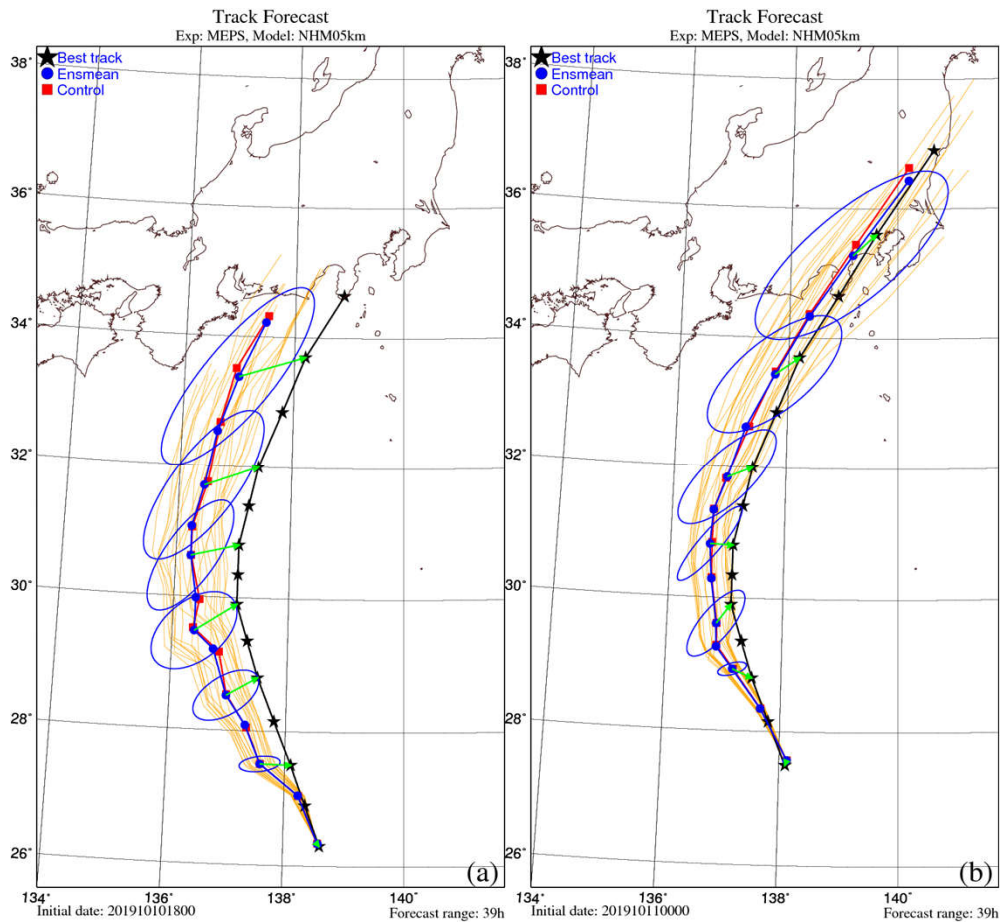


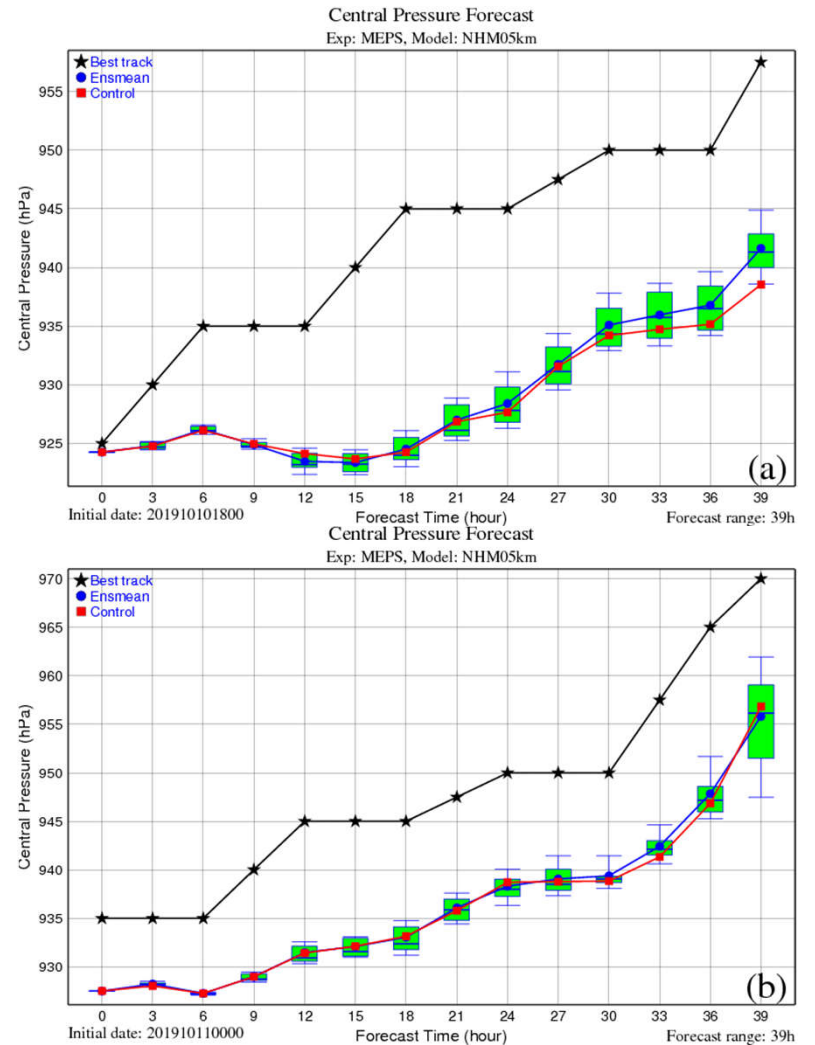
1000-member ensemble
forecasts for extreme
events: the 2019 typhoon
Hagibis and the July
2020 Kyushu heavy rain

