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Atmospheric Chemistry and Physics Discussions

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Interactive comment

Interactive comment on "An overview of meso-scale aerosol processes, comparison and validation studies from DRAGON networks" *by* Brent N. Holben et al.

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Referee 1 Lorraine RemerâĂŤ

I believe I speak for all co-authors that we appreciate Lorraine's careful and insightful review of the DRAGON overview paper. Clearly her experience with AERONET data both DRAGON and the global data set surfaced deficiencies in the manuscript that I hope is now addressed and I believe will address many of the other two referees concerns. Lorraine and I had several good discussions that lead to the following response/change which 'was' in red.

Lorraine correctly pointed out that several 'reasons' for conducting DRAGON like campaigns were described on pages 3 (comparison between in situ and RS techniques), page 7 ('The Philosophy. . .') and page 15 ('The initial concept. . .') giving the reader the appearance that there is a moving goal and disproportionately emphasizing results of papers that don't even appear in the special issue while most of the contributing papers were satellite comparisons/validations.

Well spotted Lorraine! I believe the issue was in part due of my chronological writing of the events. I feel this is relatively easy to resolve through better word and phrase choices.

Page 3 comment: At the end of page 2 we've posed the case for a need for improved spatial and temporal aerosol characterization that neither point, satellite nor model results can address. The next paragraph describes the motivation for DRAGON opening the door for more emphasis on the papers in this special issue:

'The series of Distributed Regional Aerosol Gridded Observation Network (DRAGON) campaigns arose in 2011 primarily as a means to foster collaboration and comparison of the remote sensing community and in situ community of measurements and retrievals of the intensive properties of aerosols such as single scattering albedo, particle size distribution, complex index of refraction, etc. Note that earlier DRAGON like campaigns were completed to assess spatial and temporal intensive and extensive properties for comparison to satellite retrievals and thus provided further motivation for satellite and model intercomparisons with high resolution ground-based measurement systems. . . .'

Page 6L34-35: We changed philosophy to method as this is a methods section describing how each campaign was designed to support an IOP and achieve a particular objective.

Page 15L8 to 10: 'The initial concept behind the DRAGON campaigns. . .' This is actually a results section so the above first line was replaced by: 'Three important research results have come from the DRAGON campaigns: 1) In situ and remote sensing aerosol comparisons; 2) aerosol process studies; and 3) satellite and model validation studies. The first DRAGON focus on in situ versus remote sensing comparisons of aerosol optical, radiative and microphysical physical properties pre and post dates this issues but merits a brief discussion. Schafer et al, . . .'

Four paragraphs later we added:

'By far the largest application of the DRAGON data sets has been in validation of satellite data. Most synoptic scale validation teams assume a spatial uniformity about a ground-based control point often citing Anderson et al (2003) nominal 100 km. Frequently queries are made about the spatial representation of AERONET sites for which there is no simple answer due to proximity to aerosol sources, local and synoptic meteorology. The DRAGON campaigns have provided a better understanding for specific circumstances that lend themselves to better assessing the spatial resolution of various satellite systems and high and low resolution model assessments. Prior to this issue, Munchak et al. (2013). . .'

Thus the three widely dispersed conflicting motivation sections have been redefined as objectives, methods and results that we feel pulls the paper together much better and addresses the concerns that Lorraine raised regarding proper representation of the actual contributing papers.

Table 1 and 2 headings have been revised according to:

Table 1, shows the principle parameters measured by sun and sky scanning spectral radiometers for the aerosol types likely encountered. Eleven published validations/comparisons were made during field campaigns over the last 20 years; these are Ra=Ramanathan et al, 2000; Re=Remer et al., 1997; H=Haywood et al, 2003; L=Leahy et al., 2007; B=Bergstrom et al., 2003; Chand et al., 2006; E=Eck et al., 2010; Rp=Reid et al, 2003; Ru=Reid et al., 2008; S=Smirnov et al., 2003; Sc=Schafer et al., 2008; T=Toledano et al., 2011; O=Osborne et al., 2008 and J=Johnson et al., 2009.

Note that in the authors opinion most categories are incomplete, regionally based, not updated and/or lack direct relevance to these types of comparisons and are designated with a -. Conversely a + designation is the opposite.

Table 2 The aerosol types detectable from remote sensing (RS) techniques are compared with in situ field measurements. We show only those direct RS/in situ comparisons. Unlike table 1, here the aerosol type describes the properties of the aerosols rather than sources. We acknowledge that aerosol typing is difficult and still subjective and incomplete. (C=Corrigan et al., 2008; E=Esteve et al., 2012; Sc=Schafer et al., 2014, 2017 in preparation). Some studies appearing below are described in Table 1.

