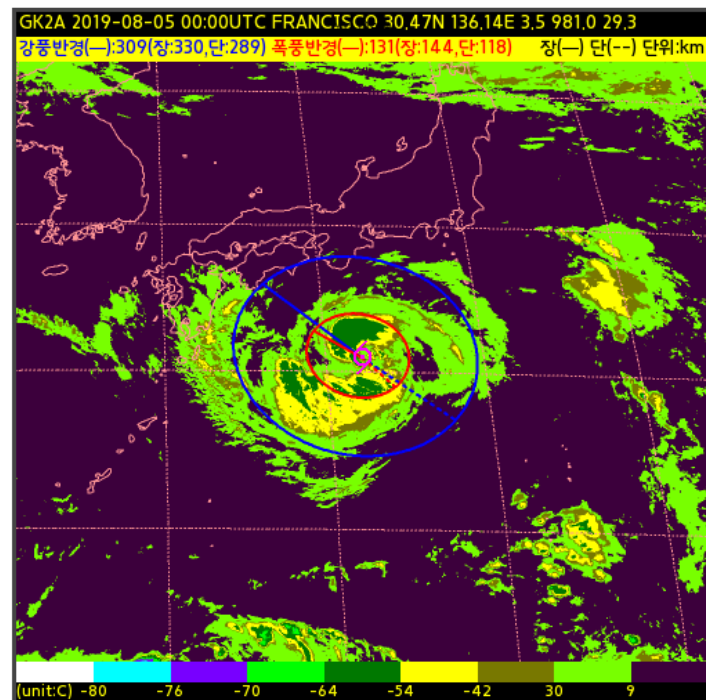
SDT Analysis : 2019Year - FRANCISCO (1908)

SDT Analysis Graph Analysis Typhoon Route Image Typhoon Route Video IR Radius of Gail Verify Radius of Gail MW Radius of G

2019-08-05 00:00:00 UTC



강풍반경 장반경: 329.71km
강풍반경 단반경: 288.65km
강풍반경 평균반경: 309.06km
폭풍반경 장반경: 144.03km
폭풍반경 단반경: 118.36km
폭풍반경 평균반경: 131.23km



Coefficient of Gail Radius 15
Coefficient of Storm Radius 25
Minimum Limit Dist of Center 48

☐ Drawing users:
☒ Automatic ☐ Manual
☒ Radius of Gail ☐ Radius of Storm
Long radius Direction Deg
Long radius length km
Short radius length km

Additional Wind Radii

SDT Analysis : 2019Year - FRANCISCO (1908)

Analysis Date : 2019-08-05 00:00:00 UTC

SDT Analysis

Graph Analysis

Typhoon Route Image

Typhoon Route Video

IR Radius of Gail

Verify Radius of Gail

MW Radius of Gail

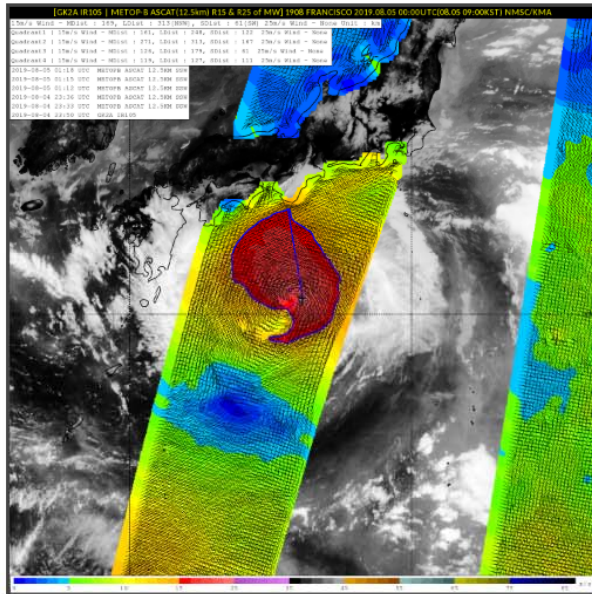
MW Typhoon Image

GTS text

PCT / TDI

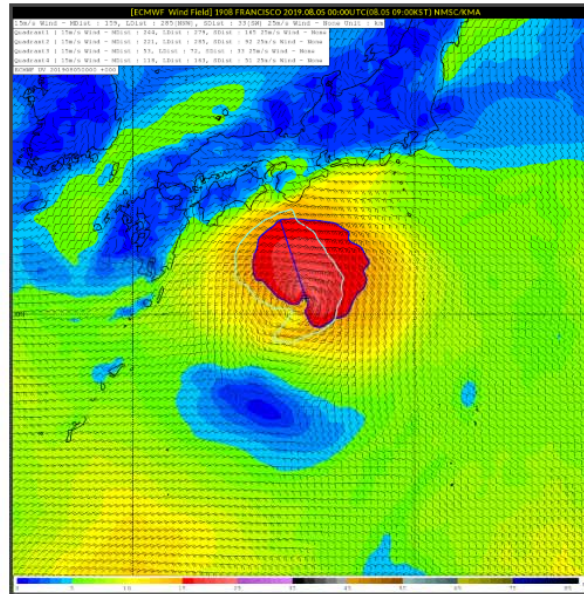
2019-08-05

00:00 utc METOPB ASCAT



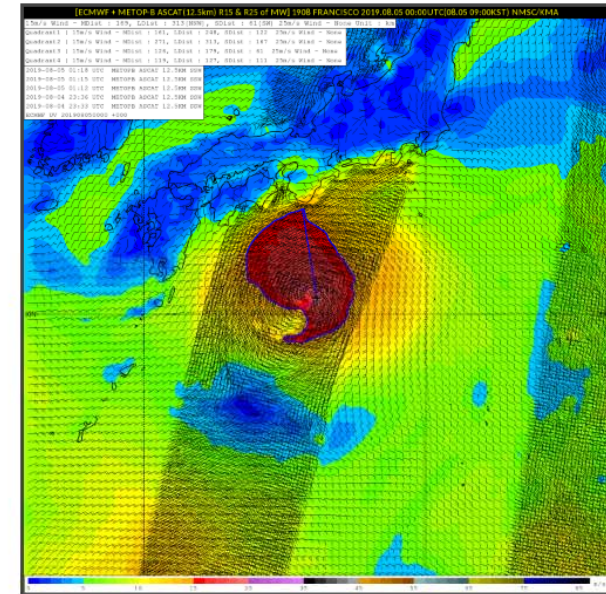
<< 강풍반경 METOPB ASCAT >>

Microwave



<< 수치모델 바람장 >>

Numerical Model



<< 강풍반경/수치모델 합성 >>

MW + Model

Search

Close

[GK2A IR105 | METOP-B ASCAT(12.5km) R15 & R25 of MW] 1908 FRANCISCO 2019.08.05 00:00UTC(08.05 00:00KST) NMSC/KMA

15m/s Wind - MDist : 169, LDist : 313(NNW), SDist : 61(SW) 25m/s Wind - None Unit : km

Quadrant1 | 15m/s Wind - MDist : 161, LDist : 248, SDist : 122 25m/s Wind - None

Quadrant2 | 15m/s Wind - MDist : 271, LDist : 313, SDist : 167 25m/s Wind - None

Quadrant3 | 15m/s Wind - MDist : 126, LDist : 179, SDist : 61 25m/s Wind - None

Quadrant4 | 15m/s Wind - MDist : 119, LDist : 127, SDist : 111 25m/s Wind - None

2019-08-05 01:18 UTC METOPB ASCAT 12.5KM SSW

2019-08-05 01:15 UTC METOPB ASCAT 12.5KM SSW

2019-08-05 01:12 UTC METOPB ASCAT 12.5KM SSW

2019-08-04 23:36 UTC METOPB ASCAT 12.5KM SSW

2019-08-04 23:33 UTC METOPB ASCAT 12.5KM SSW

2019-08-04 23:50 UTC GK2A IR105

Graph Analysis

SDT Analysis : 2019Year - FRANCISCO (1908)

