

Interactive comment on “Measurement Report: Aircraft Observations of Ozone, Nitrogen Oxides, and Volatile Organic Compounds over Hebei Province, China” by Sarah E. Benish et al.

Anonymous Referee #1

Received and published: 15 July 2020

Review of “Measurement Report: Aircraft Observations of Ozone, Nitrogen Oxides, and Volatile Organic Compounds over Hebei Province, China”

A critical evaluation and assessment of what worked and what did not during the ARIAs campaign is missing in the present manuscript.

CO /CO₂ ratio: How do the measurements of CO / CO₂ compare to ground based measurements in urban centers of China? How do the CO / CO₂ of the ARIAs study compare to measurements on other continents where pollution control measures have led to decreasing CO / CO₂ ratios over time? How do the CO / CO₂ ratios in plumes that are associated with biomass burning (Fig. 5a) compare to studies of biomass burn-

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ing emission ratios? How many flights showed evidence of biomass burning emissions such as from past harvest residue burns?

Hydrocarbon profiles: How do the hydrocarbon values and their enhancement ratios to CO measured during ARIAs compare to ground based measurements in metropolitan areas of China, Europe or the US? How do they compare to biomass burning profiles?

Fig. 4: How many vertical profiles were flown over each of the four cities? The uniformly high NO_y values from 0 to 3 km altitude over 3 of the cities are puzzling. In particular the uniformly high NO_y values above 2300 m are in contrast to cleaner conditions at these altitudes as indicated by the CO mixing ratios. In contrast, over the home airport near Shijiazhuang the NO_y measurements show a much wider range of mixing ratios throughout the altitude range of the flights. How consistent were the NO_y measurements throughout the deployment?

The instantaneous O₃ production rate and the VOC or NO_x limitation: As intense city or power plant plumes age and mixing with the surrounding air during transport, the photochemical ozone production tends to transition from being more VOC to more NO_x limited. To capture these transitions and adjustments with a photochemical box model is challenging and is not captured by running the box model simply for 3 days as done in the present paper (line 143). How was the photochemical box model run for the present study? Were the *j*-values held constant or was their diurnal cycle taken into account?

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2020-194>, 2020.

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