Global and Regional EPSs in simulating extremely severe tropical cyclonic storm FANI in a unified modeling framework

Ashu Mamgain, Abhijit Sarkar

National Centre for Medium Range Weather Forecasting (NCMRWF),
Ministry of Earth Sciences, Government of India
A-50, Institutional Area Phase-2, Sector 62, Noida (U.P), India
(ashu.mamgain@gov.in)

The ensemble Prediction system in NCMRWF (called NEPS-G) at 12 km horizontal grid resolution has been running operationally since June 2018 with 22 perturbed members (Mamgain et al 2020a; 2020b). The model features 70 vertical levels ranging from the ground to the model lid at about 80 km above the surface. In the present NEPS-G, the 22 analysis perturbations are generated by Ensemble Transform Kalman Filter (ETKF) method. Perturbations of sea-surface temperature are included in the model perturbations. The model uncertainties are taken care by the Stochastic Kinetic Energy Backscatter (SKEB) and Stochastic Perturbed Tendencies (SPT) schemes. Ten days long forecast provided by NEPS-G at 00 UTC is the combination of 11 members from 00 UTC cycle and lagged 11 members from 12 UTC cycle.

The uncertainty that occurs in the limited area forecasts on both temporal and spatial scales can be represented by EPSs at a regional scale. A Short-range (0-75h) ensemble prediction system (EPS) in the NCMRWF (called NEPS-R; Prasad et al., 2019) is at convective scale (~4km) with 11 perturbed ensemble members. It has 80 vertical levels up to a height of 38.5 km. The model uncertainties are taken care of by Random Parameters (RP) scheme. NEPS-R is centering over the domain 62^{o} E-106^{o} E; 6^{o} S 41^{o} N. To understand the added value of NEPS-R, it is evaluated with respect to the 12-km NEPS-G for an extremely severe tropical cyclonic storm FANI. Day 1 to Day 3 Forecast with 11 perturbed members at 00 UTC from both the models has been considered here for this cyclone case. There is an ongoing study with more number of cyclone cases which will demonstrate the performance of both the models at different stages of cyclone development.

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References:

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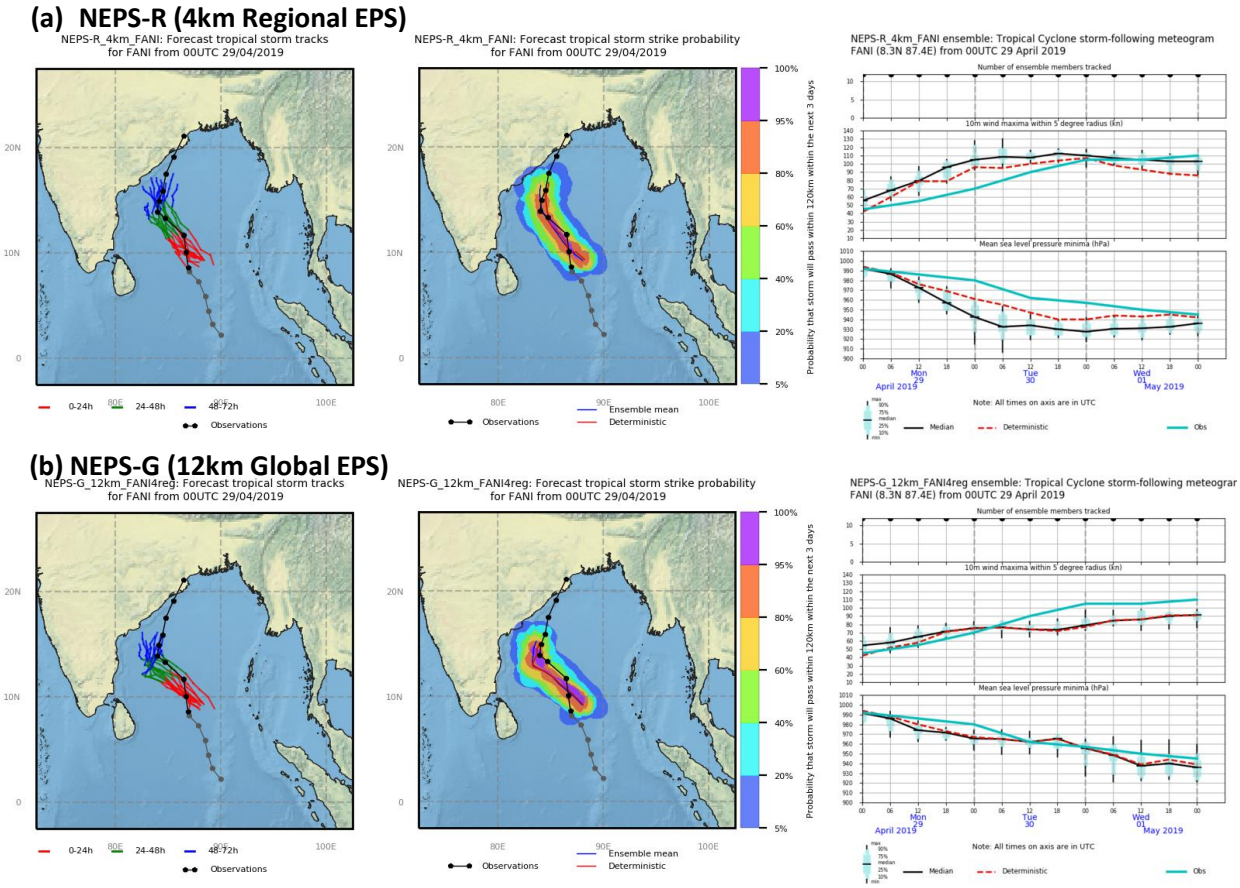