SDT Analysis

Graph Analysis

Typhoon Route Image

Typhoon Route Video

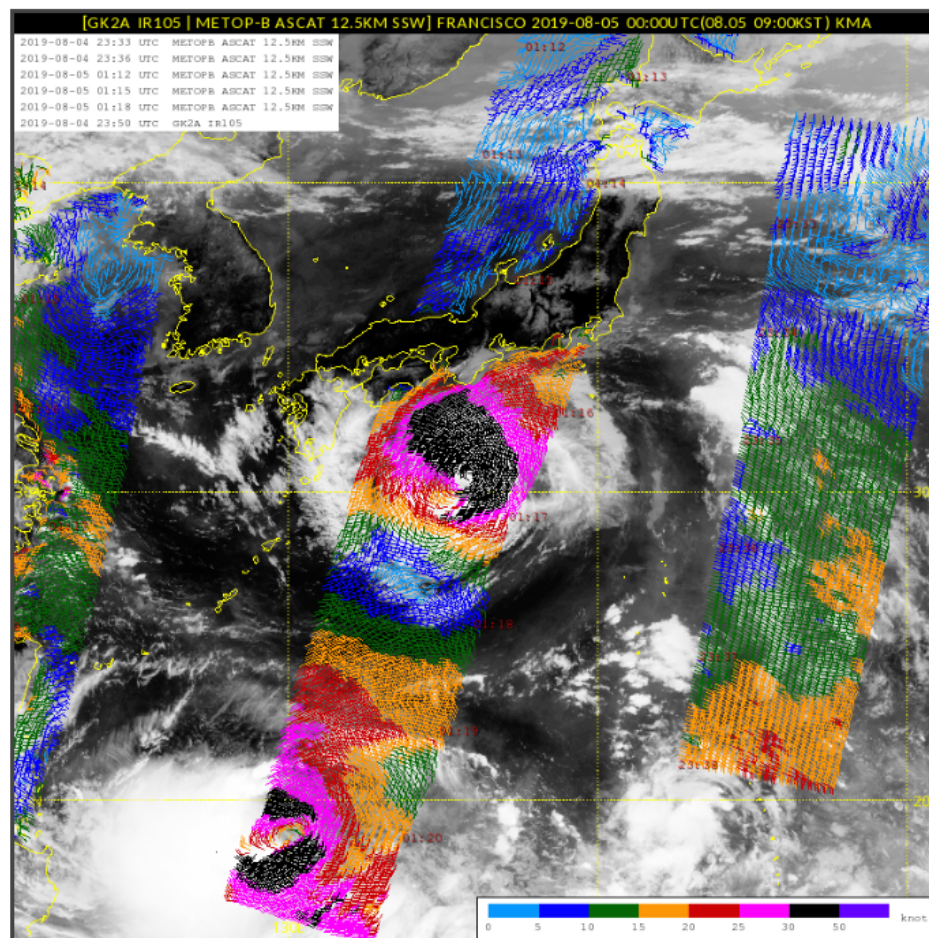
IF

해상풍(METOP-A/B, SCATSAT1)

DMSP SSM/I

2019-08-05

00:00 utc METOPB ASCAT



<< METOPB ASCAT >>

SDT Analysis : 2019Year - FRANCISCO (1908)

Analysis Date : 2019-08-05 00:00:00 UTC

SDT Analysis

Graph Analysis

Typhoon Route Image

Typhoon Route Video

IR Radius of Gail

Verify Radius of Gail

MW Radius of Gail

MW Typhoon Image

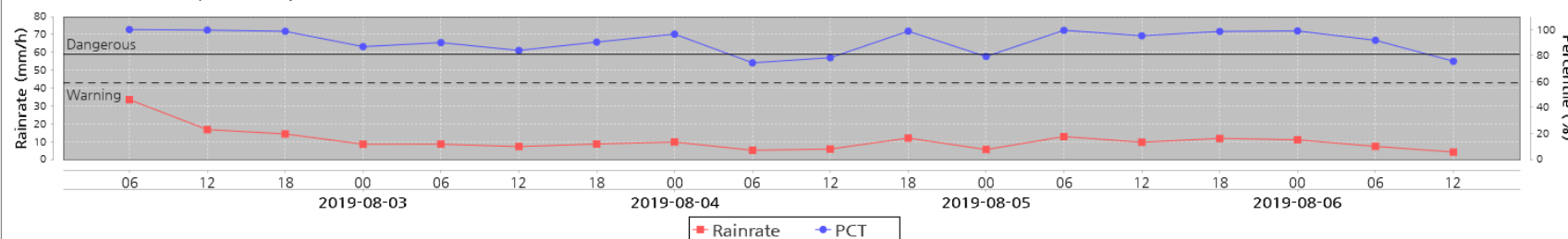
GTS text

PCT / TDI

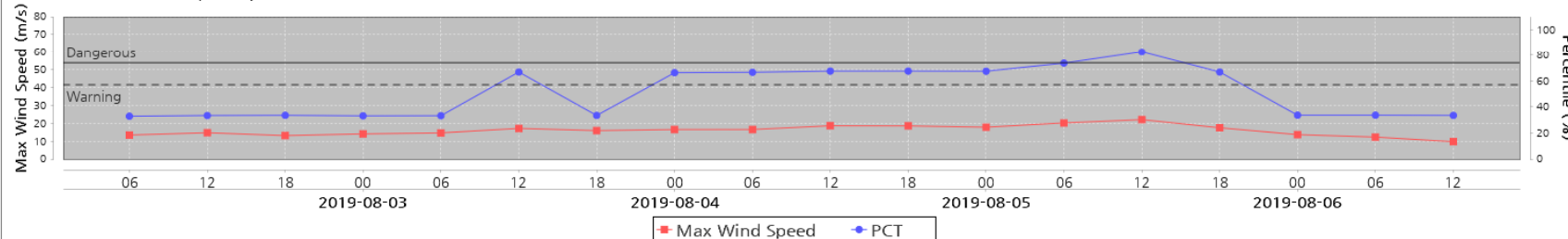
PCT

TDI

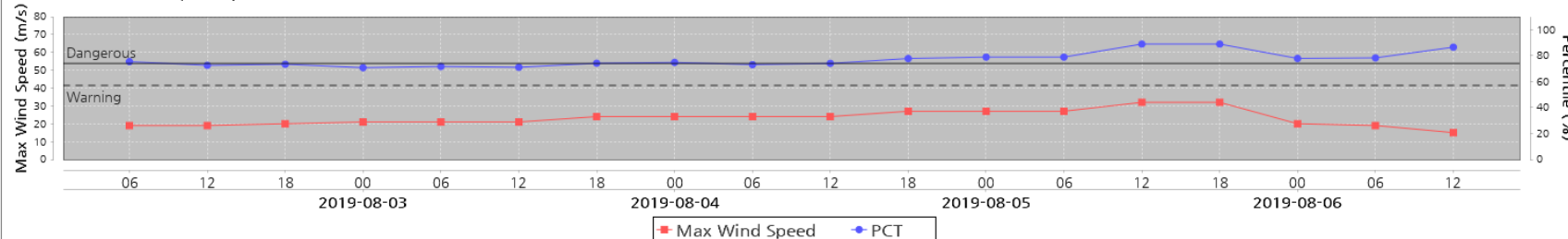
PCT : GK2A(RainRate)



PCT : GK2A(AMV)



PCT : GTS(KMA)



