

A Control Simulation Experiment for August 2014 severe rainfall event using a regional model

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Data Assimilation Research Team

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Control Simulation Experiment; CSE, (*Miyoshi and Sun 2021*)

- **Weather Control**

- Control in the desired direction using the chaos of the atmosphere

- **Presentations of CSE in EGU2022**

- **Control Simulation Experiments with the Lorenz-96 Model** (by Qiwen Sun)

- **From Predictability to Controllability: Control Simulation Experiment (CSE)**

(by Takemasa Miyoshi)

- **A CSE for a typhoon case with a global numerical weather prediction system**

(by Koji Terasaki)

- **A CSE for a severe rainfall event using a regional model “SCALE”**

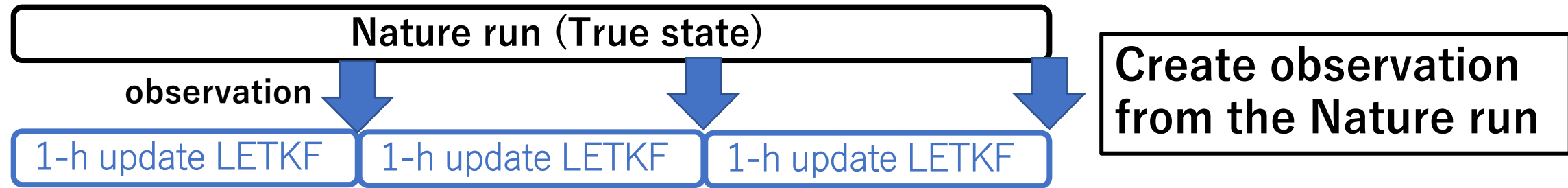
(This presentation)



This event brought 284 mm precipitation and landslide in Hiroshima city located in western Japan.

