3.5km Mesh Ensemble Simulations by NICAM-LETKF Assimilating GSMaP

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Purpose

In early July 2018, a high impact weather event including the record breaking rainfall and flood-related disaster occurred at western Japan. JAXA, RIKEN, and Univ. of Tokyo develop a data assimilation system of Local Ensemble Transform Kalman Filter (LETKF) (Terasaki and Miyoshi 2017, Kotsuki et al., 2017a,b) for the Nonhydrostatic ICosahedral Atmospheric Mode (NICAM) (Satoh et al., 2017). The current study explores predictability of the event by using higher-mesh and ensemble simulation.

NICAM-LETKF at JAXA Research Analysis (NEXRA)

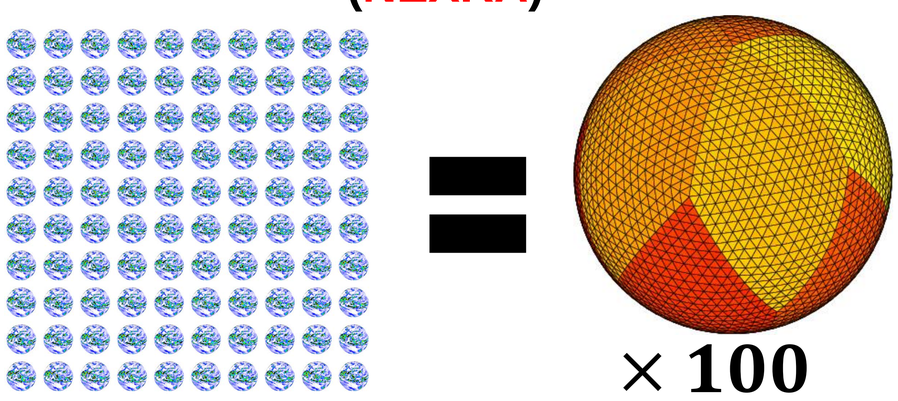


Figure. Concept of NEXRA. Precipitation is 100-member of NICAM simulation at 2017/07/01 00-24UTC (1 day)

Table. Descriptions of NEXRA

NICAM	
Spatial resolution	G-level 6 (~112 km)
Vertical resolution	38 layer (< 40 km)
Time step	450s
Cumulus parametrization	Arakawa and Schubert (1974)
Cloud microphysics	Large scale condensation

LETKF	
Algorithm	4D-LETKF (Hunt et al., 2007)
Assimilated/ external data	FNL SST/SIC PREPBUFR AMSU-A radiance GSMaP with gaussian transform.

Summary

We investigate predictability of the high impact weather event at early July 2018. Various (112/14/7/3.5 km) mesh simulations and 14-km mesh 100-member ensemble simulations are conducted. The deterministic forecasts tend to simulate northward representation, which may arise from uncertainty of analysis field. Some forecast of the 100-member ensemble forecast successfully simulate patterns of water vapor and precipitation. The difference in initial condition will be further investigated.

