Goal 2: Further development of a regional cloud-resolving ensemble analysis and forecast systems

Meteorological Research Institute,
Japan Agency for Marine-Earth Science and Technology,
Japan Meteorological Agency,
Tohoku University,
Kobe University,
Disaster Prevention Research Institute, Kyoto University, etc.

Goal 2: Further development of a regional cloud-resolving ensemble analysis and forecast systems

SPIRE Field 3

- Forecasts with probability are desired because it is difficult to predict severe events (e.g. local heavy rainfalls).
- Ensemble prediction is also expected to reduce the miss rate of their forecasts because they provide many scenarios of severe phenomena.

- The ensemble forecast systems are under development using the K-computer, and then applied to the several phenomena such as heavy rainfalls.
- The outputs of ensemble forecasts have been used as input data of inflow predictions of Dams in this project.

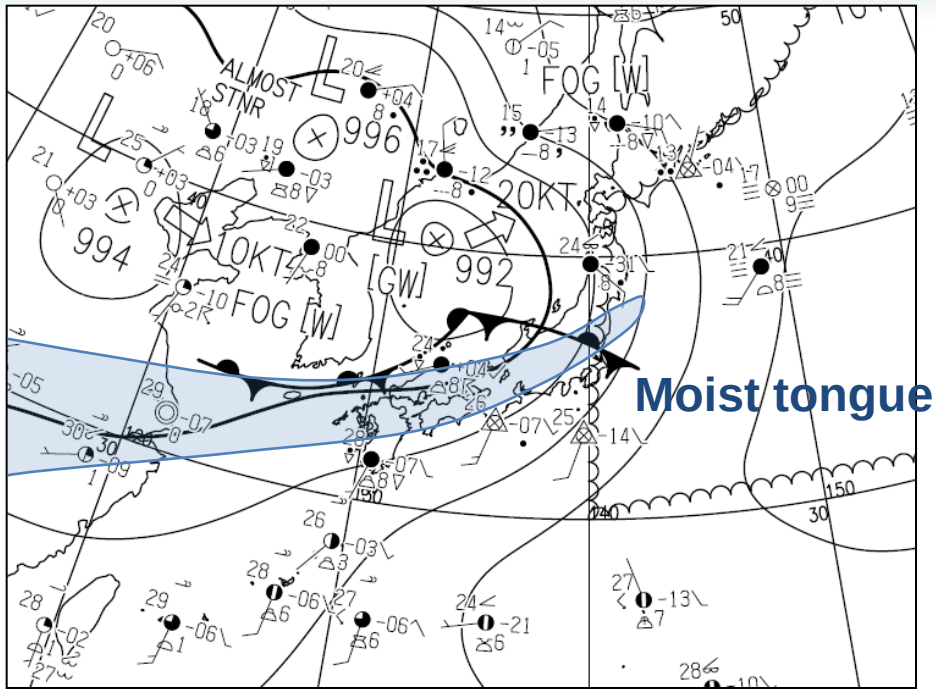
Goal 2: Further development of a regional cloud-resolving ensemble analysis and forecast systems

- The ensemble forecast systems are under development using the K-computer, and then applied to the several phenomena such as heavy rainfalls.
- The outputs of ensemble forecasts have been used as input data of inflow predictions of Dams in this project.

.

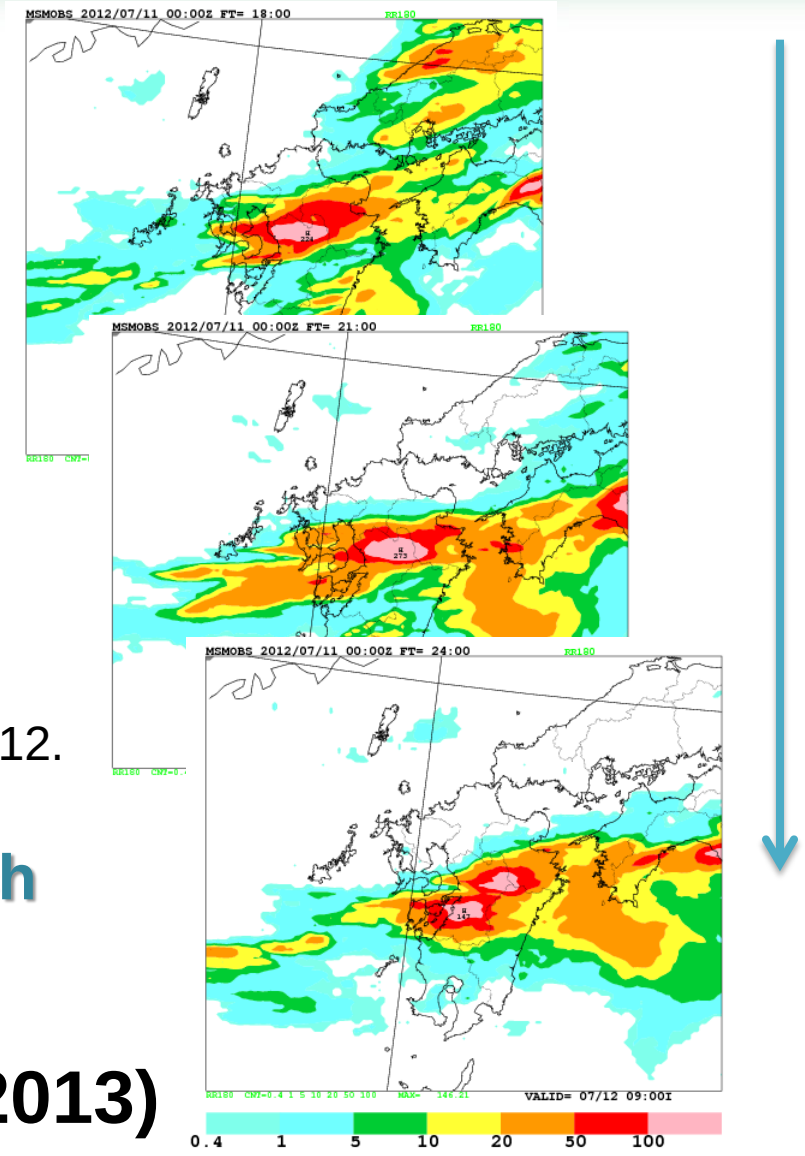
Results of the ensemble forecast systems and the applications using the outputs of ensemble forecasts, which will be not present in the following talks of this session, are shown briefly.

Northern Kyushu heavy rainfalls in July 2012



Surface weather map on 1800 UTC 11 July 2012.

3-h accumulated rainfall (OBS)



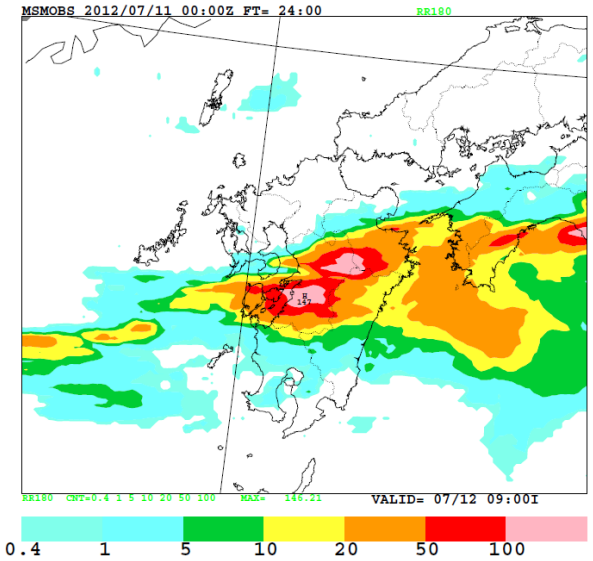
Rainfall totals reached as much as 800 mm over 5 days.