Le Duc

The 2019 typhoon Hagibis and the operational forecasts



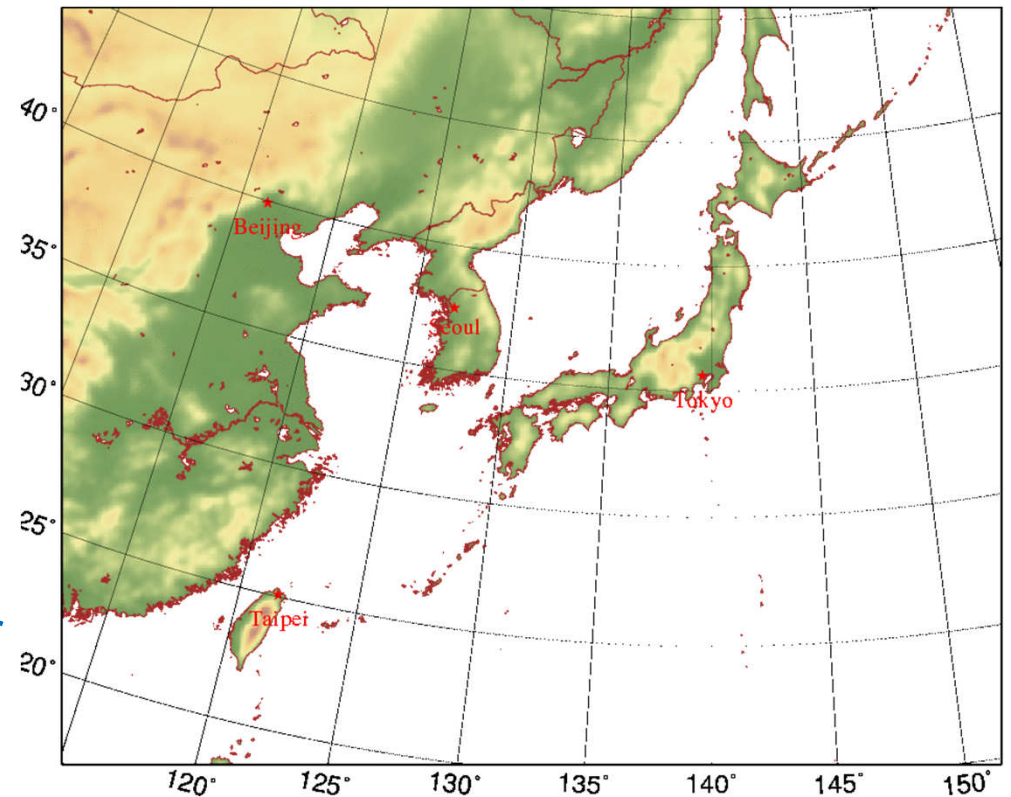
Trajectory forecasts



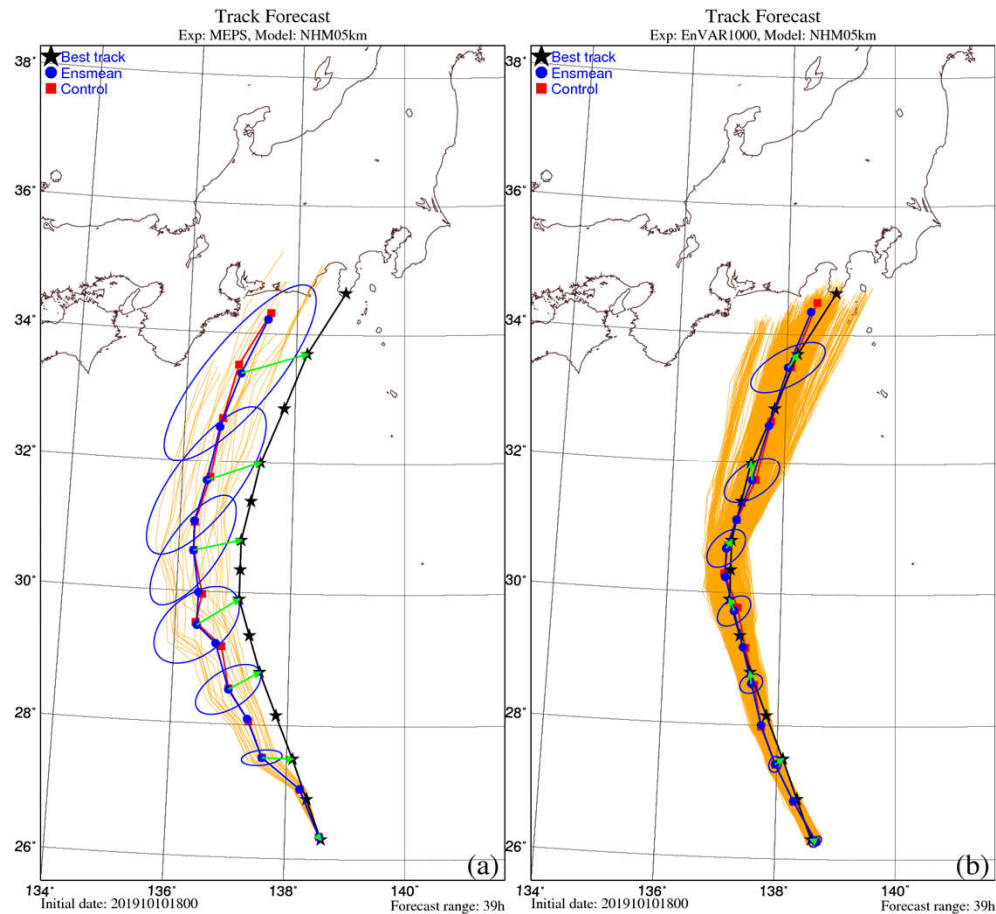
Intensity forecasts

Experimental settings

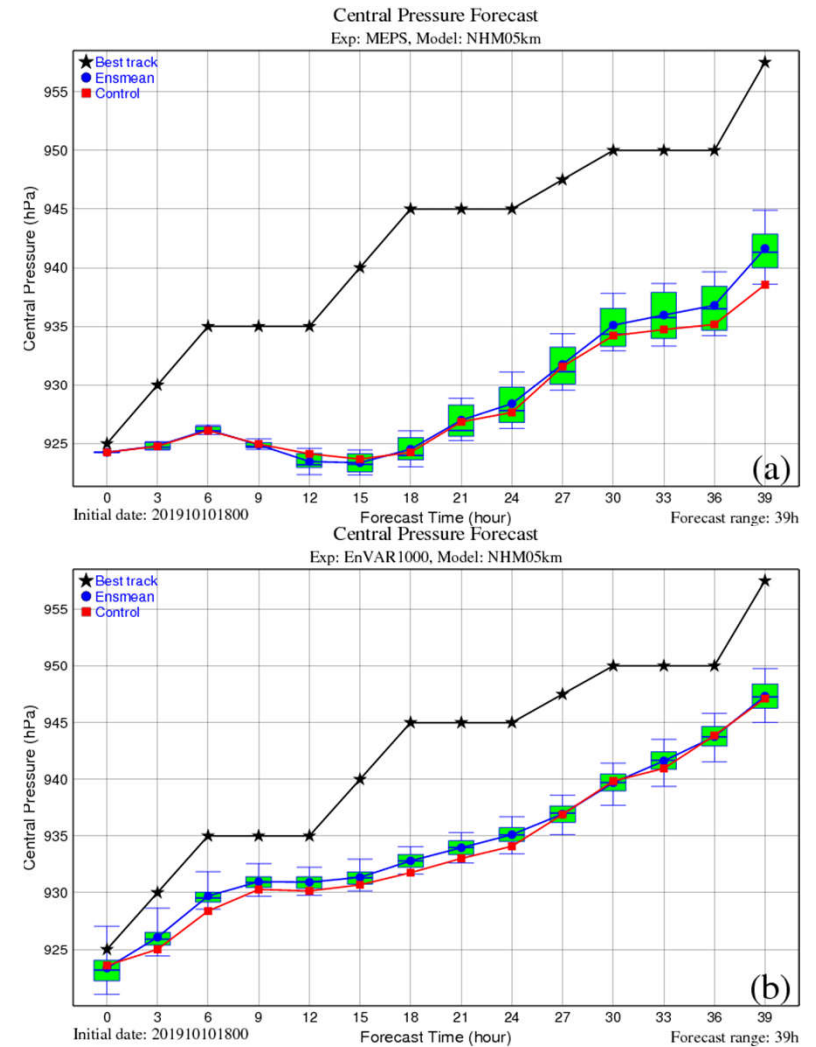
- Time: Oct 2019
- Assimilation methods: hybrid EnVAR without vertical localization
- Inflation: quadratic inflation functions
- Assimilation cycle: 3 hours
- Dual resolution: 5-15 km
- Ensemble: 1000 members
- Observations: every 30-min, conventional, GPS, Doppler radial winds
- Boundary conditions: GSM
- Extended forecasts: 5-km resolution



