

Strategy for the deployment of dropsonde observations
using sensitivity analysis guidance

T-PARC Meeting

Tsukuba, Japan

7-8 April 2008

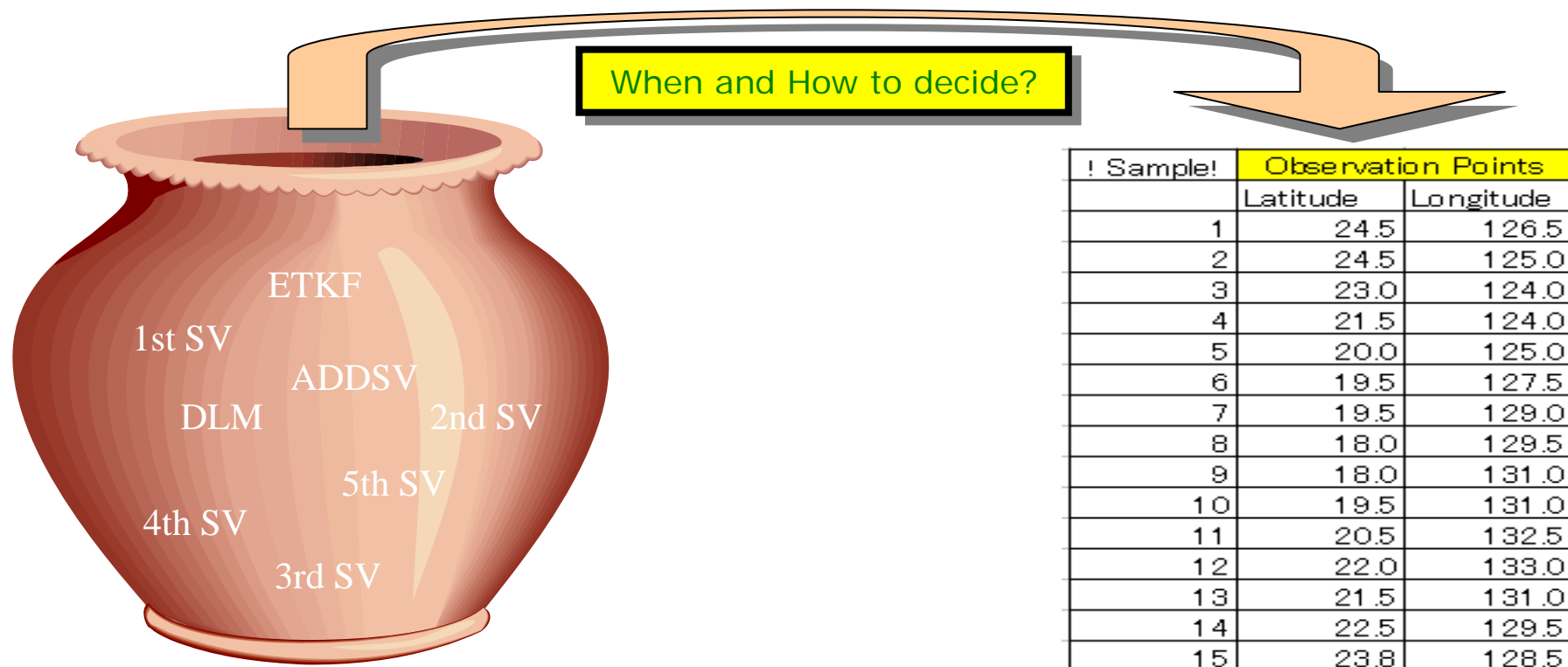
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1: Numerical Prediction Division, Japan Meteorological Agency

2: Typhoon Research Department, Meteorological Research Institute

Contents

My talk focuses on JMA's strategy about **when and how to decide the deployment of dropsonde observations** using various kinds of sensitivity analysis guidance including SV, ETKF, DLM, ADDSV, etc.



Conditions for the decision-making

Aircraft or facility related conditions;

Deadline for submitting a final flight schedule

- Considering the preparedness of a flight mission, we need to make the final decision at around T-17 at least and a tentative one at around T-23 and T-41.

Flight Duration time (DLR/Flacon; about 4 hours or 3000 km)

Number of Dropsondes for each mission (about 15)

- we should avoid overlapping observation, so we do not deploy dropsondes around the conventional sonde observation points

Avoidance of flying in storm zone

- aircraft does not fly in storm zone due to safety concerns. Referring to the latest NWP products and observation data, we need to avoid deploying dropsondes within an area where wind speeds of 50 kt or more are expected.

Sensitivity Analysis Guidance related conditions;

