

# A Development of Japan Area Storm Surge Ensemble

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- Introduction to JMA storm surge model
- Outline of Japan area storm surge ensemble (MeTs)
- How to utilize the ensemble model ?
- Summary

### Introduction to JMA storm surge model

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# JMA storm surge model

• JMA operates two storm surge models.



## **Outline of Japan area model**

	Specification
Coordinate	Lat/Lon Cartesian grid Arakawa C-Grid
Area	20.0N~50.0N, 117.5E~150.0E
Resolution	45''x30''~12'x8 (1km~16km) Adaptive Mesh Refinement (AMR)
Time step	4 seconds
Forecast range	39 hours
Calculation run	8 times/day (3 hourly)
Initial time	00,03,06,09,12,15,18,21 UTC
Number of prediction courses	In case of typhoons: 6 courses (Center, 4 courses on the forecast circles, NWP predicted course) No typhoon: 1 course (NWP predicted course)
Forcing	MSM (Meso Scale Model) GPV (5km)
Typhoon bogus	Pressure profile: Fujita (1952) Gradient wind (with inflow angle 30 deg.) Asymmetric component by typhoon movement

models don't include inundation, ocean wave and river water.



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## **Operation of Japan area model**

## No-typhoon case (1 member)

 Calculated using only MSM (JMA non-hydrostatic Meso-scale Model) as boundary condition .

## Typhoon case (1 + 5 member)

 In addition to MSM calculation, 5 model runs driven by typhoon bogus are executed with 5 possible tropical cyclone track to cover a major set of scenarios.



These 5 track are prescribed at the center and at 4 points on the probability circle.

- 1. Center track with highest possibility
- 2. Faster track
- 3. Rightward biased track
- 4. Below track
- 5. Leftward biased track

## Why do we need "ensemble" predictions?

- Storm surges depend on tracks of tropical cyclones.
- We must take into account the influence of TC track uncertainty.



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## Japan area storm surge ensemble (MeTs)

- Currently, JMA conducts ensemble-like storm surge forecasts with 5 possible typhoon tracks, but ...
- These 5 tracks are prescribed artificially, so we can't know the probability of each track. (And these tracks are very rare cases except for center course...)
- We should take into account the probability of each track to provide the probabilistic storm surge forecast.



- JMA is developing Japan area storm surge ensemble (MeTs).
- In MeTs, we plan to use "JMA Meso-scale Ensemble Prediction System (MEPS) " (in test operation from 2015/03) as meteorological forcing field.

# Outline of Japan area storm surge ensemble under development (MeTs)

	Developing model (MeTs)
Coordinate	Lat/Lon Cartesian grid Arakawa C-Grid
Area	20.0N~50.0N, 117.5E~150.0E
Resolution	45''x30''~12'x8 (1km~16km) Adaptive Mesh Refinement (AMR)
Time step	4 seconds
Forecast range	39 hours
Calculation run	1 times/day
Initial time	18 UTC
Number of prediction courses	10 ensemble members
Forcing	MEPS (Meso-scale Ensemble Prediction System) GPV (5km) (In test operation)
Typhoon bogus	—-

models don't include inundation, ocean wave and river water.



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Summary

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## **Example 0: Circumstance**







#### Example 1: Stamp Map (Storm surge distribution) T1515(GONI) (Initial 2015/08/23/18UTC)



We can view the scenarios in each member forecast and assess the possible risks of extreme events.

## Example 2: Ensemble mean and Spread



### **Example 3 : Time series charts**



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# Summary

- A Japan area storm surge ensemble is under development.
- Currently, JMA is considering the products in detail and how to utilize them.
- JMA is planning to start operating the model around 2020, in the next JMA super computer system.
- In operation, ensemble members will be increased (10 -> 21) and run 4 times/day.

## **THANK YOU!**