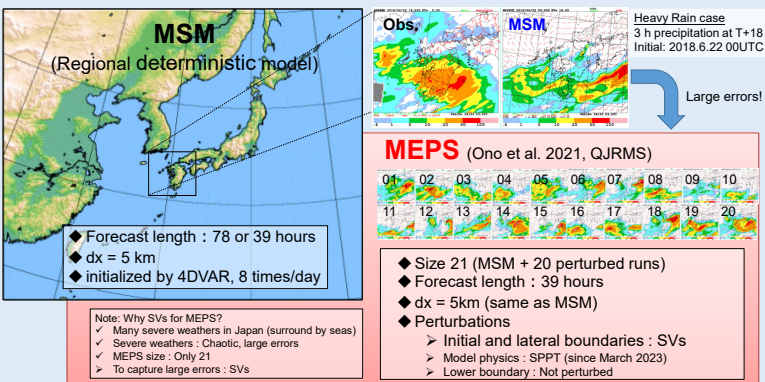


Towards the deterministic use of the regional ensemble forecasts at the Japan meteorological agency

Kosuke Ono (Meteorological research institute, Japan meteorological agency)

1. The regional EPS at the JMA

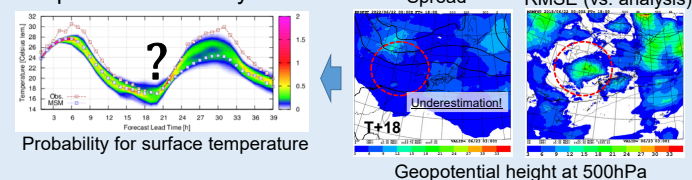
Mesoscale model (MSM) and mesoscale EPS (MEPS)



2. Background and purpose

1. Use of MEPS products by JMA's forecasters : NOT used much

- Probability is incompatible with operational deterministic forecast
- Are probabilities really reliable?

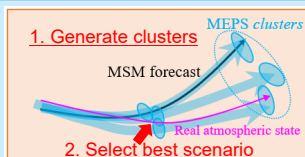


2. Requests from JMA's forecasters

- Another weather scenario different from deterministic forecast
- If MSM forecast appeared to be incorrect, replace another forecast

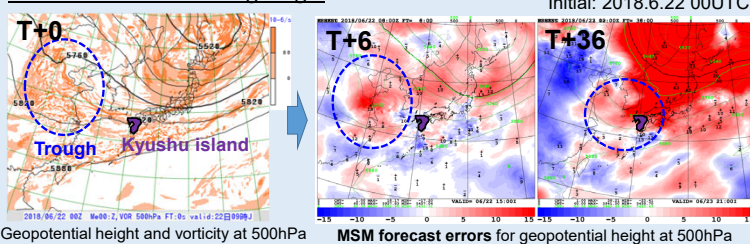
Purpose of this study

1. Generate **four scenarios** from MEPS clustering
2. Select **Best scenario** using ensemble members with small error at T+6



3. Method

1. Case and forecasting target

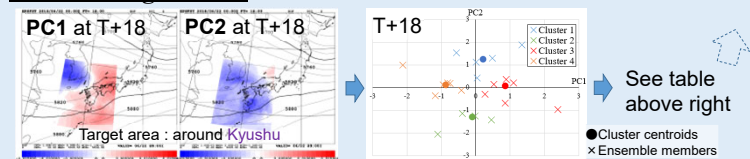


Forecasting target :

- Pressure trough approaching to Kyushu at T+0, reached at T+36
- MSM forecast : large errors

➔ **Generate 4 scenarios for geopotential height at 500hPa from MEPS and preselect best scenario**

2. Clustering method

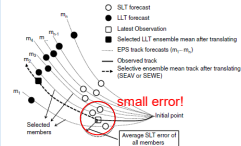


1. Principle component analysis from MEPS 21 forecasts
 2. Clustering on 2 dimensional phase space
 3. Link clusters in time direction (Ono 2023, WAF), details in oral presentation
- Note: Target area was **fixed** around Kyushu during 39 hours

3. Preselect best scenario

- ✓ Use members with small errors at T+6 (same as selective ensemble)
- ✓ Reference data
- Analysis (initial condition) for MSM

Fig.1 of Qi et al. (2014, QJRM5)



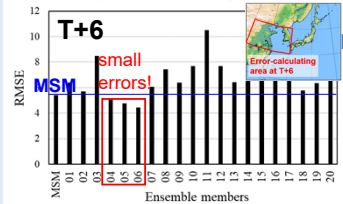
4. Result 1: Possibility of best scenario selection

