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Interactive comment on “Impact of ozone observations on the structure of a tropical cyclone using coupled atmosphere–chemistry data assimilation” by S. Lim et al.

S. Lim et al.

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General Comments:

An ensemble-based data assimilation, the maximum likelihood ensemble filter (MLEF) is employed and interfaced with the WRF-Chem to investigate the impact of ozone (O₃) assimilation on the structure of a tropical cyclone (TC). The results show that the O₃ assimilation has a notable impact on the analyses of other chemical variables (e.g., NO₂ and SO₂) as well as O₃ itself, and atmospheric variables (e.g., wind, temperature and specific humidity), especially near the TC case considered.

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Please indicate in some detail: a) How was the coupling between MLEF and WRF-Chem implemented?; b) Please highlight the impact of including/excluding MLEF had on final result; c) Please highlight where in the WRF-Chem package is ozone taken into account.

Apart from these minor issues, this is a well-written and presented ms and I recommend publication once the minor comments are addressed.

⇒ *We appreciate the positive comments by the Referee #2 along with valuable suggestions. In the following, we have provided an item-by-item reply to the referee's comments.*

a) How was the coupling between MLEF and WRF-Chem implemented?

⇒ *The coupling between the MLEF and WRF-Chem is done through an interface module that transforms the MLEF control variables into a WRF-Chem `netcdf` file, and vice versa. This interface module is a component of MLEF, and thus the WRF-Chem is not altered.*

b) Please highlight the impact of including/excluding MLEF had on final result.

⇒ *The impact of including/excluding MLEF on the final result has been described in detail in Section 3. In overview, the ozone observations had an impact on ozone analysis, as expected. The important new impact of ozone observations, enabled through the use of ensemble-based forecast error covariance, includes changes in the initial conditions of dynamical variables, such as wind and temperature, and to some extent moisture. More specific impacts of including MLEF assimilation of O_3 are discussed in Figs. 4 and 5 in detail – changes of chemical variables in Fig. 4 and changes of atmospheric variables in Fig. 5, respectively.*

c) Please highlight where in the WRF-Chem package is ozone taken into account.

⇒ *The WRF-Chem chemistry package is chosen in the `namelist.input` as a standard option #6 (CBMZ). This chemistry package includes the prediction of ozone and several other chemical constituents. Since the control variable list in the MLEF includes the ozone, it makes possible adjustment of ozone initial conditions in data assimilation.*

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