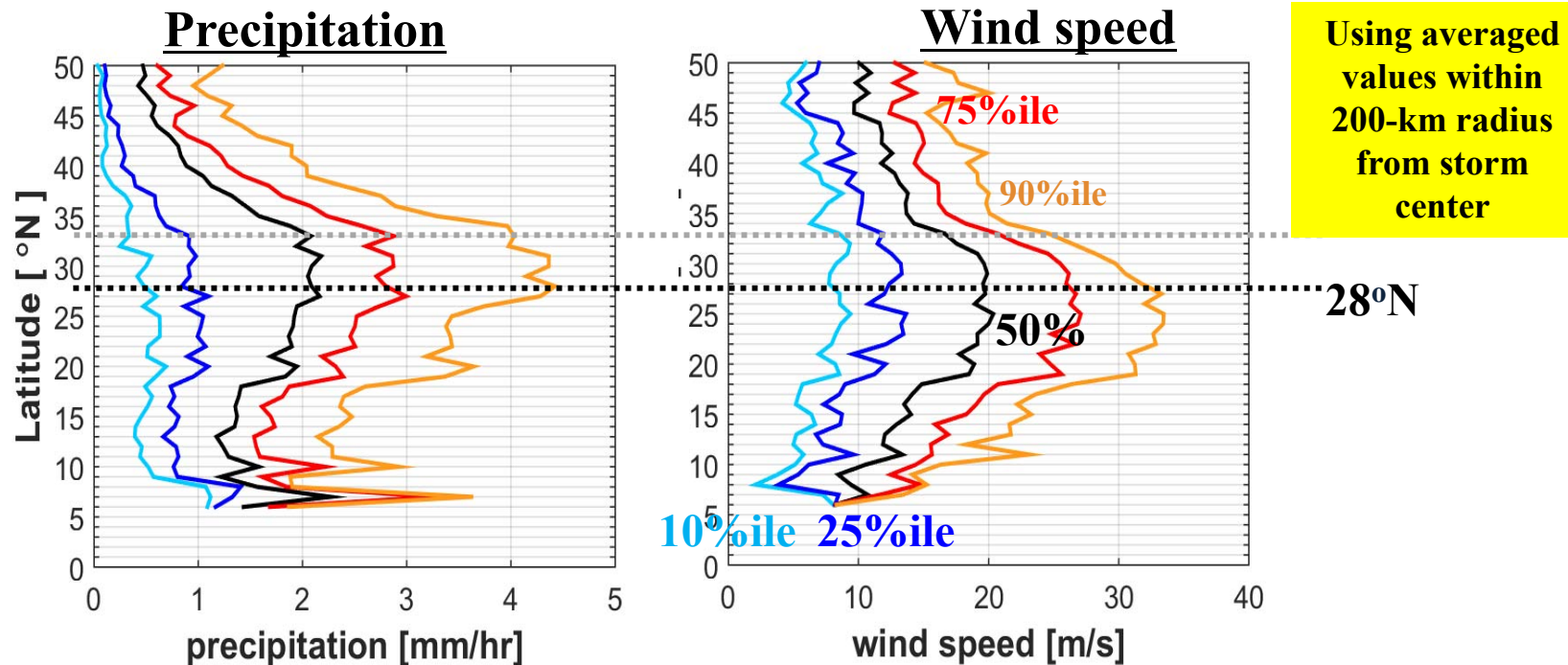
Search

Close

Percentile analysis on Rain & Wind



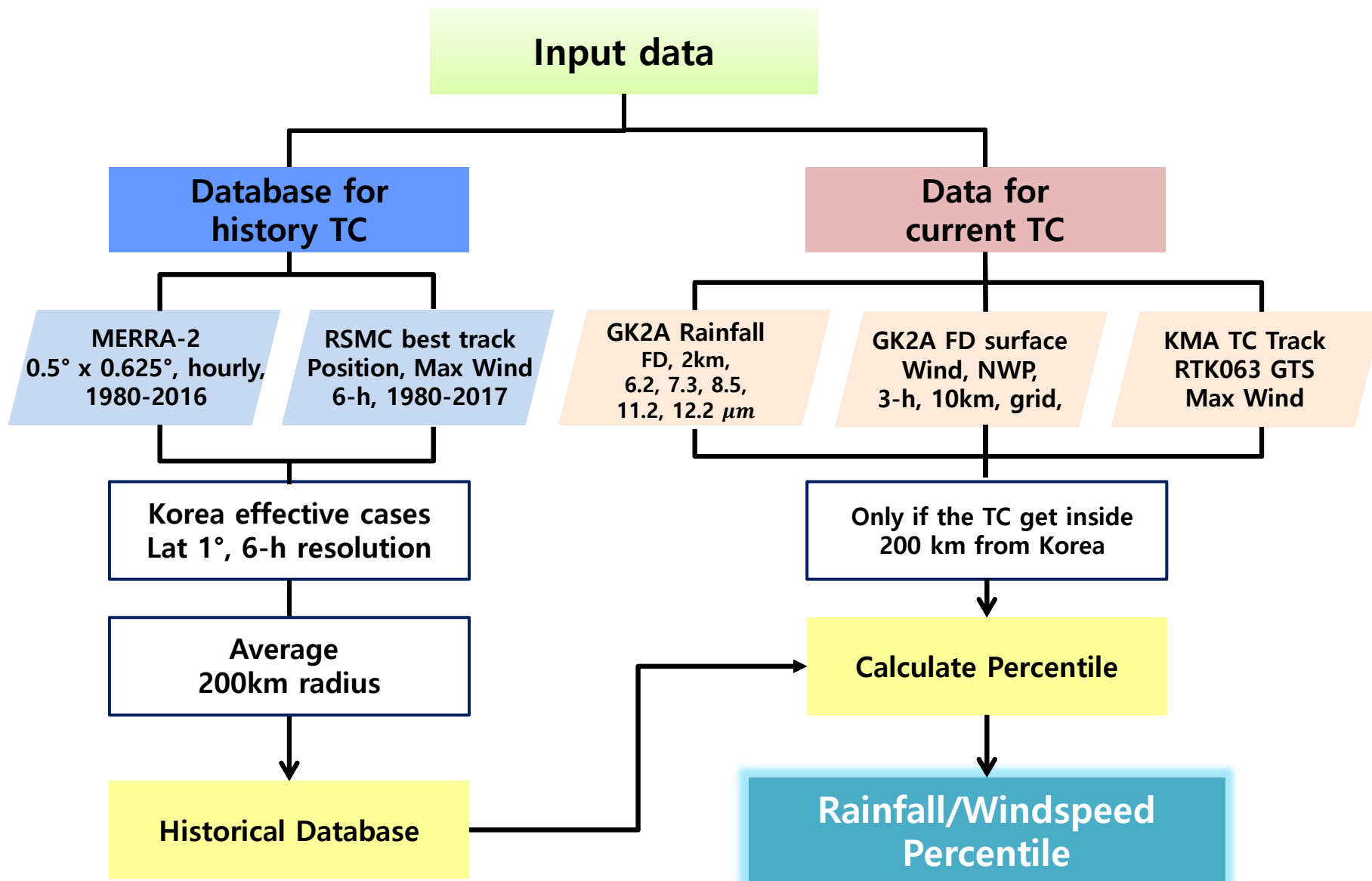
Percentile analysis for Historical Typhoons



[Example] The calculated 10%, 25%, 50%, 75%, 90% tile of precipitation and wind speed along every 1° latitude, which are estimated using MERRA-2 data for 113 historical typhoons

- ❖ Around 28°N latitude, 90%tile is about 4.3 mm/hour for precipitation and 33 m/s for wind speed. Here the values are averaged within 200-km radius from a storm center
- ❖ The latitude with peak value for rainfall data is 2-3° higher than wind speed.