(Kunii, 2013)

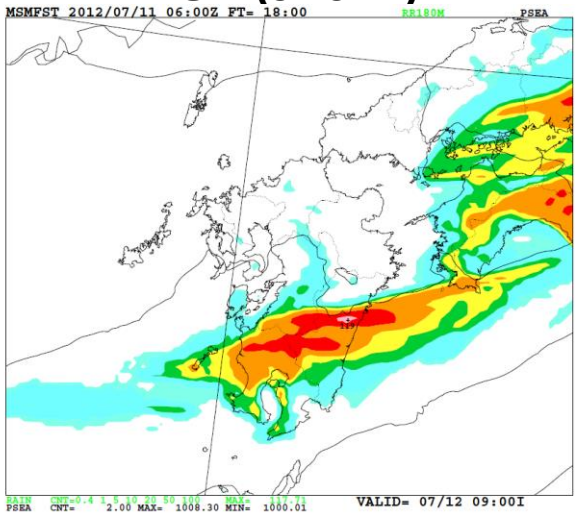
Forecast results (FT=18)

SPIRE Field 3

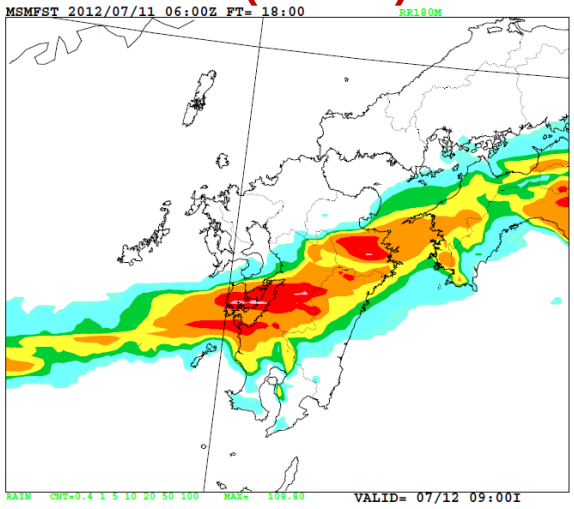
OBS



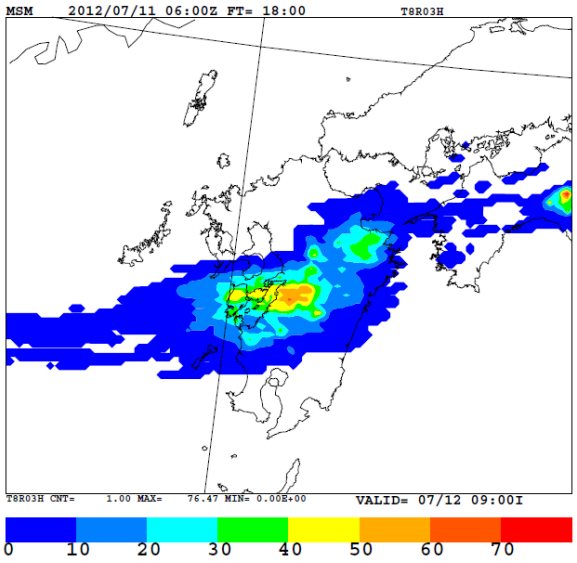
MSM (JNoVA)



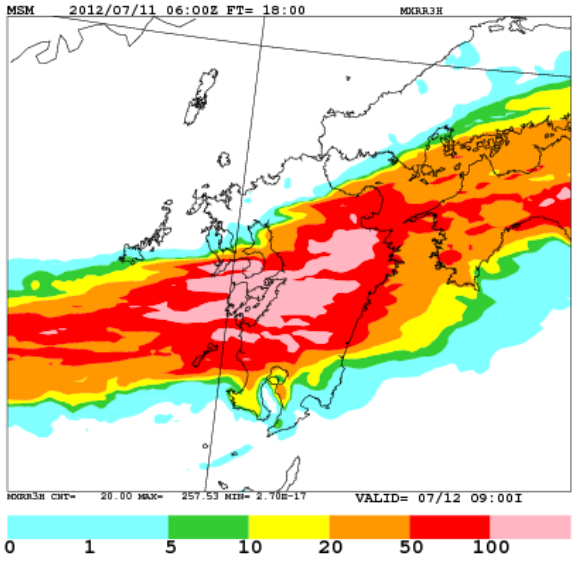
MSM (LETKF)



POP > 50mm/3h



Maximum



These information would contribute to decision-making process.

(Kunii, 2013)

Probability with different leads

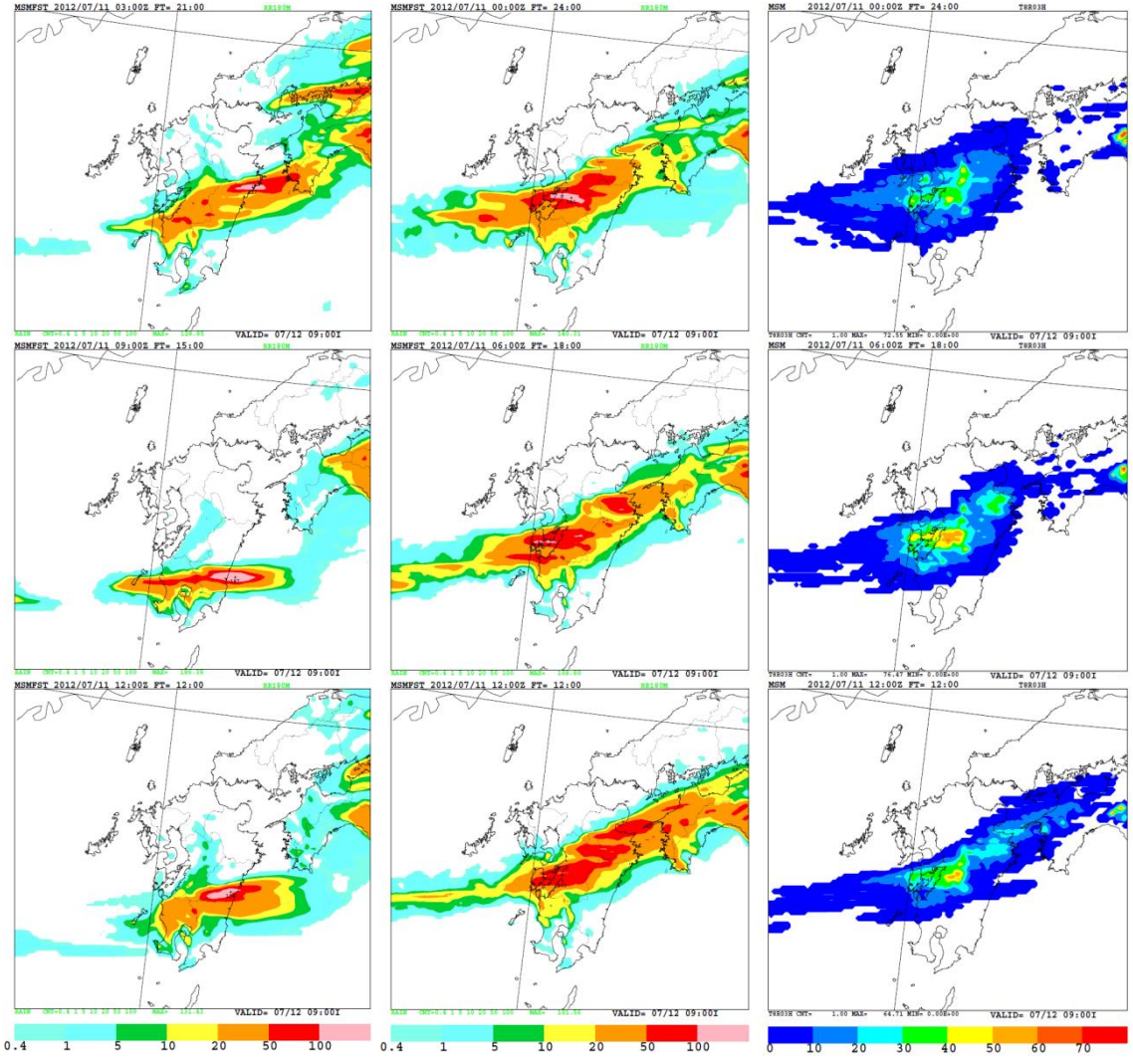
Probability of precipitation (50 mm > 3-hr) with different lead times

JMA operational | LETKF | POP (50 mm / 3 hr)

FT=24

FT=18

FT=12



(Kunii, 2013)

TOP >トピックス > 京コンピュータによる平成24年7月九州北部豪雨の予測について

京コンピュータによる平成24年7月九州北部豪雨の予測について

発表日

平成25年8月30日

概要

京コンピュータによる平成24年7月九州北部豪雨の予測実験を行った結果、大雨の予測が大きく改善されました。

本文

平成24年7月九州北部豪雨による大雨について、発生半日～1日前からの計算で高い確率で予測できる例があることが気象研究所による研究で分かりました。気象防災に関する京コンピュータを用いる研究の最初の本格的な成果で、将来的な集中豪雨の予測の改善にもつながるものと期待されます。