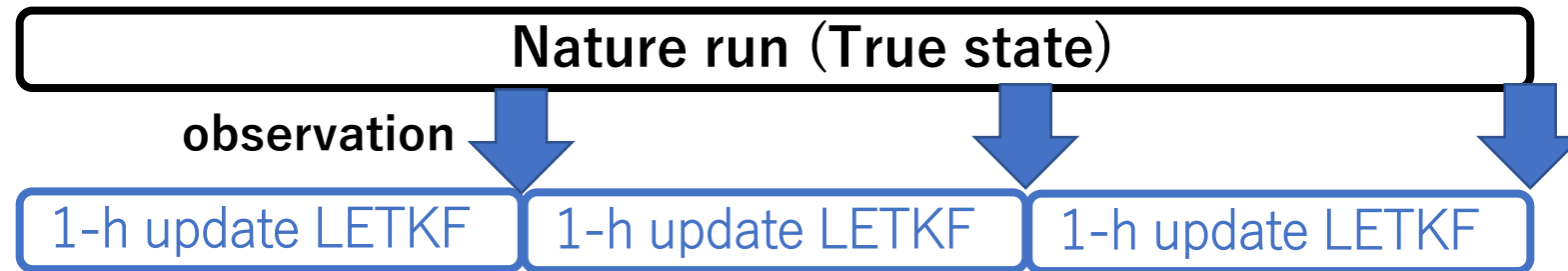
The workflow of hourly update OSSE

t=0h t=1h t=2h t=3h

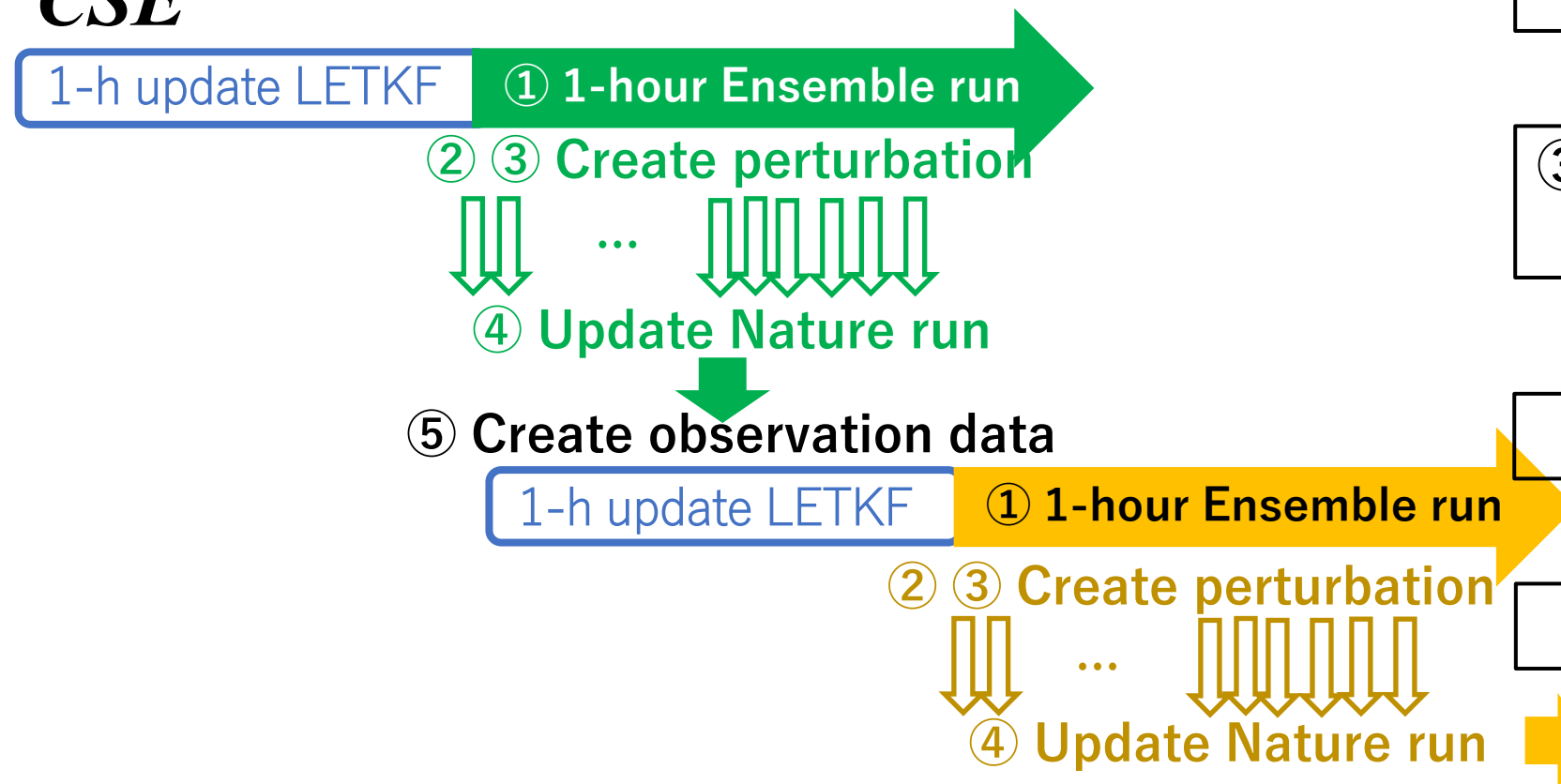


The workflow of hourly update OSSE and CSE(CSE-1)

OSSE



CSE



① Select the ensemble members with maximum and minimum precipitation.