Availability time of each product

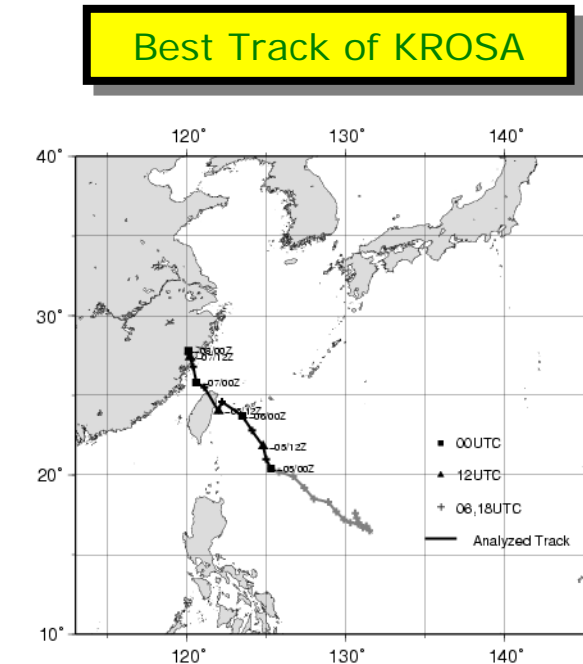
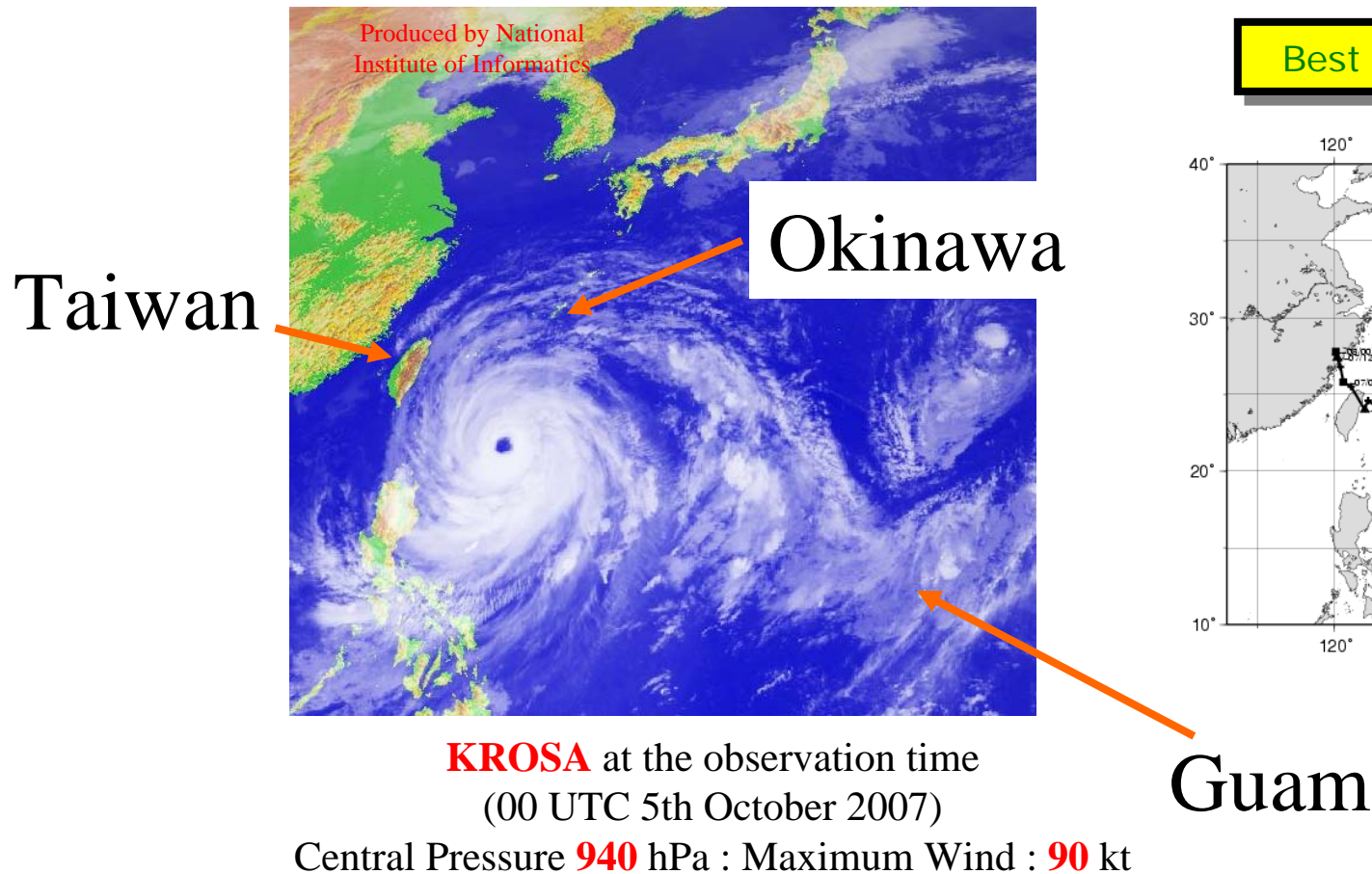
Three meetings prior to the observation

We will make a **tentative** flight plan at “T-42 meeting”, using the latest SV products by JMA. At “T-24 and T-18 meeting”, we will revise the tentative schedule, using the latest sensitivity analysis products including ETKF, DLM, ADDSV, SVs from NRL, Yonsei University and ECMWF, etc., and submit a **final** flight plan at around T-17.

	UTC	23	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22			
	JST	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	0	1	2	3	4	5	6	7			
	T-	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26			
	Daily Planning Meeting								JMA Planning Meeting																			
	UTC	23	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	0	
	JST	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	0	1	2	3	4	5	6	7	8	9	
	T-	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
	Daily Planning Meeting								JMA Planning Meeting																	Departure of aircraft	Daily Planning Meeting	Observation !!

Let's Exercise !!!

Let's follow the decision-making procedure under the assumption that a flight mission would have been conducted for Typhoon **KROSA** at 00 UTC 5th October 2007.



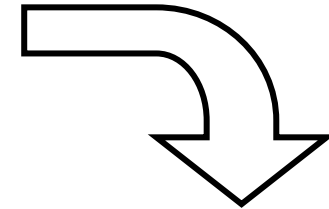
Meeting 1

2007.10.03 06 UTC (T-42 hours)

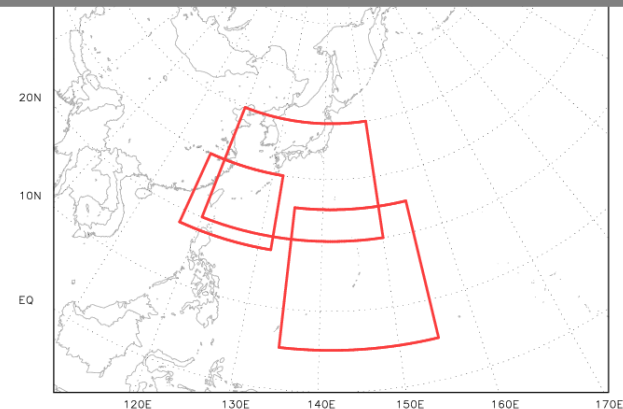
Using the latest SV products by JMA with the evaluation time of 48 hours, we design a tentative flight plan.

Specifications of sensitivity analysis calculation at JMA

- Method: Moist Singular Vector (SV)
 - ✓ horizontal and vertical resolution: T63L40
 - ✓ norm to evaluate the growth rate of SVs: total energy norm including a specific humidity term
- Evaluation time: 24 hours and 48 hours
- Target Area: **3** fixed areas (Guam, Taiwan and Japan)
- Number of SVs to be calculated: **5** for each target area
- Availability time: around 06 UTC (15 JST)



