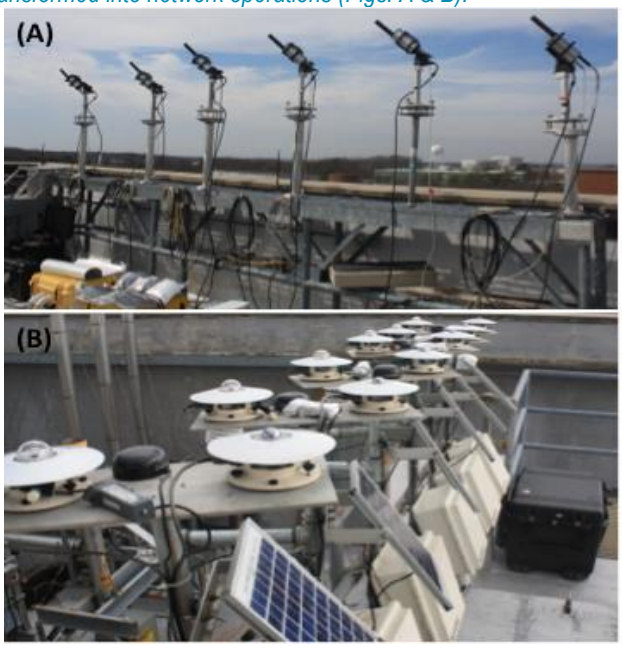
SMART

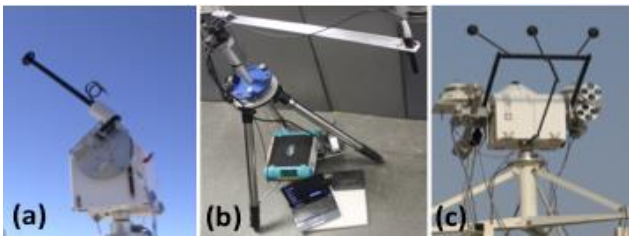
Surface-sensing Measurements for Atmospheric Radiative Transfer

The first mobile laboratory, SMART trailer established in 2001, which hosted an array of remote sensing instruments, has been transformed into network operations (Figs. A & B).



Key SMART Facts

- Nominal field configuration: unified sets, currently up to six of ground-based solar spectrometers (Fig. A), short-wave (with thermal-dome-effect corrected) and longwave irradiance radiometers (Fig. B), serving as the satellite units in "*Ground-based Formation Flight*" operations.
- Complementary setup: an additional spectroradiometer (Fig. a) in sun-tracking mode; or in surface bi-directional reflectance mode (Fig. b); and broadband radiometers on tracking station for diffuse and direct components (Fig. c) at various selected wavelength ranges.
- SMART URL: *https://smartlabs.gsfc.nasa.gov/*



Description

The original SMART instruments cover a wide spectral range, from ultraviolet to microwave, and were integrated into a 20-ft weather-sealed trailer with a thermostatic temperature control to facilitate the shipping to, and operation in, the field. As the suite evolved, SMART was transformed into six unified units (Figs. A&B), distributed around the core supersite of COMMIT-ACHIEVE mobile laboratories in 2011. Collectively, it became SMARTLabs (Surface-based Mobile Atmospheric Research & Testbed Laboratories) and has been deployed in many national and international field experiments. Many unique data sets have been generated for ground-based remote sensing and in situ studies in atmospheric sciences. 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.

Data Products

- Sun and sky solar spectral radiance at 1 nm resolution for retrieving trace gas, aerosol and cloud properties
- Surface spectral bi-directional reflectance and albedo at 1 nm resolution
- Hemispheric/direct-beam shortwave and longwave irradiance with various bands of energy partitioning

Parameters

- Solar spectra: 280~800 nm and 0.35~2.5 μm
- Broadband wavelengths: 0.3~3, 0.4~3, 0.7~3, and 4~50 μm (global, diffuse and direct component)

Science Questions To Be Addressed

- How is atmospheric composition changing?
- What are the effects of atmospheric composition changes on air quality and radiative energetics?