② Take the differences of model variables

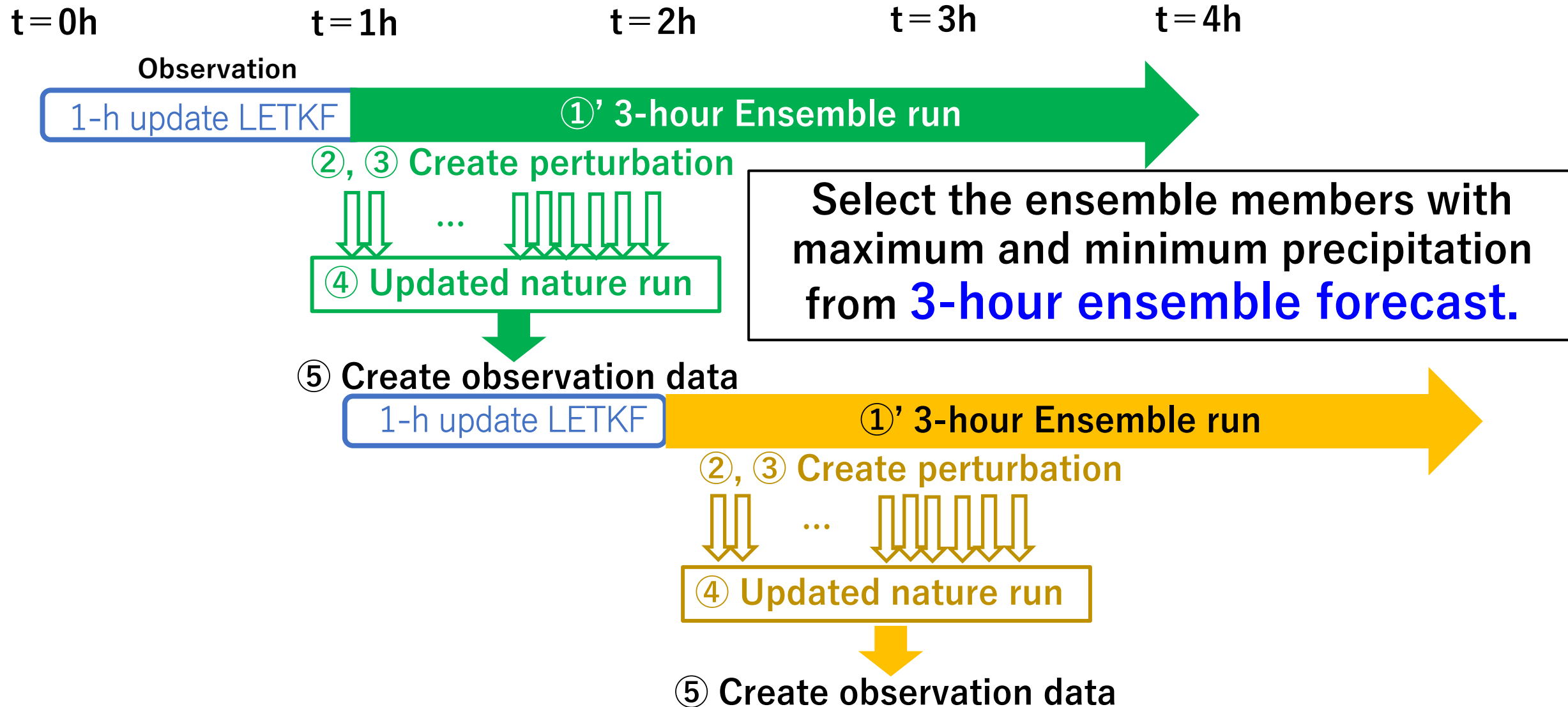
③ Normalized the amplitude of the perturbation.

④ Update the Nature run

⑤ Create observation data

⑤ Create observation data

The workflow of another CSE (CSE-3)

