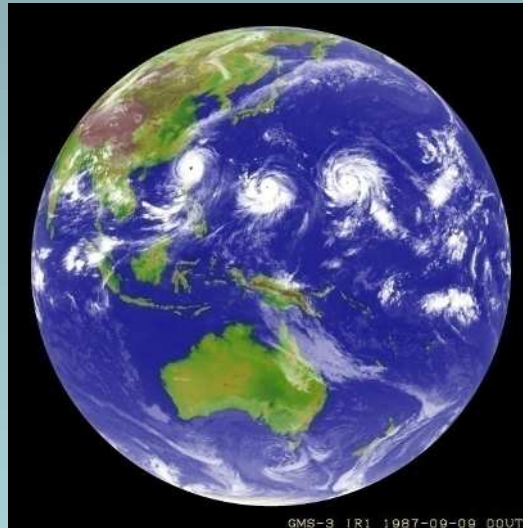


JMA/WMO Workshop on Effective Tropical Cyclone Warning in Southeast Asia
11 – 14 March, 2014

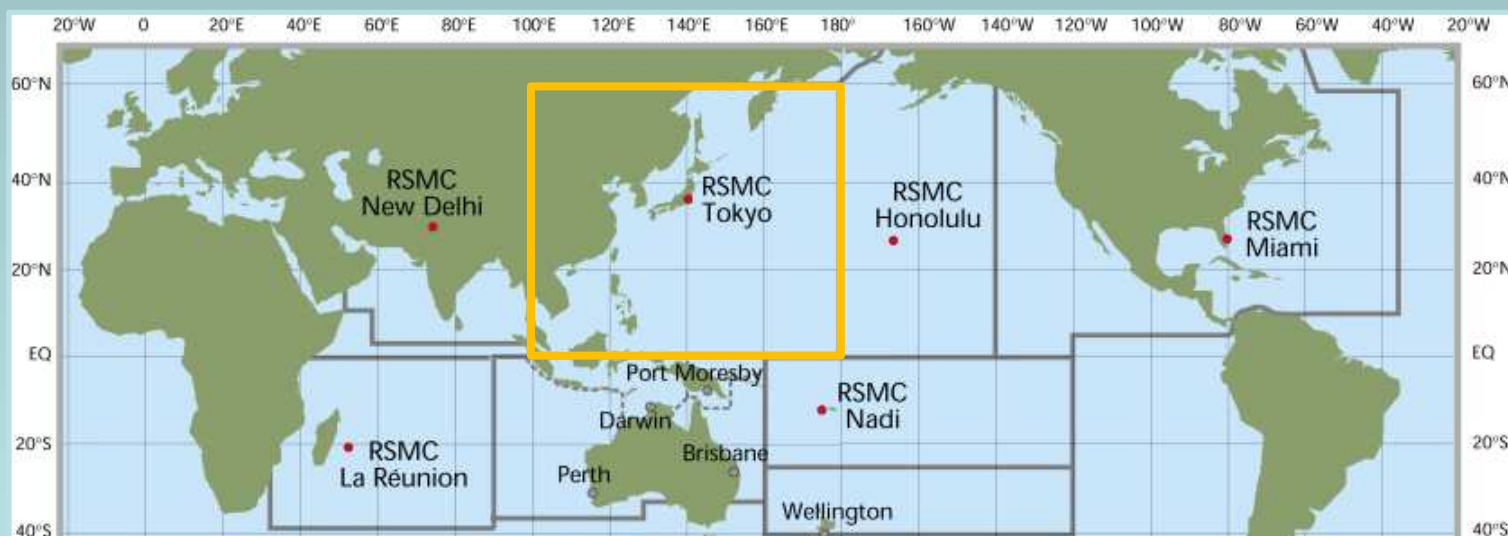
Tropical Cyclogenesis Monitoring at RSMC Tokyo



Mikio, Ueno
Forecaster, Tokyo Typhoon Center
Japan Meteorological Agency (JMA)

Outline

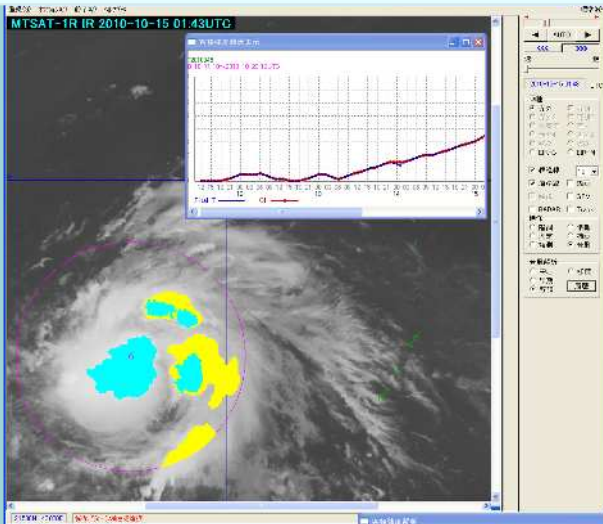
- Major Activities of the RSMC Tokyo
- Early Dvorak Analysis (EDA)
- Tropical Cyclogenesis Monitoring
- JMA Numerical Typhoon Prediction Website



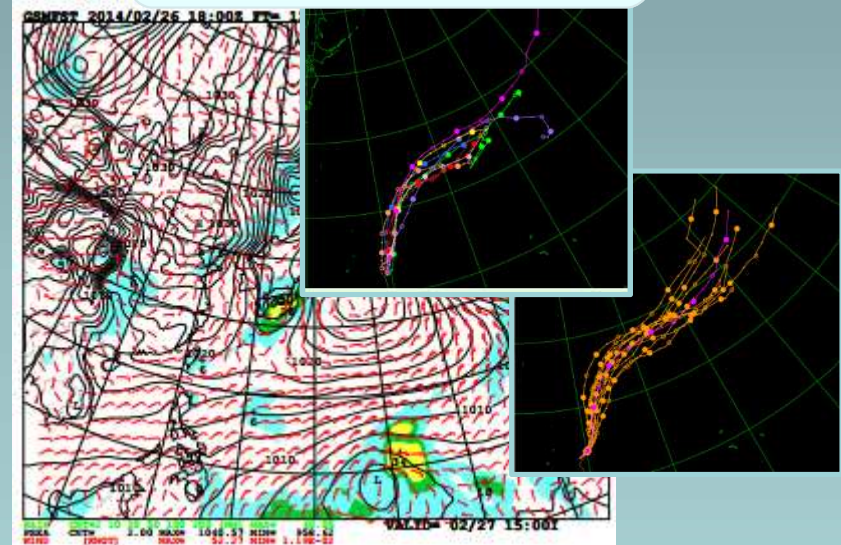
Major Activities of the RSMC Tokyo (1)

● Tropical Cyclone Analysis and Forecast

Cloud grid information objective
Dvorak analysis (CLOUD)



Numerical Prediction
Model



● Dissemination of RSMC Products via the GTS

- SAREP
- RSMC Tropical Cyclone Advisory
- RSMC Guidance for Forecast

- RSMC Prognostic Reasoning
- Tropical Cyclone Advisory for SIGMET
- RSMC Tropical Cyclone Best Track

Major Activities of the RSMC Tokyo (2)

●Provision of Products via the Internet

➤ RSMC Tokyo - Typhoon Center Website

www.jma.go.jp/jma/jma-eng/jma-center/rsmc-hp-pub-eg/RSMC_HP.htm

気象庁
Japan Meteorological Agency

Home Weather/Earthquakes News Releases Ser

Home > For NMHSs > RSMC Tokyo - Typhoon Center

RSMC Tokyo - Typhoon Center

Welcome to RSMC Tokyo - Typhoon Center

RSMC Tropical Cyclone Information

00:00 UTC, 6 March 2014 All tropical cyclones

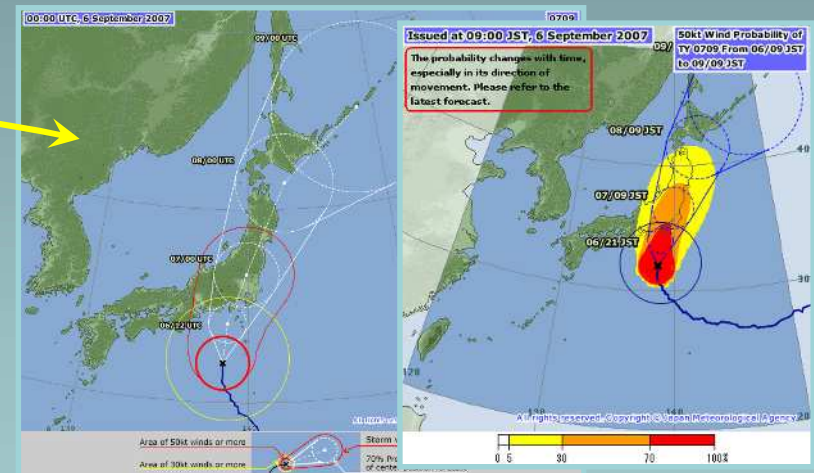
The Regional Specialized Meteorological Center Tokyo - Typhoon Center provides information on cyclones in the western North Pacific and the So Sea, including present and forecast positions as movement and intensity of tropical cyclones.

Please note that information issued by the RSM Typhoon Center represents neither official analysis nor warnings for the areas concerned. Such off information is issued by the National Meteorologic individual countries.

