Atmos. Chem. Phys. Discuss., 15, C8265–C8268, 2015
www.atmos-chem-phys-discuss.net/15/C8265/2015/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Aircraft-measured indirect cloud effects from biomass burning smoke in the Arctic and subarctic" *by* L. M. Zamora et al.

Anonymous Referee #2

Received and published: 21 October 2015

This paper uses in situ aircraft data on cloud properties from a variety of field campaigns in the Arctic and subarctic (ARCTAS, ISCCP, FIRE.ACE, and ISDAC) to determine the magnitude of subarctic and Arctic smoke aerosol-cloud interactions (ACI). Averaging the data over all campaigns gave an estimated ACI of $\sim$0.12 (out of a maximum of 0.33). The data also included a subarctic case study from ARCTAS that included clean and smoke-polluted clouds in similar geographic areas and meteorological conditions. In this case study, the estimated ACI was 0.06. The authors explain the lower value in the case study as a result of the low liquid water content (LWC) of the clouds and the high aerosol concentrations, which would result in limited formation of droplets

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

relative to the adiabatic value. They note that these ACI values could decrease shortwave radiative flux by 2-4 W m-2 or more under some low and homogeneous cloud conditions in the Arctic. The authors also show evidence that numerous background Aitken mode particles may interact with combustion particles, altering their properties.

This is a well-written paper on an important problem in climate science. The work appears to have been planned and performed well and the conclusions are generally supported by the evidence. I have some minor concerns that I have listed below that I would like to see addressed, but overall I recommend publication of the paper after these minor revisions.

Minor Comments:

P22825, L20-23: In this conclusion, the word "some" in "some low and homogeneous cloud conditions" is doing a lot of work. The text (P22843, L19-28 and P22844, L1-7) makes clear that this 2 to 4 W m-2 estimate is only valid for a specific type of low, homogenous cloud layer over surfaces with an albedo of $\sim$0.15. Given the limited applicability of this estimate of the impact, saying in the abstract and conclusions (P22849, LL21-25) that the impact is 2 to 4 W m-2 "or more" is misleading. The abstract and conclusions should make clear that this is not an appropriate value to assume for a regional impact, rather just an estimate of the impact under a very specific, but reasonable, set of subarctic conditions.

P22830, L21: Can you explain why the FSSP data was lower than the hot-wire probe measurements of LWC?

P22835, L28: "background values of 0.018" – is this of CH3CN in ppbv? If so, make that clear.

P22837, L2: Using multiple BB tracers doesn't "minimize" the uncertainty, so much as it gives you a way of estimating the uncertainty in terms of the different resulting values.

P22841, L8-11: I don't think the fact that the results increase when two clouds are

ACPD
15, C8265–C8268, 2015

excluded is enough to say that non-linear processes “were indeed” affecting the ACI values. A less strong statement, “could have affected”, would be more consistent with your evidence.

P22867, Table 2: The column formatting of this table is odd – try cutting the redundant reference from the “Range” column and expanding the “Uncertainty” column. Also need an uncertainty value for the chilled-mirror hygrometer.

P22868, Table 3: Why doesn’t this table have horizontal lines like Tables 1 and 2?

P22869, Table 4: Surely uncertainty data for the nephelometer and humidigraph exist somewhere, otherwise why should be trust the data at all?

P22879, Figure 6: This caption needs more detail, like in Figure 8.

P22880, Figure 7: The caption should discuss the CO* as well, like in Figure 5.

P22881, Figure 8: The caption doesn’t match the number or color of lines in the figure.

Typos:

P22826, L3: Need a comma between “areas” and “such”

P22833, L5-6: How about “SO42-, and submicron organic aerosol, or OA, concdentrations in ARCTAS, and by SPLAT II number concentration in ISDAC”? I’m not sure what “number composition” means.

P22835, L18: Appendix A is so short, you should just include it here.\

P22837, L24: Instead of “in the text below”, name the section (in this case Section 2.6).

P22838, L28: Again, name the section (3.1).

P22814, L26: Should this be a separate section from the text above?

P22844, L18: The order of Figure 6 and 7 should be switched, as you discuss Figure 7 before Figure 6.

ACPD

15, C8265–C8268, 2015

P22844, L29: I think it would be clearer to say “increased in smoky conditions”

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 22823, 2015.

ACPD

15, C8265–C8268, 2015