Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2019-968-AC2, 2020
© Author(s) 2020. This work is distributed under
the Creative Commons Attribution 4.0 License.

Atmospheric Chemistry and Physics Discussions

Interactive comment on "New eastern China agricultural burning fire emission inventory and trends analysis from combined geostationary (Himawari-8) and polar-orbiting (VIIRS-IM) fire radiative power products" *by* Tianran Zhang et al.

Tianran Zhang et al.

tianran.zhang@kcl.ac.uk

Received and published: 6 May 2020

Response to Referee # 2

Response: The referee has raised some concern about the issue of data aggregation to 0.1-degree resolution, which we believe we have dealt with very carefully in the paper. Below are our responses to each detailed comment provided by the referee:

(1) The authors declared that they could capture the small crop fires well happened in Eastern China, however, as we know, the fire size is often less than 100 by 100 square meters. They aggregated the fire data to 0.1-degree resolution, which is too large and not comparable with the actually existing fires. The question on small fires seem not be addressed in this manuscript.

Response:

The authors are fully aware that the Chinese agricultural lands are small and that the residue fires are also therefore small, often far less than the 100 100 m as the reviewer suggests. This is the reason we are using VIIRS-IM FRP data, which is based on 375 m pixels, rather than MODIS with its 1 km pixels. Active fire detection algorithms can identify fires covering only 0.0001 of a pixel area, and the smaller VIIRS pixels thus enable us to detect fires down to around 5 m^2 at night and perhaps down to around twice that by day (see Zhang et al., 2017 for details). Below we show a figure with VIIRS and MODIS fire pixel footprint sizes overlain on Google Earth for 11th June 2015 – and this highlights the advantage of the smaller pixel area of VIIRS. What we are doing is detecting the active fires at the full resolution of VIIRS, thus enabling us to capture even the small fires, and then aggregating the FRP from all of these fires detected in each 0.1-degree grid cell. So each grid cell represents the total FRP coming from all fires detected within it at the particular overpass time.

(2) Please compare your results with those from the inversions modelling or the forward simulations to check if your data are reliable. E.g., Table 2 in Cao et al. (Atmos. Chem. Phys., 18, 15017–15046, 2018), Li et al.(ATMOSPHERIC ENVIRONMENT, 92, 442-448, 2014).

The authors are struggling to compare our inventory data to Cao's et al 2018 modelling results or Li's et al. 2014 atmospheric species' concentration results. Below summarises our best effort comparison:

The measurements of NMVOC emission factors for different crop residues in China was not target for this study. To estimate NMVOC emissions, first we found GFAS uses a generic emission factor of 9.9g/kg for NMHC emitted from agricultural fires. When applying this to our data, we got an estimated yearly NMHC emission in Eastern China of 106-188 Gg in 2012-2015. Jain et al., 2014 suggested that the total emitted NMVOC from India is around 1.46 Mt while total NMHC is around 0.65 Mt. We can get a rough ratio of 2.25 for NMVOC/NMHC. If we assume Eastern China contribute a quarter of total agricultural burning to whole China, according to the publications we cited in Table 2, the total NMVOC emission is 0.96-1.69 Tg, lower but comparable to Cao et al., 2018 results of 2.08 to 3.13 (average 2.48) Tg yr^{-1} from biomass burning. It is also following our comparison in CO2 that our values of emissions are generally smaller than results using CYBA (Crop Yield Based Approaches) method.

Li et al. 2014 only reported concentrations rather than emissions, making it even more difficult to compare. The only thing we can try here is to compare the ratio of BC/PM2.5.The average PM2.5 concentration was reported 110.7 mg/m3, containing 7.3 mg/m3 EC in their study, which accounts around 6.5% of the particle. Our yearly emission results show that around 9% particulate mass is around black carbon, slightly higher but reasonably close to Li's results. This could be because we collected our samples close to the fire, limiting the impact of aerosol aging during transportation and consequently secondary organic aerosol formation.

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2019-968, 2020.

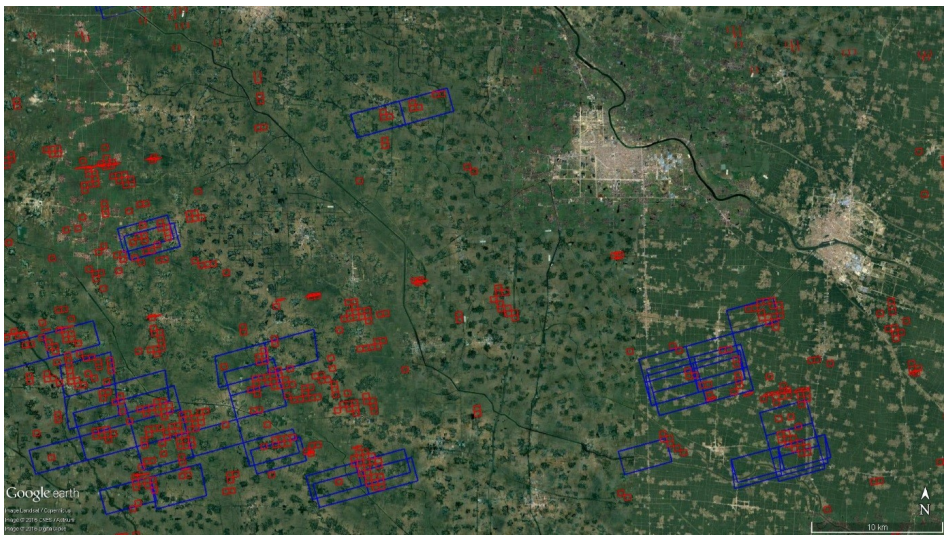

Fig. 1.