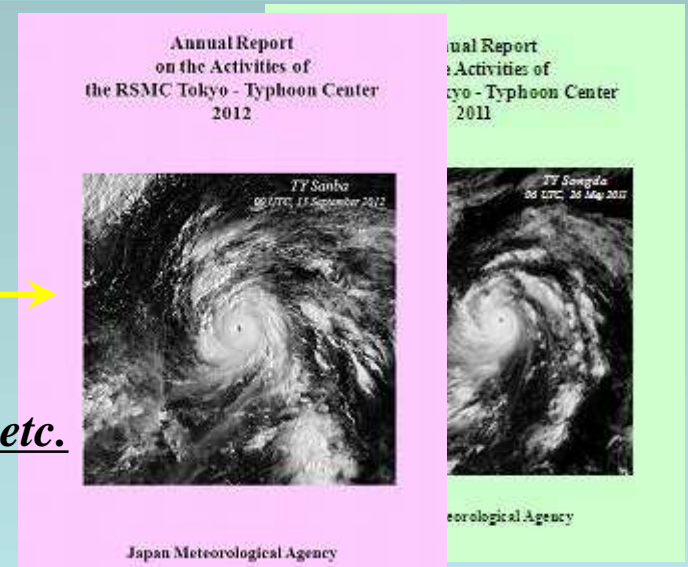
Notes on RSMC Tropical Cyclone Information

- Names of Tropical Cyclones
- Climatology of Tropical Cyclones
- Best Track Data
- Annual Report on Activities of the RSMC Tokyo - Typhoon Center
- Technical Review
- Experimental CAP Version of Tropical Cyclone Advisory
- About RSMC Tokyo - Typhoon Center

Operational TC information



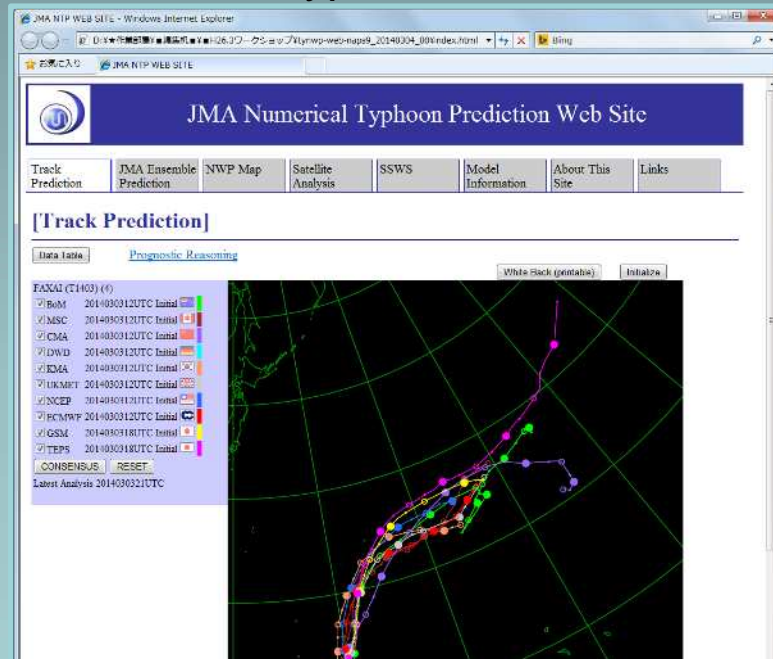
Annual Report, Technical Review etc.



Major Activities of the RSMC Tokyo (3)

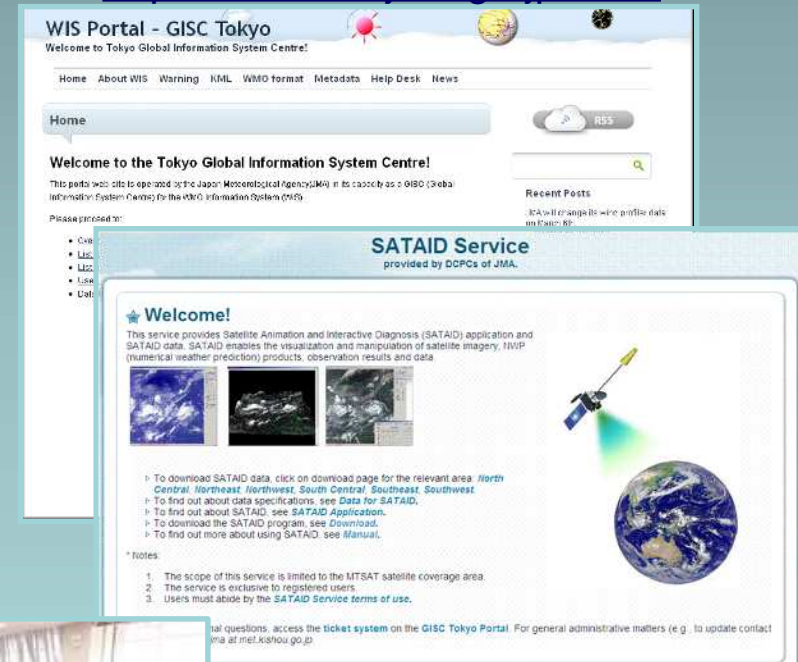
● Provision of Products via the Internet

➤ JMA Numerical Typhoon Prediction Website



➤ WIS Service

<http://www.wis-jma.go.jp/cms/>



● Training

➤ Typhoon Committee Attachment Training
(On-the-job training for typhoon analysis/forecast)



Outline

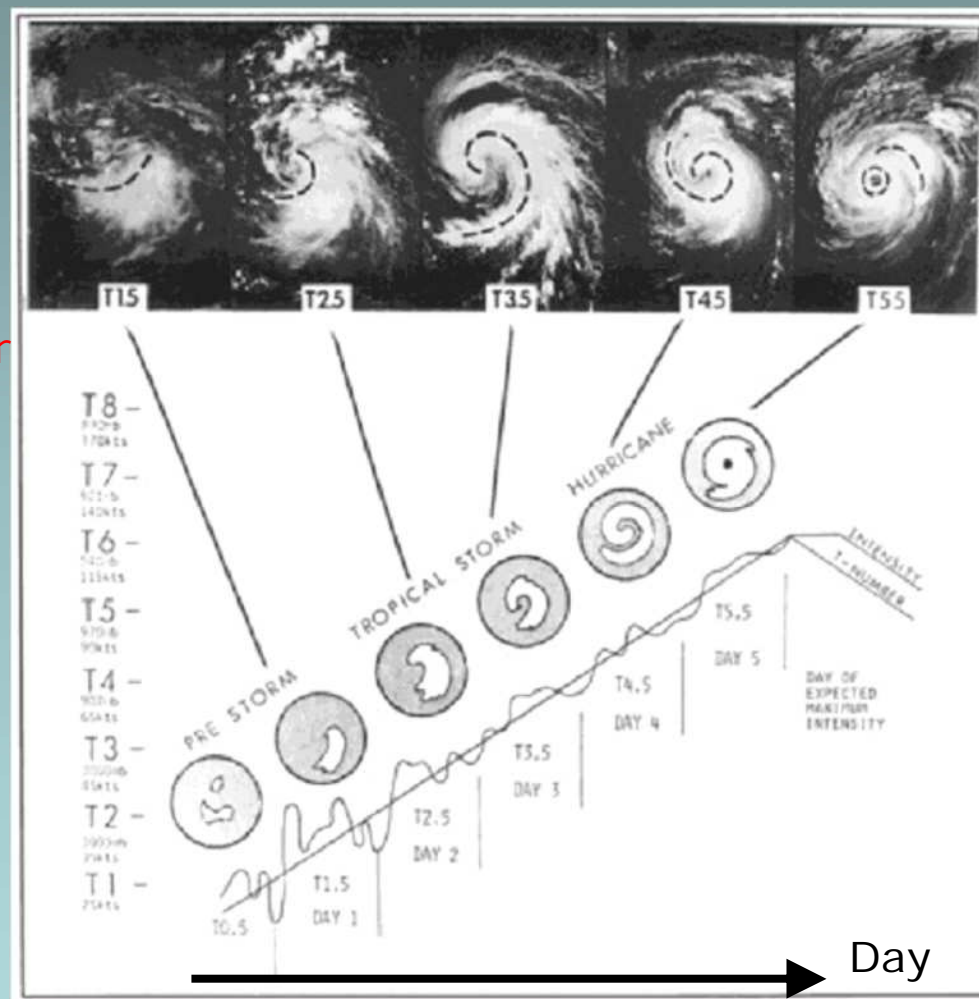
- Major Activities of the RSMC Tokyo
- Early Dvorak Analysis (EDA)
- Tropical Cyclogenesis Monitoring
- JMA Numerical Typhoon Prediction Website

Early Dvorak Analysis (EDA)

Dvorak analysis

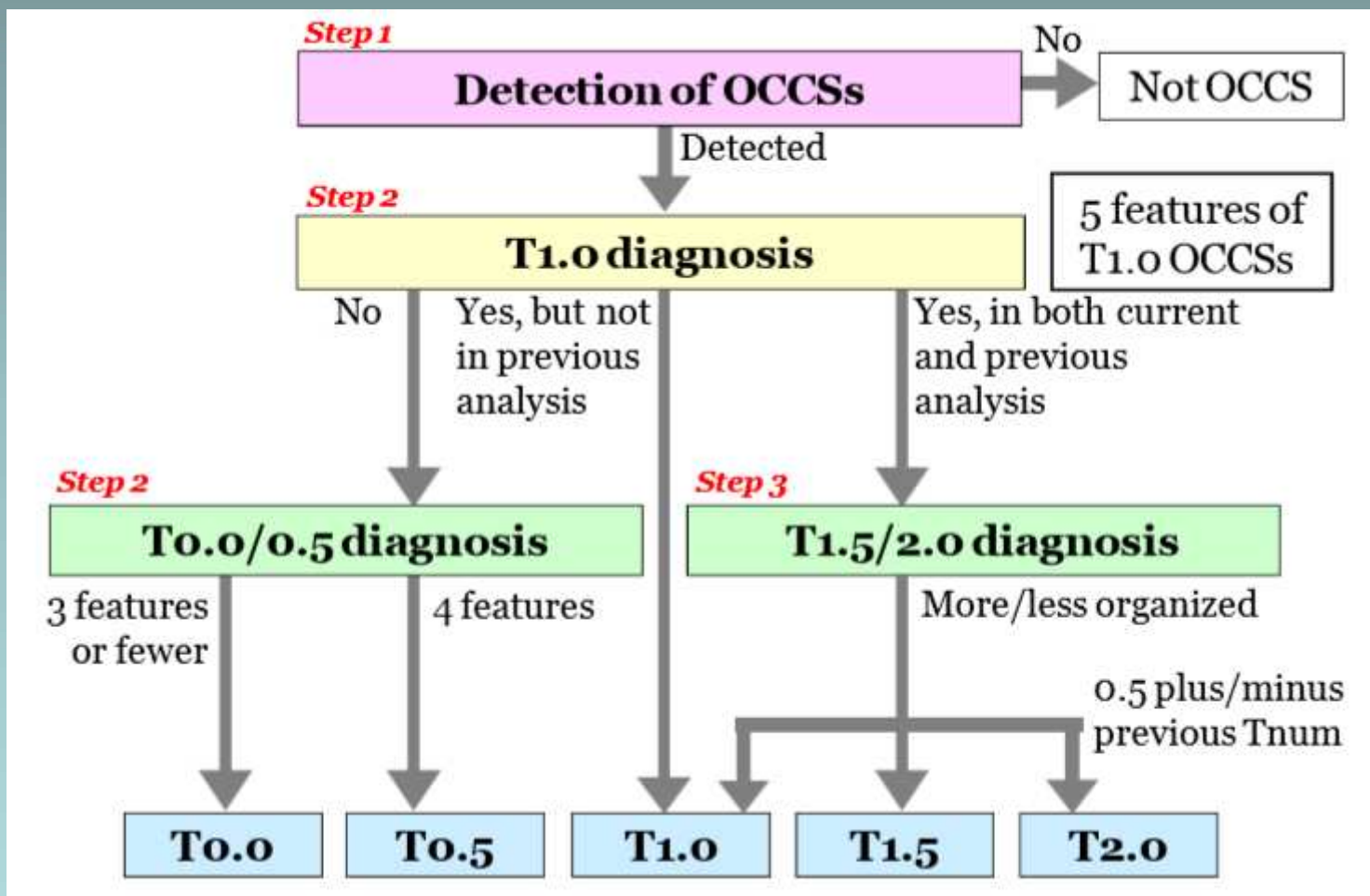
Early-stage Dvorak analysis
developed by JMA