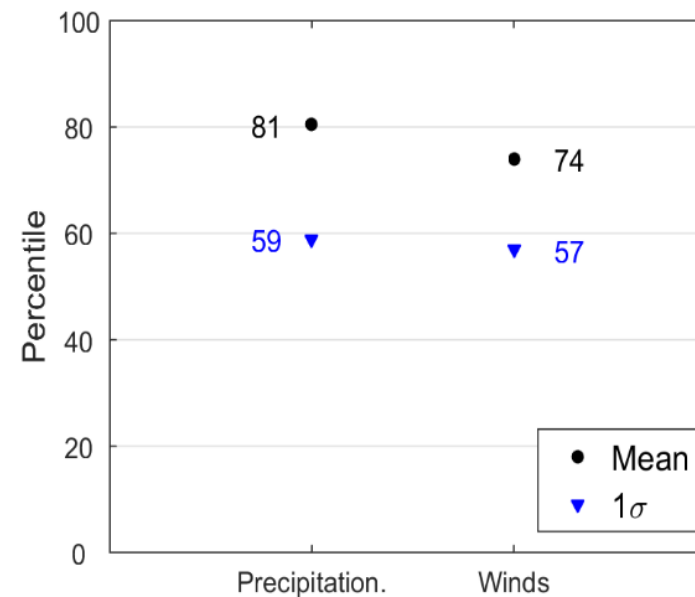
Algorithm



Rain/wind warning threshold

Warning Thresholds

Warning Thresholds (Possibility)	Types According to Percentiles		
	Rain-Dominant	Wind-Dominant	Rain-Wind-Dominant
Warning (Medium)	59th–81st Percentile	57th–73rd Percentile	Both Satisfied
Severe Warning (High)	Above 82nd Percentile	Above 74th Percentile	Both Satisfied

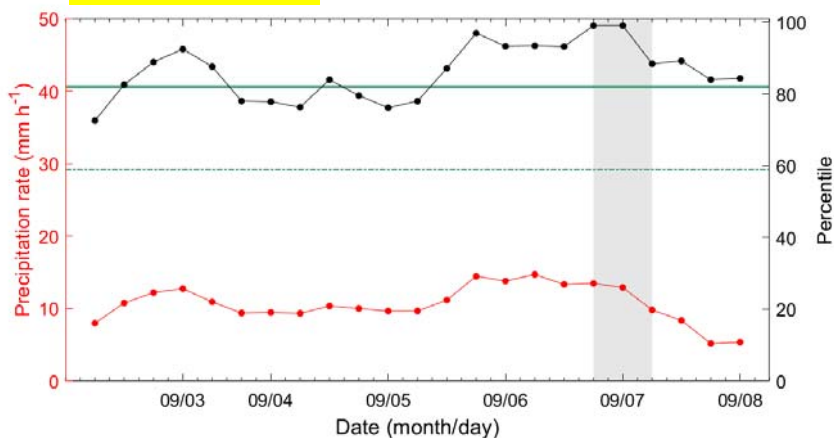


Mean and std of average top cases percentile near 32N during 1980 ~ 2017

Test Case (1913 LINGLING)

2019. 9. 2. 9:00 KST ~ 9. 8. 9:00 KST

GK2A Rain

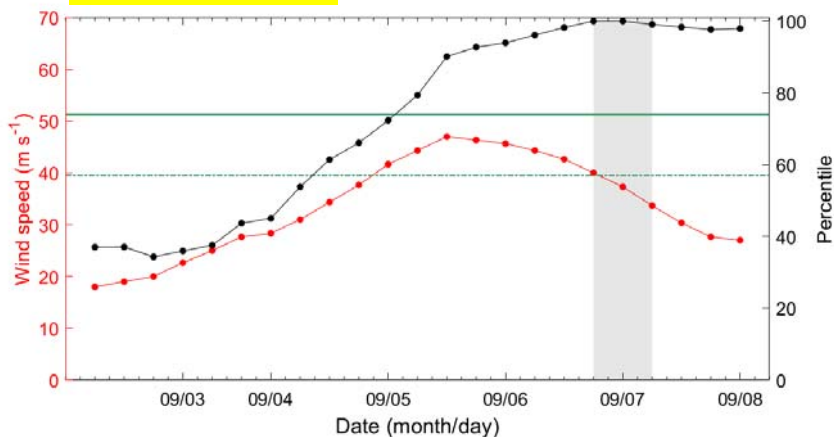


GK2A PREC : Severe
GK2A WIND : Severe
RTK WIND : Severe
to warning

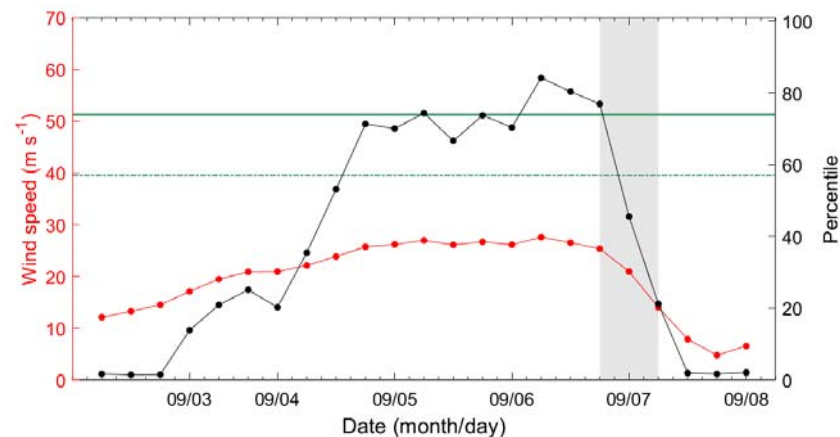
Rainfall and Wind effect



GK2A Wind

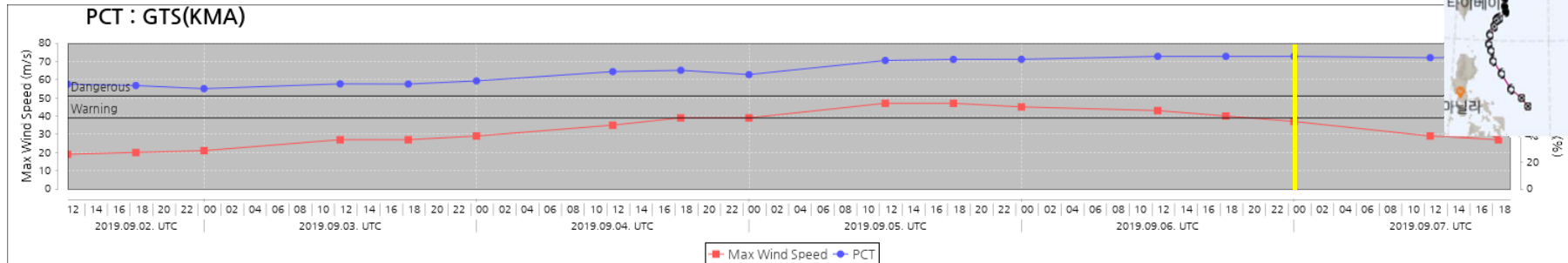


RTK Wind

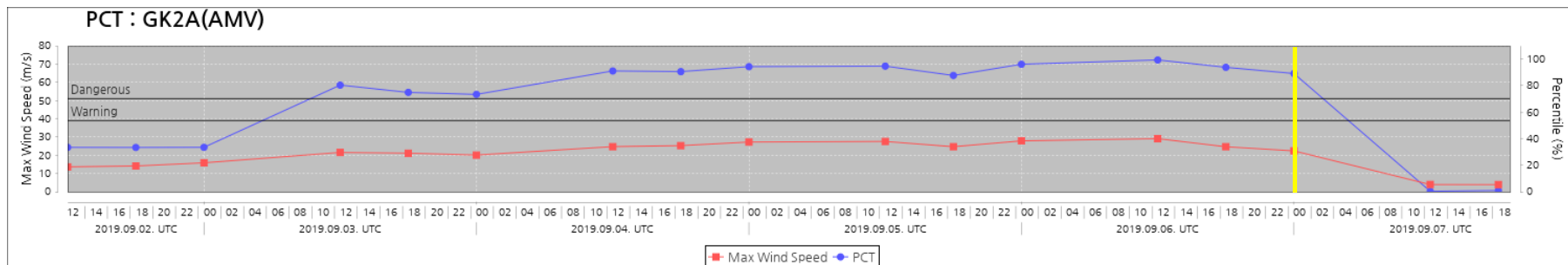


Case study – cont.

