Atmospheric Chemistry and Physics Discussions

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Comment on acp-2020-1266

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Community comment on "Opinion: Papers that shaped tropospheric chemistry" by Paul S. Monks et al., Atmos. Chem. Phys. Discuss.,
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I will add my support for some additional references to the chemiluminescence detection of NO/NO2. While Leighton's photostationary state hypothesis was fully established as you point out by the early 90's that establishment involved lots of measurements using the chemiluminescence detector. During the 70's and 80's the device was likely responsible for most of the NO/NO2 measurements used for determining the jNO2 which was crtical for model chemistry. I am not as widely read for this topic during this time period but papers by my former boss, Don Stedman, and others that I am aware of for a starting point are:

D. H. Stedman, J. O. Jackson, "The photostationary state in photochemical smog" Intern. J. Chem. Kinetics Symp. I: 493
(1975).

D. Kley, M. McFarland, "Chemiluminescence detector for NO and NO2," Atmos. Technol. 12:63 (1980)

R. E. Shetter, D. H. Stedman, and D. H. West, "The NO/NO2/O3 Photostationary State in Claremont, California," J. Air Poll. Cont. Assoc. 33:3, 212-214, 1983.

As a side note for the importance of the chemiluminescence detector for NO2. Don flew one on a commercial flight between Denver and Boston and included the data in the final report for the National Research Council entitled "The Airliner Cabin Environment Air Quality and Safety Committee on Airliner Cabin Air Quality" in 1986 which recommended a ban of smoking on commercial aircraft. That data highigted the absurdity that limiting the number of smoking rows to a few in the back of the plan spared others from the exposure. This report led to the eventual ban of smoking on US flights and laid the groundwork for all of the current limits on smoking because of the potentail negative health effects.

The following comments are totally self-serving and I point this out so that the authors can choose to totally ignore them solely on that basis if they so choose. The paragraph in the emission section on vehicle emissions includes 4 references. The works of Calvert et al., Lawson and Singer and Harley use data either in part, Calvert et. al. and Lawson, or entirely (Singer and Harley) to form a basis of their works that was collected using a remote sensing device invented by Don Stedman. The work described by Chaney was important in the development of the device Don invented as it gave Don the initial idea

(he was a colleague of Chaney and involved in his work) but the method described by Chaney was a simple time series of a single species, carbon monoxide, captured alongside a road that implied that individual vehicle plumes could be capture if one had a fast enough detector. Chaney's work provides no way for those CO measurements to be turned into fuel specific emissions that could be used for vehicle emission comparisons or inventory calculations that Calvert, Lawson and Singer an Harley rely upon in their works. It was not until Don demonstrated the high speed measurement of pollution ratio's to carbon dioxide for vehicle exhaust emissions that made this possible.

Final comment on emissions the papers by Calvert et al., Lawson and Singer and Harley do not really "verify" the California Smog Control Program. If anything these papers call into question how well these control programs actually work and strongely suggest that it is significantly less that the State believes. At the time of writing of these papers California was in denial that a small portion of the fleet was responsible for a large proportion of the total emissions. In the state's mind high emitters did not exist because all of the control programs had eliminated them. Years of measurements subsequently have proven this idea wrong.

Thanks for the effort taken so far in providing a thourougly entertainting and educational look back at all the work that has combined to get us to where we are today in our understanding of Atmospheric Chemistry.

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