NASA/GSFC SMARTLabs Mobile Facility: Probing air quality and aerosol-cloud effects on the environment

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Air quality, as a measure of natural and anthropogenic emissions of pollutants (particulate matter and trace gases) into the atmosphere, is receiving increasing global attention. It correlates with the health of humans and ecosystems and is also a reflector of meteorological processes occurring predominantly on local to regional scales. In support of the NASA Earth Observing System (EOS) and future Decadal Survey endeavor, GSFC's mobile SMARTLabs (Surface-based Mobile Atmospheric Research & Testbed Laboratories; *cf.* http://smartlabs.gsfc.nasa.gov/) were conceptualized, built and have participated in numerous field campaigns. The overarching goal of the SMARTLabs mobile facility is to enrich NASA Earth Sciences by (1) contributing to NASA satellite missions in providing calibration/validation of data products, (2) piloting innovative science research through the mobility, flexibility and rich suite of complementary instruments offered in these test-bed platforms, and (3) promoting NASA Earth Sciences through educational and public outreach activities.

The sizes of atmospheric constituents vary by several orders of magnitude (e.g., *gas molecules on the order of* 10^{-10} *m to solid hydrometeors of* 10^{-2} *m)* and their compositions, from simple substances to complex compounds. SMARTLabs integrates a unique suite of remote sensing and *in-situ* instruments for observing the properties of atmospheric components including clouds, aerosols, and precursor species. Two different kinds of data products arising from SMARTLabs are those directly measured/retrieved (spectral optical thickness, *in-situ* properties near surface, etc.) and those derived from combining products (e.g., aerosol hygroscopic growth factors). These data products reflect advances in methods of observations and technological progresses in instrumentation. As model simulations inevitably become more detailed (reflecting increased understanding of atmospheric processes), they will use and rely increasingly on such data products and, as must be expected, will feedback new instrumental requirements and observational strategies. Indeed, such refinements have made possible predictive capabilities that describe how future changes in atmospheric composition affect air quality and climate. SMARTLabs measurements and data products are uniquely poised to address these challenges. Additionally, in light of the expected hiatus in satellite observations between the conclusion of EOS flagship and the Decadal Survey missions, the mobility, flexibility and rich suite of complementary instruments offered by SMARTLabs can be utilized to probe atmospheric phenomena of interest, thus providing a test-bed platform and a *partially* gap-filling measure. We will present, as an example, results from the 7-SEAS/BASELInE (Seven SouthEast Asian Studies/Biomass-burning Aerosols & Stratocumulus Environment: Lifecycles & Interactions Experiment) conducted in spring 2013–2015 over northern Southeast Asia.

Keywords: Ground-based, Aerosol, Cloud