図表等を含めた資料全文については、下記「資料全文（京コンピュータによる平成24年7月九州北部豪雨の予測について）」をご参照ください。

問い合わせ先

気象研究所　企画室
電話：029-853-8535

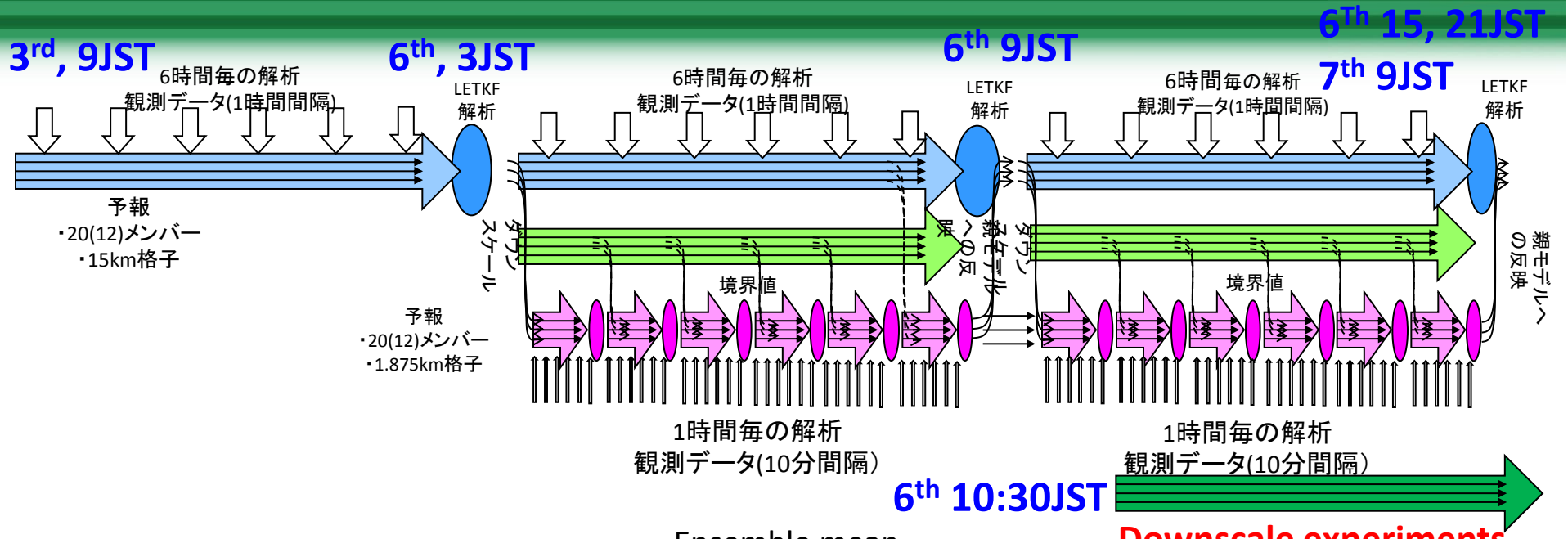
http://www.mri-jma.go.jp/Topics/press/20130830/press20130830.html

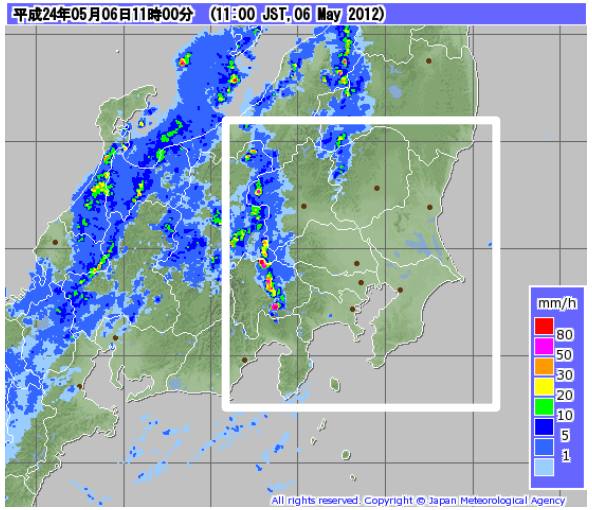
Weather and Forecasting 2013 ; e-View doi: http://dx.doi.org/10.1175/WAF-D-13-00032.1

Mesoscale data assimilation for a local severe rainfall event with the NHM-LETKF system

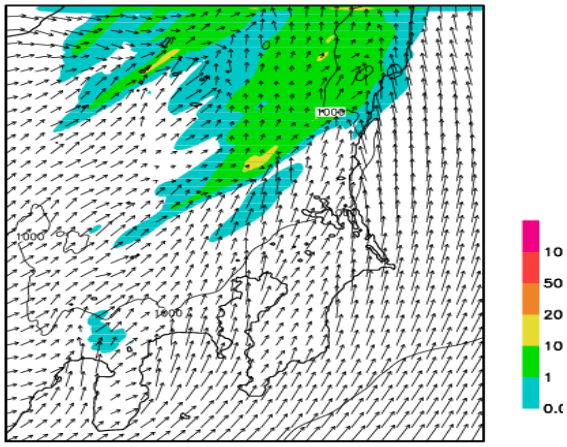
Masaru Kunii
Forecast research department, Meteorological Research Institute

Tornadoes Occurred on 6th May 2012

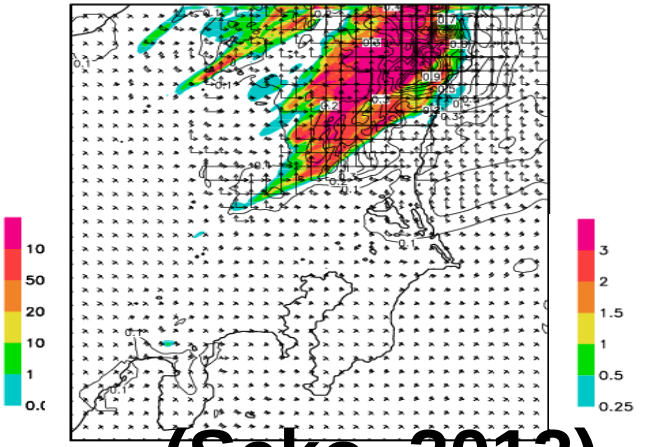




Ensemble mean
of Inner LETKF at 12JST
1 hour rainfall



Spread at 12JST
1 hour rainfall



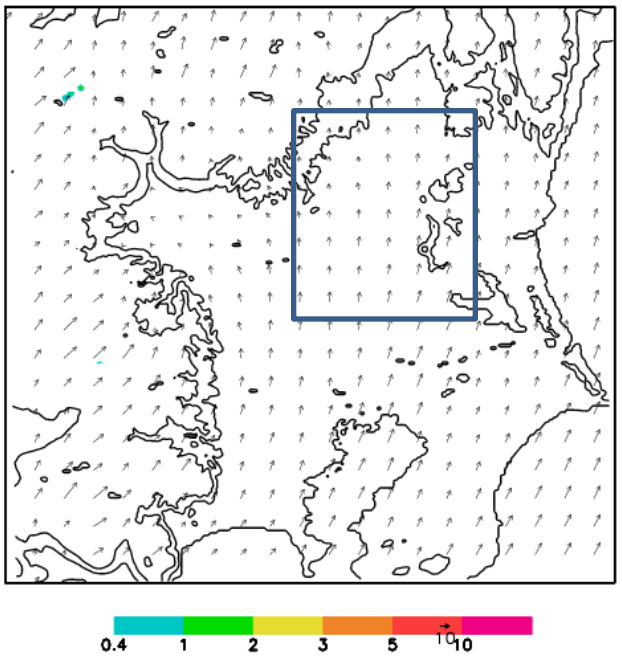
(Seko, 2013)

