

Interactive comment on “Does afforestation deteriorate haze pollution in Beijing–Tianjin–Hebei (BTH), China?” by Xin Long et al.

Anonymous Referee #3

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review to "Does afforestation deteriorate haze pollution in Beijing-Tianjin-Hebei (BTH), China?" by Xin Long et al., MS No.: acp-2017-1239

This is a study of numerical test for model WRF-Chem. Five cases were simulated: (1) the basic case of real land cover in 2013; (2) the case with land cover of 2001; (3) the case with total afforestation; (4) the case with total deforestation; (5) the case with the so called "ventilation corridors" for Beijing. Real emission inventory was used. Results of air pollutants, mainly the PM_{2.5} concentration, were displayed to show the influence of land cover change.

The major logic of this paper is: afforestation increases surface roughness, then decrease the wind speed, and then in turn, increase the haze concentration. The numerical experiments support this inference, and give quantitative results, although it is not

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significant for the formation of heavy haze in BTH area.

There is a basic problem in above inferring chain. Afforestation increases surface roughness may be true for flat terrain. But in this study of BTH area, afforestation is mainly over mountains (Taihang and Yanshan Mountains). Large uncertainty still exists in parameterization of air - land interaction over complex terrain. In addition to the effect of vegetation, drag of subgrid features of topography should be considered (Jimenez and Dudhia, 2012). Therefore, effect of any change only in land cover (vegetation) may be well within the range of WRF model uncertainty. This paper presents a 6% PM_{2.5} concentration change for the cases before/after afforestation. It can be regarded as a sensitivity test of the model, rather than a reliable result.

(Reference: Jimenez PA, Dudhia J, 2012, Improving the representation of resolved and unresolved topographic effects on surface wind in the WRF model, Journal of Applied Meteorology & Climatology, 51(2): 300-316.)

My other concerns to this work are:

- 1) MODIS land cover data, MCD12Q1, was assimilated to the WRF-Chem system. The model performance before and after the data assimilation should be provided.
- 2) The performance of WRF on representing real meteorological data should be checked, in BTH area.
- 3) About the simulation case for "ventilation corridors", the width of the corridors is 6km, the horizontal resolution of the model is also 6km. It is hard to resolve this fine structure for the model.
- 4) How to calculate the wind field difference? Why there is the largest difference of wind in Beijing between the year 2013 and 2001? (Figure 5)

Additional points are:

- 1) Correspondent to Figure 4, a map of PM source emission is needed.

2)Page 3: "afforestation is beneficial for the atmosphere to remove O₃, NO_x, SO₂, and PM_{2.5} through the dry deposition process (Zhang et al., 2015; 2017; Huang et al., 2016). Hence, a large artificial ventilation corridor system has been proposed, highly anticipated to ventilate Beijing (China forestry network, 2014, 2016b, c), but why in your corridor experiment the deforestation is used? (Page 12: " In the corridors, the barren surface with SF_{z0} of 0.01 m is used to replace other land cover categories")

4)Page 4, line 90: " The accuracy of the IGBP layer of MCD12Q1 is estimated to be 72.3-77.4% globally", what about the accuracy in BTH area?

5) Eq (5), G_f should be G_T?

6)Page 9, line 211: "The good agreements of the simulated mass concentrations of air pollutants with observations at monitoring sites in BTH show that the emission inventory used in present study and simulated wind fields are generally reasonable". Probably, but not sure. WRF is known for its overestimate of surface wind speeds, which is of importance for air pollution modelling. Here the "good agreements" of haze simulation may imply that other errors in the model have compensated this deficiency.

7) Figure 3, details about the comparison. How the modelled concentration being calculated to compare to the observation? Using the nearest grid point to the observation site?

8)Page 9, line 228-232, "The SF_{z0} change is highly correlated with the forest LCF change, with a correlation coefficient of 0.91, indicating that the afforestation is the most important factor for the increase in the SF_{z0} in BTH." This is just expected results! Need not to be "indicating".

9)Page 10, line 234, "The prevailing wind is decelerated...", what do prevailing wind mean here?

10)Page 10, 239, " The PM_{2.5} enhancement in Beijing is the most evident, corresponding to the rapid growth of forests in the west and in/on the north of Beijing". This

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is doubtful. How can the air pollution so sensitive to local change of land cover?

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