T-number



Early Dvorak Analysis (EDA)

Outline of EDA

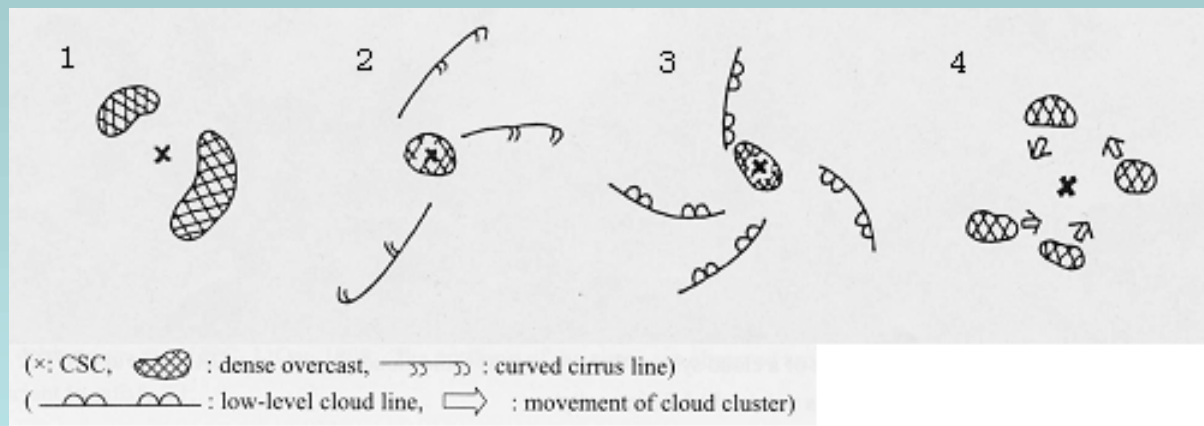


Early Dvorak Analysis (EDA)

Step1: Detection of Organized Convective Cloud System (OCCS)

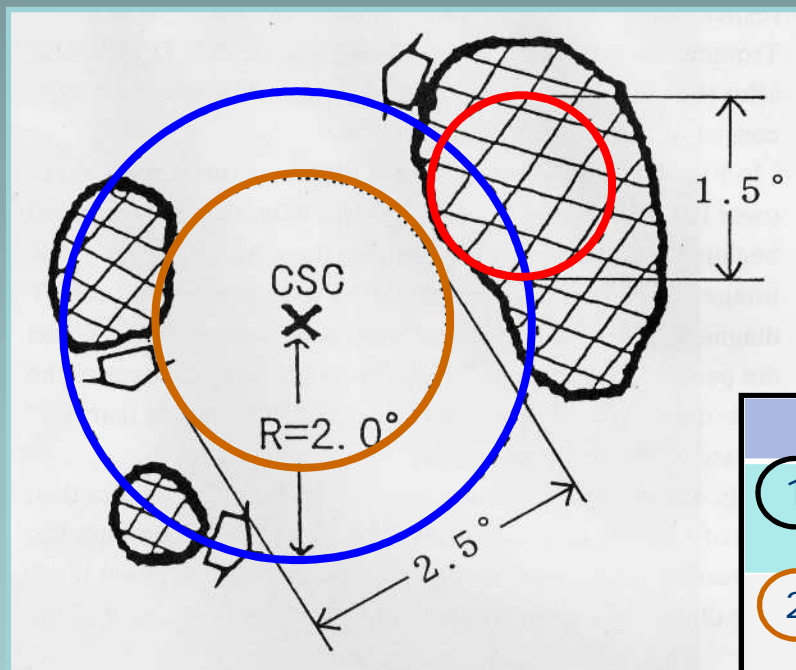
1. Dense and cold overcast bands that show some curvature around a relatively warm area.
2. Curved cirrus lines indicating a center of curvature within or near a dense, cold overcast.
3. Curved low cloud lines showing a center of curvature within two degrees of a cold cloud mass.
4. Cumulonimbus (Cb) clusters rotating cyclonically on animated images.

cloud features of OCCS and its CSC position



Early Dvorak Analysis (EDA)

Step2: T1.0 Diagnosis



Five features of T1.0 intensity

	Tsuchiya et al. (2000,2001)
1	A convective cloud system has persisted for 12 hours or more.
2	The cloud system has a CSC defined within a diameter of 2.5 deg. latitude or less.
3	The CSC has persisted for 6 hours or more.
4	The cloud system has an area of dense, cold (-31 deg. C or colder) overcast that appears less than 2 deg. latitude from the center.
5	The above overcast size is more than 1.5 deg. latitude in diameter.

Early Dvorak Analysis (EDA)

Step3: T1.5/2.0 Diagnosis

Time variation in organization of OCCSs

using satellite imagery from the previous analysis time (6 hours before) to the present

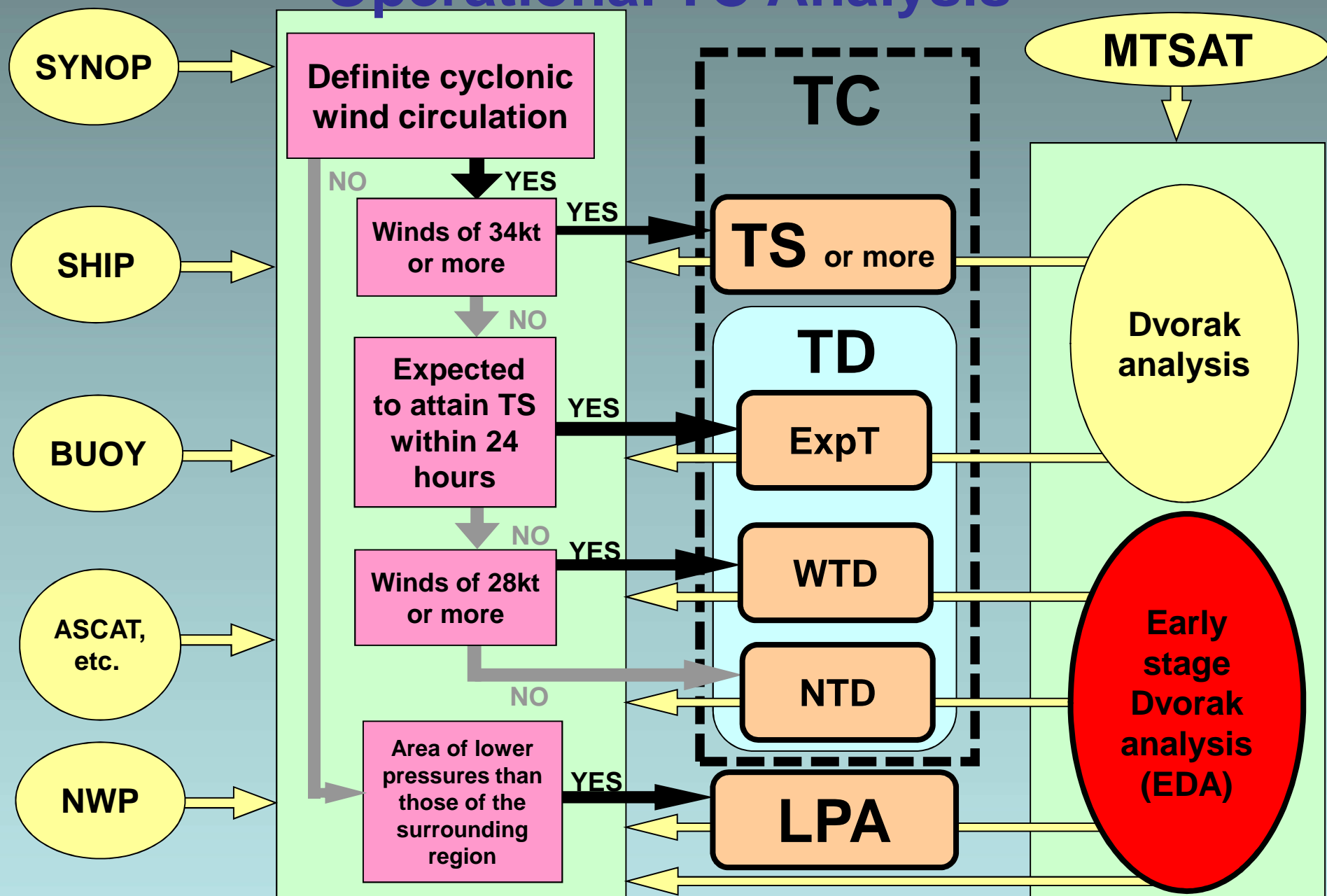
[view points]

- cyclonic cloud circulation
- curvature and length of a curved band-shaped cloud



More organized:	the previous T-number plus 0.5
Less organized:	the previous T-number minus 0.5
Few or no change:	the previous T-number persists

Operational TC Analysis



Early Dvorak Analysis (EDA)

T-number	NTD or not	WTD or not	Possibility of developing into TS
0.0	Unlikely	Unlikely	Poor
0.5	Likely		
1.0	Highly likely	Likely	Fair
1.5		Highly likely	High
2.0			

Unlikely: lower than 30%

Likely: 30 to 70%

Highly likely: higher than 70%

Poor: lower than 40%

Fair: 40 to 70%

High: higher than 70%

[Reference] Kishimoto et al. (2006) and Kishimoto (2007)

Early Dvorak Analysis (EDA)

Typical examples of TD diagnosis using **surface observations**, **ASCAT** and **NWP** depending on the T-number of OCCSs

T-number of OCCSs	TD diagnosis	WTD diagnosis	ExpT diagnosis
0.0	It is monitored as a potential TD.	It is monitored as a potential WTD.	It is monitored as a potential ExpT.
0.5	If it has definite cyclonic wind circulation and winds of Beaufort Scale 6 (22 to 27 kt), it is determined as a TD.		
1.0	It is determined as a TD.	If it has winds of about Beaufort Scale 7 (28 to 33 kt), it is determined as a WTD.	If it has winds of about Beaufort Scale 7 (28 to 33 kt) and NWP definitely predicts the development within 24 hours, it is determined as an ExpT.
1.5		It is determined as a WTD.	If NWP predicts the development within 24 hours, it is determined as an ExpT.
2.0			It is determined as an ExpT.