Observed spatial pattern of water vapor

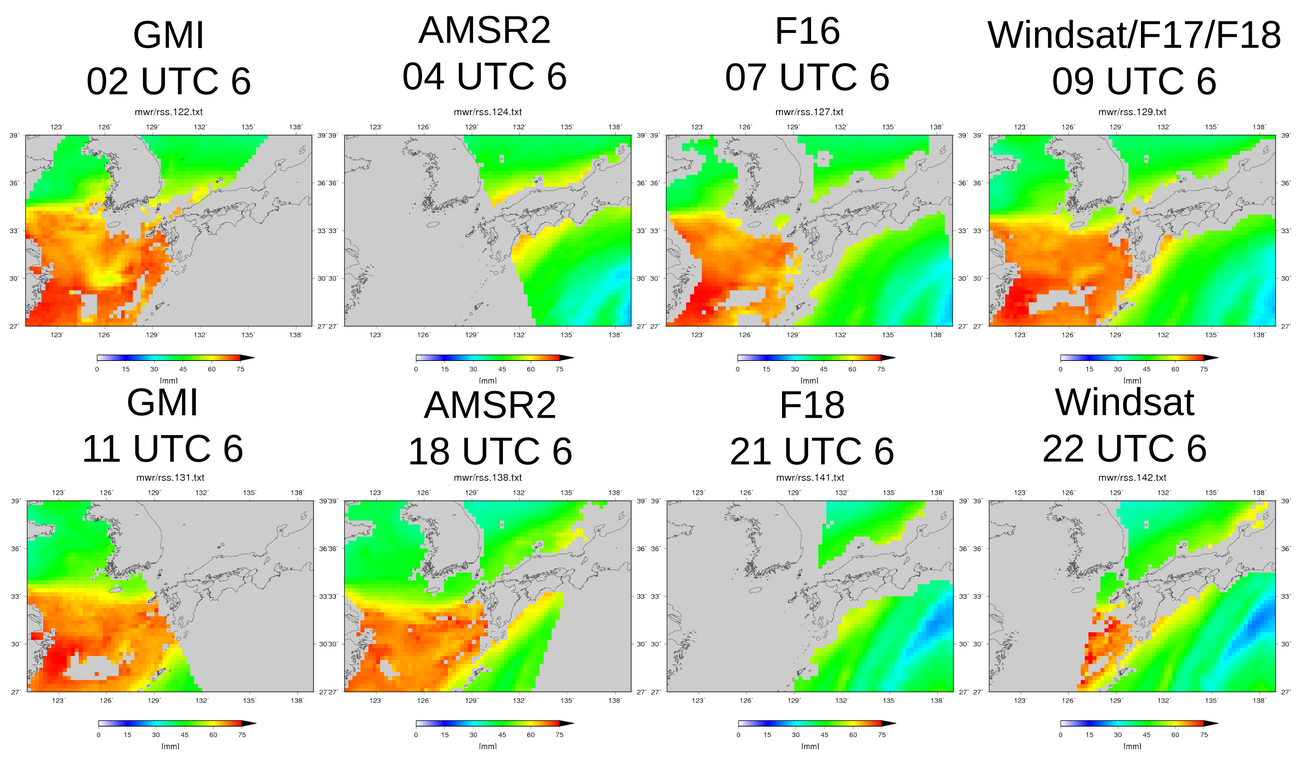


Figure. Hourly snapshot of column water vapor [mm] observed by various microwave imager. Data are provided by Remote sensing systems.

Deterministic forecasts

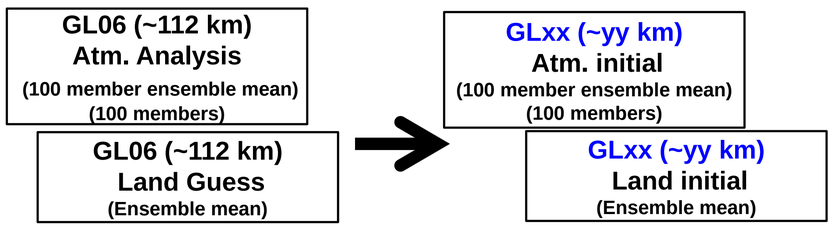


Figure. Re-grid from NEXRA analysis to initial condition for various mesh simulations

Table. Experimental design

Mesh	112km	14km/7km/3.5km
Cumulus convection	Prognostic A-S scheme	Not used
Cloud microphysics	Large scale condensation	Modified NSW6 (Roh and Satoh, 2014)

Radar-AMeDAS

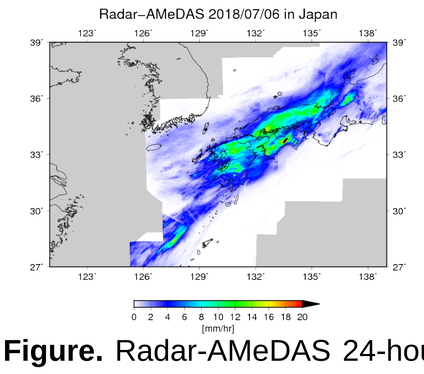


Figure. Radar-AMeDAS 24-hour averaged precipitation (mm/hr) during 00-24UTC 6, July.

