Updated August 15, 2018

The following studies potentially contain data useful for updating the supplemental tables that originally appeared in Akagi et al 2011 and that have been updated twice on-line since then. The data in these "new papers" could be used as is or used to update the global averages computed in the current supplemental tables. We will calculate updates when time becomes available, but a user may wish to incorporate the new data themselves. Questions or suggestions for additional studies to consider for updates can be directed to Bob Yokelson at: bob.yokelson@umontana.edu

Note: This paper claims emission factors from a wide variety of sources have been underestimated, but I have not yet investigated if this may be due to experimental factors since it appears to be lab-based rather than in-situ?: https://www.atmos-chem-phys.net/18/7691/2018/

PART I. Recent additions not yet added to an earlier list below of projected updates to each supplemental table, which constitutes PART II.

Crop residue fires in Mexico (lab only):
https://www.tandfonline.com/doi/abs/10.1080/10962247.2018.1459326

PEAT: Peat fire EF from Malaysia:
http://onlinelibrary.wiley.com/doi/10.1002/2017GB005709/full and for a few gases (CO_2, CO, CH_4) from a ship off Sumatra by Nara et al.:
http://www.tandfonline.com/doi/pdf/10.1080/16000889.2017.1399047?needAccess=true

EFPM for peat fires, potentially questionable derivation of high values (fire fronts move, sites have mixed age, random sampling should still work, etc (detailed review available)):
https://agupubs.onlinelibrary.wiley.com/doi/abs/10.1029/2017JD027827

BRICK KILNS (possible new category for future). Recent data from Mexico that also cites and compares to previous work (except for AMS paper from Nepal listed next): https://www.atmos-chem-phys.net/18/6023/2018/ and brick kilns (AMS data from Nepal): https://www.atmos-chem-phys-discuss.net/acp-2018-369/

Cooking fire papers to evaluate: updated 08-15-18.
http://pubs.acs.org/doi/10.1021/acs.est.7b02436#.We4lqmkCj-Y.facebook and
https://www.atmos-chem-phys.net/17/13721/2017/ and https://www.atmos-chem-phys-discuss.net/acp-2018-487/

BOREAL FOREST: EFs from the Fort McMurray fire are reported by Landis et al., 2017 in Science of the Total Environment.

PART II. New papers not added to supplemental tables yet, but already identified earlier as useful and listed by the supplemental table they could be used to update.

Table S1 (savanna): This table was updated Feb 2015. No further updates are planned now, but on-going work on Australia should prove relevant.

Table S2 (boreal forest): No updates are planned at this time. Downwind data from the BORTAS campaign is available for a few stable species, but no MCE, etc. Work is in progress analyzing aged smoke from the Fort McMurray Fire.

Table S3 (tropical forest): New aerosol EF for evergreen tropical forest and cerrado from the SAMMBA campaign: https://www.atmos-chem-phys.net/18/5619/2018/

Table S4 (temperate forest): This was updated May 2014. Three new papers are relevant.

1) Liu et al., 2017 provides EFs for many gases and aerosol species for western US wildfires from the 2013 SEAC^{4}RS and BBOP campaigns. Much higher EFPM are seen for wildfires than prescribed fires:

Liu, X., Huey, L. G., Yokelson, R. J., Selimovic, V., Simpson, I. J., Müller, M., Jimenez, J. L., Campuzano-Jost, P., Beyersdorf, A. J., Blake, D. R., Butterfield, Z., Choi, Y., Crounse, J. D., Day, D. A., Diskin, G. S., Dubey, M. K., Fortner, E., Hanisco, T. F., Hu, W., King, L. E., Kleinman, L., Meinardi, S., Mikoviny, T., Onasch, T. B., Palm, B. B., Peischl, J., Pollack, I. B., Ryerson, T. B., Sachse, G. W., Sedlacek, A. J., Shilling, J. E., Springston, S., St. Clair, J. M., Tanner, D. J., Teng, A. P., Wennberg, P. O., Wisthaler, A., and G. M. Wolfe.: Airborne measurements of western U.S. wildfire emissions: Comparison with prescribed burning and air quality implications, J. Geophys. Res. Atmos., 122, 6108-6129, doi:10.1002/2016JD026315, 2017. http://onlinelibrary.wiley.com/doi/10.1002/2016JD026315/full