Outline

- Major Activities of the RSMC Tokyo
- Early Dvorak Analysis (EDA)
- Tropical Cyclogenesis Monitoring
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Tropical Cyclogenesis Monitoring

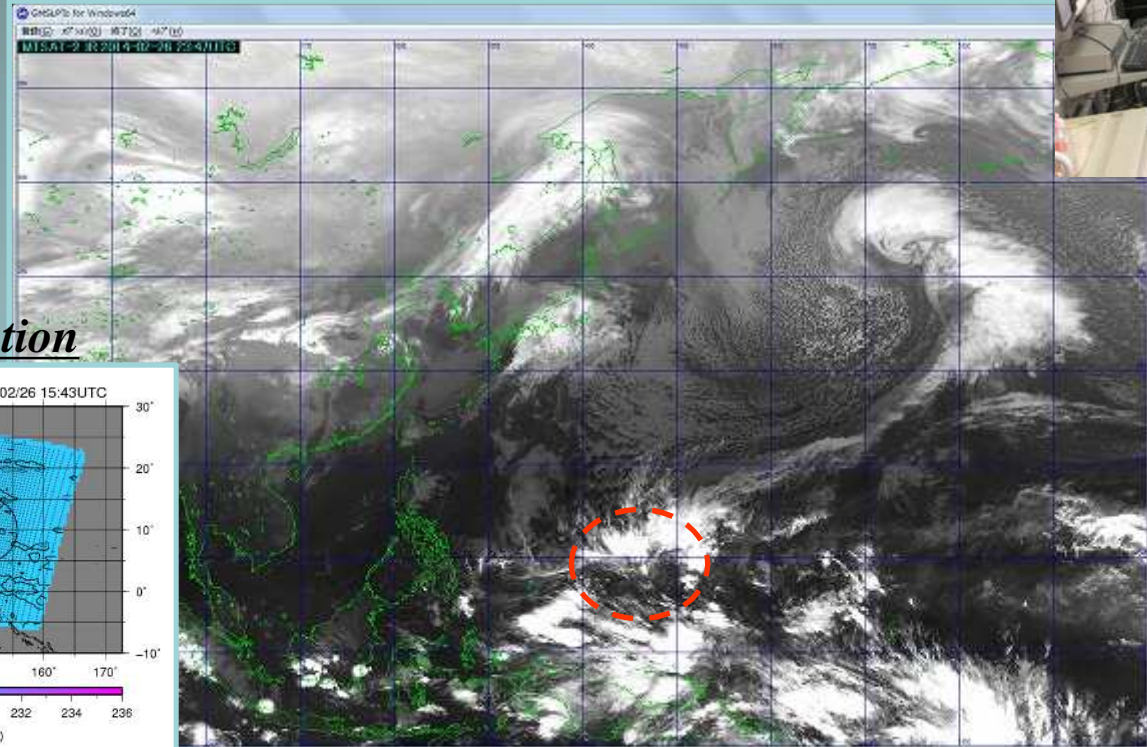
JMA TC Forecast

2100 UTC, 26 Feb.



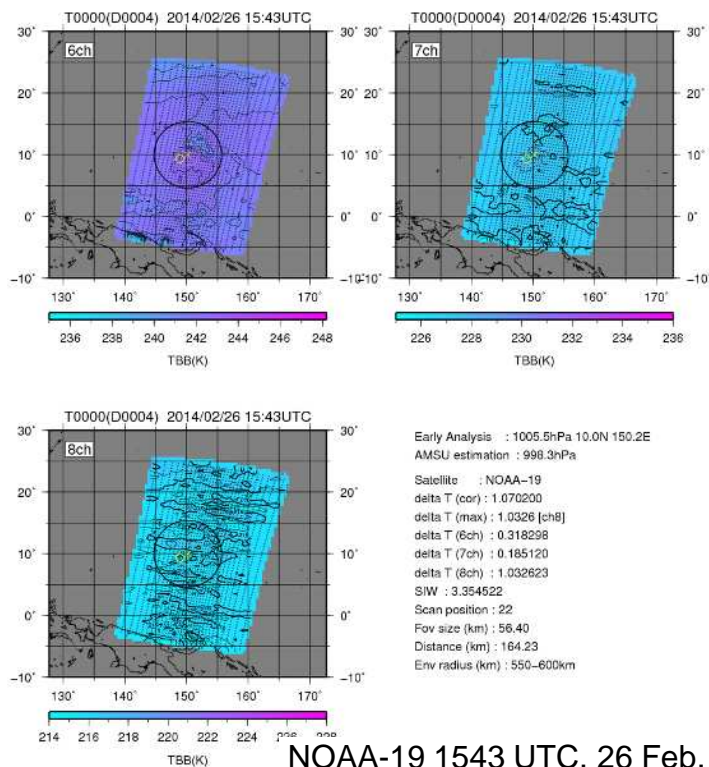
MTSAT Images

00 UTC, 27 Feb.

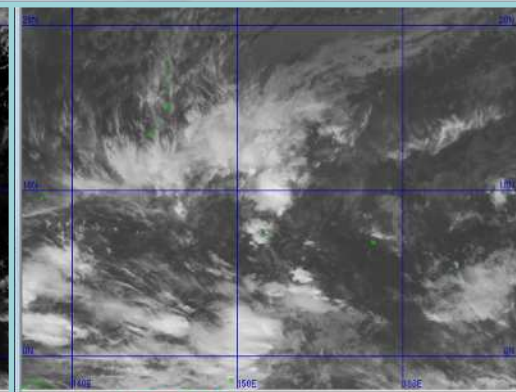
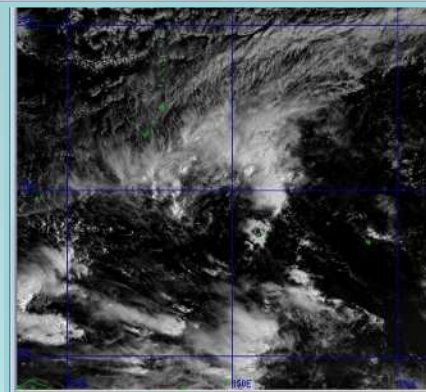


Morning Briefing (27 Feb. 2014)

AMSU TC Intensity Estimation



NOAA-19 1543 UTC, 26 Feb.



MTSAT-2 2014-02-26 22:41:11

チャンネル: 10

操作: 拡大, 縮小, 移動

表示: 雲色, 初期

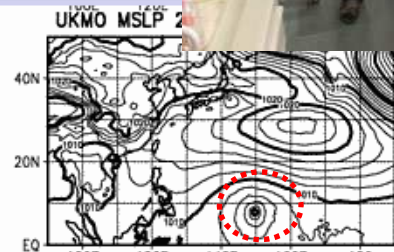
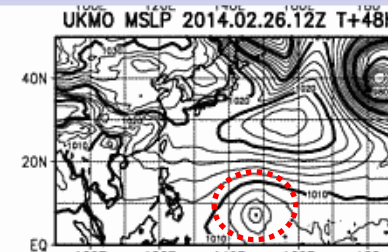
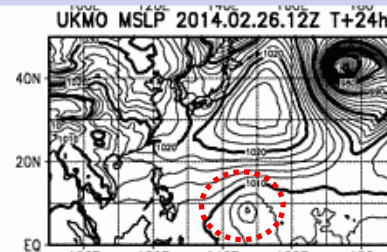
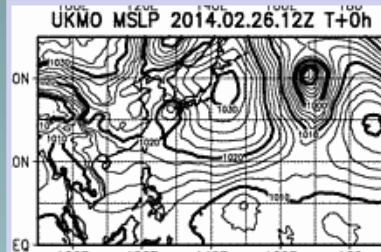
速度: 10

Tropical Cyclogenesis Monitoring

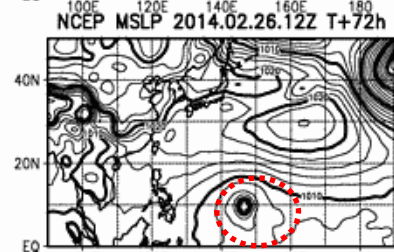
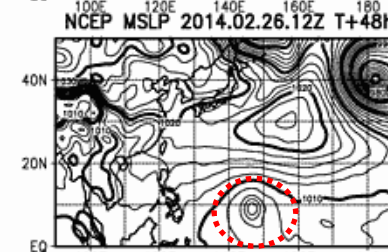
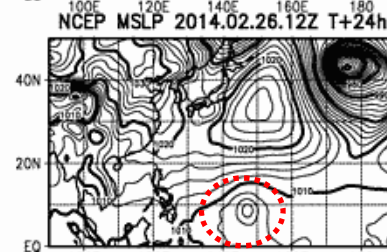
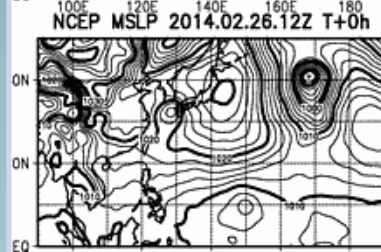
NWP Prediction Map