Target areas for SV calculations



Results are available at

http://eps.kishou.go.jp/EP SMRF/Products_T HORPEX/Strpb/JMA/strpb.html

Send email to thorpex@mri-jma.go.jp

to get ID and password

Guam

Taiwan

Japan

Initial SV

Final SV

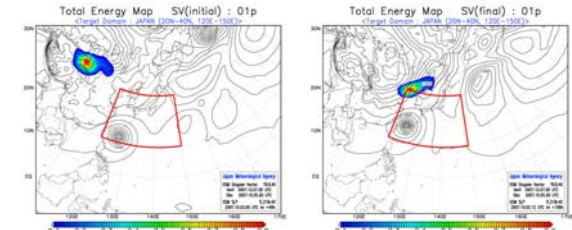
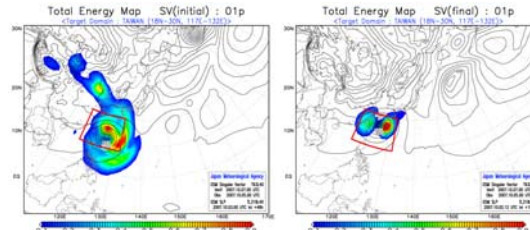
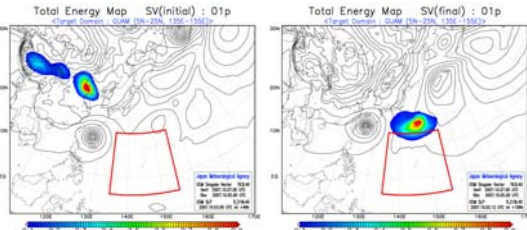
Initial SV

Final SV

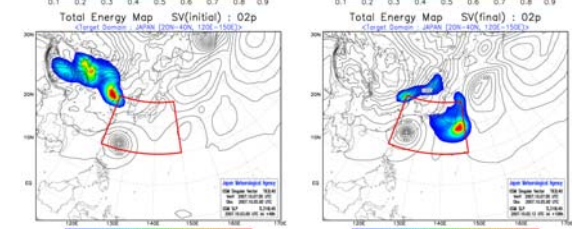
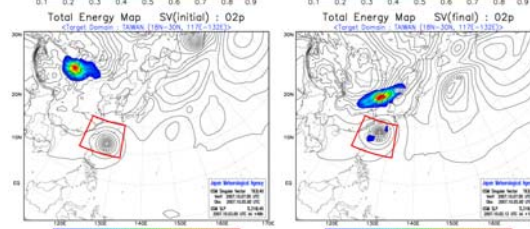
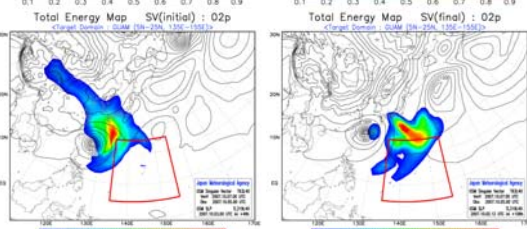
Initial SV

Final SV

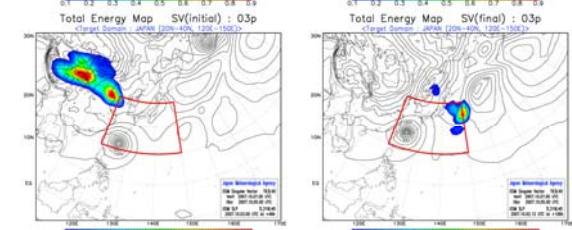
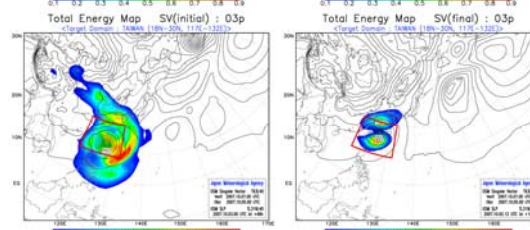
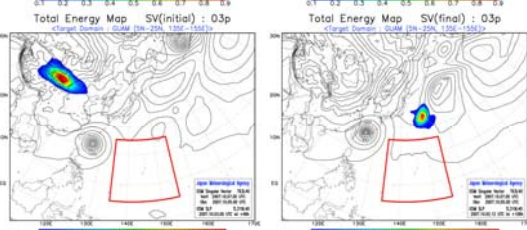
1st SV



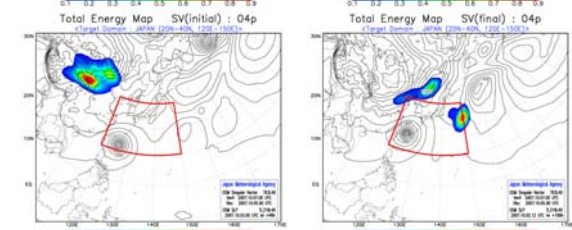
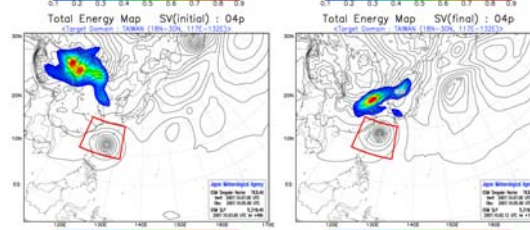
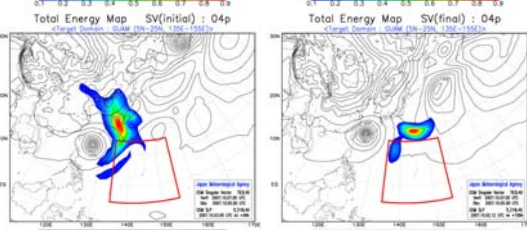
2nd SV



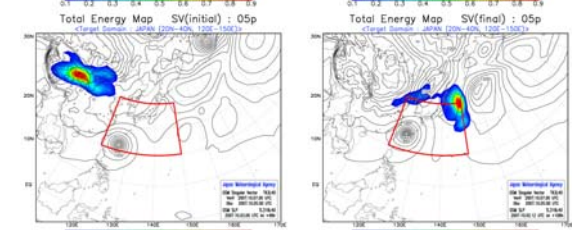
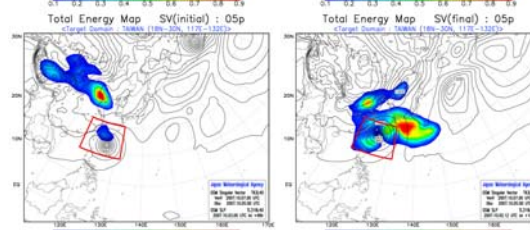
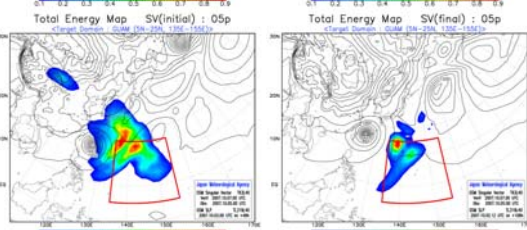
3rd SV



4th SV



5th SV



Step 1. Making a sensitivity analysis guidance

Step 1-1

3 target areas \times 5 modes =
15 initial SVs, or **15 candidates** for a sensitivity analysis
guidance, are available at each SV calculation.