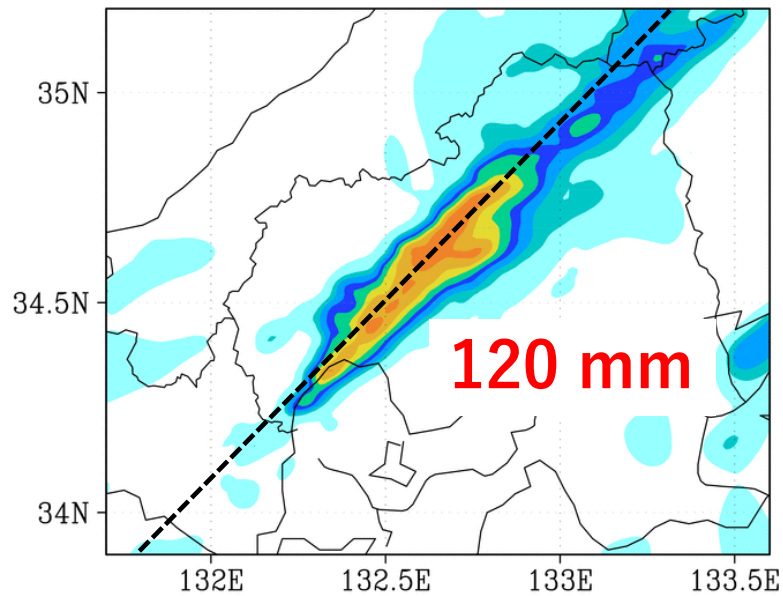


6-hour accumulated rainfall amount

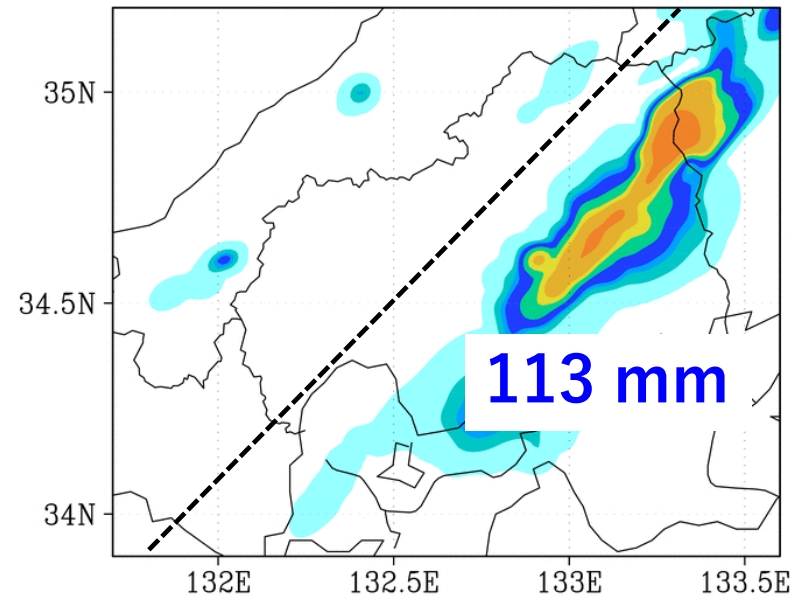
09:00 – 15:00 UTC, August 20, 2014

[mm]

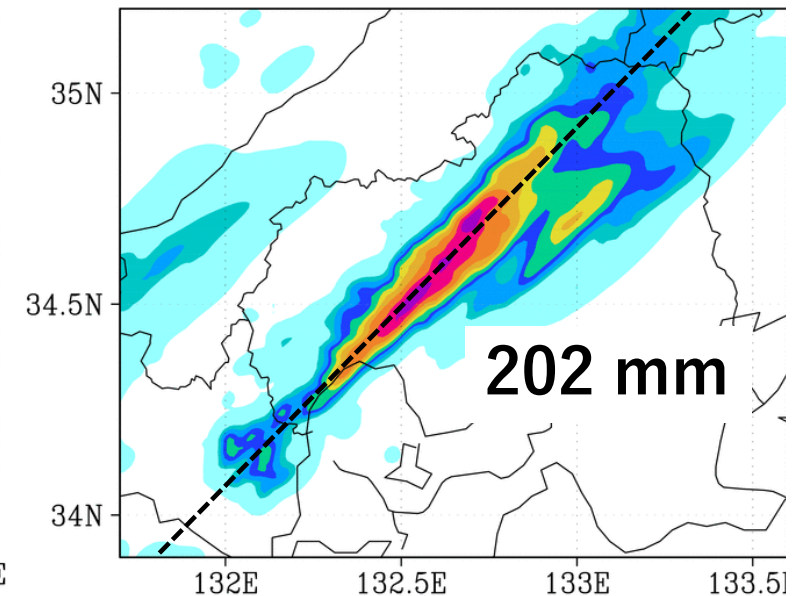
CSE-1



CSE-3



Nature run



CSE-1: Perturbations were created from 1-hour ensemble forecasts.

