# PREFACE

Leading nations of the eighteenth century were vexed with the inadequacy of the means for navigating ships at sea. Their small scientific establishments knew that the solution was an improvement of the technology for the measurement of time, and a muster eventually led to the development of the ship's chronometer, the modern clock. Society now faces the issue of global climate change. Resources have been appropriately focused on the advancement of theoretical circulation models and the computers to run them. But it has become gradually apparent that, like our forerunners, we also have a fundamental problem with a core measurement technology: The absolute accuracies (i.e., fractional error of quantity sensed) of our best radiometers are much inferior to those of eighteenth-century clocks. The present status of both satellite and ground-based radiometry taxes our ability to monitor the thermodynamics of global change. For example, consider the direct forcing of aerosols (i.e., Houghton et al. 2001), which are unevenly distributed with short lifetimes, questionable chemical composition, and mind-boggling microphysical characteristics (i.e., Diner et al. 2004). Radiometers on satellites offer the only prospect of comprehensively surveying aerosol forcing to the global energy balance and hydrological cycle. An accurate knowledge of aerosol forcing over a test interval is a prerequisite for the evaluation of a decadal-scale climate model, which must predict the response to such forcing (and others).

The papers in this special section discuss results from the Chesapeake Lighthouse and Aircraft Measurements for Satellites (CLAMS) field campaign, which was conducted in summer 2001 to validate aerosol and radiation products based on the Moderate Resolution Imaging Spectroradiomater (MODIS), the Multiangle Imaging Spectraradiometer (MISR), and the Clouds and the Earth's Radiant Energy System (CERES) instruments on the Earth Observing System (EOS) *Terra* spacecraft (Smith Jr. et al.). Much of CLAMS concentrated on the CERES Ocean Validation Experiment (COVE) sea platform off the coast of Virginia, where special measurements (i.e., Gatebe et al.) enabled a test of EOS over water—the most ubiquitous boundary condition for solar photons approaching the earth–atmosphere system. Each of the MODIS, MISR, and CERES teams deployed radiometers on aircraft with spectral coverage corresponding to their respective instruments on *Terra* [the MODIS airborne simulator and the Airborne Multiangle Imaging Spectroradiometer (AirMISR) on the ER-2 at 20 km and broadband PSPs on a low-level OV-10], and each evaluated retrievals related to aerosol forcing (Levy et al.; Remer et al.; Kahn et al.; Jin et al.; Ignatov et al.). MISR calibration was advanced (Kahn et al.).

CLAMS data can be obtained from the NASA Langley Atmospheric Sciences Data Center (http://eosweb.larc.nasa.gov). The combination on *Terra* of multispectral imagery (MODIS), a multiangle sensor (MISR), and broadband accuracy (CERES) is a boon for diagnosing particular aspects of aerosol forcing. This combination will not be found on another spacecraft for years. A more thorough analysis of the CLAMS field data is needed to exploit this unique constellation of sensors and further hone retrievals of aerosols and their forcings. For example, the current CERES inversion for flux under clear conditions does not distinguish how two scenes, one with coarse and the other with fine aerosols (which might have the same optical depth at a reference wavelength), scatter differently with angle. For such tasks, CLAMS fortunately included specialized airborne measurements of in situ aerosol physical (Magi et al.) and chemical (Castanho et al.) properties and spectral optical depth (Redemann et al.). Two CLAMS airborne measurements

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can serve as pilot resources for aerosol retrievals with other satellites sensors: high-resolution thermal infrared (Smith Sr. et al.) for direct forcing to longwave and a photopolarimeter (Chowdhary et al.) for aerosol absorption of shortwave.

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## REFERENCES

Diner, D. J., and Coauthors, 2004: PARAGON: An integrated approach for characterizing aerosol climate impacts and environmental interactions. *Bull. Amer. Meteor. Soc.,* **85,** 1491–1501.

Houghton, J. T., Y. Ding, D. J. Griggs, M. Noguer, P. J. van der Linden, and D. Xiaosu, Eds., 2001: *Climate Change 2001: The Scientific Basis.* Cambridge University Press, 944 pp.

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