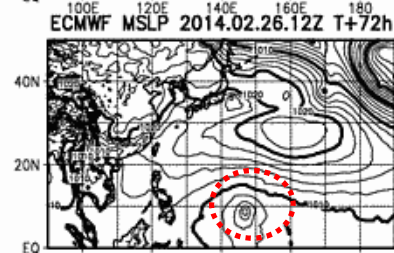
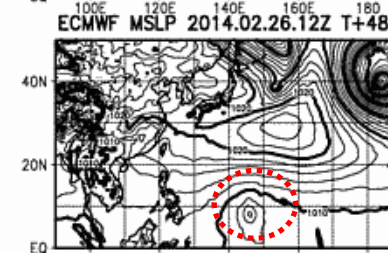
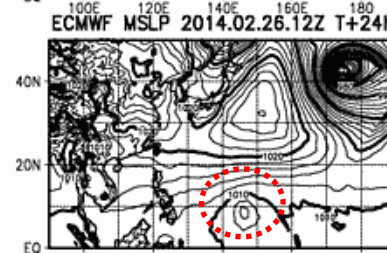
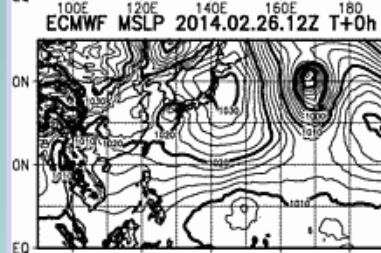
UKMO



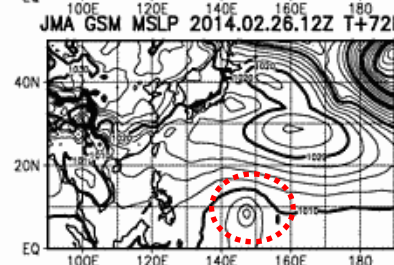
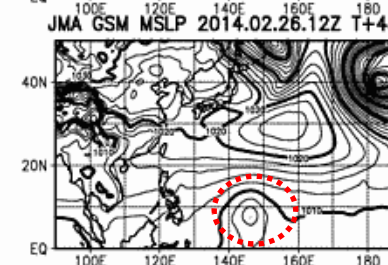
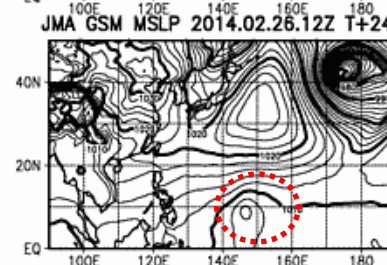
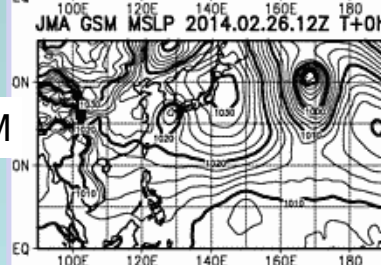
NCEP



ECMWF



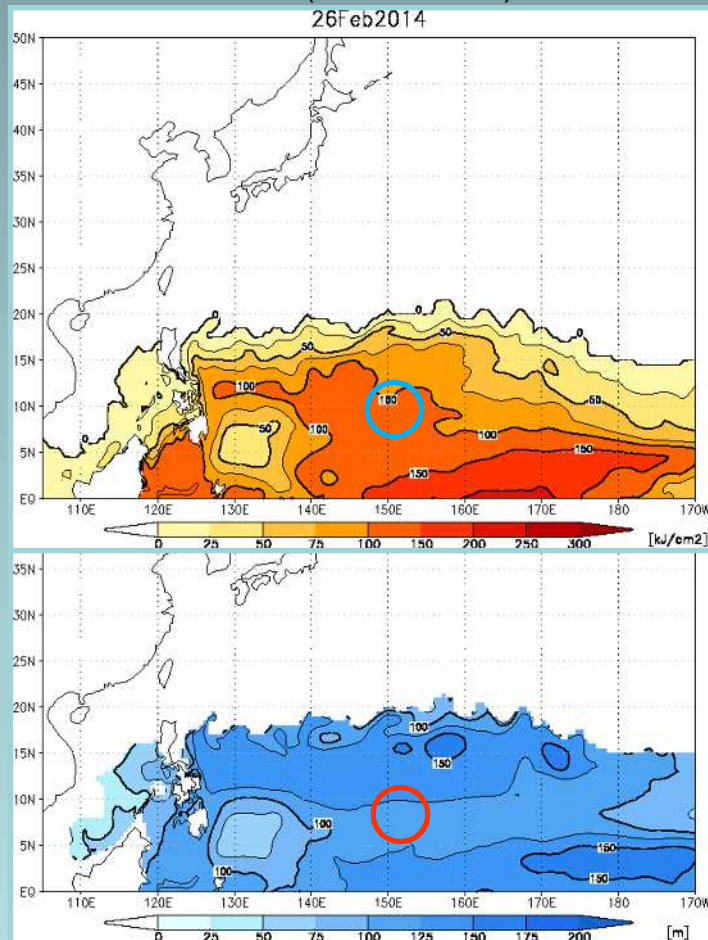
JMA GSM



Tropical Cyclogenesis Monitoring

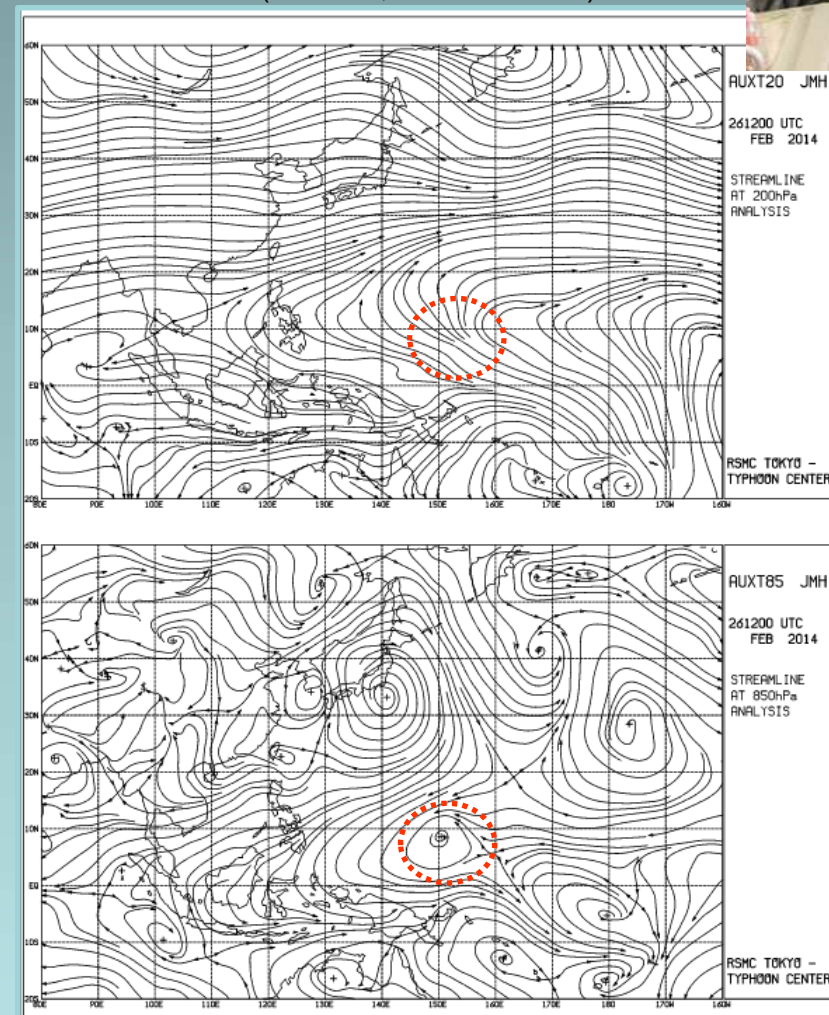
Tropical Cyclone Heat Potential

TCHP (26 Feb. 2014)



Stream Line

(12 UTC, 26 Feb. 2014)



200 hPa

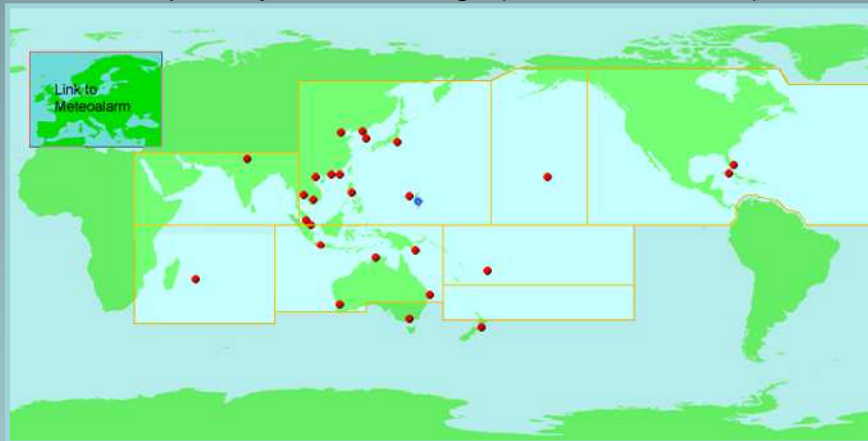
850 hPa



Tropical Cyclogenesis Monitoring

Tropical Cyclone Information Center by HKO

Tropical cyclone warnings (18 UTC, 26 Feb.)



Heavy Rain/Snow (18 UTC, 26 Feb.)

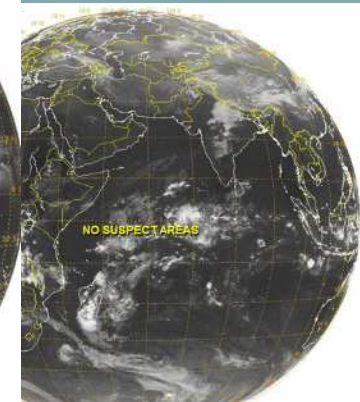
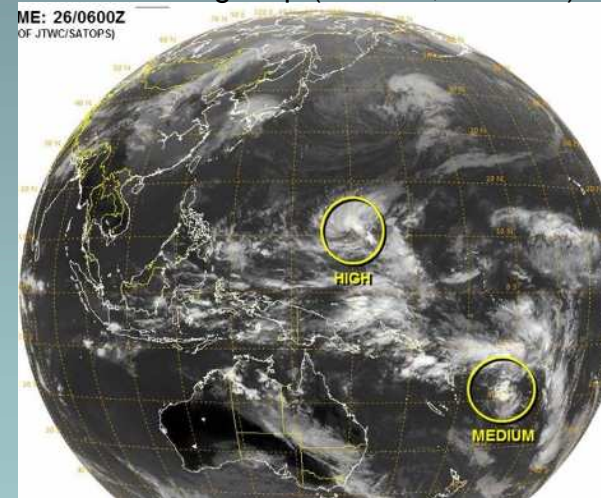


Solomon Islands: 135 mm

Indonesia: 55-100 mm

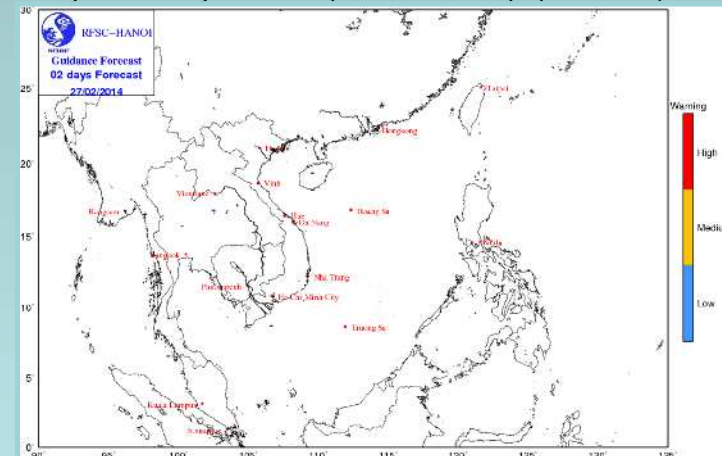
TC Warning by JTWC

TC Warning Map (06 UTC, 26 Feb.)