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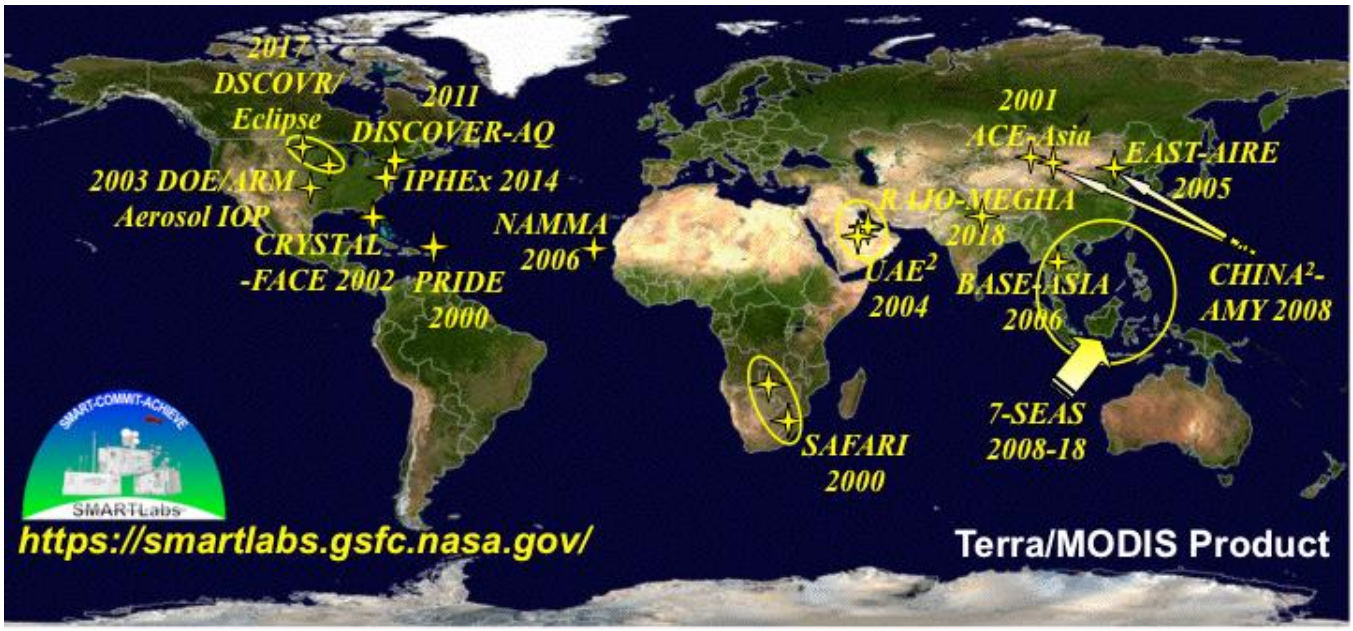
Key References

- Ji and Tsay, *JGR*, 2010, doi:10.1029/2009JD013483
- Ji, Tsay, et al., *JGR*, 2011, doi:10.1029/2011JD016466
- Hansell, Tsay, et al., *JGR*, 2014, doi:10.1002/2013JD021423

Planned and Participated Campaigns



PRIDE (Puerto RIco Dust Experiment), Puerto Rico, June-July 2000; ***SAFARI*** (Southern Africa Fire-Atmosphere Research Initiative), southern Africa, August-September 2000; ***ACE-Asia*** (Aerosol Characterization Experiment – Asia), eastern Asia, March-May 2001; ***CRYSTAL-FACE*** (Cirrus Regional Study of Tropical Anvils and Cirrus Layers – Florida Area Cirrus Experiment), Florida, July 2002; ***UAE²*** (United Arab Emirates United Aerosol Experiment), Arabian Gulf, August-September 2004; ***EAST-AIRE*** (East Asian Study of Tropospheric Aerosols: an International Regional Experiment), China, February-July 2005; ***BASE-ASIA*** (Biomass-burning Aerosols in South East-Asia: Smoke Impact Assessment), Thailand, February-May 2006; ***NAMMA*** (NASA African Monsoon Multidisciplinary Activities), Cape Verde, August-September 2006; ***CHINA²-AMY08*** (Cloud, Humidity Interacting Natural/Anthropogenic Aerosols in Asian Monsoon Year-2008), China, April-October 2008; ***7-SEAS/Dongsha*** (7-South East Asian Studies/Dongsha), Dongsha Island, Taiwan, March-June 2010; ***DISCOVER-AQ*** (Deriving Information on Surface conditions from COlumn and VERtically resolved observations relevant to Air Quality), Greater Washington-Baltimore area, July 2011; ***7-SEAS/Son La*** (7-South East Asian Studies), Son La, Vietnam, March-April 2012-2013; ***IPHEx*** (Integrated Precipitation and Hydrology Experiment), eastern U.S., May-June 2014; ***7-SEAS/BASELInE*** (Biomass-burning Aerosols & Stratocumulus Environment: Lifecycles & Interactions Experiment), northern Southeast Asia, March-April 2013-2015; ***DSCOVR/Eclipse*** (Deep Space Climate Observatory – Solar Eclipse), mid-West U.S., August 2017; ***7-SEAS/Yen Bai*** (7-South East Asian Studies), Yen Bai, Vietnam, March-April 2018; ***RAJO-MEGHA*** (Radiation, Aerosol Joint Observation – Modeling Exploration over Glaciers in Himalayan Area), Nepal and India, April-June 2018; ***7-SEAS*** (7-South East Asian Studies), Maritime Continent, August-September 2018