Improving weather forecasting in the Philippines through WRF dynamical downscaling and data assimilation

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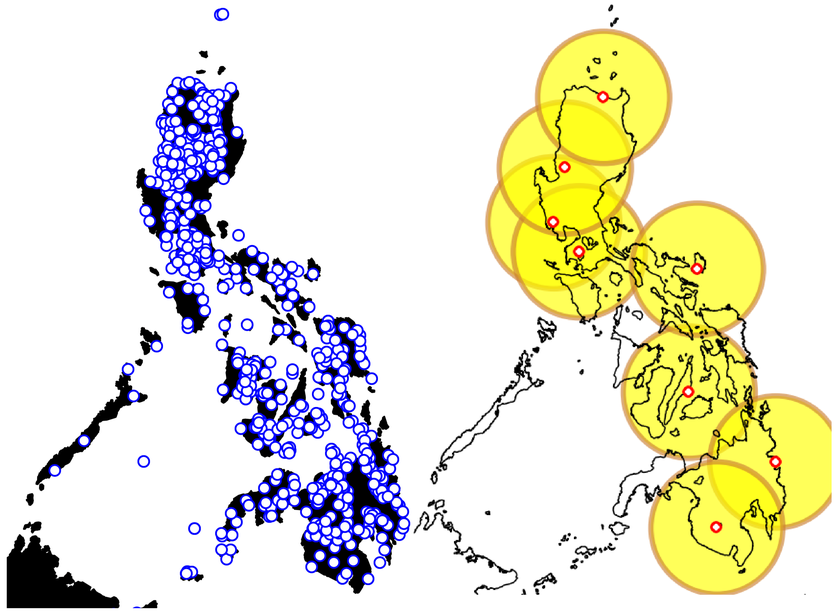
NOAH — WISE PROJECT

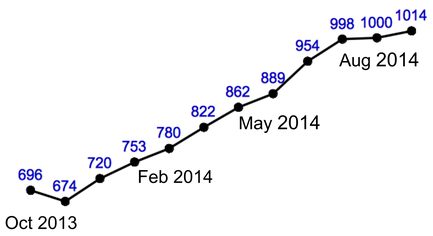
The Weather Information-integration for System Enhancement (WISE) Project is a multi-agency effort that aims to enhance numerical weather prediction through the use of Weather Research and Forecasting (WRF) model in:

1. Dynamical downscaling of global forecast system to 12-km and 4-km resolution over the Philippines
2. Sensitivity testing of microphysics, cumulus parameterization, and initial and boundary conditions
3. Data assimilation of surface measurements, Doppler radar reflectivity and velocity, and satellite radiances

Metrics for objective forecast verification are used to evaluate the performance skills of the model.