Step 1-2

Interest is in the error growth of a tropical cyclone.
Therefore, **checking “with eyes” whether or not each final
SV is related to the error growth of a tropical cyclone**, we
select the corresponding initial SV as the candidate for a
sensitivity analysis guidance.

Step 1-3

When there are several candidates, **by averaging them**, we
produce a sensitivity analysis guidance.

Step 1-2

Guam

Taiwan

Japan

Step 1-3

Initial

Final SV

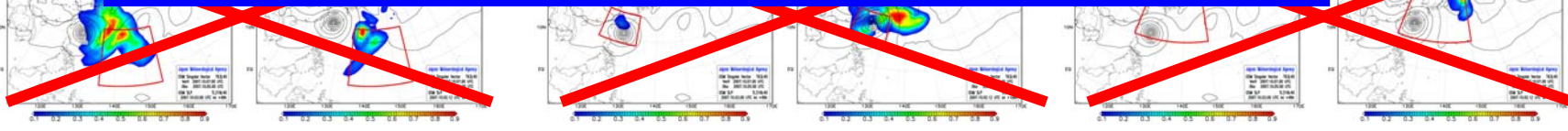
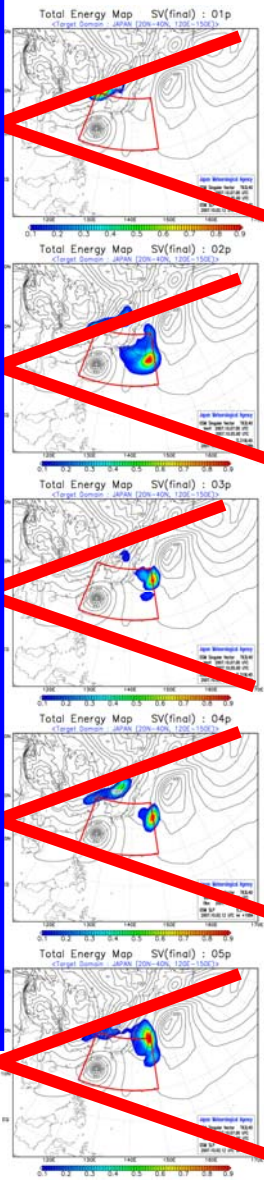
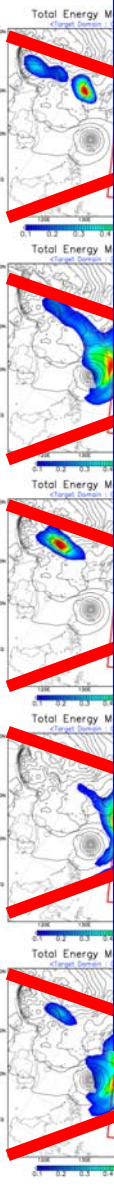
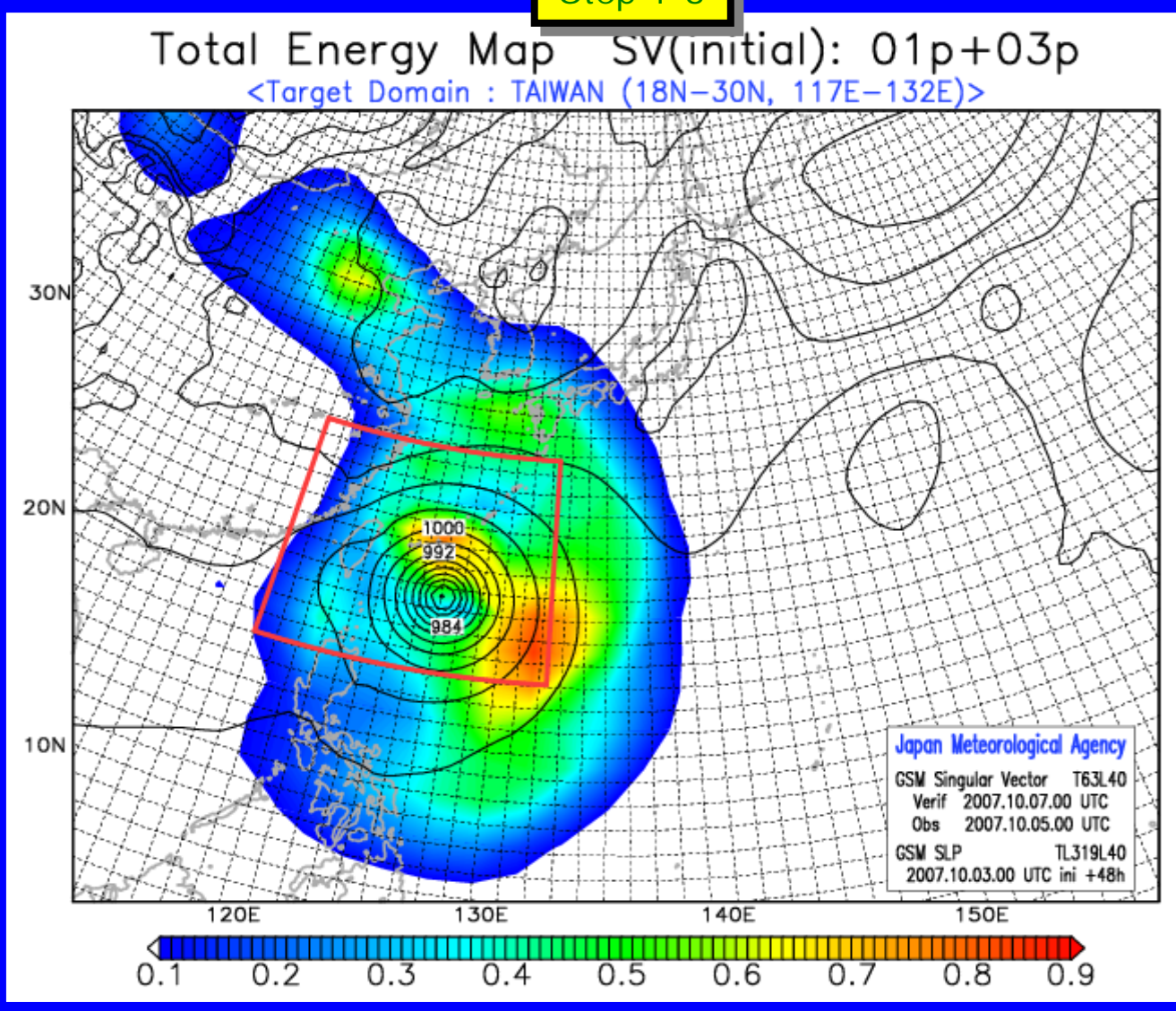
1st SV

