Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2017-608-AC2, 2017


Atmospheric Chemistry and Physics Discussions
Open Access
EGU



# *Interactive comment on* "Chemical characterization of fine particulate matter emitted by peat fires in Central Kalimantan, Indonesia, during the 2015 El Niño" *by* Thilina Jayarathne et al.

**Thilina Jayarathne et al.**

betsy-stone@uiowa.edu

Received and published: 15 December 2017

Referee #2 Comment 1: Given there are only few measurements of smoke aerosol properties in Maritime Continents (MC), the work presented here surely is timely and highly relevant to the ACP. The paper is missing a body of literature on the work recently done by 7SEAS program in this region, particularly those paper in the 7SEAS' special issue published in Atmospheric Research in 2013. Note, the link between El Nino and fires still remain unclear; what is known in this part of the world is that Hurricane in subtropical Philippines can lead to large fires in Indonesia. This is worth mentioning,



Printer-friendly version

Discussion paper

as the paper seems to say that it is the El Nino year that made this study interesting - which is not. Reid, J., E. Hyer, R. Johnson, B. N. Holben, J. Zhang, J. R. Campbell, S. A. Christopher, L. D. Girolamo, L. Giglio, R. E. Holz, C. Kearney, J. Miettinen, E. A. Reid, F. J. Turk, J. Wang, P. Xian, R. J. Yokelson, G. Zhao, R. Balasubramanian, B.-N. Chew, S. Janai, N. Lagrosas, P. Lestari, N.-H. Lin, M. Mahmud, B. Norris, A. X. Nguyen, N. T. K. Oahn, M. Oo, S. Salinas, and S.-C. Liew, 2013. Observing and understanding the Southeast Asia aerosol system by remote sensing: An initial review and analysis for the Seven Southeast Asian Studies (7SEAS) program, Atmospheric Research, 122, 403-468.

Wang, J., C. Ge, Z. Yang, E. J. Hyer, J. S. Reid, B.-N. Chew, M. Mahmud, Y. Zhang, and M. Zhang, 2013. Mesoscale modeling of smoke transport over the Southeast Asian Maritime Continent: interplay of sea breeze, trade wind, typhoon, and topography, Atmospheric Research, 122, 486-503.

Response to Referee #2 Comment 1: We thank the reviewer for their review of this manuscript and their suggestions to improve it. The recommended references make an important point. While it is clear that smoke impacts peak in El-Nino years, the actual interannual variability in the amount of burning is harder to measure and multiple factors may influence that. As suggested, we added the recommended references to the introduction and have clarified the conditions that lead to large peat burning impacts in Indonesia. We have revised the first paragraph of the introduction with the following text:

“Major peat burning impacts have coincided with the El Niño Southern Oscillation (e.g., 1997-98, 2006, 2015), during which warmer conditions decrease dry season precipitation, which lowers the water table of peatlands, increases their flammability, and promotes longer-range transport of the smoke (Reid et al., 2013). Within a season, meteorological factors contribute to peat-burning pollution events and transport, including typhoons and wind patterns (Wang et al., 2013). Notably, even in non-El Niño years, peat burning remains an important source of biomass burning emissions in Southeast

Asia (Reid et al., 2013).The 2015 peatland fire episode that occurred September – November 2015 occurred during an El Niño year and was reported as the strongest peatland fire episode since 1997-98 (Parker et al., 2016; Koplitz et al., 2016; Huijnen et al., 2016). "

Referee #2 Comment 2: Relevant work regarding the importance of smoke aerosol composition on regional climate can be found below. It is important to discuss if the past modeling work in this region, based on your data of smoke optical properties, is good enough or has large uncertainties - likely a huge overestimation or underestimation of smoke absorption? Such discussion is important as the abstract of this manuscript says so, yet the manuscript itself touched very little on the recent modeling work of smoke radiative effects in that region.

Ge, C., J. Wang , and J. S. Reid, 2014, Mesoscale modeling of smoke transport over the Southeast Asian Maritime Continent: coupling of smoke direct radiative feedbacks below and above the low-level clouds, Atmos. Chem. Phys. , 14, 159-174.

Response to Referee #2 Comment 2: Modeling smoke climate impacts in SE Asia involves the initial emissions, transport, and evolution of smoke aerosol from multiple fuel types. The focus of this paper is the first in-situ PM measurements of the tropical peat fire emissions and we prefer not to broaden it to a comprehensive discussion of past modeling in the region. However, we agree with the reviewer that additional context is useful and we have added further discussion of the observed OC:EC ratios and their variability. The following text has been added as the third paragraph in section 3.2:

"The prior lack of information on light absorption by peat burning emissions could potentially limit the accuracy of direct radiative forcing estimates in Southeast Asia (Ge et al., 2014). Previously, Ge et al. (2014) modeled radiative forcing using OC:EC values up to 17. Our much larger OC:EC values could imply a more strongly scattering aerosol is relevant depending on the extent to which regional emissions are dominated

by peat burning. in addition, with new measurements of BrC presented in our companion paper (Stockwell et al., 2016), the role of BrC in direct radiative forcing should be evaluated in future assessments of this kind."

Referee #2 Comment 3: Finally, the fire emission inventory still has large uncertainty, and it is unclear how the measured results here compare with the results widely used by different inventories. Can we say OC/BC ratio uncertainty or variation is a factor of 2 or 3? See below several papers and references therein.