CSE-3: 3-hour ensemble forecasts.

Additional CSEs

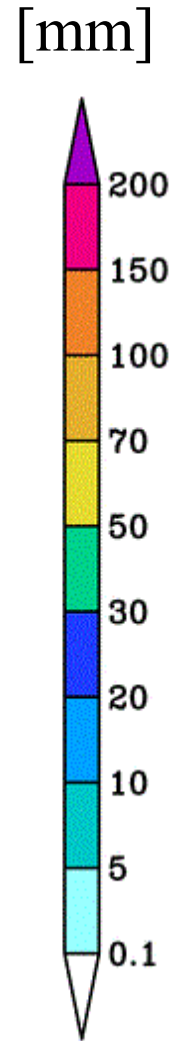
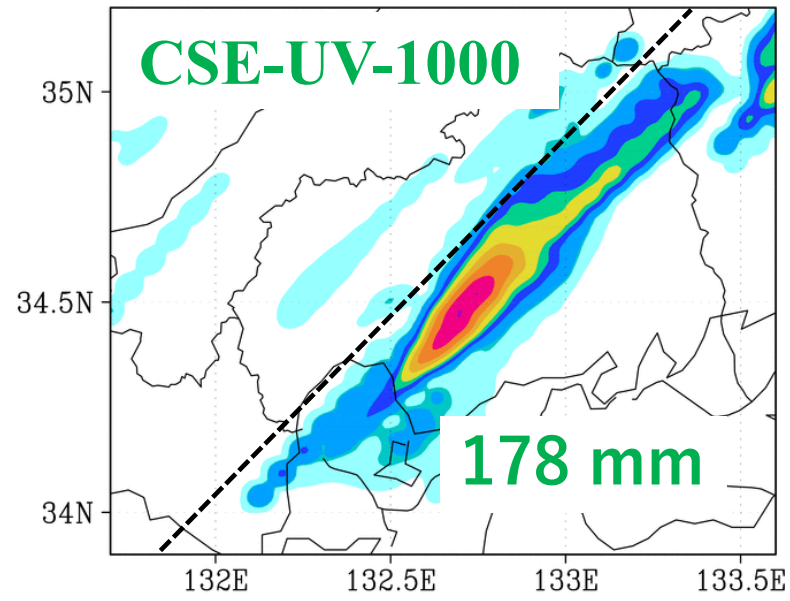
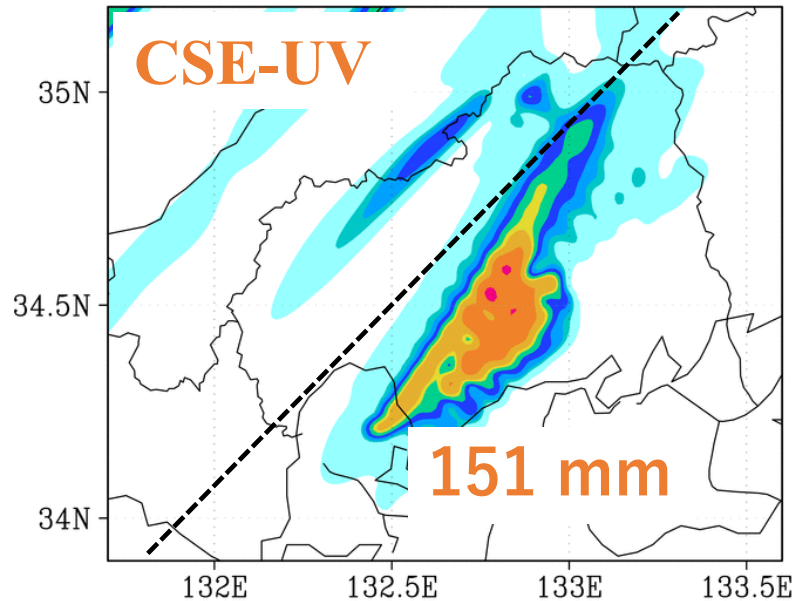
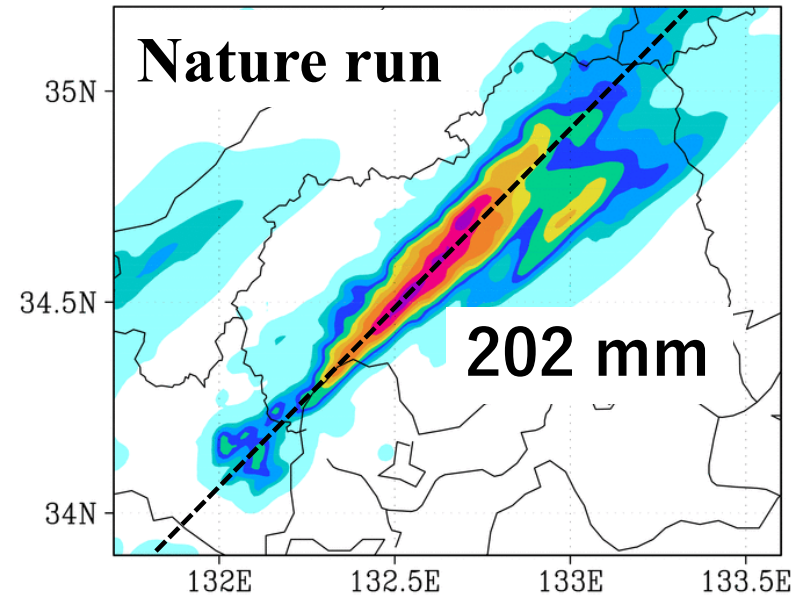
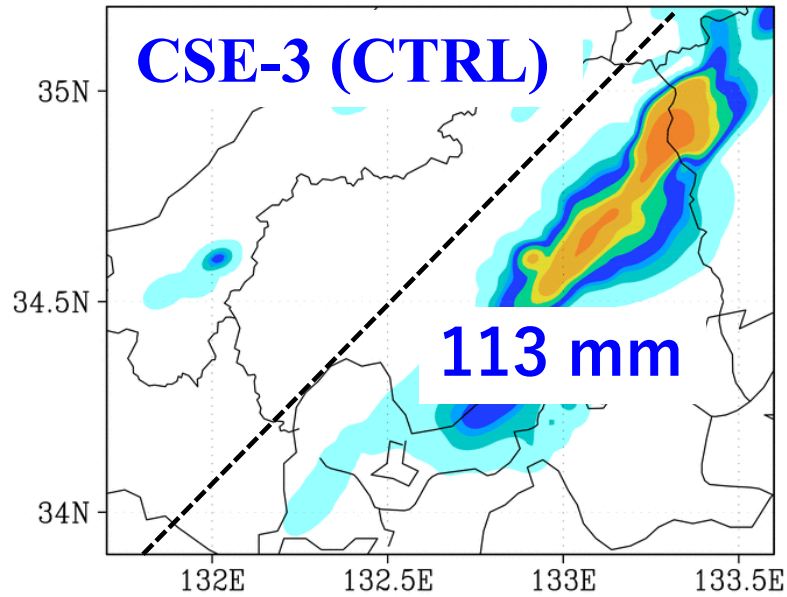
- The following experiments which perturbed only horizontal wind (U, V) were performed.

CSE-UV-All : Perturbed horizontal wind (UV) in all vertical layers.

CSE-UV-1000 : Perturbed UV under 1000-m level.

- For a reference, **CSE-3** is assumed as a control run (CTRL).

6-hour accumulated rainfall amount



Summary and further study

- By giving effective perturbations to the Nature run at each time step, we succeeded in controlling the amount and area of precipitation.
- If the perturbed vertical layers were limited, the impact on the amount and area of precipitation became small.
- To consider more realistic control, another CSE which focuses on the perturbations with a limited horizontal area will be performed.