Downscale experiment with Δx=350m

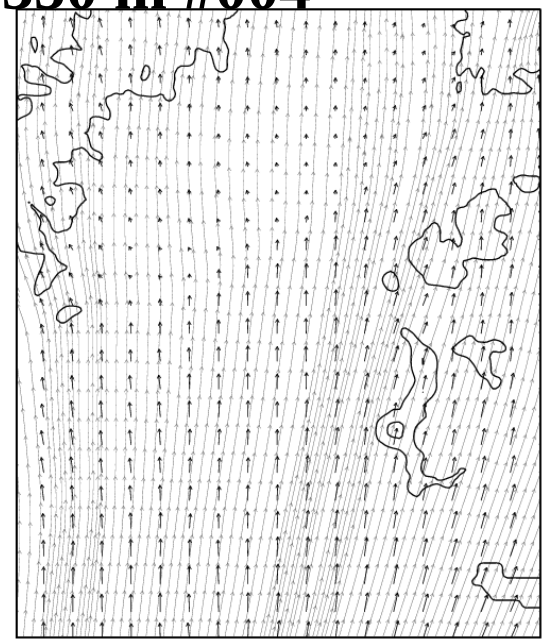
From 1130JST
to 1430JST

 # 004 :
Intense vortex is maintained.
 # 007:
Intense vortex wasn't generated.

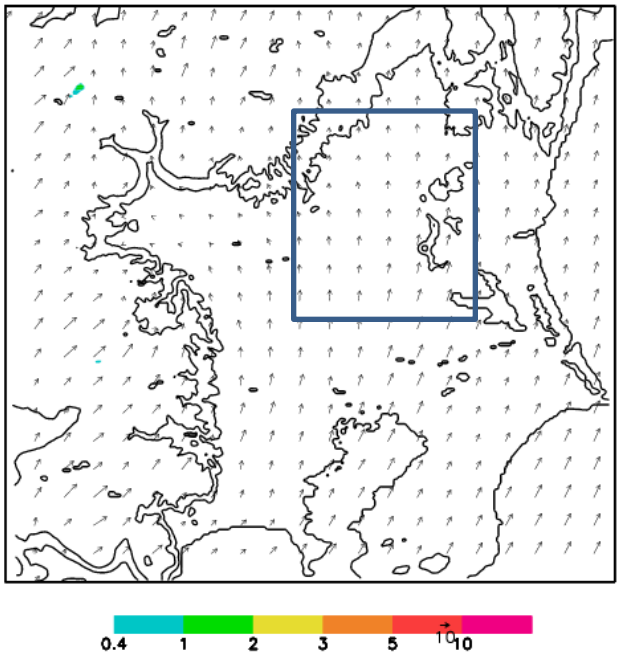
350 m #004



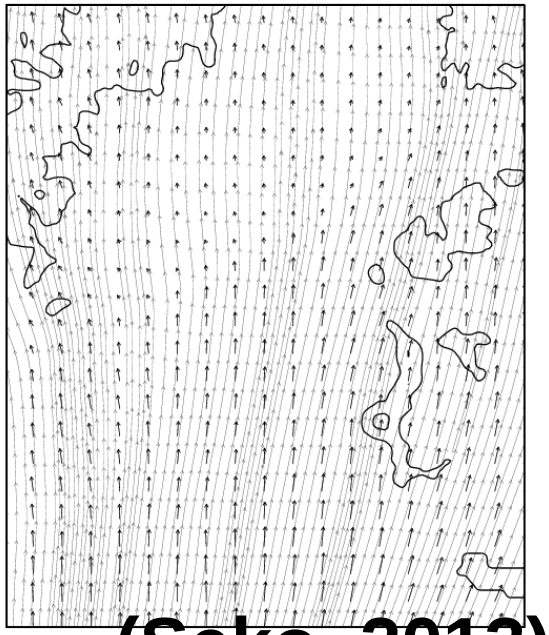
350 m #004



350 m #007



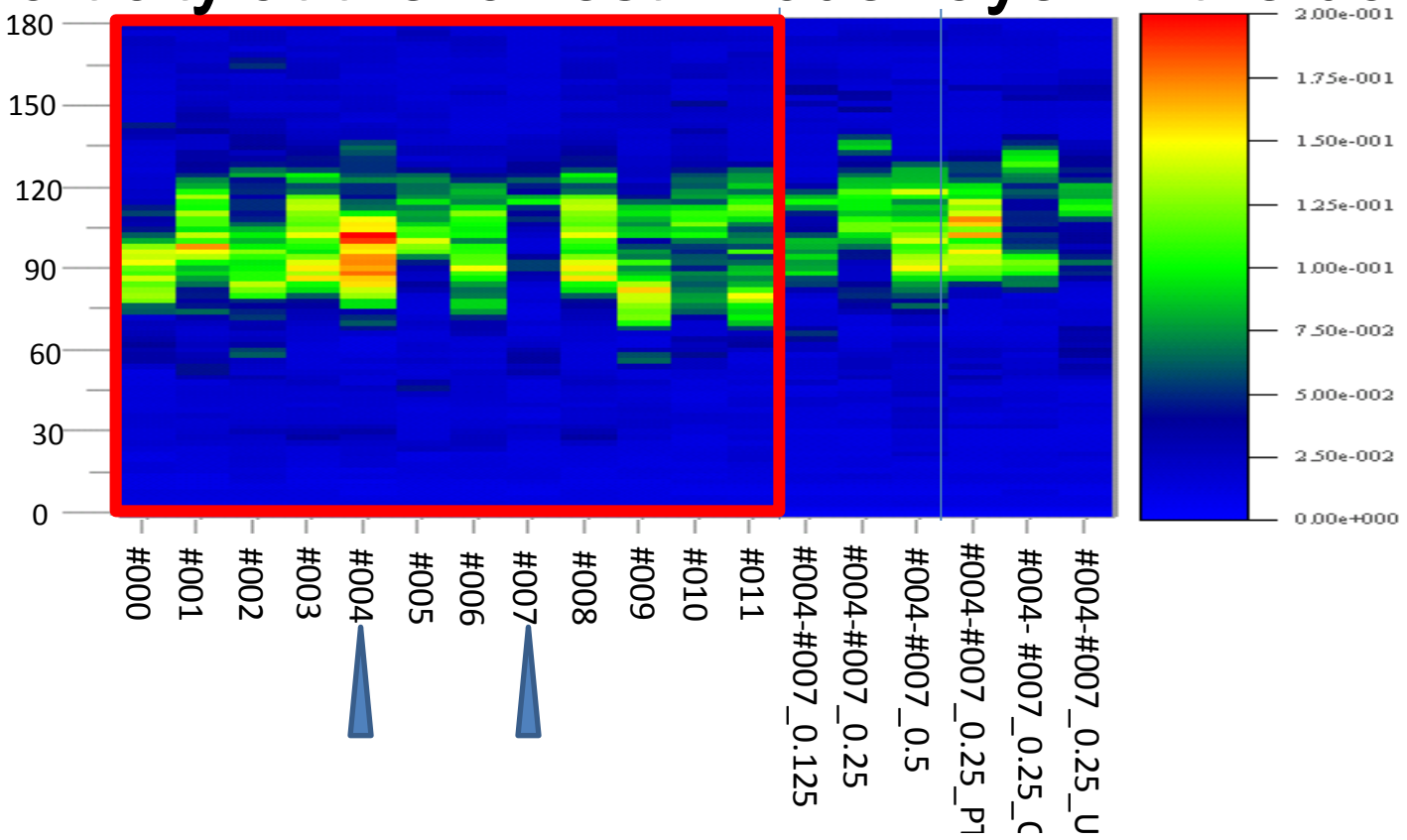
350 m #007



(Seko, 2013)