1000-member EnVAR forecasts started at 03 JST - 20191011

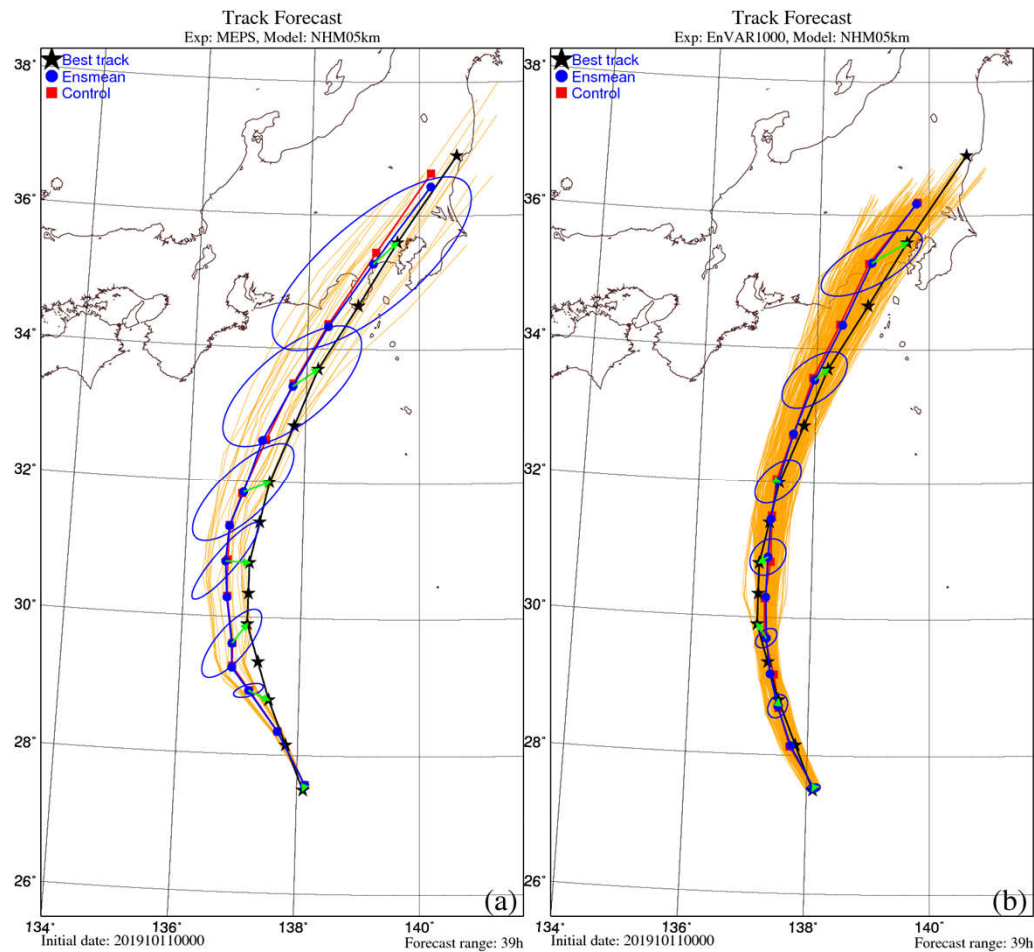


Trajectory forecasts

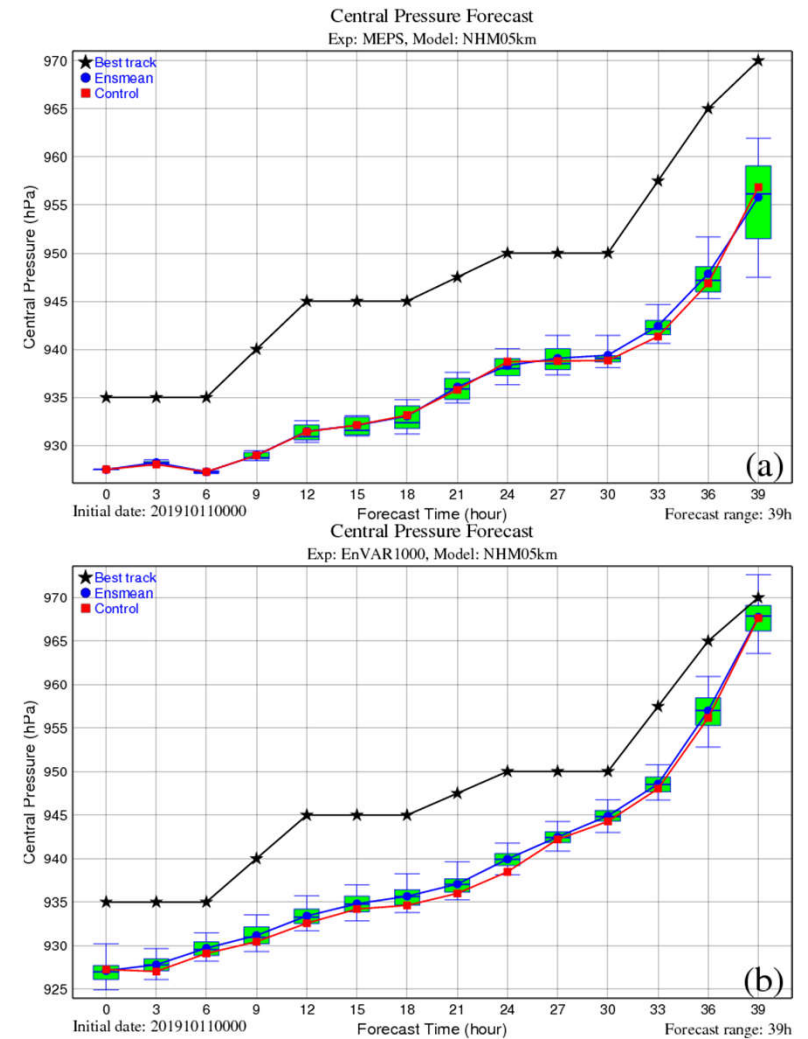


Intensity forecasts

1000-member EnVAR forecasts started at 09 JST - 20191011



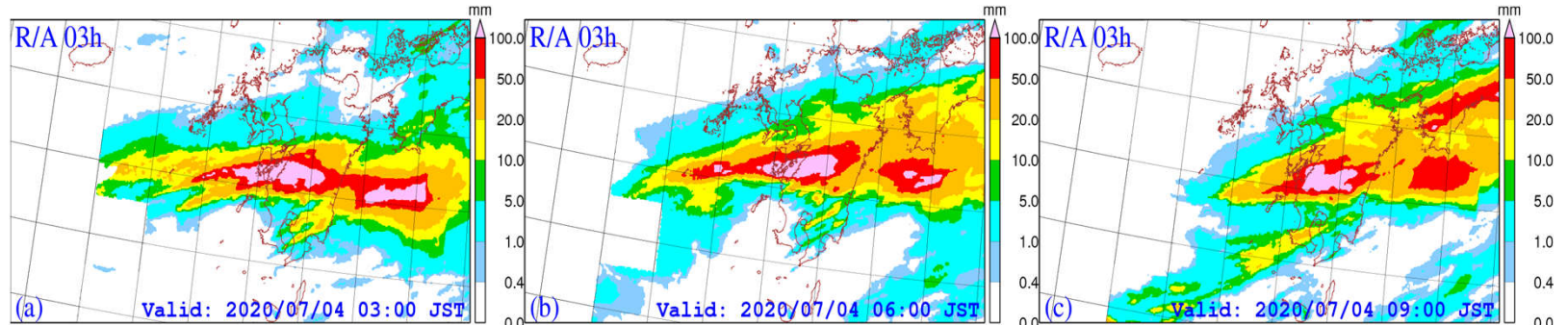
Trajectory forecasts