Guidance products by RFSC-Hanoi

Day 2: heavy rainfall (>30mm/24h) (12 UTC, 25 Feb.)

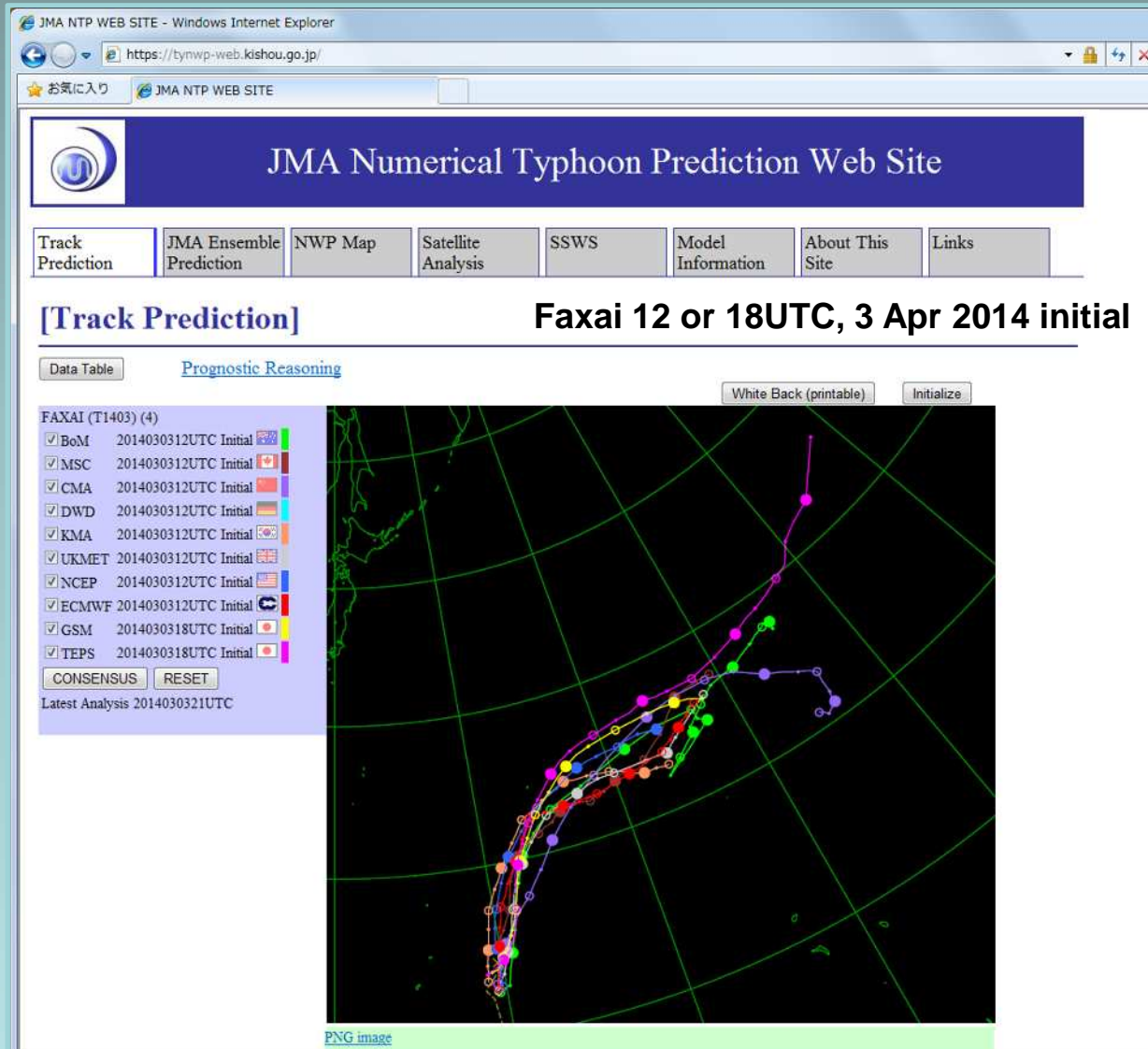


Outline

- Major Activities of the RSMC Tokyo
- Early Dvorak Analysis (EDA)
- Tropical Cyclogenesis Monitoring
- JMA Numerical Typhoon Prediction Website

JMA Numerical Typhoon Prediction Website

<https://tynowp-web.kishou.go.jp/>



Track predictions of major NWP centers

- BoM (Australia)
- MSC (Canada)
- CMA (China)
- DWD (Germany)
- KMA (Korea)
- UKMO (UK)
- NCEP (USA)
- ECMWF
- JMA (Japan)

JMA Numerical Typhoon Prediction (NTP) Website (1)

<https://tynwp-web.kishou.go.jp/>

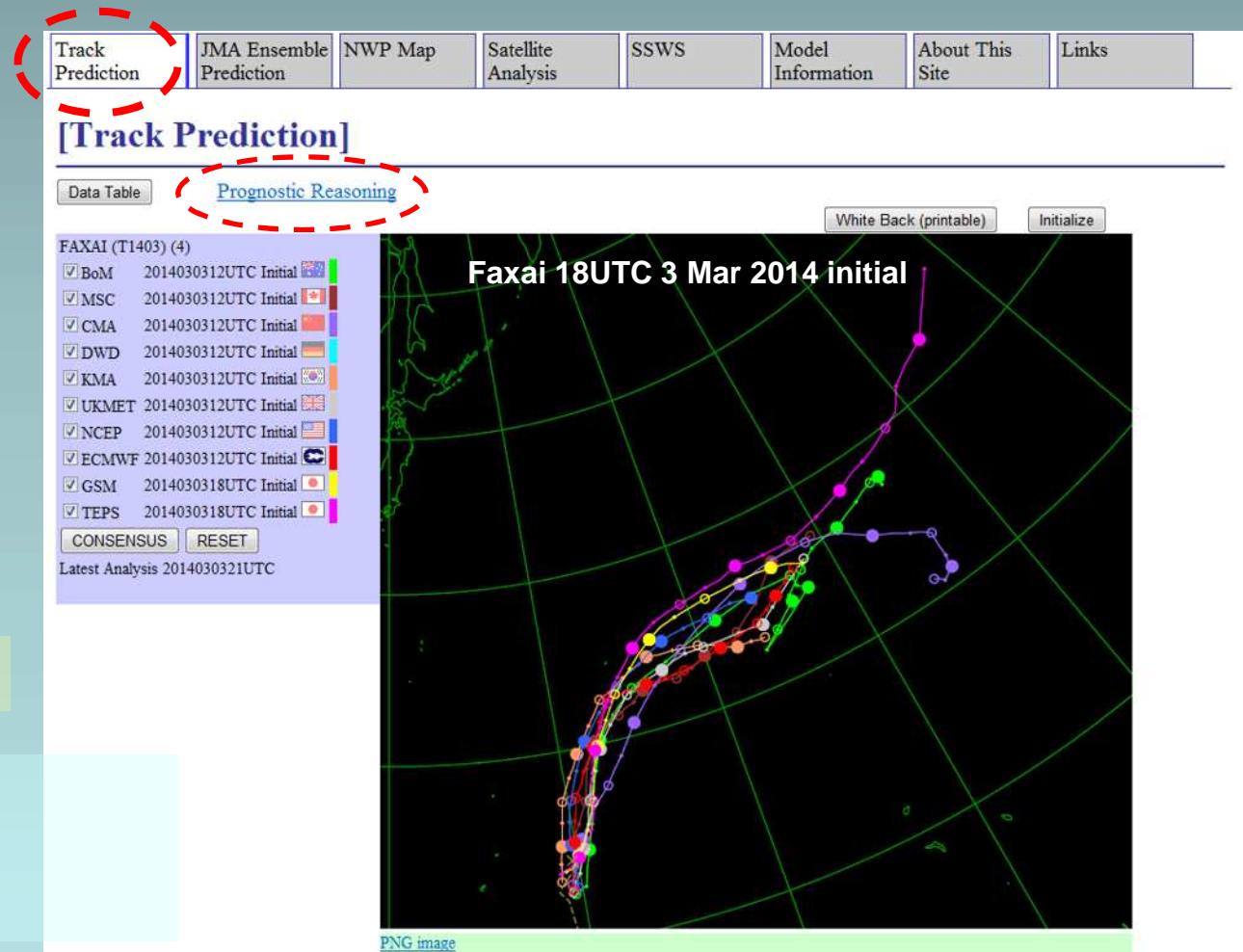
- available for registered users only
- user name and password are given by JMA on request
- registration of IP addresses of your PCs is required

Track predictions of major NWP centers

- BoM (Australia)
- MSC (Canada)
- CMA (China)
- DWD (Germany)
- KMA (Korea)
- UKMO (UK)
- NCEP (USA)
- ECMWF
- JMA (Japan)