Favorable factors of intense vortices

Vorticity at the lowest model layer in the domain

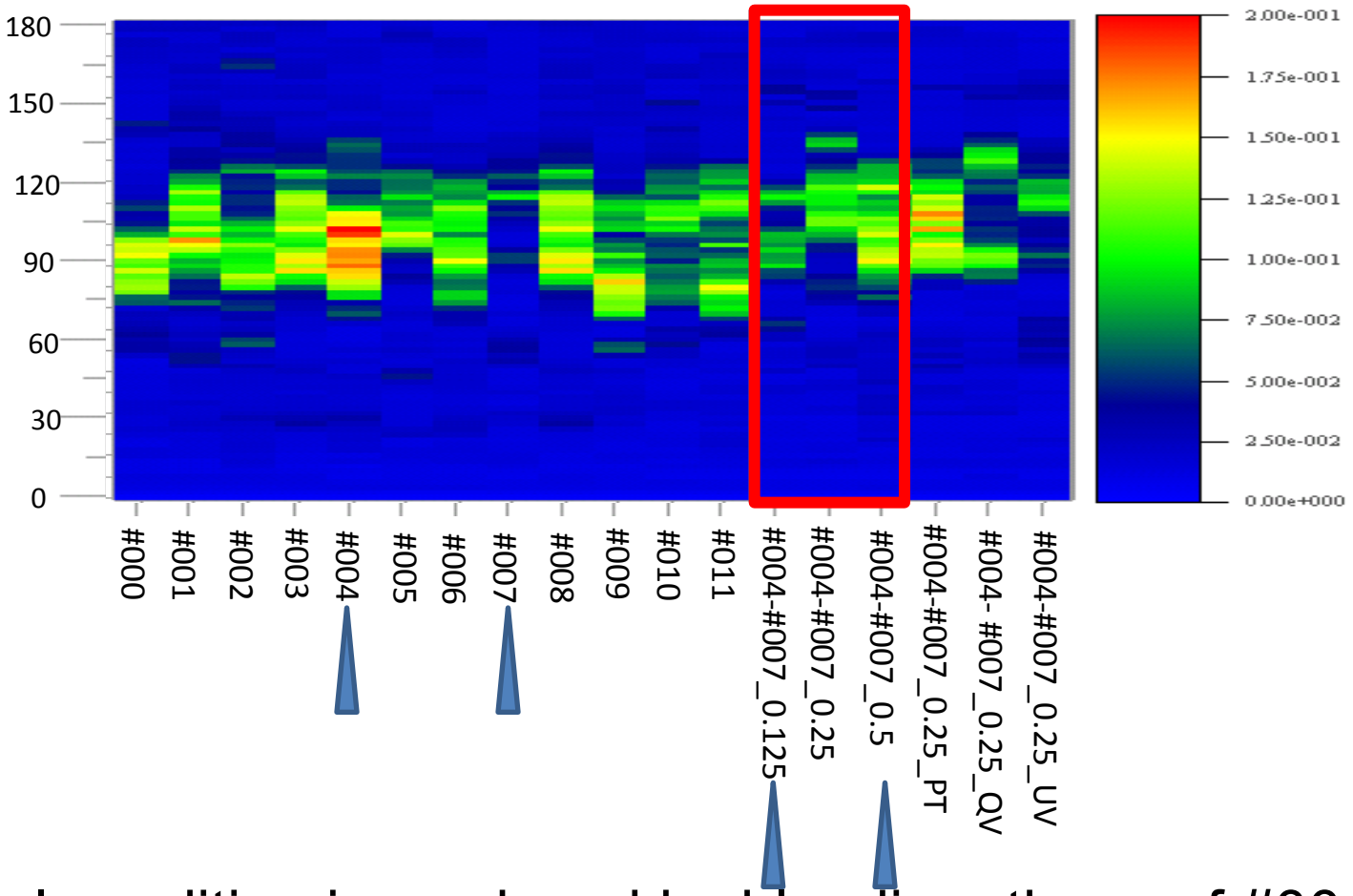


-Vertical axis indicate the forecast time(min).

-In #004, intense vortex was generated,
while in #007 intense vortex was not generated.

(Seko, 2013)

Vorticity at the lowest model layer in the domain

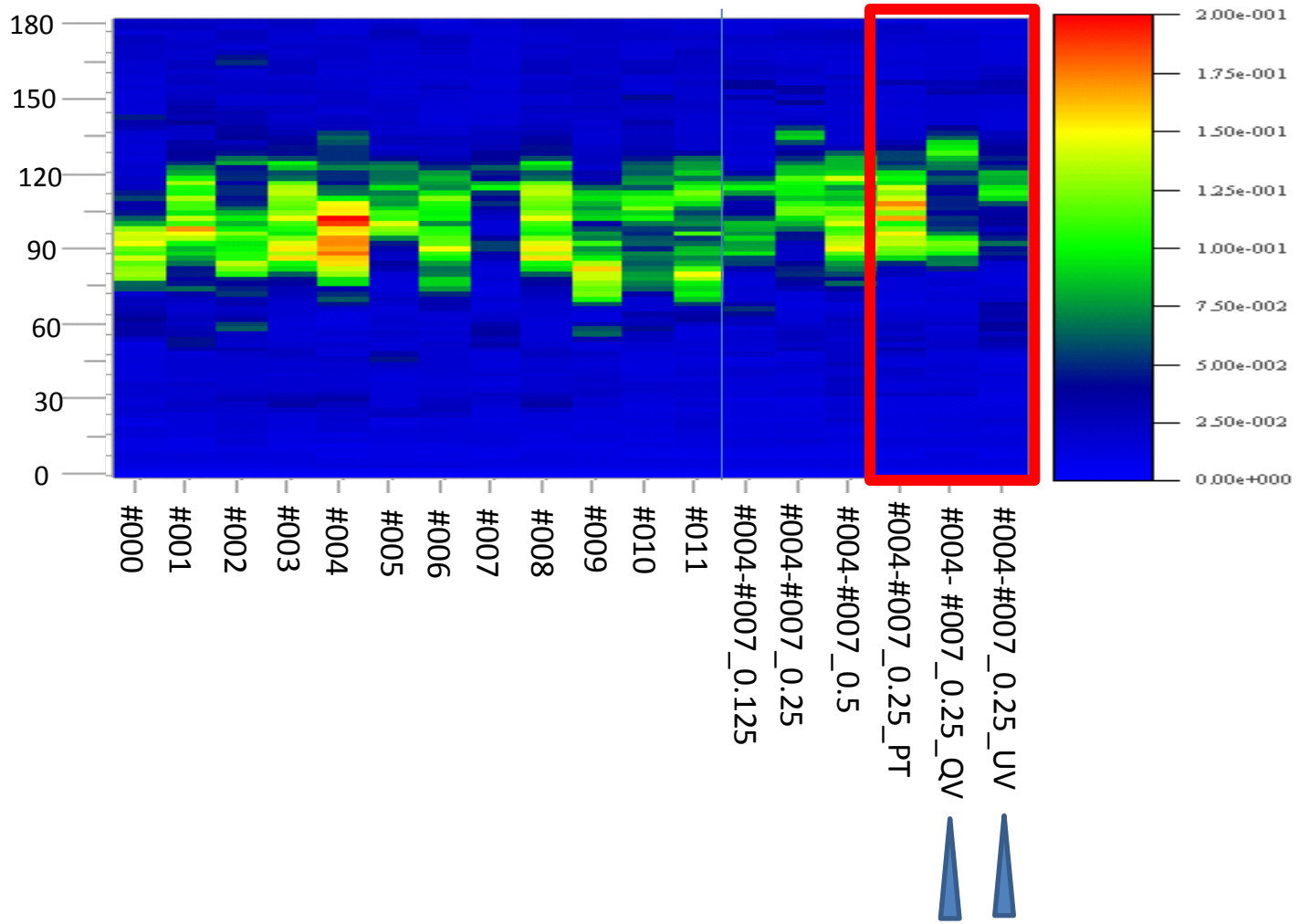


-Initial condition is produced by blending those of #004 and #007 using a following equation.

$$I_{blended} = w \times I_{\#004} + (1 - w) \times I_{\#007}$$

-Weaker vorticity was produce when smaller w was used.

(Seko, 2013)