2) A paper by Muller et al in ACP provides useful EF for a small prescribed fire: http://www.atmos-chem-phys.net/16/3813/2016/

3) The old nephelometer-based temperate forest prescribed fire PM2.5 EF from Burling et al. (2012) should be replaced with the new EFPM1 for the same fires based on AMS: http://onlinelibrary.wiley.com/doi/10.1002/2014JD021848/full

May, A., McMeeking, G., Lee, T., Taylor, J., Craven, J., Burling, I., Sullivan, A., Akagi, S., Collett, Jr., J., Flynn, M., Coe, H., Urbanski, S., Seinfeld, J., Yokelson, R. J., and Kreidenweis, S.: Aerosol emissions from prescribed fires in the United States: A synthesis of laboratory and aircraft measurements, J. Geophys. Res., 119, 11826–11849, doi:10.1002/2014JD021848, 2014.

4) New lab-based EF for gases and optical properties from FIREX in:

Koss, A. R., Sekimoto, K., Gilman, J. B., Selimovic, V., Coggon, M. M., Zarzana, K. J., Yuan, B., Lerner, B. M., Brown, S. S., Jimenez, J. L., Krechmer, J., Roberts, J. M., Warneke, C., Yokelson, R. J., and de Gouw, J.: Non-methane organic gas emissions from biomass burning: identification, quantification, and emission factors from PTR-ToF during the FIREX 2016

laboratory experiment, Atmos. Chem. Phys., 18, 3299-3319, https://doi.org/10.5194/acp-18-3299-2018, 2018. https://www.atmos-chem-phys.net/18/3299/2018/

Selimovic, V., Yokelson, R. J., Warneke, C., Roberts, J. M., de Gouw, J., Reardon, J., and Griffith, D. W. T.: Aerosol optical properties and trace gas emissions by PAX and OP-FTIR for laboratory-simulated western US wildfires during FIREX, Atmos. Chem. Phys., 18, 2929-2948, https://doi.org/10.5194/acp-18-2929-2018, 2018. https://www.atmos-chem-phys.net/18/2929/2018/

Table S5 (peat): Three new papers contain major upgrades for EF for Indonesian peat fires.

1) FLAME-4 lab data for many gases based on PTR-TOF-MS and FTIR (Stockwell et al., 2015) http://www.atmos-chem-phys.net/15/845/2015/ . See also Hatch et al 2015 and 2017 in ACP for extensive speciation of isomers and many alkanes not measured by mass spec. https://www.atmos-chem-phys.net/17/1471/2017/ and https://www.atmos-chem-phys.net/15/1865/2015/

2) Gases, gravimetric $PM_{2.5}$, and aerosol optical properties measured in situ in Borneo in 2015 (Stockwell et al., 2016a) http://www.atmos-chem-phys.net/16/11711/2016/

3) More extensive gravimetric $PM_{2.5}$ data and chemical speciation measured in situ in Borneo: Jayarathne et al., 2018, https://www.atmos-chem-phys.net/18/2585/2018/

Table S6 (chaparral): FLAME-4 (extensive lab EF for gases, Stockwell et al., 2015): http://www.atmos-chem-phys.net/15/845/2015/ more lab EF for gases in FIREX papers cited above.

Table S7 (open cooking, should rename the table "open wood cooking"): Three updates possible.

