Aerosol Remote Sensing From Space

Determination of Atmospheric Aerosol Properties Using Satellite Measurements; Bad Honnef, Germany, 16–19 August 2009

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Aerosol optical depth (AOD), a measure of how much light is attenuated by aerosol particles, provides scientists information about the amount and type of aerosols in the atmosphere. Recent developments in aerosol remote sensing was the theme of a workshop held in Germany. The workshop was sponsored by the Wilhelm and Else Heraeus Foundation and attracted 67 participants from 12 countries.

The workshop focused on the determination (retrieval) of AOD and its spectral dependence using measurements of changes to the solar radiation backscattered to space. The midvisible AOD is usually applied to define aerosol amount, while the size of aerosol particles is indicated by the AOD spectral dependence and is commonly expressed by the Angstrom parameter. Identical properties retrieved by different sensors, however, display significant diversity, especially over continents. A major reason for this is that the derivation of AOD requires more accurate determination of nonaerosol contributions to the sensed satellite signal than is usually available. In particular, surface reflectance data as a function of the viewing geometry and robust cloud-clearing methods are essential retrieval elements. In addition, the often needed assumptions about aerosol properties in terms of absorption and size are more reasons for the discrepancy between different AOD measurements.

Algorithms for AOD retrieval from various satellite instruments were presented at the workshop. Results were compared among AOD retrievals and with quality references provided by ground-based Sun photometry. Central to the discussions were accuracy assessments of popular aerosol satellite products by the Moderate Resolution Imaging Spectroradiometer (MODIS) and the Multiangle Imaging Spectroradiometer (MISR). Their overall performance is similar, with MISR performing better over land and MODIS performing better over oceans. Standard deviations for AOD on a global annual average basis are assessed at 25% over oceans and 75% over continents. However, accuracy differs on a regional and seasonal basis, and temporally and spatially more stratified error assessments are needed for meaningful applications in modeling (e.g., data assimilations).

In a comparison involving all sensor data, retrieval performances were investigated in a blind test with synthetic data. Best performances were achieved by sensors with multiangular and polarimetric capabilities. This includes retrievals with the underexploited Polarization and Directionality of the Earth's Reflectances (POLDER) sensor. With fewer a priori assumptions, higher accuracy (e.g., through a better surface characterization) and more details (e.g., spherical and nonspherical aerosol) in the aerosol retrievals are possible.

Other topics of discussion included the benefits of multiangular observations, observations of polarized signals, added value by active (lidar; light detection and ranging) remote sensing methods to provide data on the vertical distribution of aerosol particles, and effects of environment (e.g., surface properties, neighboring clouds) or a priori assumptions (e.g., the spherical shape of aerosol particles) on aerosol retrieval.

The workshop was conducted in a collegial atmosphere and was well received by all participants. Strong enthusiasm was voiced to repeat such a focused workshop on aerosol remote sensing on a regular basis. This meeting would not have been possible without the considerable financial and organizational support of the Wilhelm and Else Heraeus Foundation. All oral presentations are accessible at http://www.iup.uni-bremen.de/~hoyning/.

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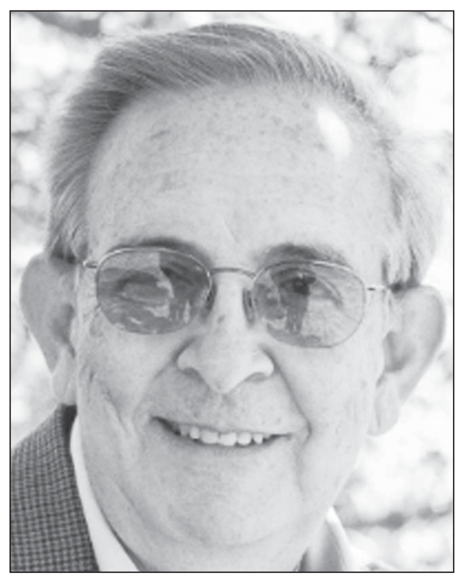
ABOUT AGU

Rodríguez-Iturbe Receives 2009 William Bowie Medal

Ignacio Rodríguez-Iturbe was awarded the 2009 William Bowie Medal at the AGU Fall Meeting Honors Ceremony, held on 16 December 2009 in San Francisco, Calif. The medal is for "outstanding contributions to fundamental geophysics and for unselfish cooperation in research."



Ignacio Rodríguez-Iturbe

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Citation

I am honored to summarize the seminal contributions of Ignacio Rodríguez-Iturbe to the understanding of water's role in environmental geophysics and ecology. He is the foremost surface water hydrologist in the world and has expanded the frontiers of geophysics repeatedly by identifying and opening new research areas. I will highlight what I consider to be his three principal contributions.

His work on probabilistic rainfall modeling and measuring, and network design, produced a range of widely used models of the rainfall process. He was first to provide a sound theoretical basis for sampling the rainfall process in space and time. This statistical theory accounts for the multidimensional structure of the process and provides number, location, and operating duration of ground stations needed to sample rainfall with a given degree of accuracy. The work has become a standard reference in Europe and the Americas.

His theory of the geomorphological unit hydrograph was the first to connect the geomorphologic structure of the river basin to its hydrologic response, making a major impact upon the field. It brought understanding of the streamflow response of a river basin in a generalized fashion based upon topography—the "Holy Grail" of surface water hydrologists since before the days of Robert E. Horton! Subsequently, he brought to this problem ideas from fractal theory and the growth of biological networks, leading directly to a pathbreaking book with Andrea Rinaldo, *Fractal River*