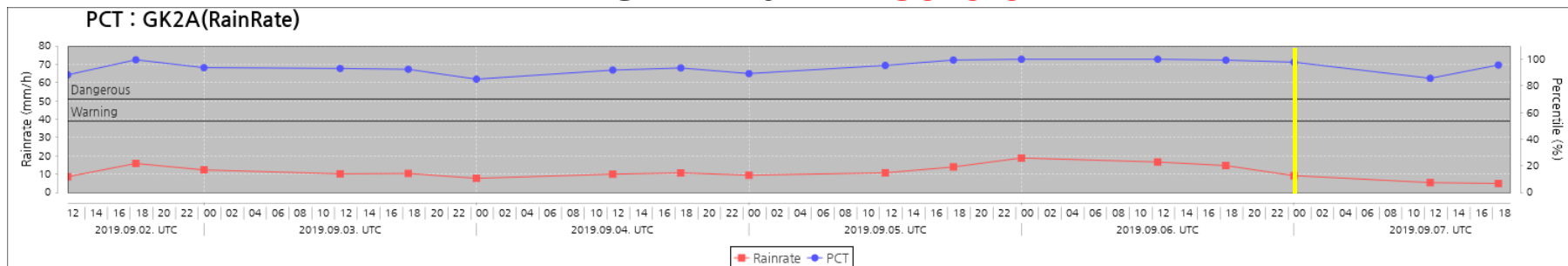
2019. 9. 2. 9:00 KST ~ 9. 8. 9:00 KST
RTK Wind → **Severe**



GK2A Wind → **Severe**



GK2A Rain → **Severe**



32°N

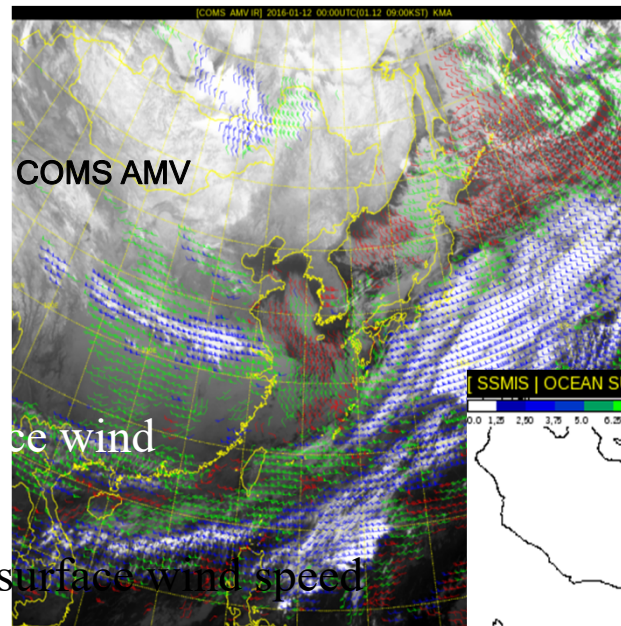
Application of Lower level Winds



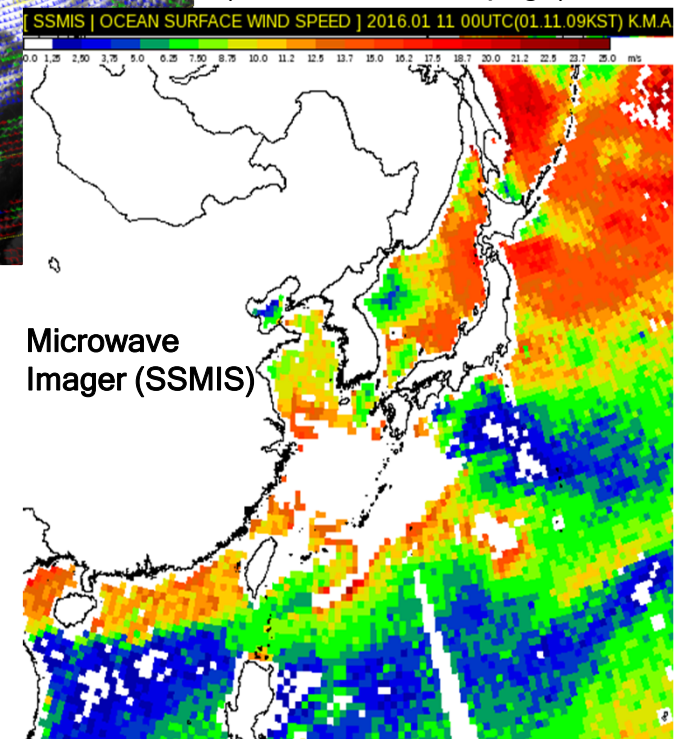
Background

❖ GEO wind field

- COMS AMV
 - 1000-700hPa
 - 700-400hPa
 - above 400hPa
- Scatterometer (ASCAT) sea surface wind
 - 2 times per 1day
- Microwave Imager (SSMIS) sea surface wind speed
 - 2 times per 1day



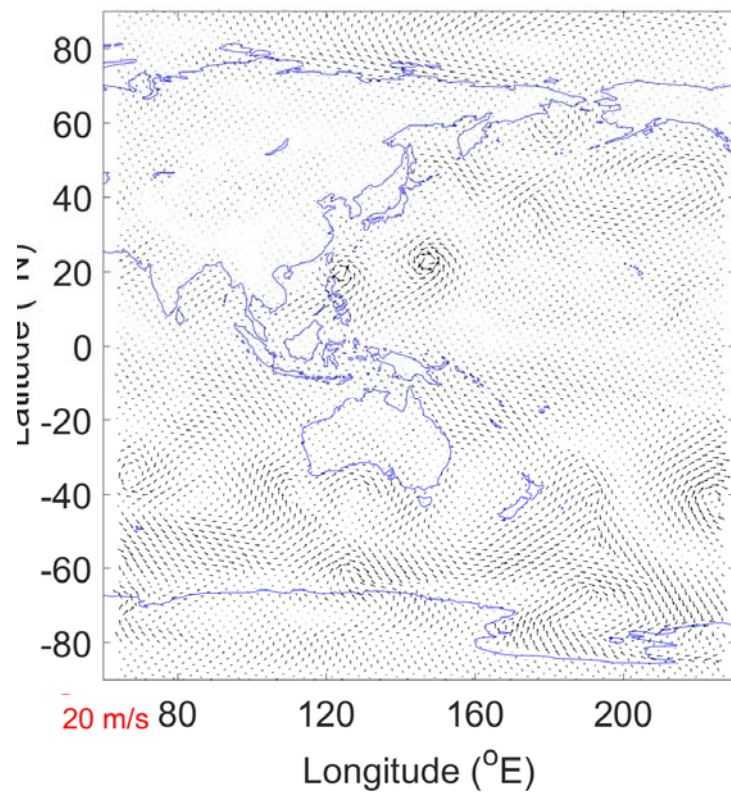
(from KMA/NMSC page)



