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Interactive comment on "Assimilation of Himawari-8 Imager Radiance Data with the WRF-3DVAR system for the prediction of Typhoon Soulder" *by* Dongmei Xu et al.

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Reply to reviewer 2

This paper studies the effect of assimilating satellite observations on the prediction of typhoon. The predictions are made with WRF model, and initialization is performed by its 3D-VAR system. The technique is not new but the claim of novelty is that the system incorporates the newest data from a geostationary (in contrast to polar-orbiting) satellite, namely Himawari-8. Improvements in the predicted track and intensity of typhoon Soudelor are found with the assimilation of the satellite data. This is a timely study with potentially useful results. Nevertheless, clarifications are needed on some

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Discussion paper

of the technical details:

(1) The conclusion of this work relies on a small number of runs without exploring the dependence of the prediction on tunable parameters in WRF-3DVAR, for example those for the spatial correlation length and the scale of background variance. Previous studies have shown that the predictions of typhoon/hurricane tracks depend on those parameters (Xu et al. 2019, Meteorol. Appl., doi:10.1002/met.1820; Chou and Huang 2011, Adv. Meteorology, doi:10.1155/2011/803593). If this study just uses the default setting of those parameters, it would be useful to provide justifications or demonstrate that the results are robust with respect to tuning of the parameters. ———————— Reply: Thanks for the pointing it out. The sentences are added as "The length scale and the variance scale are set to be 0.5 and 1 respectively after several sensitivity experiments conducted on tuning the background error. Similar conclusions are also found in Shen and Min (2015) with the scale factors related to the static background error covariance." to make it clear.

(2) Since only clear-sky data is assimilated, one would guess that most of the satellite data over the cloudy area surrounding the core of typhoon are rejected. Yet, from Figs. 10(a) and 10(b) it appears that some distinctive small-scale structures (e.g., multiple spiral bands of high humidity) are created over the vortex core of the typhoon after the assimilation of satellite data. Are those structures artificial (e.g., due to numerical schemes of the model) rather than a realistic effect of assimilation of satellite observation? Related to this, it would also be interesting to compare the detail of the wind field near the center of the typhoon, but the vectors in Fig. 10 are hard to read. It would be useful to modify the figure to improve clarity. ———————— Reply: We agreed that most of the AHI clear-sky radiance data over the typhoon core area are rejected. However, the environment can be adjusted to some extent with the obtained observations. The model status in the cloudy area will also be modified with the spatial correlation in the background error covariance. The similar findings for small-scale information in the cloudy area can also be referred in Wang et al., (2018). Fig. 10 is

also replotted to improve the clarity. Related explanations are also added as “It should be pointed out that the model status in the cloudy area are modified due to the spatial correlation in the background error covariance. The similar findings for small-scale information in the cloudy area can also be referred in Wang et al., (2018).”

(3) Figure 11(a), which shows the key result for typhoon tracks, is hard to read. The 3 tracks all look like solid lines that it is not possible to identify which is which. There seems to be random drawings in the background but it is not clear what they are (continental boundaries?) The labeling at left for the ordinate is cut off. Also, only one set of predictions is shown. What about other predictions made at different initial times? Do they exhibit similar behaviors? [This is also related to the comment in (1) concerning the robustness of results, given the small number of runs.] ——————————
— Reply: Thanks for the helpful advice. We replotted the tracks with colorful lines in the revised manuscript. The random drawings in the background is also removed. The labeling at left is also kept. The forecast from 0000 UTC 02 August 2015 is also added for the track in Figure 12a. The forecast ranges are extended from 18 hours to 48 hours. In addition, the mean track errors, maximum surface wind speed error, and the minimum sea level pressure error are also calculated for two forecasts initialized at 0000 UTC and 0600 UTC presented in Figure 12c, and Figure 13.

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