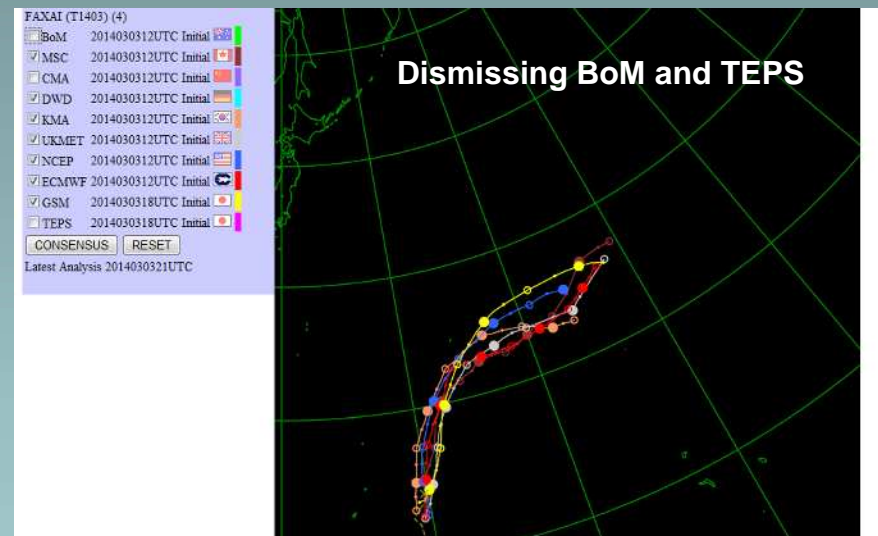
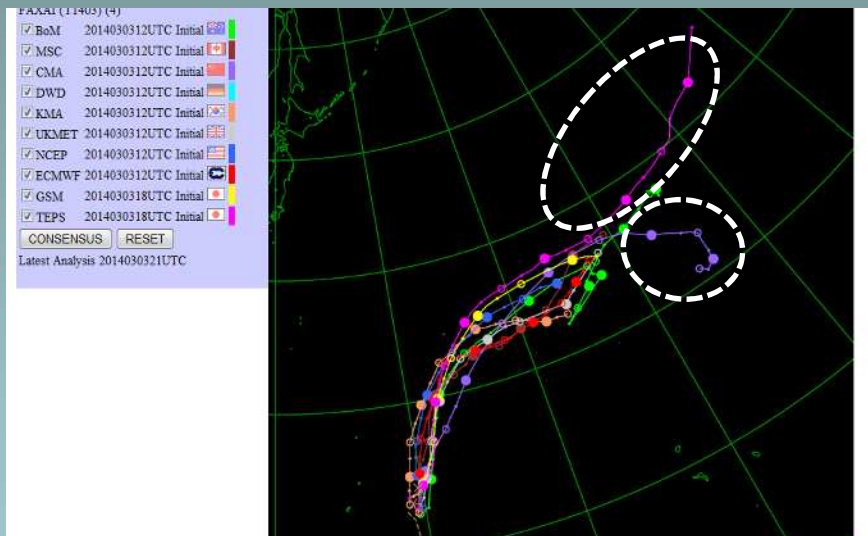
◆ *Selective Consensus*

Prognostic reasoning provided by the JMA's forecaster is available.



◆ *Selective Consensus*

- Dismissing some tracks and average the remaining tracks



➤ JMA Numerical Typhoon Prediction (NTP) Website (2)

Multiple forecast tracks by running JMA's Typhoon Ensemble Prediction System (TEPS) from slightly different initial values respectively.

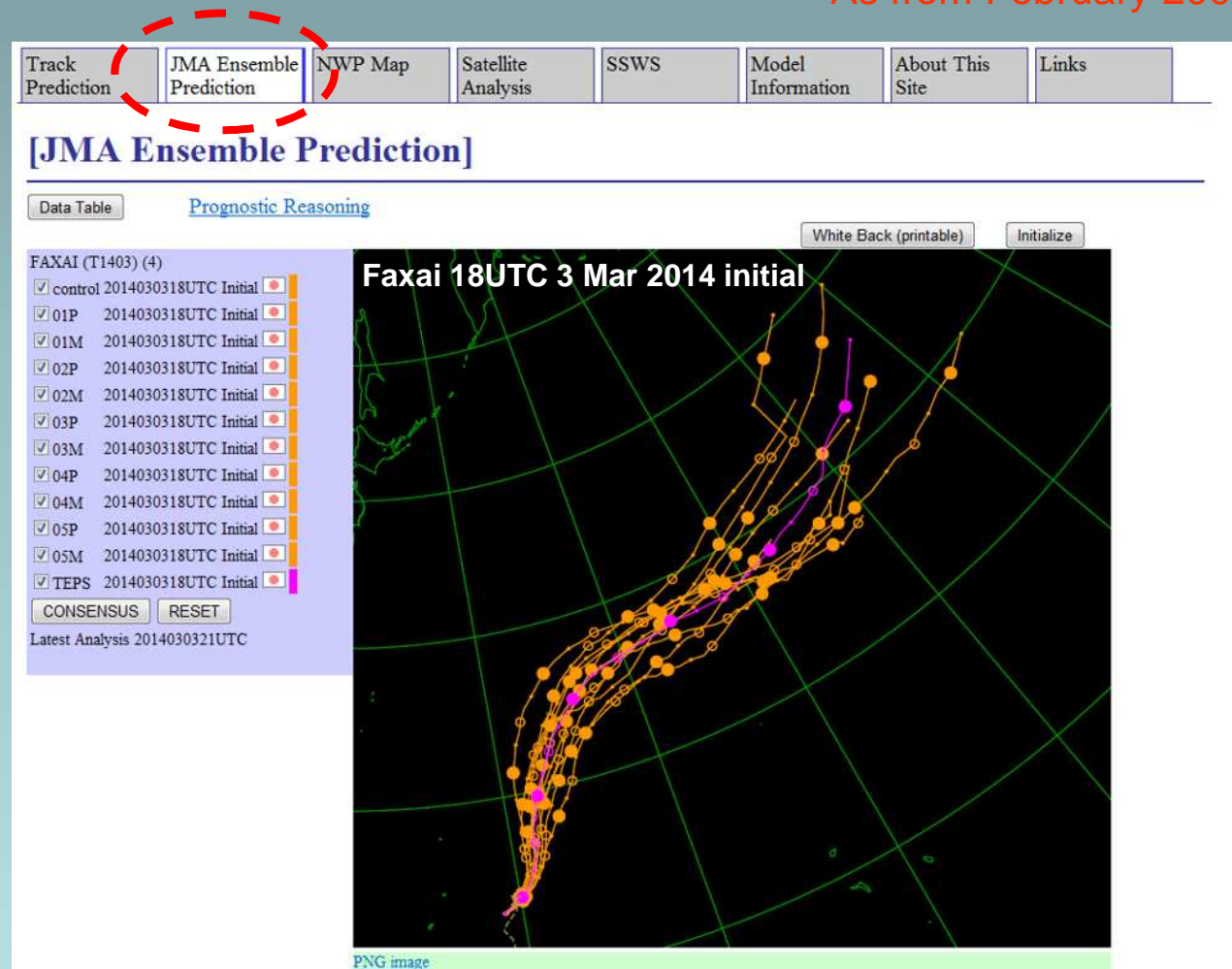
As from February 2008

JMA TEPS

11 members
60 km in horizontal
60 vertical layer
FT=132h
(00, 06, 12, 18UTC)

◆ Consensus of members

- Ensemble mean
- Selective consensus



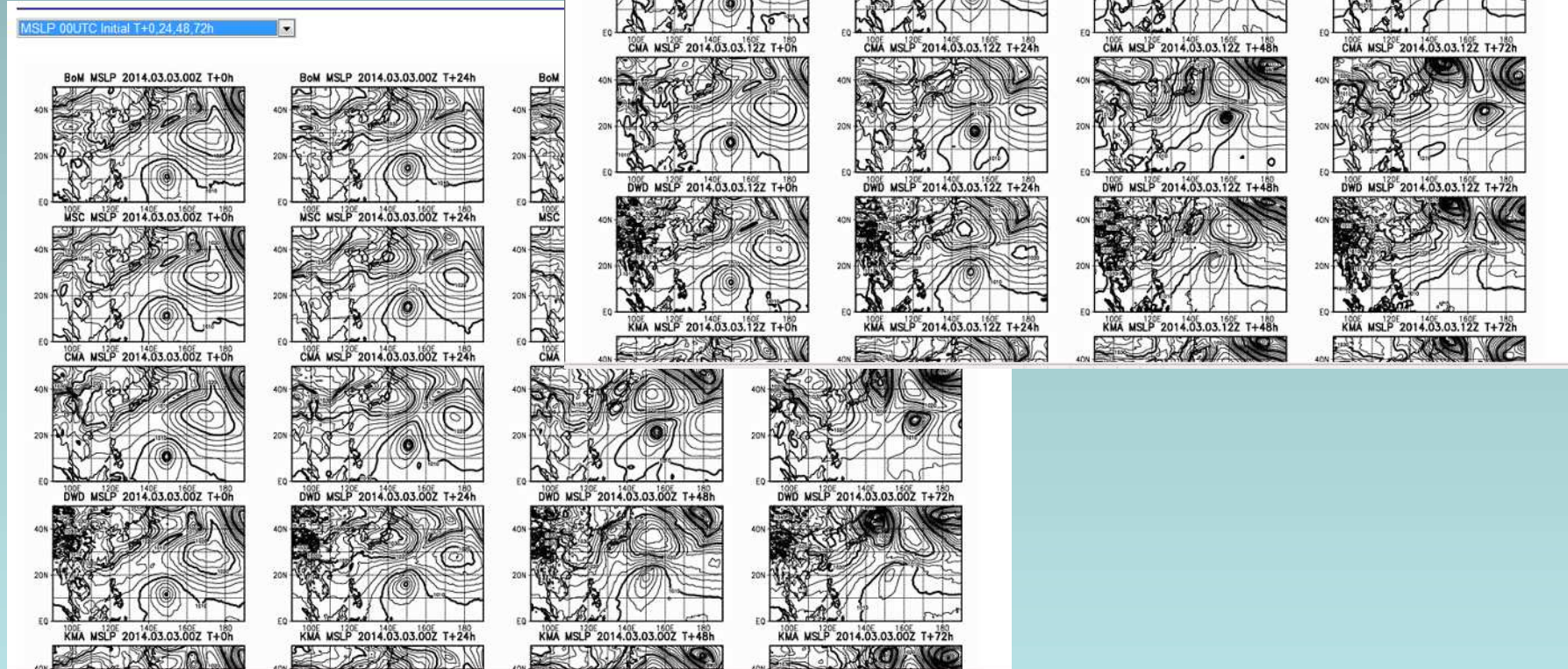
➤ JMA Numerical Typhoon Prediction (NTP) Website (3)

NWP prediction maps:

- Mean Sea Level Pressure
- 500hPa GPH

00 and 12UTC initial
(T+0, 24, 48, 72,)

12 UTC initial
(T+96, 120, 144, 168))



➤ JMA Numerical Typhoon Prediction (NTP) Website (4)