Figure 1. FANI intensified into an extremely severe cyclonic storm and reached its peak intensity on 2nd May 2019. The rapid intensification in wind speed has been nicely captured by NEPS-R as compared to NEPS-G as shown in storm following meteograms. However, NEPS-G performs better in initial stage of cyclone development

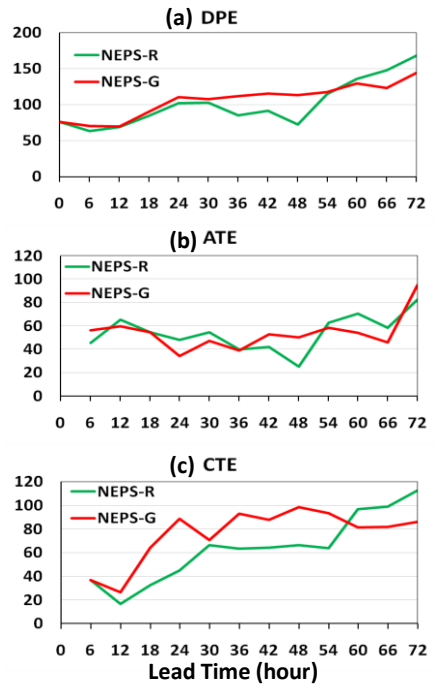

Figure 2. Variation of (a) Direct position error (DPE), (b) Along-track error (ATE), and (c) Cross-track error (CTE) of NEPS-G and NEPS-R with lead time for Fani averaged over 29th April to 2nd May 2019 are shown. DPE and CTE are lower in NEPS-R till 54 hours of the forecast

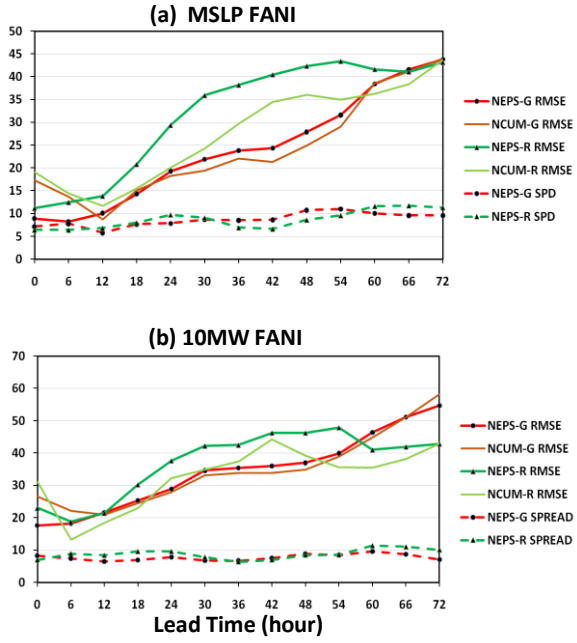

Figure 3. RMSE and Spread in (a) MSLP, and (b) 10m wind speed indicates that RMSE of both the variables are higher in case of NEPS-R whereas spreads in both the models are comparable. NCUM-R is the deterministic/control member of the regional model whereas NCUM-G is deterministic/control member of the global model.