

8th International Conference on Fog, Fog Collection and Dew  
Taipei, Taiwan, 14–19 July 2019  
IFDA2019-160  
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## **The recent improvement and progress in operational visibility forecast at NCEP**

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Fog/low visibility is a high impact weather to aviation, ocean and ground transportation but more difficult to predict than other types of weather due to its complexity in model physical parameterizations. Tremendous efforts in fog prediction have been made in the past decades, but most of them are focused on fog simulation instead of fog's operational forecast. An obvious hurdle for fog operational prediction is that the micro-physical scheme in the current operation models is not specific for fog but for high level clouds and precipitation. Fog is still not an official forecast guidance at National Centers for Environmental Prediction (NCEP) of NOAA. As a result, forecasters are just using low visibility as an agent to predict fog which is diagnosed from model post processor. The performance of low visibility forecast from various operational models at NCEP is still low, much lower than other predictions such as precipitation from the same models a decade ago ( Zhou, et al 2011). Since then a lot of efforts have been dedicated to improving the visibility operational forecast at NCEP, including continuous increase in model resolution, tuning of visibility algorithm in the post processor, and improvement in analysis and observational data for visibility verification. This paper will present a brief summary of the these efforts and how much the skill improvement has been achieved after these efforts: (1) the overall Equitable Threat Score (ETS) of low visibility (<1000m) forecast from various models at NCEP has been raised from 5% 10 years ago to currently 10% (2) NCEP's high resolution rapid refresh model HRRR (5km) is more skillful than its lower resolution rapid refresh model RAP (13km), (3) the ETS of low visibility forecast from HRRR already reach 30% which is at same level as precipitation forecast at NCEP, (4) the modified visibility algorithm is also credited for the improvement of visibility prediction.