1) Gases and aerosol optical properties measured on wood open cooking in Nepal (Stockwell et al., 2016b) http://www.atmos-chem-phys.net/16/11043/2016/

2) FLAME-4 lab extensive gases (Stockwell et al., 2015): http://www.atmos-chem-phys.net/15/845/2015/

3) Gravimetric $PM_{2.5}$ data and chemical speciation measured in situ in Nepal: (Jayarathne et al., 2018, https://www.atmos-chem-phys.net/18/2259/2018/acp-18-2259-2018.html

Table S8 (rocket stoves): Three updates possible.

1) Nepal (field, gases and aerosol optical properties, Stockwell et al., 2016b) http://www.atmos-chem-phys.net/16/11043/2016/

2) FLAME-4 (lab, extensive gases, Stockwell et al., 2015) http://www.atmos-chem-phys.net/15/845/2015/

3) Gravimetric $PM_{2.5}$ data and chemical speciation measured in situ in Nepal: (Jayarathne et al., 2018, https://www.atmos-chem-phys.net/18/2259/2018/acp-18-2259-2018.html

Table S9 (charcoal making) No new EF studies to our knowledge.

Table S10 (charcoal burning): One new study.

1) Nepal (field, gases and aerosol optical properties, Stockwell et al 2016b): http://www.atmos-chem-phys.net/16/11043/2016/

Table S11 (dung open cook): Two new studies.

1) Nepal (field, gases and aerosol optical properties, Stockwell et al., 2016b) http://www.atmos-chem-phys.net/16/11043/2016/

2) Gravimetric $PM_{2.5}$ data and chemical speciation measured in situ in Nepal: (Jayarathne et al., 2018, https://www.atmos-chem-phys.net/18/2259/2018/acp-18-2259-2018.html

Table S12 (pasture maintenance) No new EF studies to our knowledge.

Table S13 (crop residue): Four possible updates.

1) FLAME-4 (lab data, extensive gases, Stockwell et al., 2015) http://www.atmos-chem-phys.net/15/845/2015/

2) US field measurements on NASA-DC-8 (Liu et al., 2016) Agricultural fires in the southeastern US during SEAC^{4}RS: Emissions of trace gases and particles and evolution of ozone, reactive nitrogen, and organic aerosol, J. Geophys. Res., 121, 7383-7414, doi:10.1002/2016JD025040, 2016.
http://onlinelibrary.wiley.com/doi/10.1002/2016JD025040/abstract

3) Nepal field measurements (gases and aerosol optical properties, Stockwell et al., 2016b): http://www.atmos-chem-phys.net/16/11043/2016/ Also Jayarathne et al., 2018: https://www.atmos-chem-phys.net/18/2259/2018/acp-18-2259-2018.html

4) The Mexican crop residue burning EF from Yokelson et al. (2011) should be normalized to lower fuel %C values (~40%) closer to new literature average %C for this fuel type. E.g. multiply existing values by 0.8.

5) As we note in section 2.3.13 of Akagi et al 2011, the EF for pile burning of crop residue are much higher than the EF for burning loose in the field, which is typical of mechanized agriculture. This paper estimates the relative amount of the two burning practices in Vietnam: https://www.sciencedirect.com/science/article/pii/S0269749117349394

To be evaluated:

1) http://www.sciencedirect.com/science/article/pii/S1352231017304247
2) "Emissions of Glyoxal and Other Carbonyl Compounds from Agricultural Biomass Burning Plumes Sampled by Aircraft, Zarzana, KJ et al ENVIRONMENTAL SCIENCE & TECHNOLOGY, 51 (20):11761-11770; 10.1021/acs.est.7b03517 OCT 17 2017

Table S14 (garbage burning): Two possible updates:

1) Gases and aerosol optical properties measured in situ in Nepal in 2015 (Stockwell et al., 2016b): http://www.atmos-chem-phys.net/16/11043/2016/

2) Gravimetric $PM_{2.5}$ data and chemical speciation measured in situ in Nepal: (Jayarathne et al., 2018, https://www.atmos-chem-phys.net/18/2259/2018/acp-18-2259-2018.html