INVESTMENT ON RADARS AND GROUND SENSORS

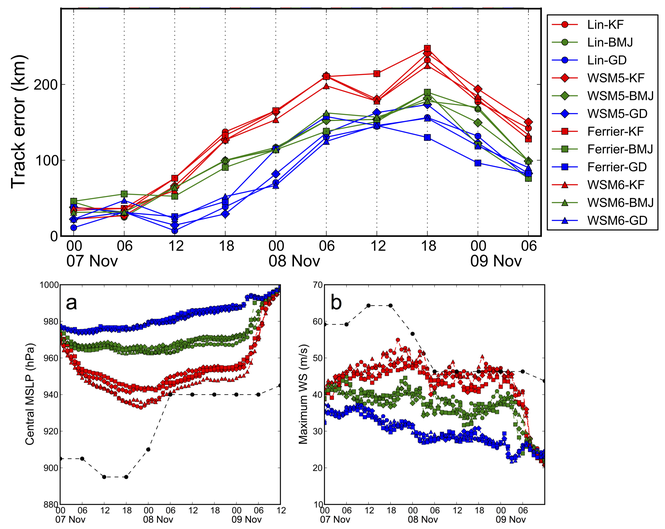




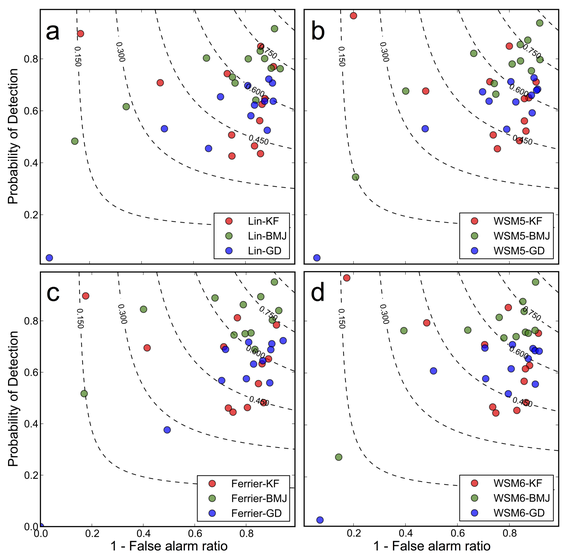
(Upper left) Locations of automatic weather stations (AWS) and rain gauges; (upper right) locations of Doppler radars; (left) evolution of the number of AWS deployed over the Philippines

Increased investment of the Philippine government on weather sensors for wider weather monitoring and forecasting.

SENSITIVITY TESTING: TC HAIYAN CASE



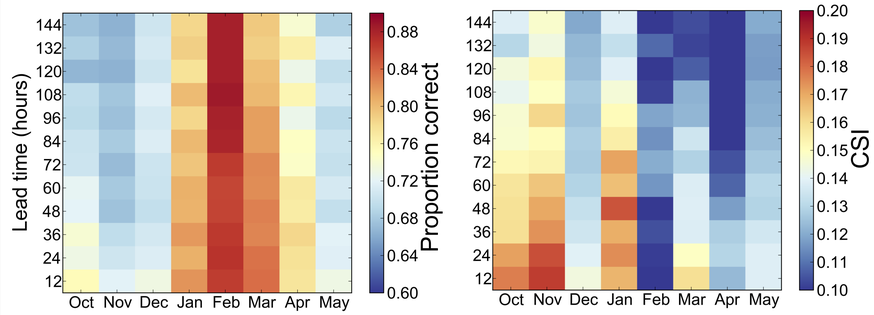
Grell-Devenji (GD: blue) cumulus physics scheme produced least track errors while Kain-Fritsch (KF: red) provided the best forecast for the intensity of TC Haiyan (both for central pressure and maximum winds.

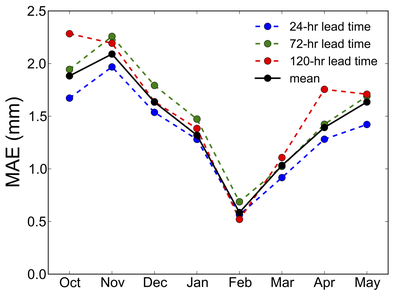


Betts-Miller-Janjic (BMJ: green dots) closely estimated the rainfall brought by Haiyan as indicated by the data points being closer to the upper right corner.

Microphysics schemes (Lin, WSM5, WSM6 and Ferrier) had a small impact on the performance of WRF model.

WRF PERFORMANCE OVER THE PHILIPPINES



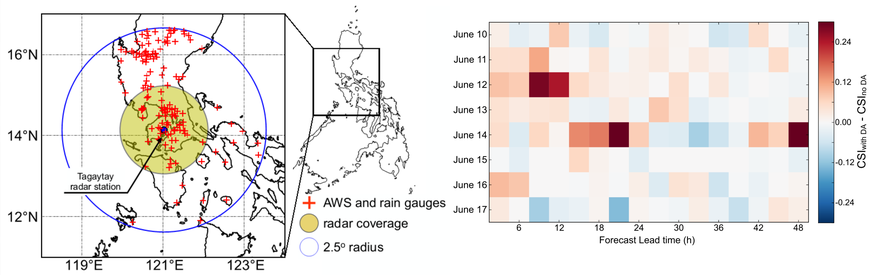


Wet season (Oct, Nov and Dec): PC ~ 0.7
Dry season (Jan, Feb, Mar): PC ~ 0.9

The increase in performance is attributed to the **increase in number of correct negatives** during the dry season. **CSI drastically decline in December** or during the transition from wet to dry season.

The predictability of actual rainfall values increases during dry season.

IMPACT OF DATA ASSIMILATION



Improvement on WRF rainfall prediction by assimilating radar reflectivity and velocity with mostly positive critical success index (CSI) anomaly based on 8 numerical experiments initialized on June 10 - 17, 2014 at 12UTC.

FUTURE EFFORTS

- Assessment of the impact of data assimilation, particularly that of MODIS calibrated radiances, brightness temperature and cloud products
- Greater utilization of satellite data for the evaluation of forecast performance
- Multi-model comparison and ensemble forecasting

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