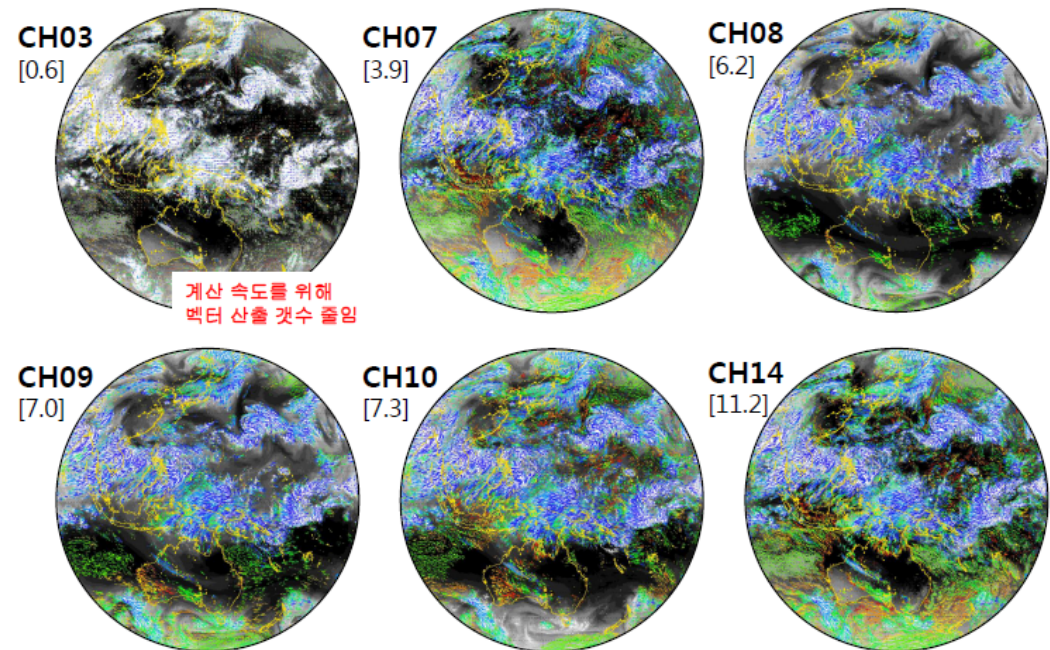
Full Disk Wind

❖ FD wind data

➤ UM model data

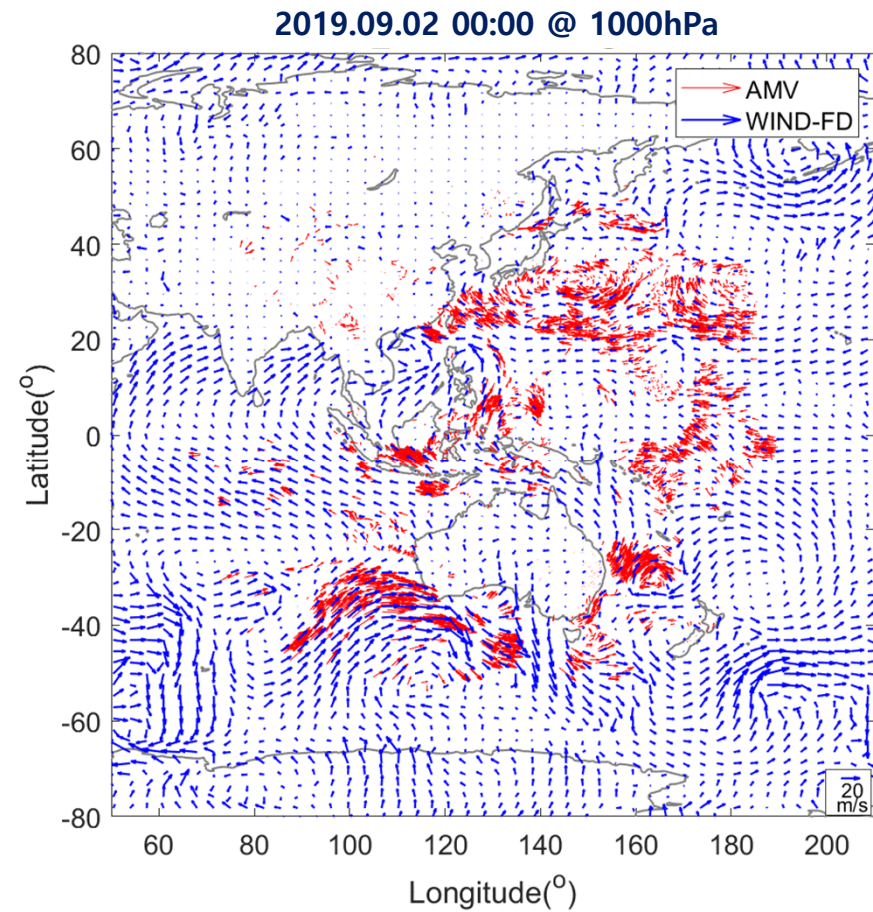
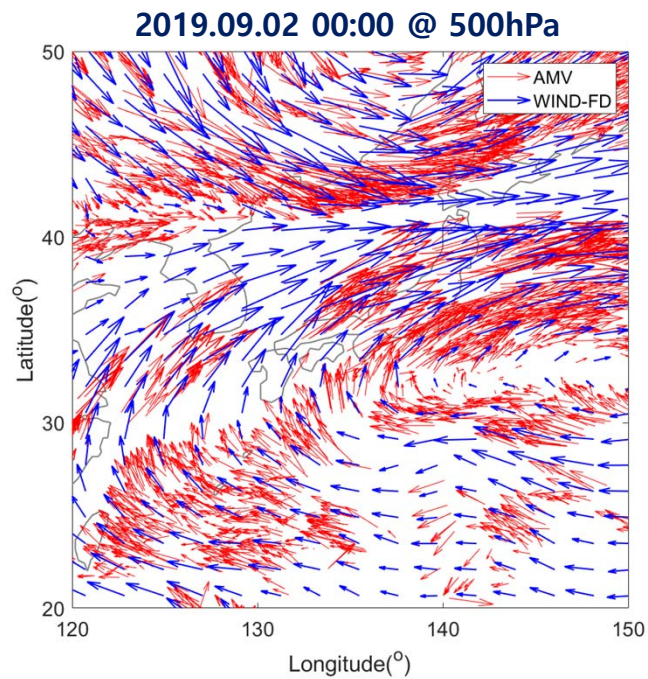


➤ AMV



Validation

TC LINGLING(1913) : WIND-FD

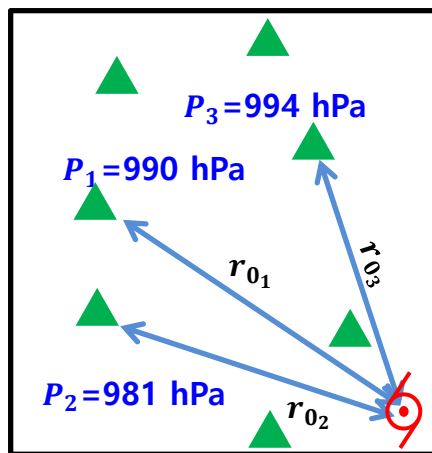


COMPASS



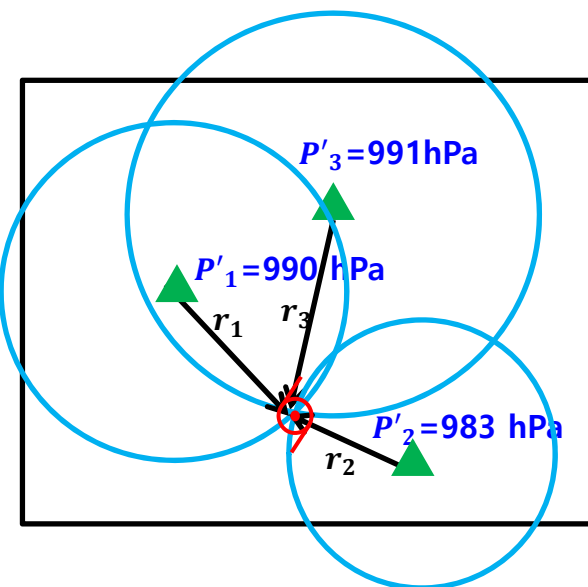
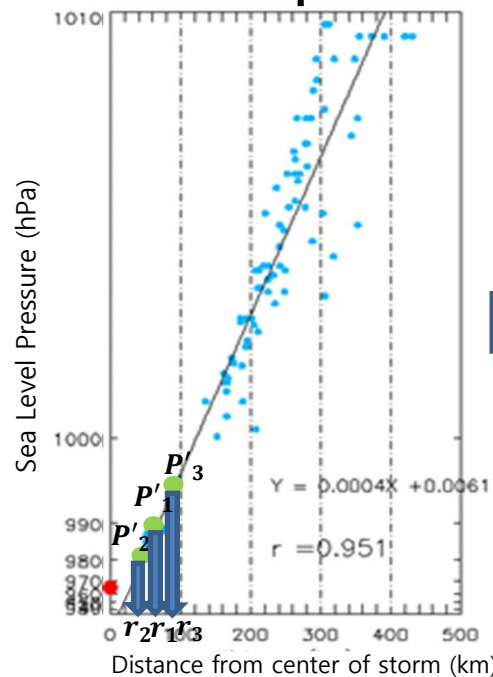
COMPASS technic using ground data