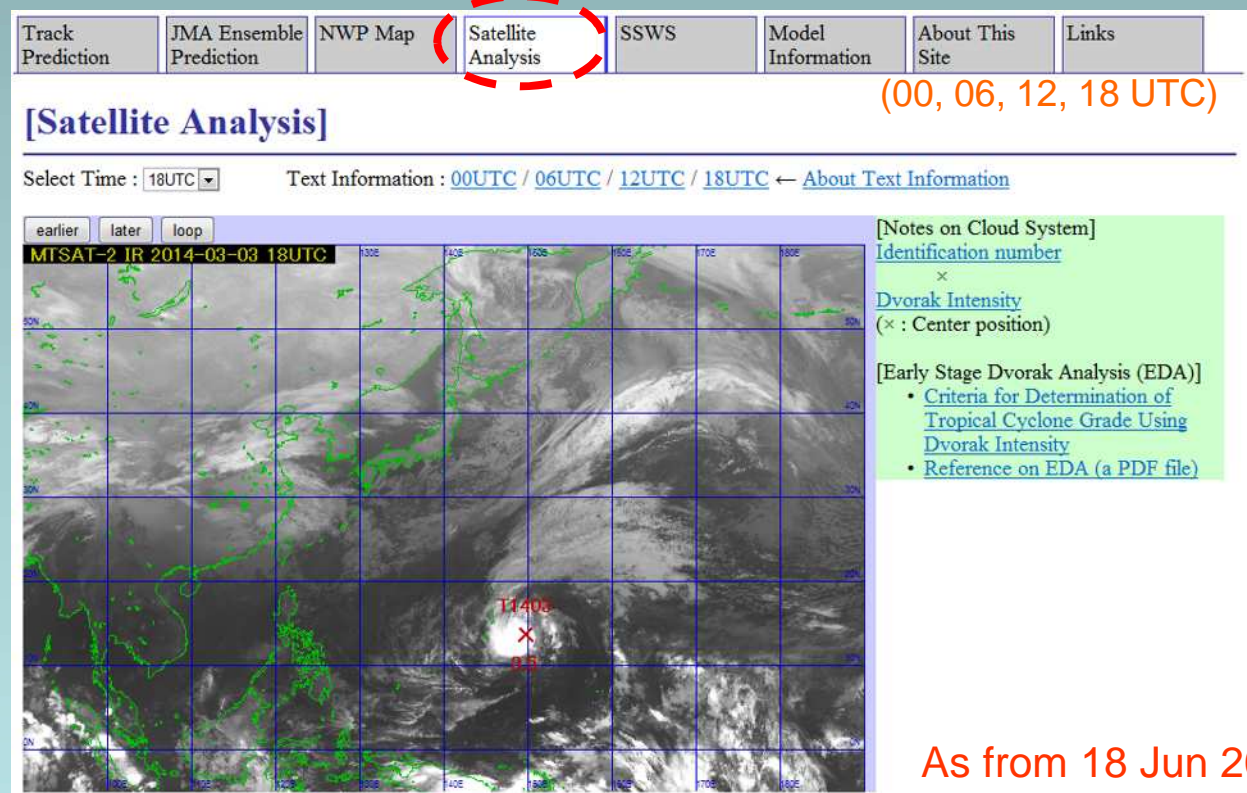
- RSMC Tokyo routinely makes a satellite analysis to monitor the formation of a tropical cyclone and its development using the Early stage Dvorak Analysis (EDA) and the conventional Dvorak Analysis.
- The Dvorak technique (developed in 1974 by Vernon Dvorak) is a widely used system to subjectively estimate tropical cyclone intensity based on visible and infrared satellite images.

EDA:

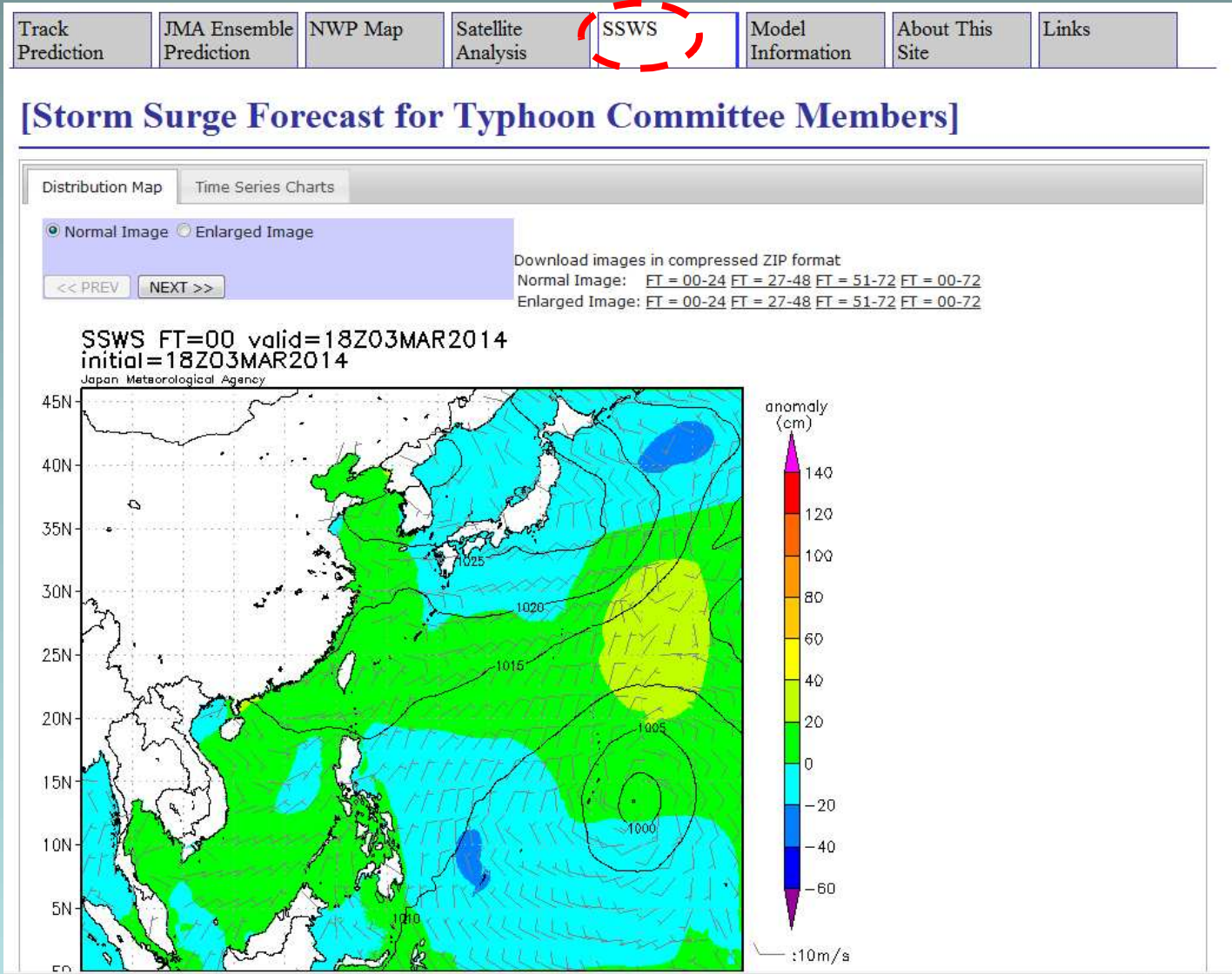
- Organized Convective Cloud Systems (OCCSs)
- TDs

Dvorak Analysis:

- developing TDs
- named TCs (TSs, STSs, TYs)

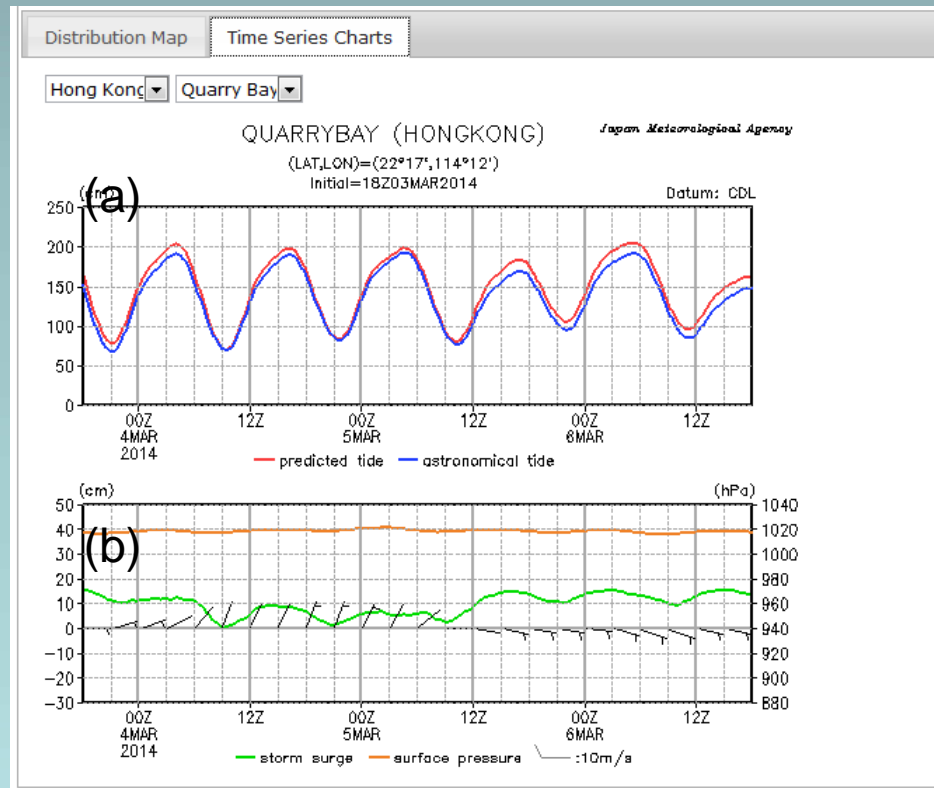


➤ JMA Numerical Typhoon Prediction (NTP) Website (5)



➤ JMA Numerical Typhoon Prediction (NTP) Website (6)

- RSMC Tokyo started to provide storm surge time series charts at one station on 5 June.
- Charts are provided for ten selected points according to the request by Members.



Left: example of a time series data at Quarry Bay (Hong Kong)

(a) Predicted (red) and astronomical (blue) tides.

(b) Storm surges (green), surface pressure (orange) and wind barbs.