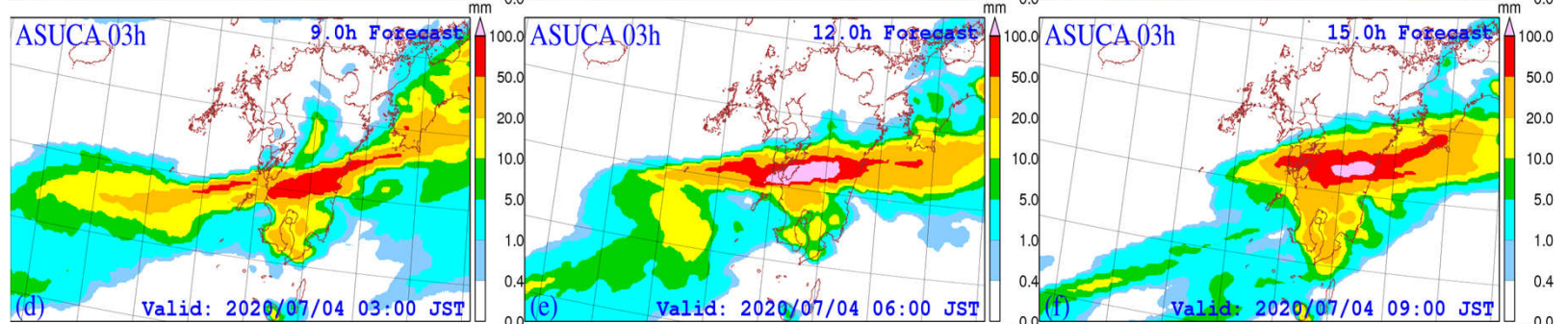
Intensity forecasts

The July 2020 Kyushu heavy rain and the operational forecasts

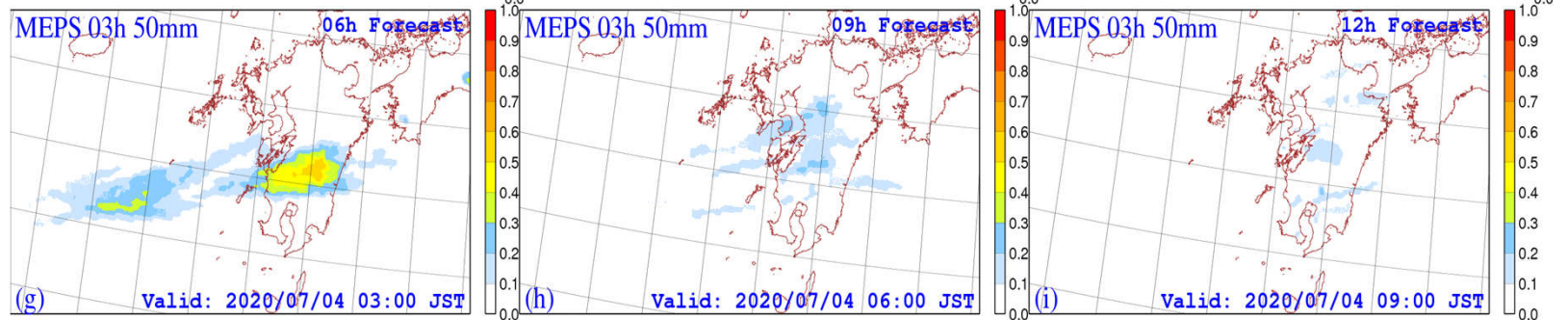
Observations



Deterministic forecasts

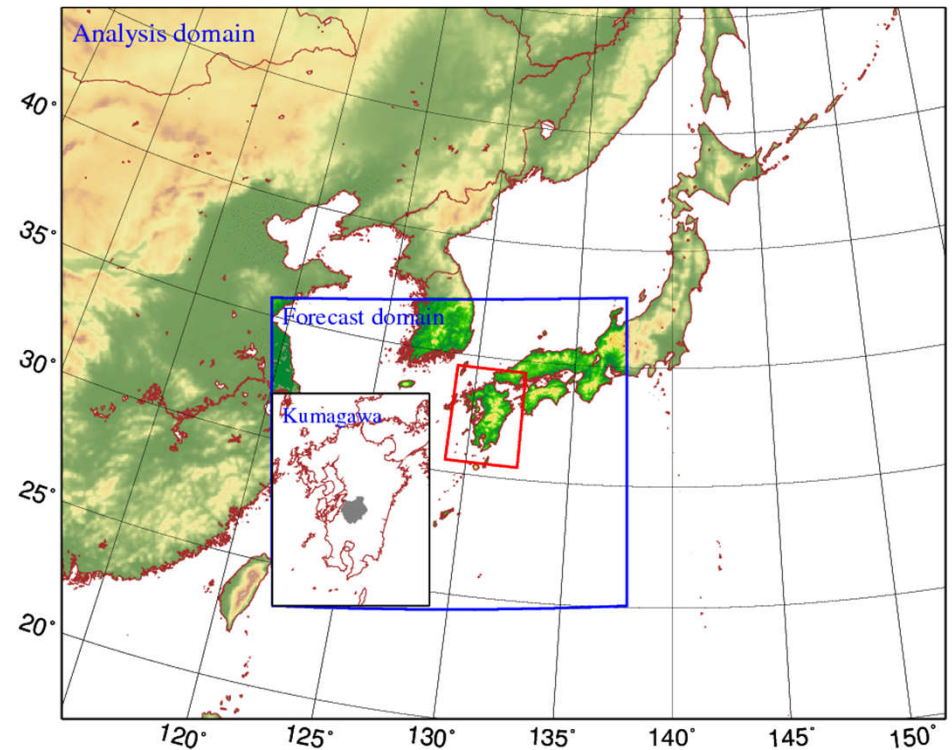


Probabilistic forecasts



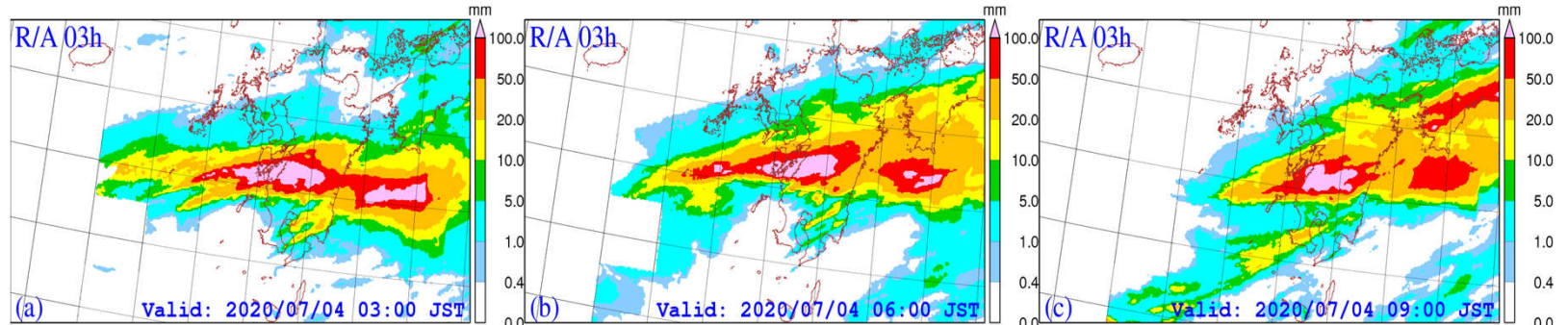
Experimental settings

- Time: July 2020
- Assimilation methods: LETKF without vertical localization
- Inflation: adaptive inflation functions
- Assimilation cycle: 3 hours
- Dual resolution: 5-15 km
- Ensemble: 1000 members
- Observations: every 30-min, conventional, GPS, Doppler radial winds
- Boundary conditions: GSM
- Extended forecasts: 2-km resolution