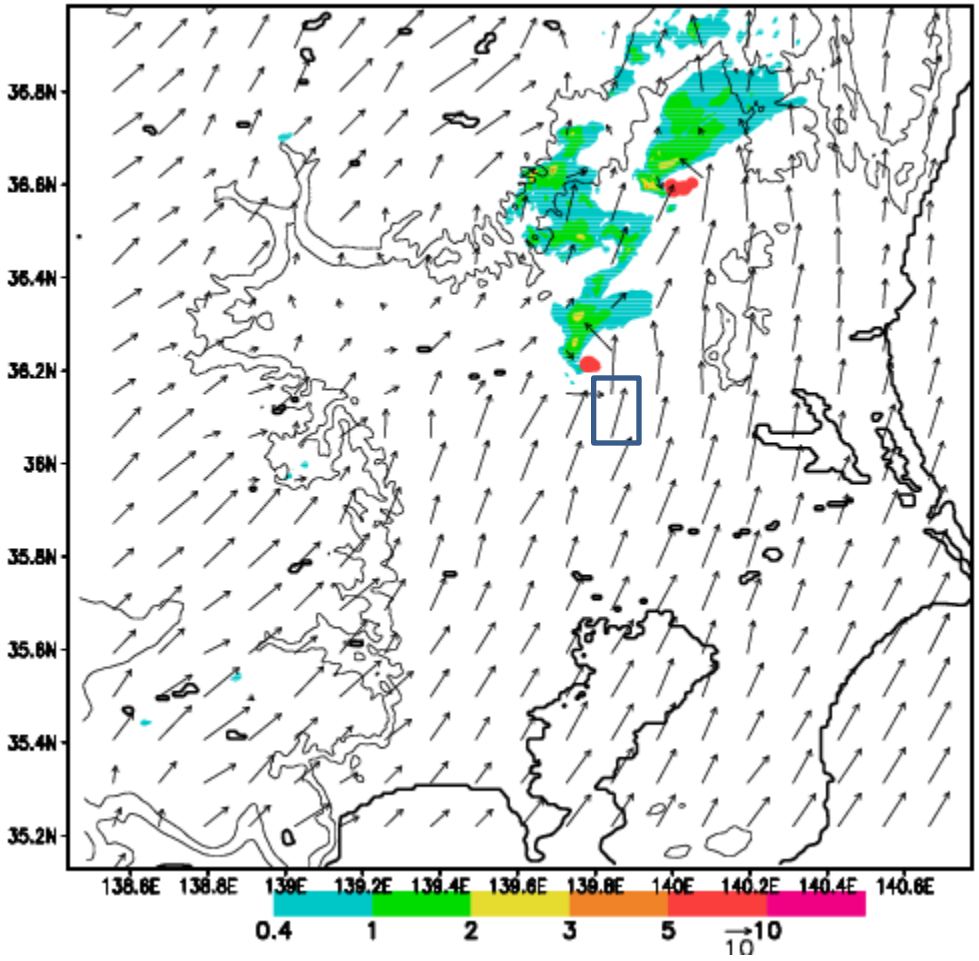


-When the horizontal wind and Qv were placed by those of #007, vortices became weaker.

-This result indicates that the horizontal wind and Qv of #004 are favorable for conditions.

(Seko, 2013)

Relation between intensity of vorticity and environments on inflow side

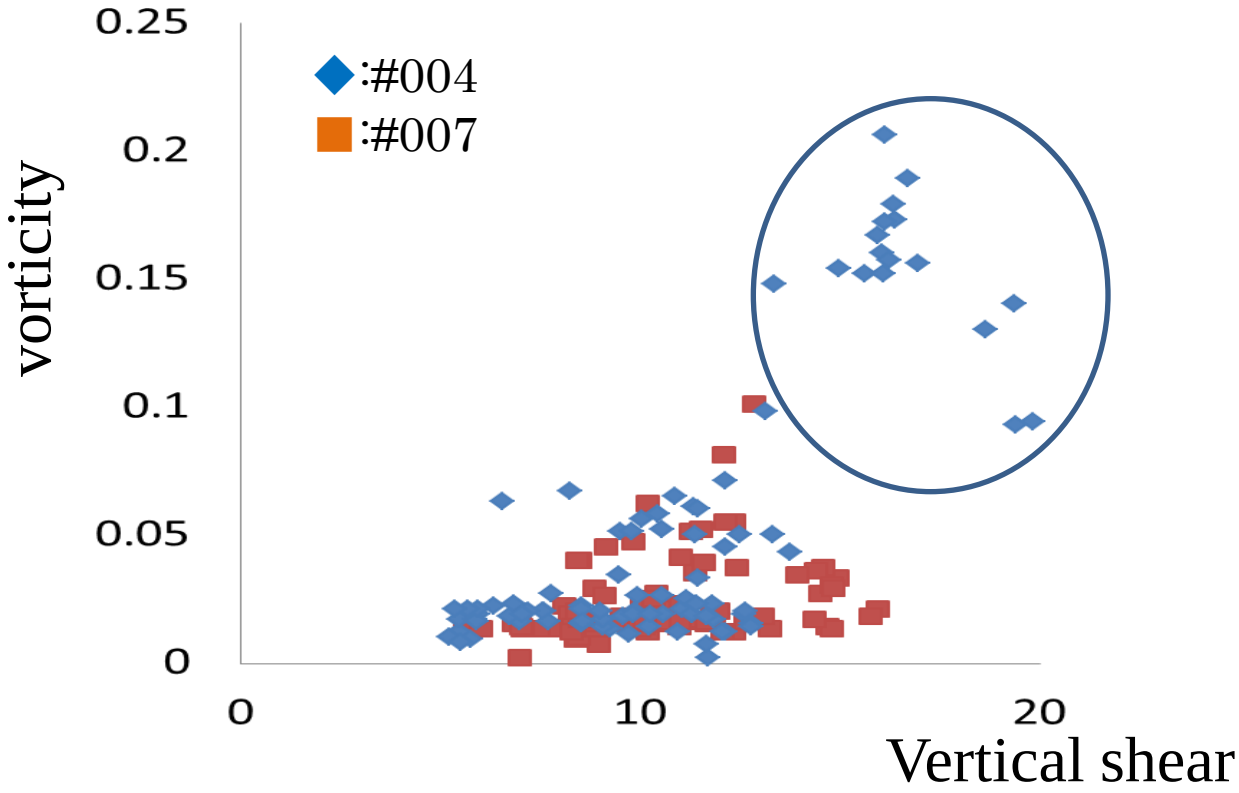


-Average of environments, such as vertical shear, in the rectangle of 6 km x 9 km at the southeastern side of maximum vorticity were obtained from the outputs of #004 and #007 .

-Scatter diagrams of these values and vortices indicates the relation between intensity of vorticity and environments.

(Seko, 2013)

Vertical shear between z=2.5 km and 0.8 km



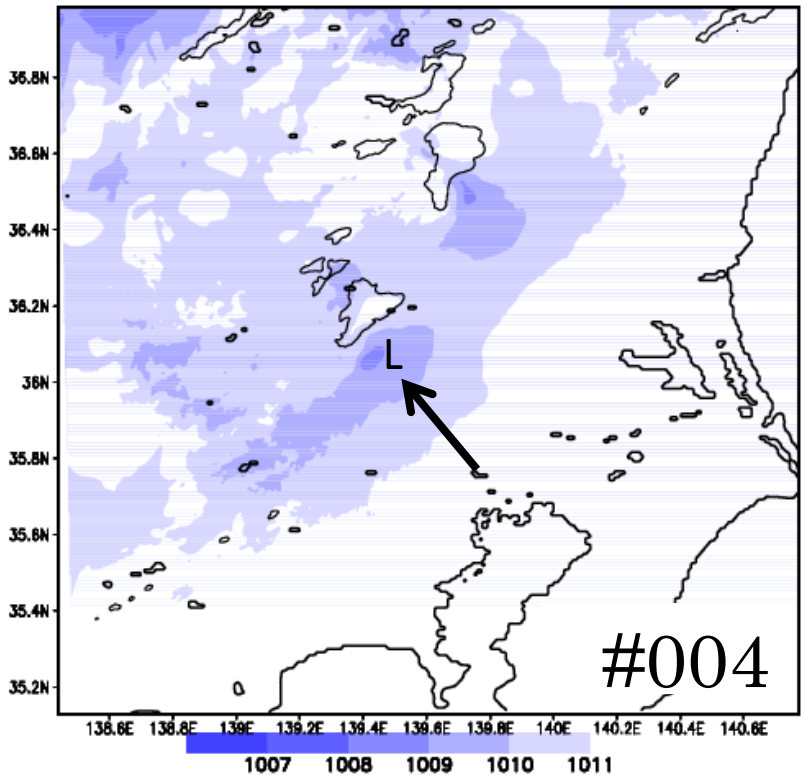
-In #004, the vorticity was intense when vertical shear was high (indicated by a blue circle).

-Vertical shear of #007 was relatively weaker than that of #004.