Sea level pressure

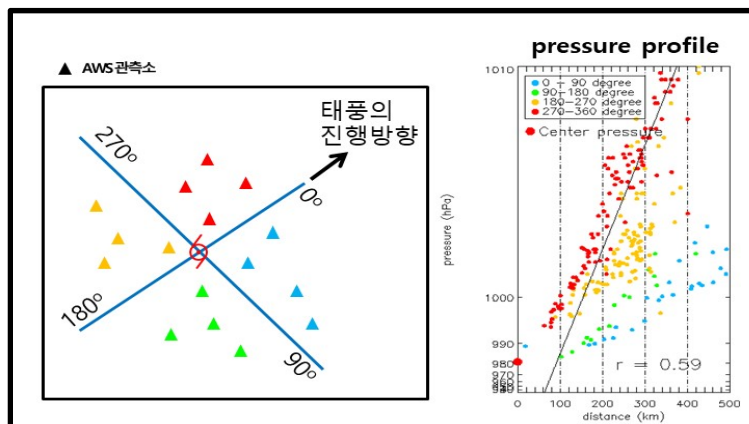


▲ AWS

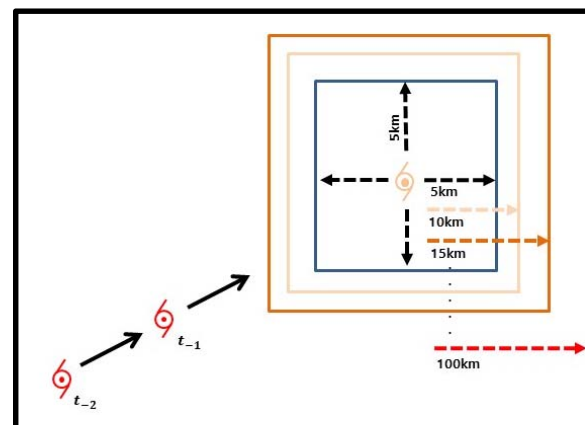
Pressure profile



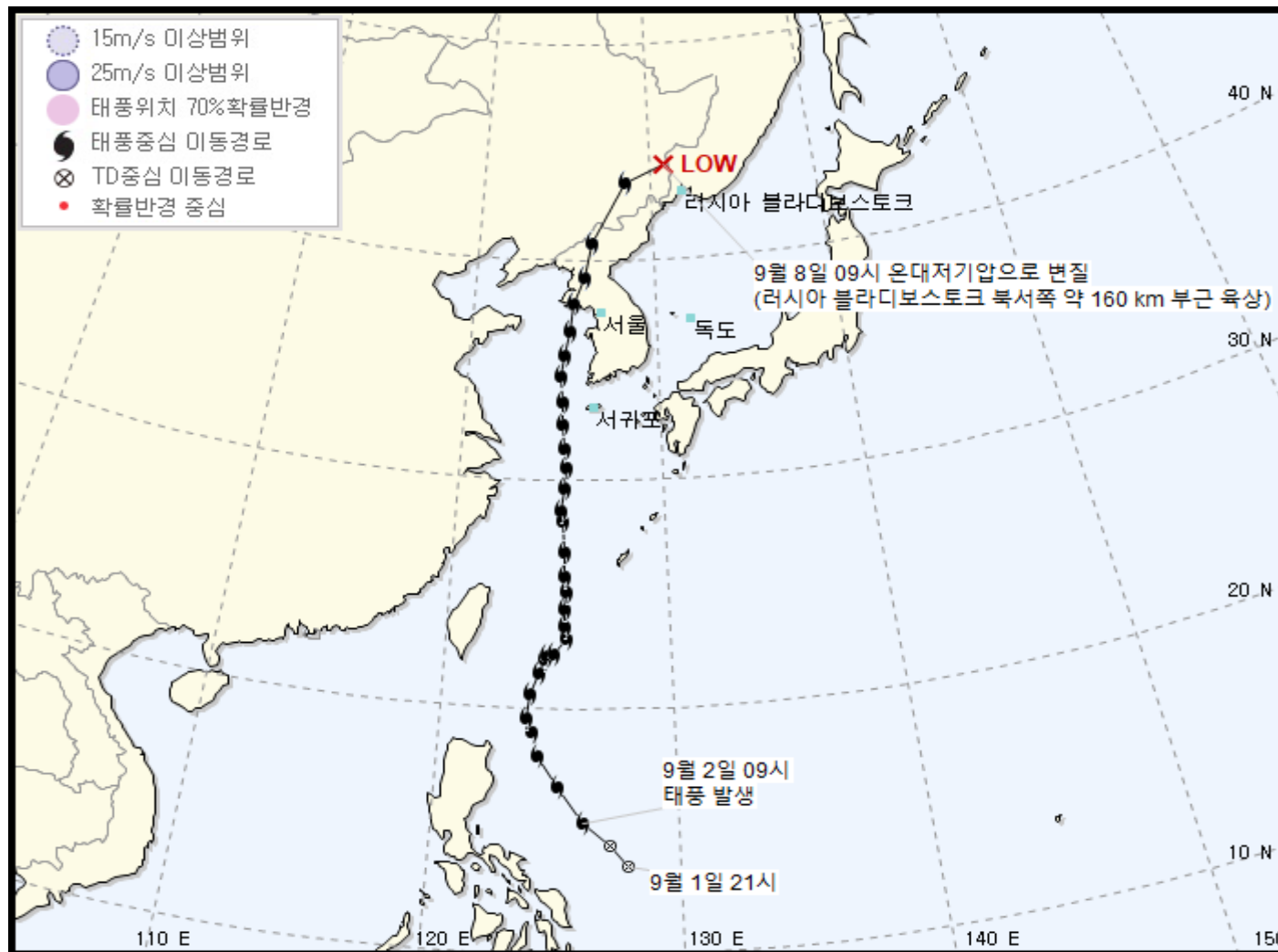
Sub 1



Sub 2

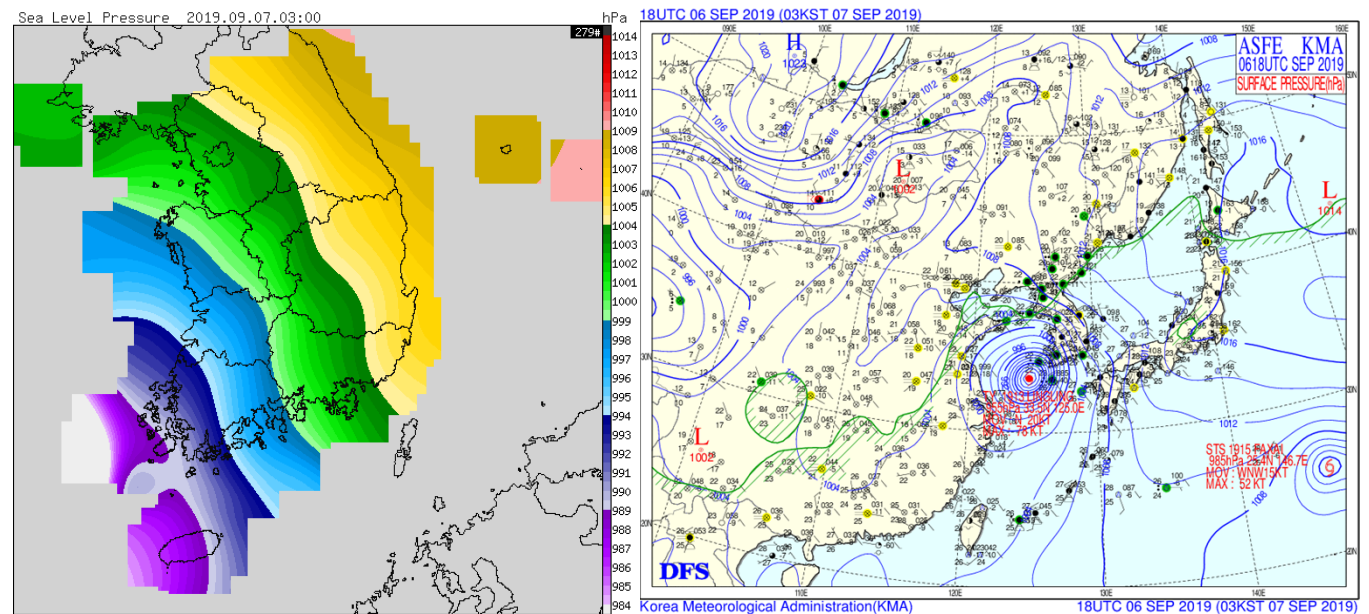
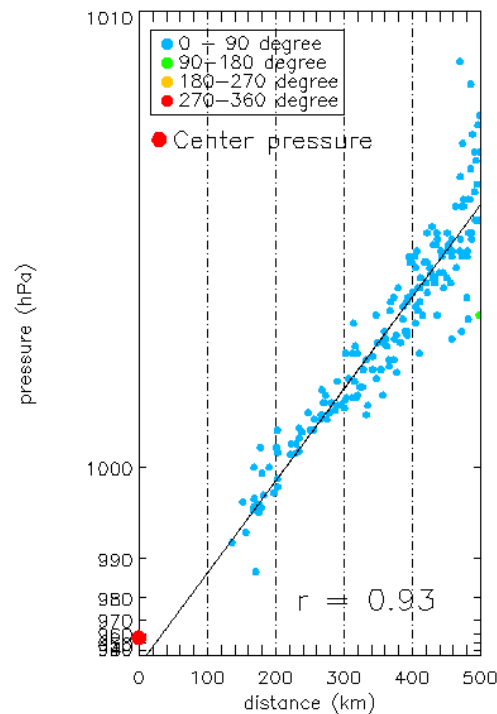
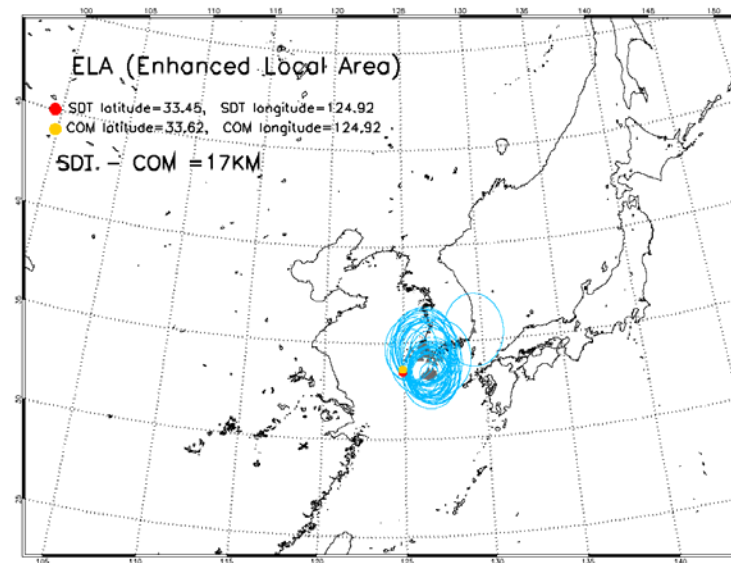