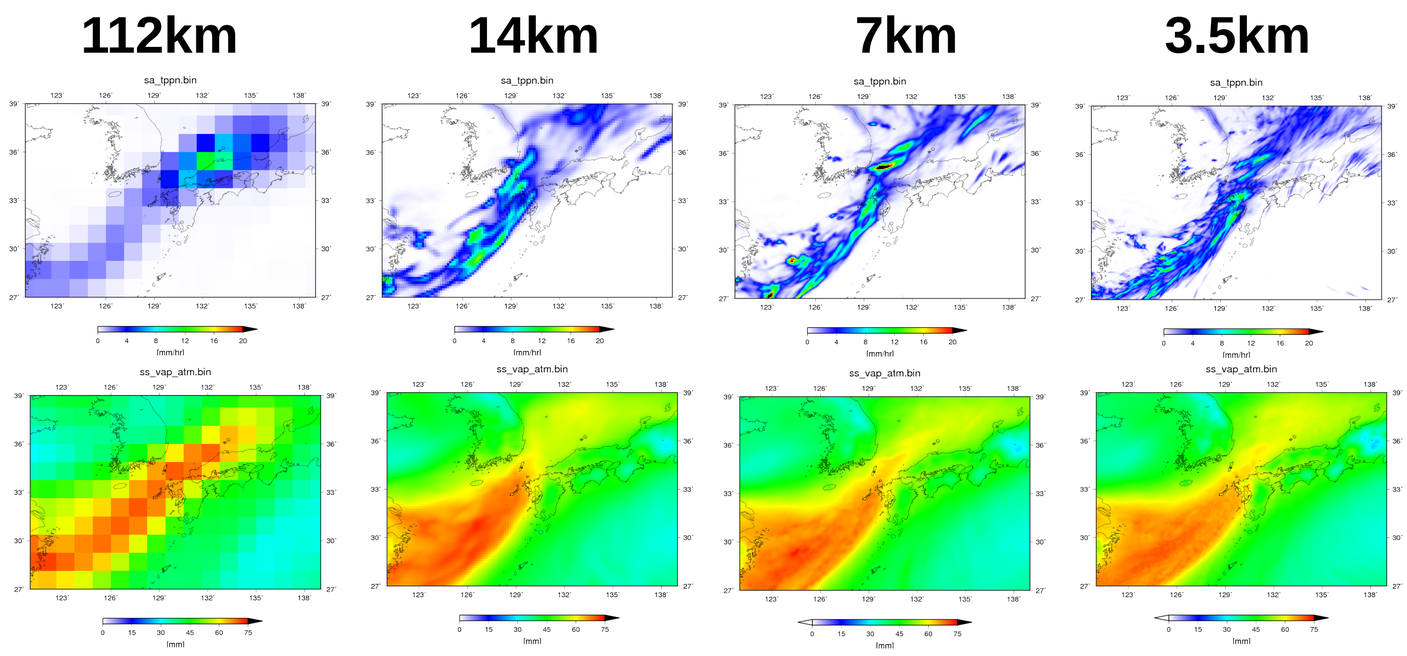
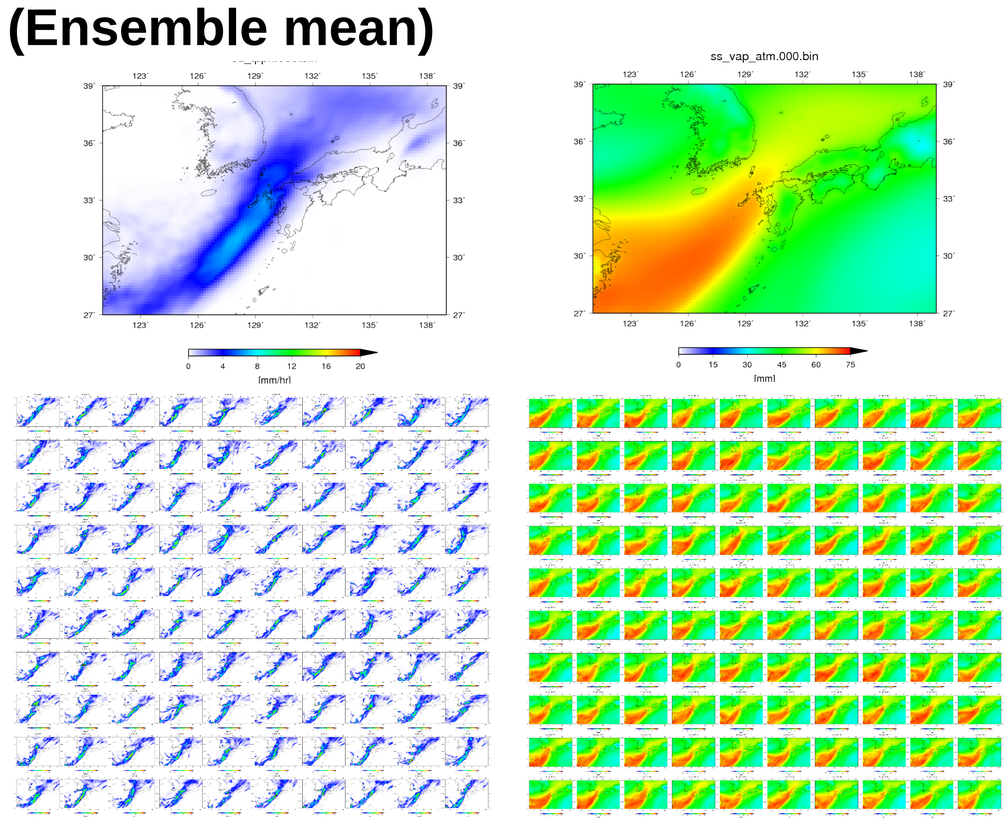