Lorraine would like to have seen new information coming from this paper as a synthesis of the group contributions. In otherwords why have the special issue? A tough question that we talked about a bit and resulted in a complete rewrite of the conclusion:

The DRAGON campaigns afford the opportunity to observe and assess aerosols under a variety of aerosol types and meteorological conditions. Thirteen mulit-month mesoscale DRAGON campaigns were conducted and described that measured intensive and extensive aerosol properties at high spatial and temporal resolution. The results shown in these studies challenge the long held assumptions of large-scale aerosol spatial uniformity as too simplistic and prove improved accuracies of higher resolution satellite and model retrievals as well as afford a deeper understanding of aerosol process studies. From the DRAGON campaigns, we know that in situ and ground based remote sensing of SSA has a bias of ∼0.01, aerosol cloud processing occurs and can be detected with high resolution remote sensing at scales of a few kilometers, and finer resolution satellite products can capture the mesoscale spatial variability of aerosol although also showing that modifications to satellite and model algorithms and assumptions may be necessary in order to achieve the required accuracy of these finer resolutions. The unique opportunities for validation of high spatial resolution satellite aerosol retrievals and assessment of regional model estimates of aerosol optical, radiative and microphysical properties is only beginning to be mined.

The DISCOVER-AQ and KORUS-AQ campaigns in concert with in situ surface and airborne measurements provide for detailed comparison and assessment against remotely sensed aerosol properties and further results are expected. The papers presented in this issue demonstrate the variety of research opportunities and sets the stage for new applications such as nighttime lunar meso-scale AOD assessments for the recent KORUS-AQ and ORACLES campaigns and future DRAGON networks.

The minor comments:

As suggested–some references were added throughout the introduction but these are not comprehensive as the statements being referenced are rather broad. Remer et al, 2002, and Sayer et al., 2015 for satellite validation, Dubovik et al., 2002, Anderson et al, 2003, Dubovick et al., 2006 for aerosol characterization, Kinne et al., 2003 for global models and Rubin et al., 2017 for model assimilation.

I modified the last sentence of the first paragraph of page 3 to be generic as I could not recall a clear reference for the initial statement.

Page 3 Line 37: The 'This issue' was removed in the course rewriting that paragraph

The last paragraph before the tables discusses the need to have a common terminology between the RS and in situ communities to make an apples to apples comparison for aerosols.

Page 4 lines 1-2: Suggested rewrite of 'Indeed' phrase–change is accepted. Page 4 Table 1 caption. Suggested rewrite: largely accepted and modified including elimination of + and -: Table 1, Principle intensive parameters measured by sun and sky scanning spectral radiometers for five aerosol types. Thirteen published validations/comparisons of these retrievals against in situ measurements were made during field campaigns prior to 2010; these are Ra=Ramanathan et al, 2000; Re=Remer et al., 1997; H=Haywood et al, 2003; L=Leahy et al., 2007; B=Bergstrom et al., 2003; Chand et al., 2006; E=Eck et al., 2010; M=Müller et al., 2010, Mü= Müller et al., 2012, Rp=Reid et al, 2003; Ru=Reid et al., 2008; S=Smirnov et al., 2003; Sc=Schafer et al., 2008; T=Toledano et al., 2011; O=Osborne et al., 2008 and J=Johnson et al., 2009. Note that most categories are incomplete, most studies are regionally based, not updated for the current inversion algorithm and/or not relevant to total column ambient retrievals. Page 4 Table 2 caption. Suggested rewrite: Fully accepted. Table 2 The aerosol types detectable from remote sensing (RS) techniques and compared with in situ field measurements. We show only those direct RS/in situ comparisons. Unlike table 1, here the aerosol type describes the properties of the aerosols rather than sources. We acknowledge that aerosol typing is difficult and still subjective and incomplete. (C=Corrigan et al., 2008; E=Esteve et al., 2012; Sc=Schafer et al., 2014, 2017 in preparation). Some studies appearing below are defined in Table 1. Page 5 lines 15-16. I'm confused. The retrieval gives % spherecity. It can't assume spherical models entirely.

Agreed this was incorrectly worded and pointed out by Reviewer 2 also. Following is the rewrite: Note that the AERONET retrieval scheme of Dubovik and King (2000) report the size in terms of particle radius with the fine to coarse mode limits of 0.0005 microns to the inflection point to 15 microns. The inflection point of each retrieval lies between modes varying from 0.44 to 0.99 micron in volume distributions that is composed of discrete particle sizes from a mixture of spheres and spheroids with a fixed shape distribution (Dubovik et al., 2006). Page 5 line 25. Typo: Ben-AmiâĂŤCorrected. Page 6 line 20. There is no bold type in the table, though it is mentioned here. –Phrase removed. Page 8 line 41. Is there a published reference for DISCOVER-AQ? There should be by now. – No the website is the best overview of the campaigns so far and is so referenced. Page 13 line 6. SEAC4RS was 2013; KORUS-AQ was 2016. Shouldn't these sections be switched? Also shouldn't CATZ come before TIGERZ? Yes and yes. Done. Page 13 line 25: it's should be itsâĂŤDone. Page 14 Table 3. Discov AQ should be DISCOVER AQ. I remember seeing it elsewhere without capital letters, but I don't see that no –Done.

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Discussion paper

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