2nd SV

3rd SV

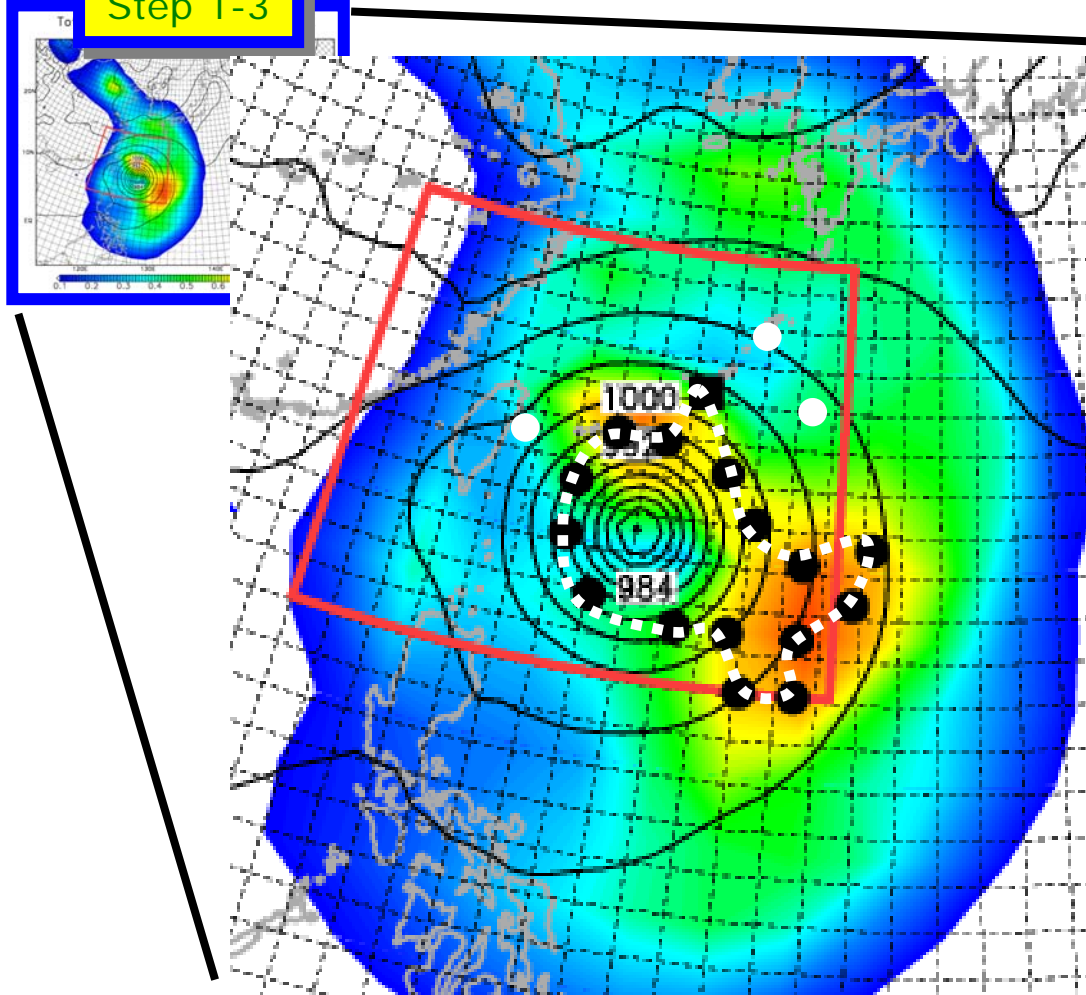
4th SV

5th SV



Step 2. Deploying dropsondes

Step 1-3



1. Deploy dropsondes (about 6 to 8) around a TC in a circle pattern independent of a sensitivity analysis guidance. (These observations would be useful when evaluating the effectiveness of sensitivity analysis technique)

2. Deploy as many dropsondes as possible in the sensitivity area as far as flight duration time permits.

✓ Black box; Okinawa, airplane base point

✓ Black dots; Dropsonde observation points

✓ White dots; Conventional sonde observation points

Meeting 2

2007.10.04 00 UTC (T-24 hours)

Following the outcome of the International Daily Planning Meeting at T-23 and using updated sensitivity analysis guidance available by the time of Meeting 2, we will adjust the flight path, if necessary.

List of Institutions which provide Sensitivity Analysis Guidance

Now, Prof. Sharan Majumdar from University of Miami is compiling the document about the strategy of targeted observations using sensitivity analysis guidance. In the document, providers and availability time of the guidance are described.

Institution	Method	Real-time?	Availability before obs time?	How often?	TC Stage	Verification Region (fixed/variable?)	Main facilities
NRL Monterey (Reynolds)	NOGAPS Singular Vectors (SVs)	Yes	-48h	Daily	Formation, Recurvature	Fixed? 1:Guam? 2:Taiwan? 3:Japan?	All
NRL Monterey (Bishop)	Ensemble?	Maybe	-48h	Daily	Possible for TCs. More likely for Winter	?	All
JMA	JMA SVs	Yes	-42h (sensitivity product with 2 day lead time) -18h (sensitivity product with 1 day lead time)	Daily	Recurvature and ET	Fixed?	All, particularly Falcon
ECMWF	ECMWF SVs	Yes	?	?	All	Fixed?	All
National Taiwan University	MMS Adjoint-Derived Sensitivity Steering Vector	Yes	?	?	Formation, Recurvature	Variable?	All, particularly DOTSTAR
U. Miami	ETKF v2.0 (w/ combined NCEP GFS + ECMWF + CMC + JMA (?) + NOGAPS (?) ensemble)	Yes	-42h, -18h	Daily	All	Most likely variable, based on predicted TC location	All
UK Met Office	ETKF v1.0 (w/ UKMO ensemble)	Yes	?	?	All	Variable?	All
NOAA	NCEP GFS Ensemble Variance	Yes	?	4x daily	All	N/A	All
Yonsei University (Korea)	MMS SVs	Yes	?	Daily	Recurvature and ET	Variable	All
UWashington / NCAR	WRF EnKF ensemble sensitivity	Yes	-21h	2x daily	Genesis, intensity change	Variable	Falcon, ELDORA
NRL Monterey (Langland)	Synthetic Observation Ensemble	No	?	N/A	All	Variable?	MTSAT rapid-scan winds