1. Clustering results and error estimation at T+6

Clustering results for geopotential height at 500hPa with temporal connection

Forecast lead time	Members in cluster 1	Members in cluster 2	Members in cluster 3	Members in cluster 4
0	01 06	11 16	00 03 04 05 07 09 10 12 18	02 08 13 14 15 17 19 20
3	06 07 13 14	03 04 17	00 01 05 09 12 18 20	02 08 10 11 15 16 19
6	00 02 07 13 14	03 04 05 12 17	01 06 09 18 20	08 10 11 15 16 19
9	00 02 07 13 14	03 04 12	01 05 06 09 17 18 20	08 10 11 15 16 19
12	00 06 07 13 18	03 08 16 17	01 02 04 05 09 20	10 11 12 14 15 19
15	00 02 05 06 10 18	08 15 16	01 03 04 09 17 20	07 11 12 13 14 19
18	05 06 05 17	15 16	00 01 02 03 04 08 09 10 17 20	07 11 12 13 14 18 19
21	04 05 06 17	15 16	01 03 09 10	00 02 07 08 11 12 13 14 18 19 20
24	04 05 06 17	07 14 15 16	01 03 08 09 10	00 02 11 12 13 18 19 20
27	00 04 05 06 12 17	14 15 16	01 02 03 08 09 10	07 11 13 18 19 20
30	00 04 05 06 12	02 14 15 16	01 03 08 09 10 17	07 11 13 18 19 20
33	04 05 19	02 14 15	00 01 03 06 08 09 10 12 17	07 11 13 16 18 20
36	04 05 19	09 14 15	00 01 03 06 08 10 12 17	02 07 11 13 16 18 20
39	04 05 19 20	09 10 14 15 17	00 01 03 06 08 12	02 07 11 13 16 18

RMSE for geopotential height at 500hPa



Members 04,05,06 : Small errors

- ✓ Did not belong to same cluster around Kyushu for T+0~15 (Probably 04,05,06 constitute same cluster in the upstream regions)
- ✓ Compose same cluster after T+18 (trough approaching)
- ✓ Cluster 1 is candidate for best scenario

Check the answer

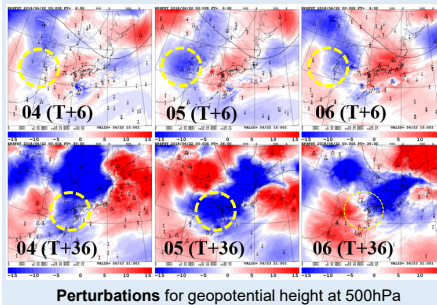
RMSE for geopotential height at 500hPa at T+36 (Also check graph in Section 5)

Possibility of best scenario selection

	00 (MSM)	MEAN	Cluster 1	Cluster 2	Cluster 3	Cluster 4
RMSE	11.3	12.1	8.2	23.5	11.5	15.4

2. Why it worked

✓ Check perturbation patterns of members 04,05,06



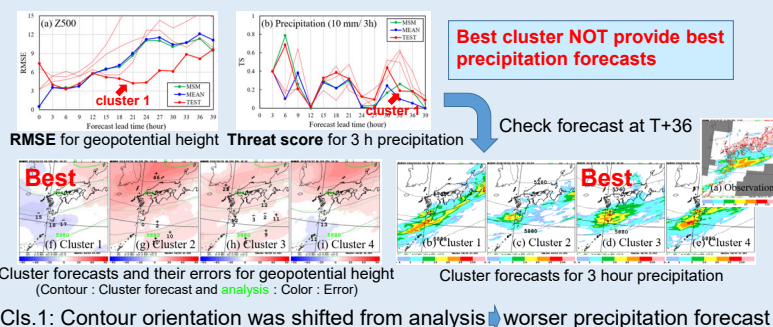
Note : **Opposite** of MSM error pattern (figs. in Section 3) close to analysis

- Negative sign at the trough tip (within yellow circle) at T+6
- ✓ Closer to analysis than MSM
- This trend persisted at T+36 except for member 06

Linear perturbation/error growth enabled member preselection

5. Result 2 : Application to precipitation forecasts

Question : Best cluster gives better precipitation forecast? : No!



Cls.1: Contour orientation was shifted from analysis worse precipitation forecast

6. Summary and future works

Summary

- ✓ Possibility of best scenario selection for geopotential height at 500hPa because of linear perturbation/error growth
- ✓ Such best scenario did NOT provide best precipitation forecast

Future works

- ✓ Which clustering element is best for clustering in rain/snow events
- ✓ How to preselect best scenario for precipitation

Heavy snow case