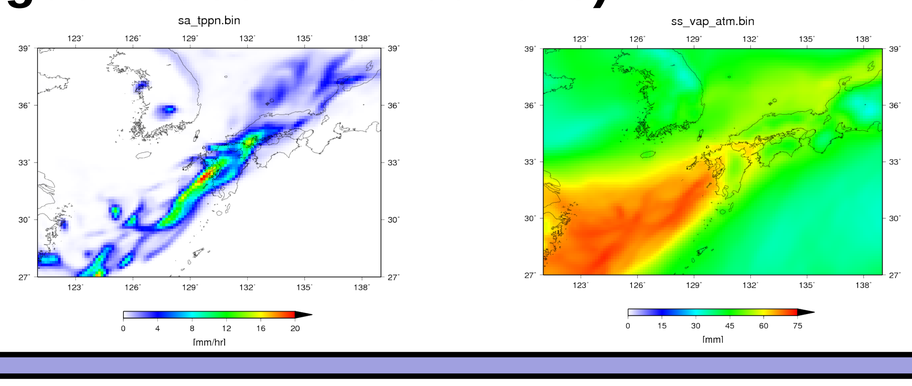
Figure. Various mesh simulations from analysis initialized at 00UTC 5 July, 2018. The results indicate 24-hour (00-24 UTC 6, July) averaged precipitation (mm/hr) (top) and column water vapor (mm) (bottom).

14-km mesh 100-member ensemble forecasts

(Ensemble mean)



(A good case: member 073)



References

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