Web site to get sensitivity analysis guidance

EOL TPARC/TCS-03 Dry Run Field Catalog September 2007

Calendar: September 2007

Quick Links: Facilities Status, Operations Plan of the Day, TPARC Weather Discussion, NPS Weather Briefing Website

Information Links: JTWC Website, Honolulu Weather, Guam Weather, Iliamna Weather, Navy/Naval Operations Center (NOC) 434-0200, Boulder Operations Center (BOC) 437-xxxx

University Corporation for Atmospheric Research
PO Box 6000 Boulder, CO 80307 USA

Case Proposal

Case Proposal Deadline: 10/11/2007 at 10:00 UTC

Forecast Charts (EPS Mean/Spread): 2007111312 2007111300 2007111312 2007111400 2007111412 2007111500

Saturday 10 November 2007 00UTC @ECMWF Ensemble Forecast 1x095 VT, Wednesday 14 November 2007 00UTC

Surface: Mean sea level pressure: Ensemble mean (contours, hPa) / Ensemble spread (shaded, hPa)

Proposed Cases: U1.2007111400

Proposed by: moh (10/11/2007 at 09:57 UTC)

Lat1: 62.7 Lon1: -6.3 Verification Time: 2007111400

Lat2: 63.2 Lon2: 18 Target Time: 2007111206

Case Description: Heavy precipitation and strong winds forecasted for Wednesday over central Europe. Large uncertainty in the MSLP field.

EOL Web site @ UCAR

http://catalog.eol.ucar.edu/tparc_2007/index.html

PREVIEW site @ ECMWF

[http://... \(coming soon\)](http://...)

We will be able to get graphics of various kinds of sensitivity analysis guidance through the above web sites on a real-time basis during the T-PARC period.

Meeting 3

2007.10.04 06 UTC (T-18 hours)

Using the latest SV products by JMA with the evaluation time of 24 hours, we will adjust the tentative flight plan and make a **final decision**.

Guam

Taiwan

Japan

Initial SV

Final SV

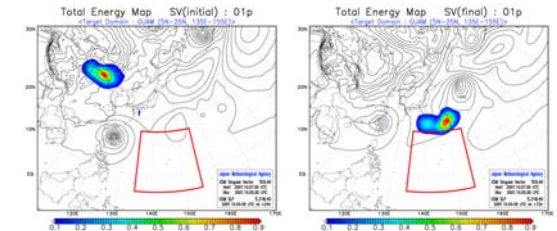
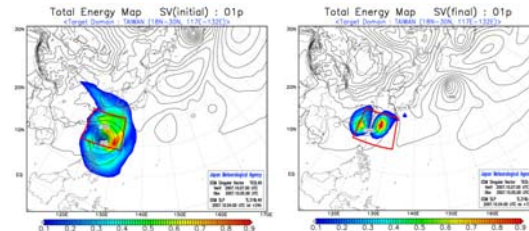
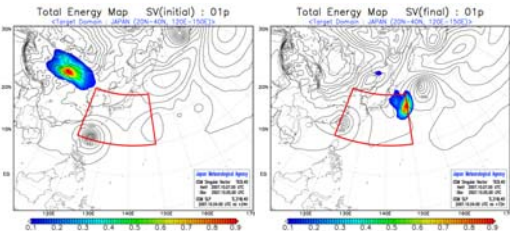
Initial SV

Final SV

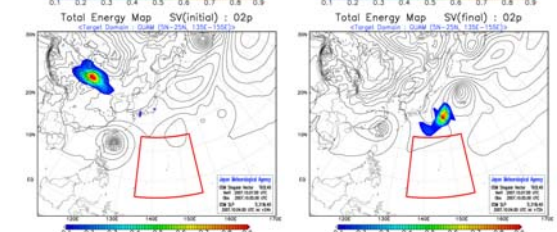
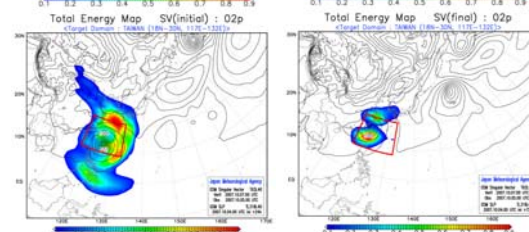
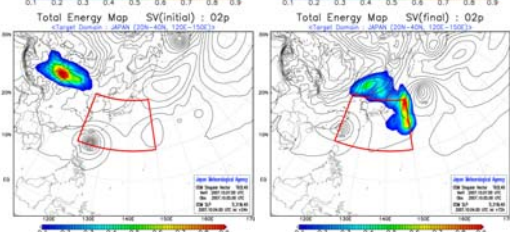
Initial SV

Final SV

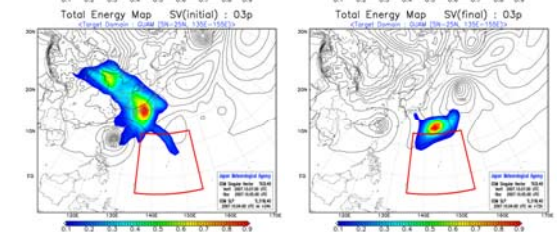
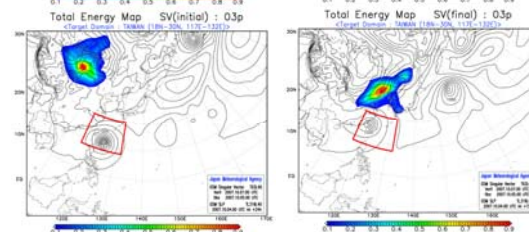
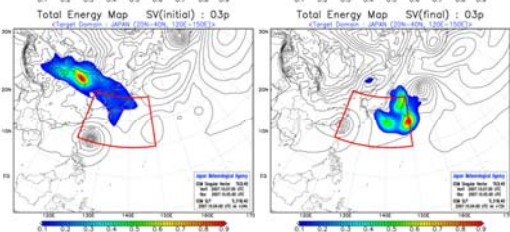
1st SV



