AEROCOM/AEROSAT: use of satellite observations in evaluating global aerosol models

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In contrast to most aerosol species, black carbon and dust absorb visual light and may heat the atmosphere. However, their overall effect is highly uncertain. In this study we explore the use of novel satellite AAOD (Absorptive Aerosol Optical Depth) measurements in evaluating global (AEROCOM) models.

Two POLDER retrieval products, and one product each from OMI and a CALIOP/MODIS combination are intercompared and evaluated with AERONET ("truth") data. While all products have skill in measuring AAOD, there are substantial biases amongst the products. In particular, we note a bias between the two POLDER products of 0.04 in SSA (Single Scattering Albedo), independent of AOD (Aerosol Optical Depth). Identification of the cause of this bias would allow a substantial improvement in AAOD observations. However, we show that even with such biases, consistent evaluation of global models with satellite products is possible.

In particular we show that there can be substantial under- and over-estimates of AAOD, depending on model. Furthermore, in recent years, models have diverged amongst themselves. This can be traced to different emission inventories, and we show that satellite AAOD may be used to provide constraints on these emissions. At the same time, models still differ in their particle properties, and we show that this can, to some extent, be evaluated with observations as well.

In addition, we will introduce a similar study for an ensemble of 14 satellite products of AOD. This larger ensemble allows us to study AOD diversity between the products in detail. In particular, we show that this diversity is a pretty good predictor of AOD uncertainty (versus "truth" data) in multi-year averages. This provides us with uncertainty estimates even in the absence of truth data, which allows many exciting applications (to be discussed).

These studies are the fruit of collaboration between the AEROCOM (AEROsol Comparisons between Observations and Models, https://aerocom.met.no) and AEROSAT (International Satellite Aerosol Science Network, https://aero-sat.org) communities.

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