Zhang, F., J. Wang , C. Ichoku, E. Hyer, Z. Yang, C. Ge, S. Su, X. Zhang, S. Kondragunta, J. Kaiser, C. Wiedinmyer, and A. da Silva, 2014. Sensitivity of mesoscale modeling of smoke direct radiative effect to the emission inventory: A case study in northern sub-Saharan African region, Environmental Research Letter, 9, 075002.

Koppmann, R., K Czapiewski, JS Reid, A review of biomass burning emissions, part I: gaseous emissions of carbon monoxide, methane, volatile organic compounds, and nitrogen containing compounds R Koppmann, K Czapiewski, JS Reid – Atmospheric Chemistry and Physics, 2005.

Reid, J. S., Koppmann, R., Eck, T. F., and Eleuterio, D. P.: A review of biomass burning emissions part II: intensive physical properties of biomass burning particles, Atmos. Chem. Phys., 5, 799-825, 2005.

My recommendation is that the importance of BC/OC ratio measured in this paper should be discussed in the context of these past work, so that, as said in the abstract, these measurments are valuable for the emission inventory community and atmospheric modeling community.

Response to Referee #2 Comment 3: As stated above, models must consider multiple fuels, transport, and evolution. These first in-situ measurements of tropical peat fire emissions should be considered in future models, but the exact implementation scheme is beyond the scope of this paper. Regarding past emissions inventories we

can say the following. Sometimes the values used are a guess that is often not easily recovered from the literature. Koppmann et al. (2005) was never accepted/finished and only discussed gases. Reid et al. (2005) and Andreae and Merlet (2001) do not give peat-specific values. Akagi et al. (2011) give values for peat that are used widely, e.g. in FINN and GFED. Those values were based on one lab fire that we do already compare to extensively (Christian et al., 2003).

Works Cited

Ge, C., Wang, J., and Reid, J. S.: Mesoscale modeling of smoke transport over the Southeast Asian Maritime Continent: coupling of smoke direct radiative effect below and above the low-level clouds, Atmospheric Chemistry and Physics, 14, 159-174, 10.5194/acp-14-159-2014, 2014.

Huijnen, V., Wooster, M., Kaiser, J., Gaveau, D., Flemming, J., Parrington, M., Inness, A., Murdiyarso, D., Main, B., and van Weele, M.: Fire Carbon Emissions Over Maritime Southeast Asia in 2015 Largest Since 1997, Scientific reports, 6, 26886, 2016.

Koplitz, S. N., Mickley, L. J., Marlier, M. E., Buonocore, J. J., Kim, P. S., Liu, T., Sulprizio, M. P., DeFries, R. S., Jacob, D. J., and Schwartz, J.: Public Health Impacts of the Severe Haze in Equatorial Asia in September–October 2015: Demonstration of a New Framework for Informing Fire Management Strategies to Reduce Downwind Smoke Exposure, Environmental Research Letters, 11, 094023, 2016.

Parker, R. J., Boesch, H., Wooster, M. J., Moore, D. P., Webb, A. J., Gaveau, D., and Murdiyarso, D.: Atmospheric CH4 and CO2 Enhancements and Biomass Burning Emission Ratios Derived from Satellite Observations of the 2015 Indonesian Fire Plumes, Atmos. Chem. Phys., 16, 10111-10131, 2016.

Reid, J. S., Hyer, E. J., Johnson, R. S., Holben, B. N., Yokelson, R. J., Zhang, J. L., Campbell, J. R., Christopher, S. A., Di Girolamo, L., Giglio, L., Holz, R. E., Kearney, C., Miettinen, J., Reid, E. A., Turk, F. J., Wang, J., Xian, P., Zhao, G. Y., Balasubramanian,

R., Chew, B. N., Janjai, S., Lagrosas, N., Lestari, P., Lin, N. H., Mahmud, M., Nguyen, A. X., Norris, B., Oanh, N. T. K., Oo, M., Salinas, S. V., Welton, E. J., and Liew, S. C.: Observing and understanding the Southeast Asian aerosol system by remote sensing: An initial review and analysis for the Seven Southeast Asian Studies (7SEAS) program, Atmospheric Research, 122, 403-468, 10.1016/j.atmosres.2012.06.005, 2013.

Stockwell, C. E., Jayarathne, T., Cochrane, M. A., Ryan, K. C., Putra, E. I., Saharjo, B. H., Nurhayati, A. D., Albar, I., Blake, D. R., Simpson, I. J., Stone, E. A., and Yokelson, R. J.: Field measurements of trace gases and aerosols emitted by peat fires in Central Kalimantan, Indonesia, during the 2015 El Nino, Atmospheric Chemistry and Physics, 16, 11711-11732, 10.5194/acp-16-11711-2016, 2016.

Wang, J., Ge, C., Yang, Z. F., Hyer, E. J., Reid, J. S., Chew, B. N., Mahmud, M., Zhang, Y. X., and Zhang, M. G.: Mesoscale modeling of smoke transport over the Southeast Asian Maritime Continent: Interplay of sea breeze, trade wind, typhoon, and topography, Atmospheric Research, 122, 486-503, 10.1016/j.atmosres.2012.05.009, 2013.

---

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2017-608, 2017.