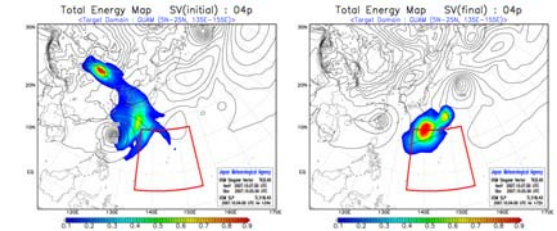
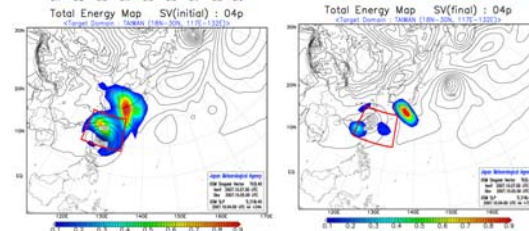
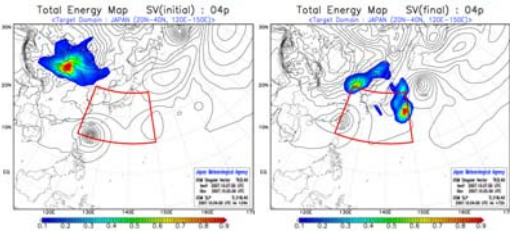
2nd SV



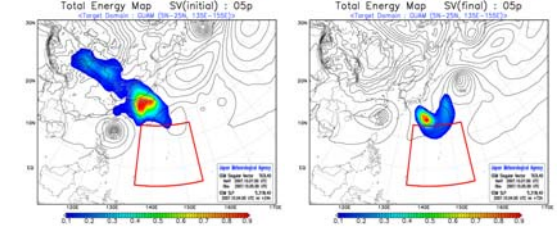
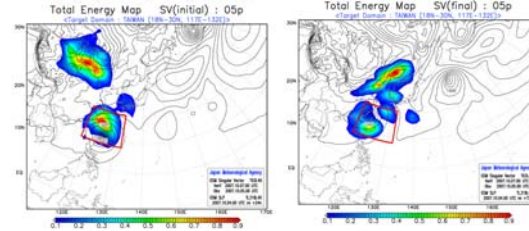
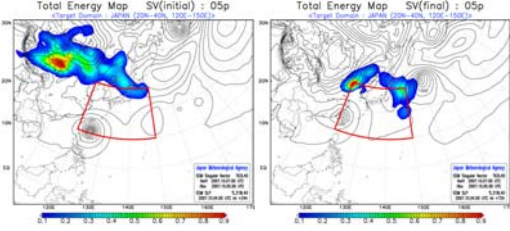
3rd SV



4th SV



5th SV



Step 1-2

Guam

Taiwan

Japan

Step 1-3

Initial

Final SV

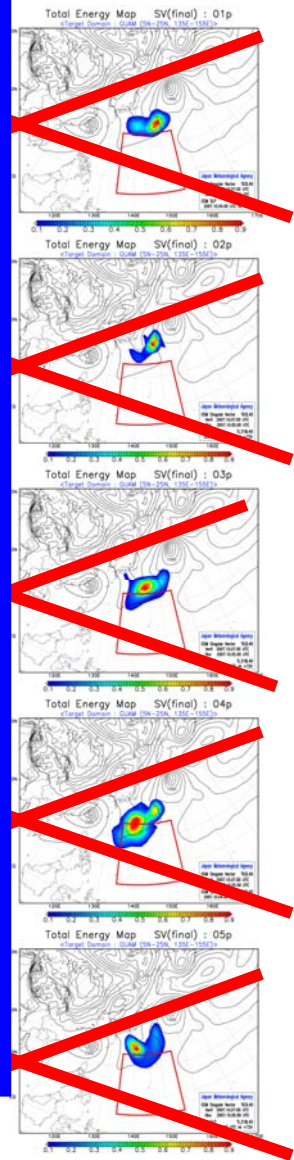
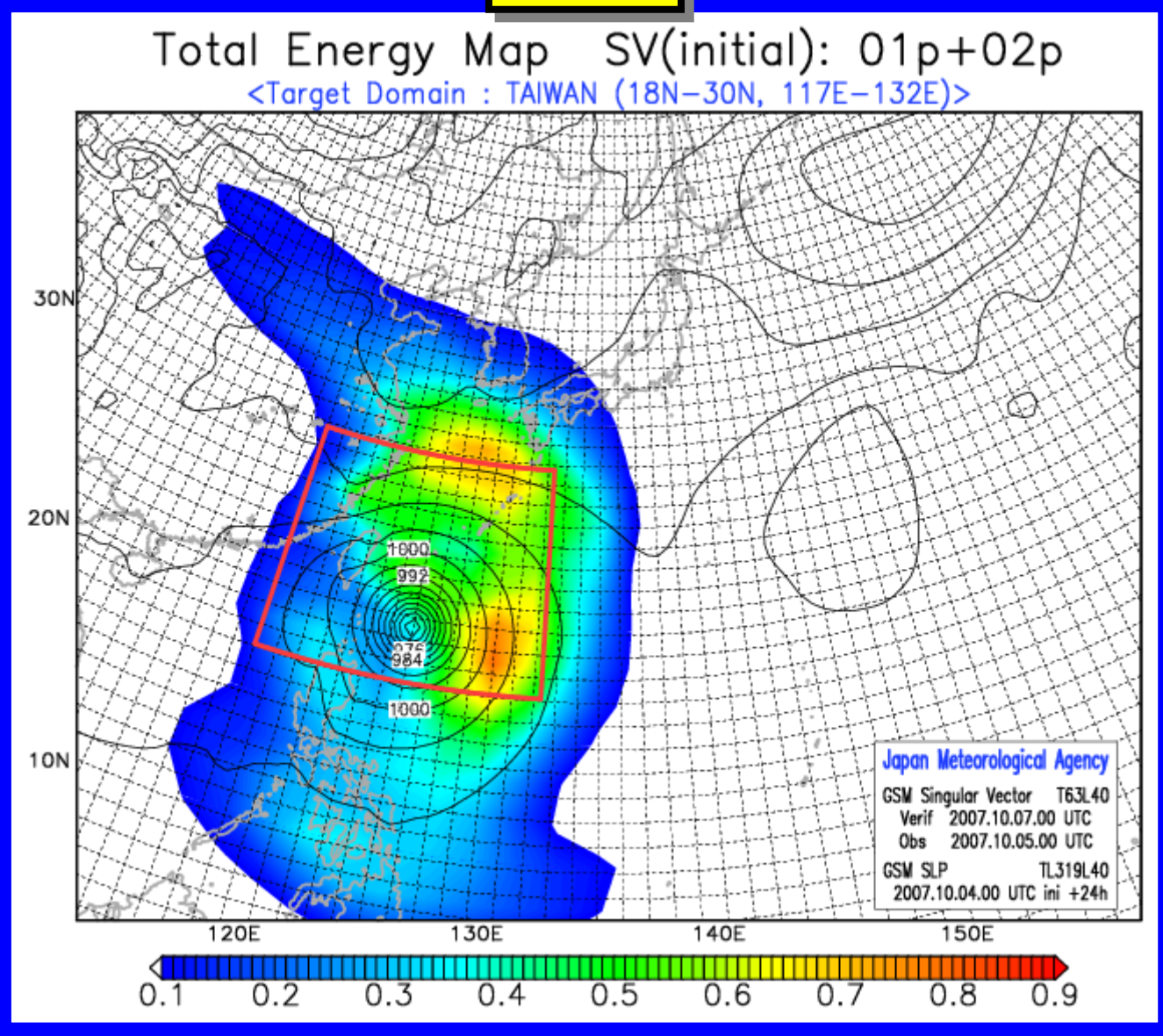
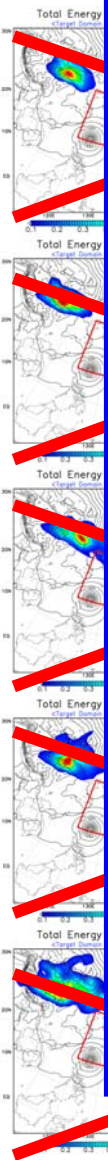
1st SV