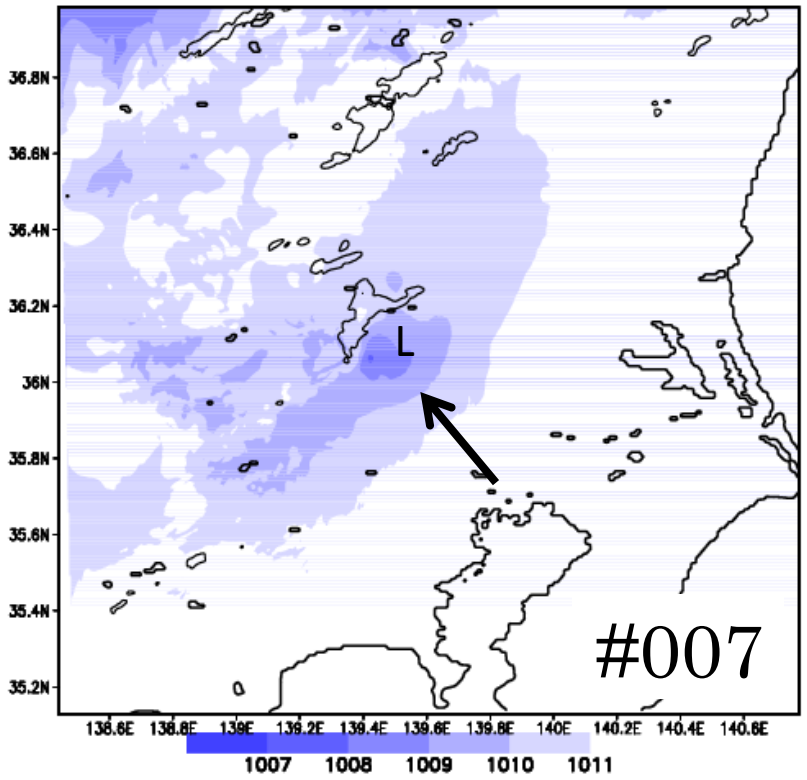
(Seko, 2013)

Sea level pressure distributions at 38min=12:08

Sea level pressure #004
38min=12:08



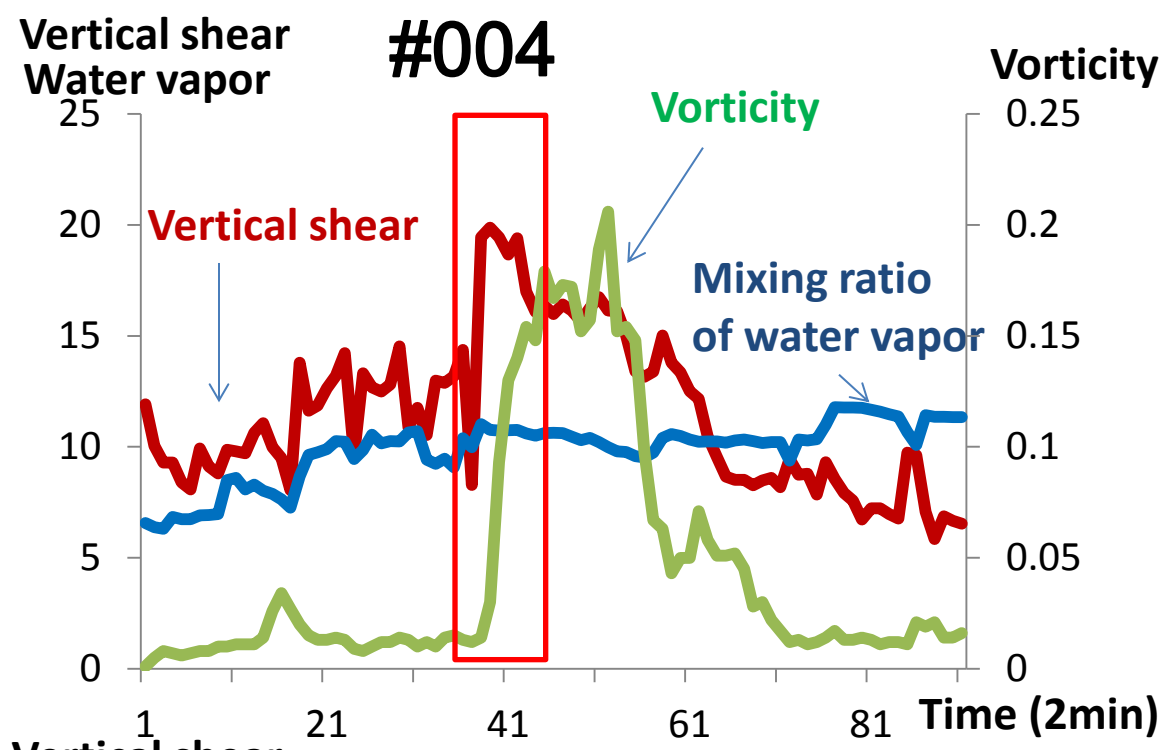
Sea level pressure #007
38min=12:08

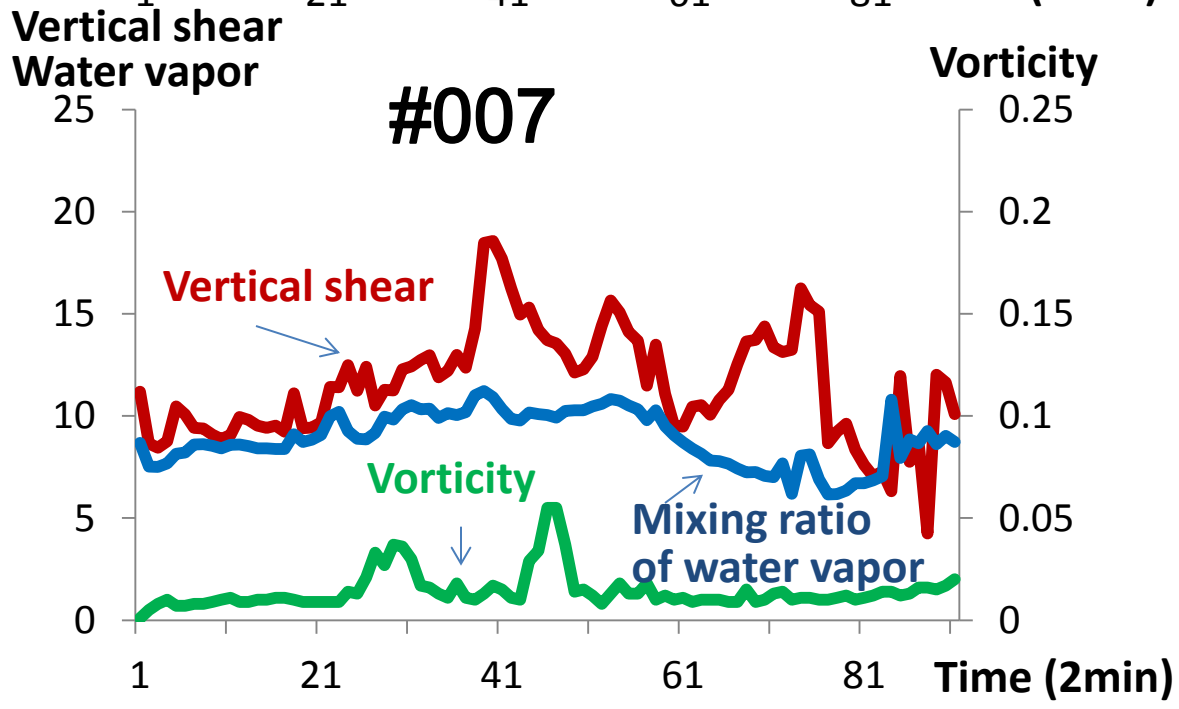


-Low-pressure area of #007 was wider than that on #004.

-It is expected that the more intense southerly wind region expanded widely in #007 due to the wider low-pressure area.

(Seko, 2013)





Temporal variations of vertical shear, water vapor and vorticity

-Vorticity intensified when vertical shear became larger under the humid air condition.

-This result indicates that two factors are needed and that vertical shear is the trigger of this case event.