Test case 1913 LINGLING

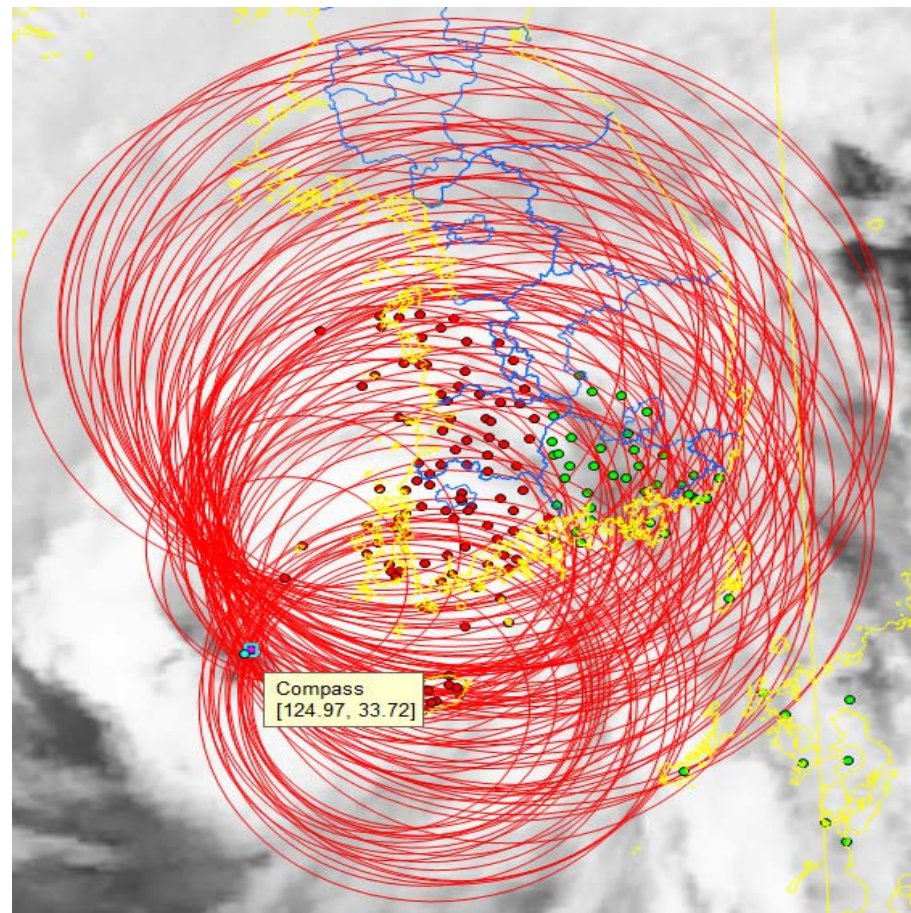
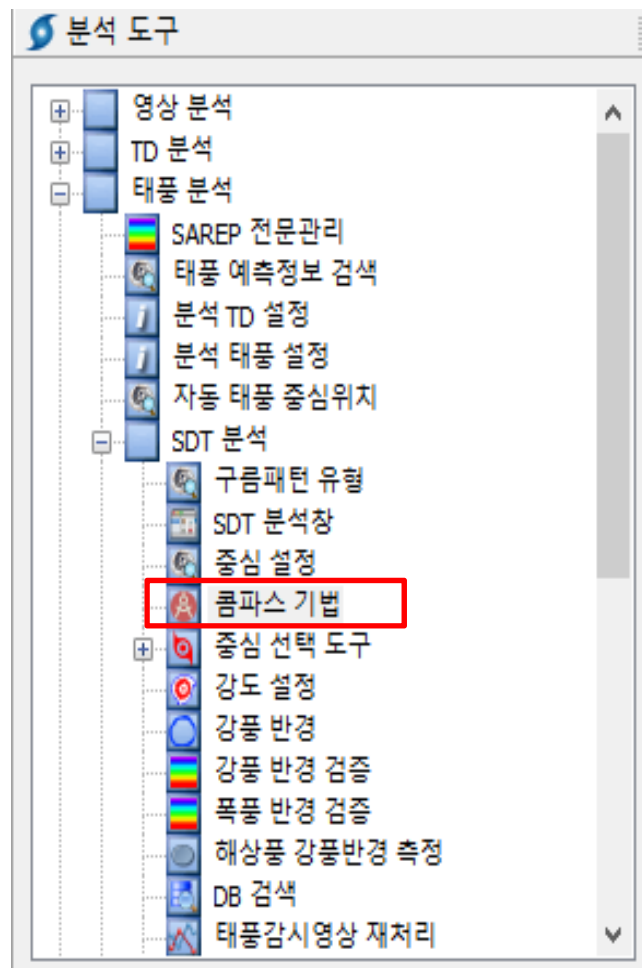


Test case - 1913 LINGLING

Time	Diff	Time	Diff
03KST	17 km	12KST	43 km
06KST	16 km	15KST	49 km
09KST	29 km	18KST	14 km



Test the Compass Technic on the system



1913 Typhoon LINGLING

**Thank you
for your attention!**