2nd SV

3rd SV

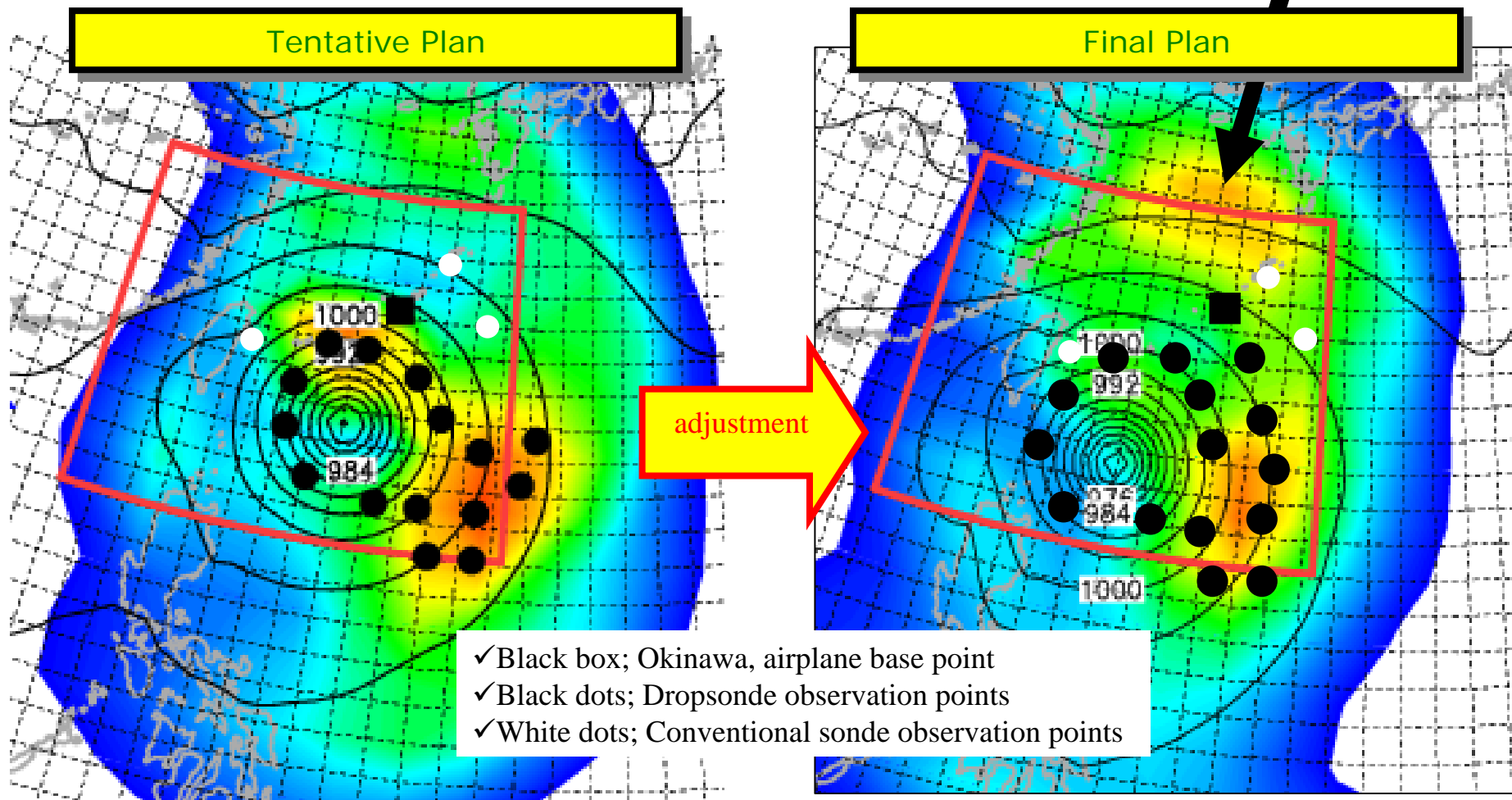
4th SV

5th SV



Adjust the tentative flight plan and make a final path

Though a new high sensitive area has appeared, we will have to give up observing this area by aircraft because a drastic revision of the flight plan at the final stage is not permitted. Instead, if possible, a research vessel could observe within or near the area.

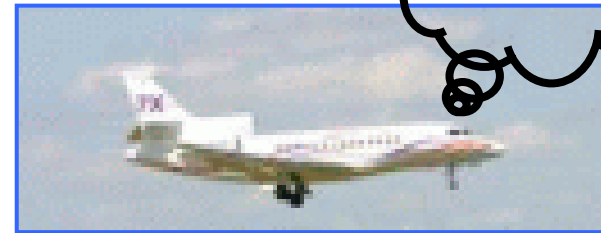
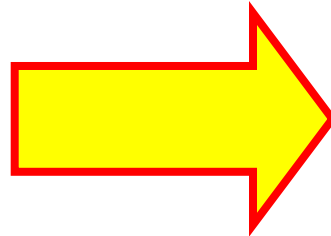


Finish

Enjoy Japan! Enjoy Cherry Blossom !!

! Sample!	Observation Points	
	Latitude	Longitude
1	24.5	126.5
2	24.5	125.0
3	23.0	124.0
4	21.5	124.0
5	20.0	125.0
6	19.5	127.5
7	19.5	129.0
8	18.0	129.5
9	18.0	131.0
10	19.5	131.0
11	20.5	132.5
12	22.0	133.0
13	21.5	131.0
14	22.5	129.5
15	23.8	128.5

Data Submission



Roger!