(Seko, 2013)

研究成果

LETKFネストシステムを用いた2012年5月6日のつくば竜巻のアンサンブル予報実験

Results of Research

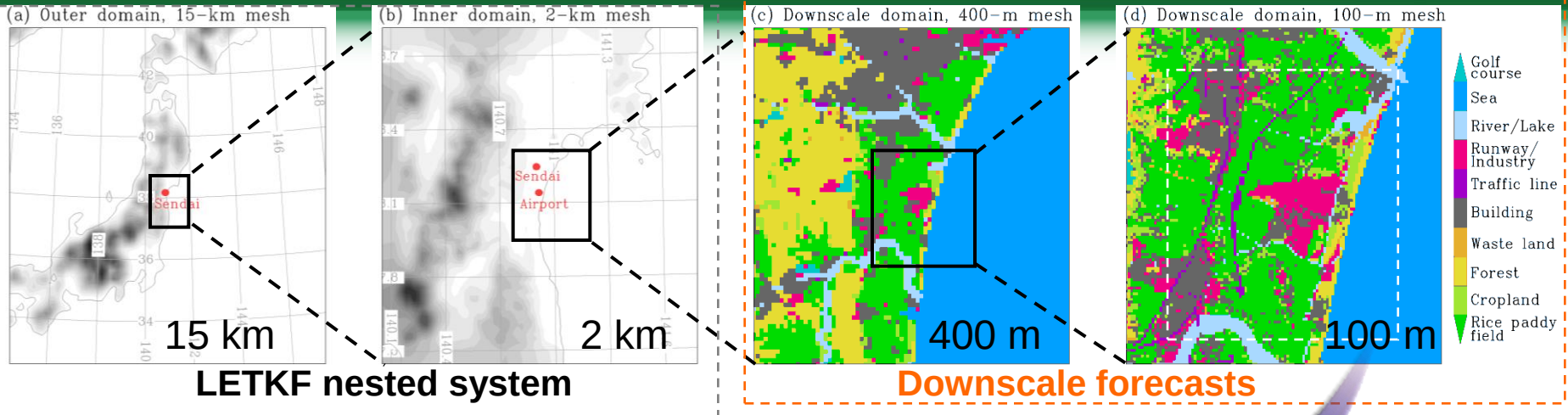
Ensemble forecast experiments on tornadoes that occurred in Tsukuba on May 6, 2012

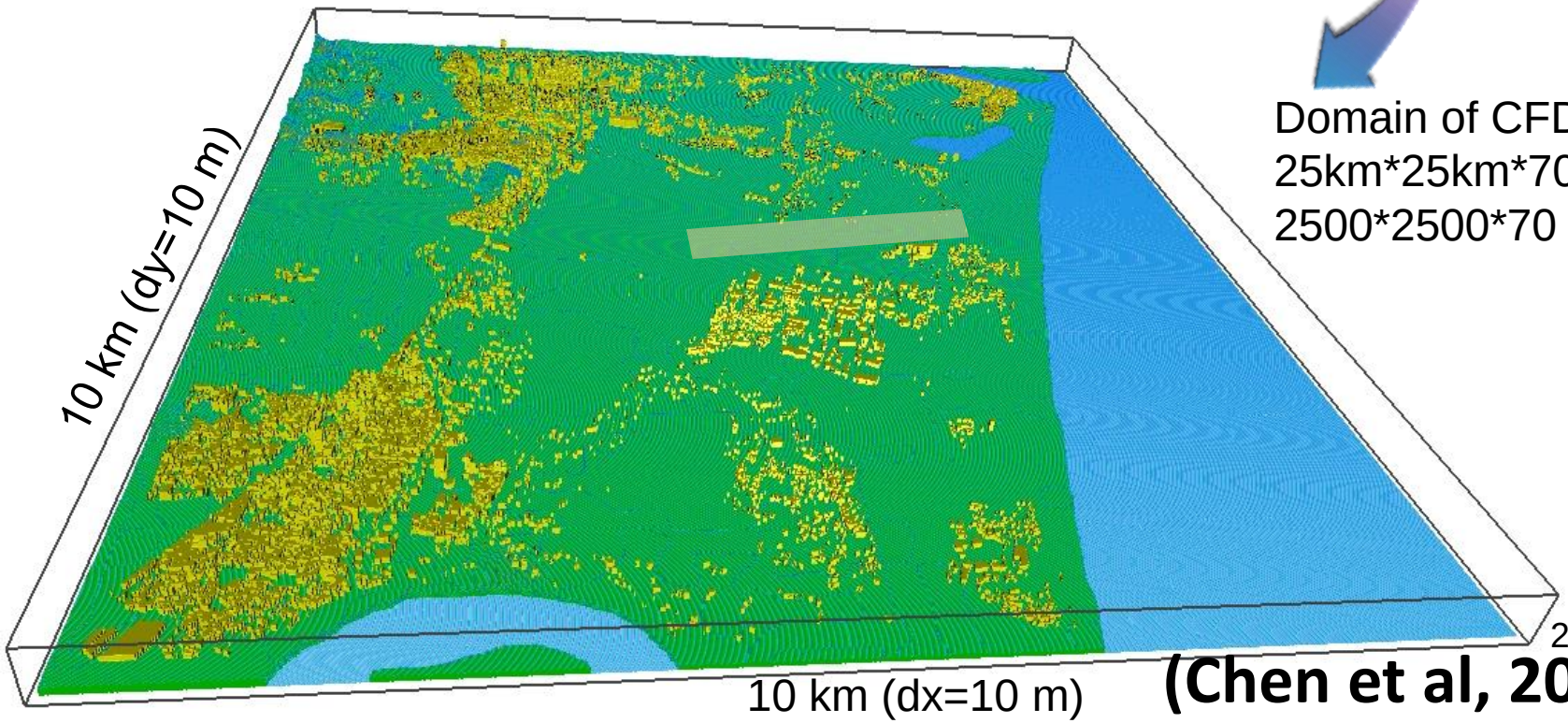
Summary

Experiments were conducted by changing the initial value of a cloud resolution numerical model to forecast tornadoes. For the experiments, a two-way nesting system using a Local Ensemble Transform Kalman Filter (LETKF), a leading-edge data assimilation technique, was developed. Figure 1 shows a tornado developmental distribution obtained from the ensemble forecast by LETKF at the time the strongest tornado ever recorded in Japan landed around Tsukuba and caused enormous damage on May 6, 2012. Using a 350m resolution model, 10

https://www.jamstec.go.jp/hpci-sp/info/research_results/research_results.en.html

Simulation of Sea breeze





Domain of CFD
25km*25km*700m
2500*2500*70 points

(Chen et al, 2013)

研究成果

東北大学ダウンスケールシステムDS3を用いた京コンピュータによる海風前線三次元構造の超高解像度数値実験

Results of Research

Super high-resolution modeling of 3D structures of the sea breeze front head by the Down-Scaling Simulation System (DS3)

Summary

The sea breeze has an important influence on the local weather and environment over the coastal areas. In particular, the passage of sea breeze front can bring a sudden change of winds, temperature, air quality, and even convective weathers. To date, however, it still remains a big challenge to realistically predict the detailed structures and progress of the sea breeze front over coastal city.

http://www.jamstec.go.jp/hpci-sp/info/research_results/research_results_chen.en.html

Results of the ensemble forecast systems and applications using outputs of ensemble forecasts will be presented in this session

(1)インクリメント法 LETKFの2011年九州大雨への適用
黒田　徹 (海洋研究開発機構/気象研究所)

(2) Ensemble forecast of storm surges induced by the typhoon Haiyan
Le Duc (海洋研究開発機構/気象研究所)

(3) NHM-EnVarシステムの開発　折口征二 (気象研究所)

(4) NHM-LETKFを用いた台風同化実験　國井　勝 (気象研究所)

(5) A forward step to new-era urban NWP:3D structure of the sea-breeze front head as revealed by super high-resolution mesoscale simulation
陳　桂興 (東北大)

(6) 大規模山岳地域洪水土砂流出解析手法の開発
山敷庸亮 (京都大防災研究所)

(7) 京を用いた超高解像度気象シミュレーション
大泉　伝 (海洋研究開発機構)

(8)　Ensemble flood forecasting using transposition of NWP rainfall fields considering orographic rainfall
Yu Wansik (京都大防災研究所)

(9) アンサンブル洪水予測　小林健一郎(神戸大)

Results of the ensemble forecast systems and applications using outputs of ensemble forecasts will be presented in this session

(1) An application of increments LETKF on 2011 Kyushu heavy rain
Tohru Kuroda (JAMSTEC, MRI)

(2) Ensemble forecast of storm surges induced by the typhoon Haiyan
Le Duc (JAMSTEC, MRI)

(3) Development of the NHM-EnVar system
Seiji Origuchi (MRI)

(4) Data assimilation experiments for TCs with the LETKF
Masaru Kunii (MRI)

(5) A forward step to new-era urban NWP:3D structure of the sea-breeze front head as revealed by super high-resolution mesoscale simulation
Guixing Chen (Tohoku. Univ.)

(6) Development of large-scale flush flood and debris flow modeling
Yousuke Yamashiki (DPRI)

(7) Ultra high-resolution meteorological simulation using the K computer
Tsutao Oizumi (JAMSTEC)

(8) Ensemble flood prediction
Ken-ichiro Kobayashi (Kobe Univ.)

(9) Ensemble flood forecasting using transposition of NWP rainfall fields considering orographic
Yu Wansik (DPRI)