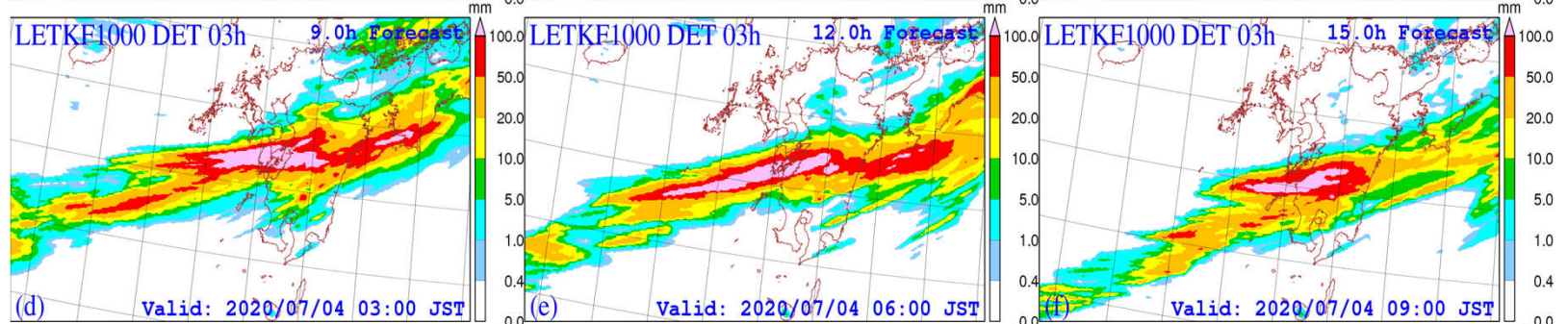


1000-member LETKF forecasts over Kyushu

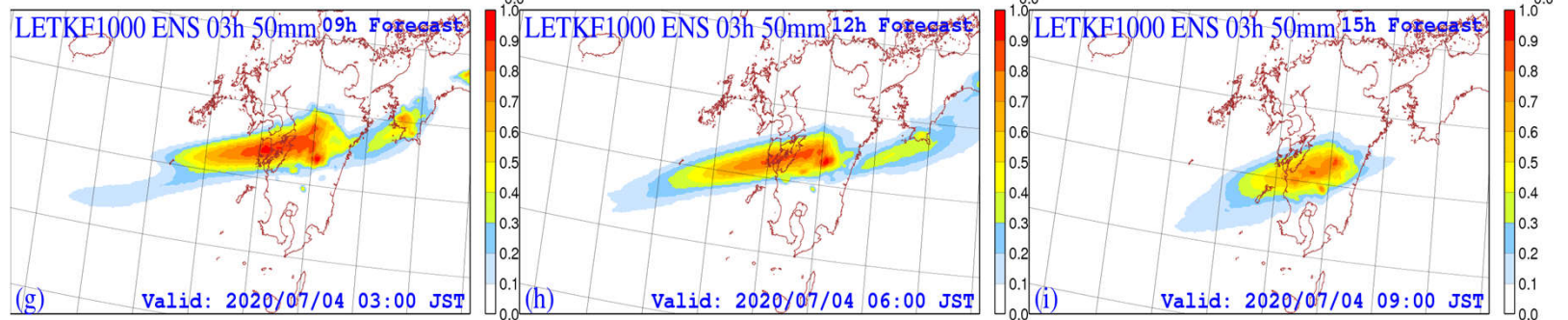
Observations



Deterministic forecasts



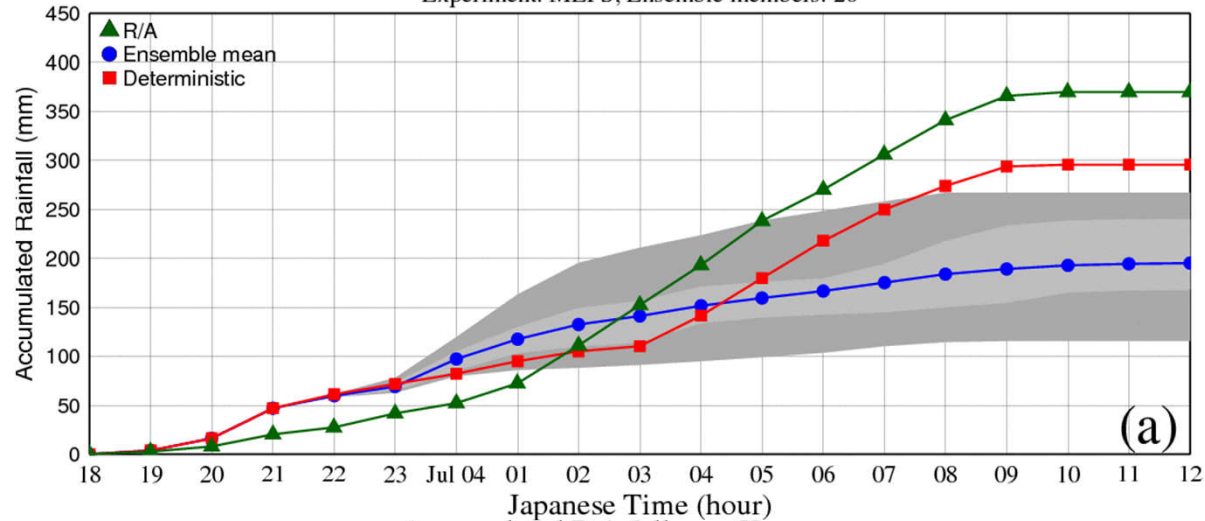
Probabilistic forecasts



1000-member LETKF forecasts over Kumagawa

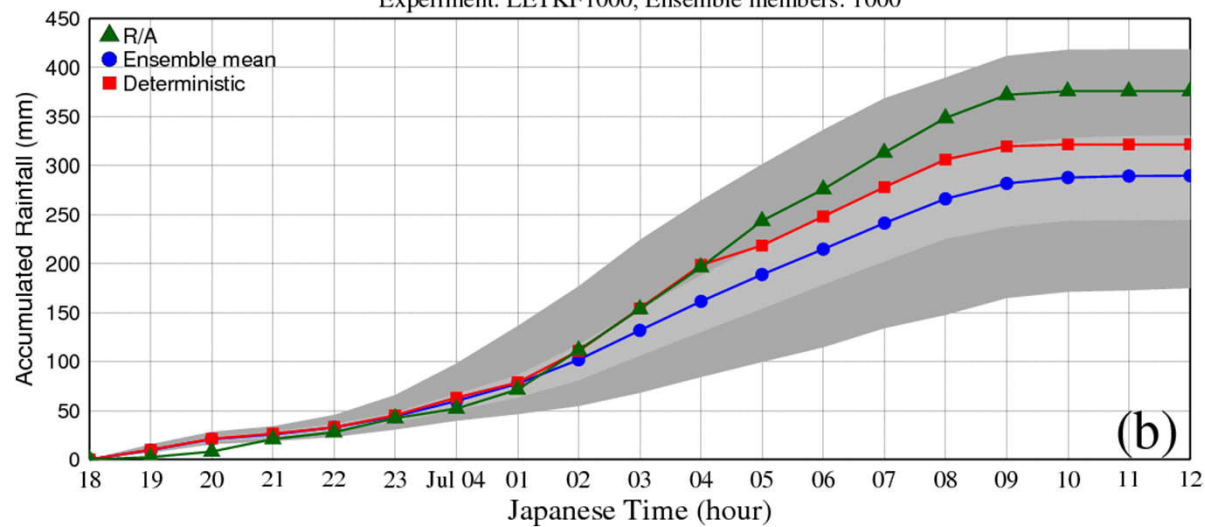
Accumulated Rainfall over Kumagawa

Experiment: MEPS; Ensemble members: 20



Accumulated Rainfall over Kumagawa

Experiment: LETKF1000; Ensemble members: 1000



Summary

- 1000-member data assimilation experiments and resulting 1000-member ensemble forecasts are performed for the 2019 typhoon Hagibis and the July 2020 Kyushu heavy rain.
- Forecast performances are improved considerably compared to the operational forecasts. The reason for such improvements can be contributed to removal of vertical localization in data assimilation.