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# Continuation of Data Analysis Software Development for the Atmospheric Emitted Radiance Interferometer (AERI)

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Institution URL: http://cimss.ssec.wisc.edu/aeriwww/aeri/
Projects URL: http://www.arm.gov/docs/instruments/static/aeri.html

FY 1999 $165K
FY 1998 $165K
FY 1997 $155K
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**DOE Program Manager:** Patrick A. Crowley

**KEYWORDS:** radiative transfer, temperature profiles, moisture profiles

**OBJECTIVE:** To improve the modeling of radiative transfer for the molecular atmosphere, to improve the retrieval of temperature and moisture profiles of the planetary boundary layer, and to develop cloud-radiance parameterizations that relate climate-model variables to effective cloud radiances.

**APPROACH:** A long-term quality-measurement experiment continues to provide valuable insight into the size and character of uncertainties in clear-air radiative-transfer models. An improved planetary boundary layer retrieval algorithm has been implemented that combines data from a variety of sensors to best characterize the atmospheric state in the first 3 km of the Earth's atmosphere in both clear and cloudy conditions. Algorithms are being developed to obtain microphysical cloud properties from the infrared spectra.

**RESULTS TO DATE:** Important progress has been made in retrieving temperature and moisture profiles from AERI radiance information. A retrieval algorithm has been developed at the University of Wisconsin and implemented at Pacific Northwest National Laboratory (PNNL) in Richland, Washington allowing automated retrieval profiling. The AERI temperature and profiling technique has been augmented by combining retrievals from NOAA's spacebased Geostationary Operational Environmental Satellite (GOES) with the ground based retrievals. Temperature root mean square differences between the retrievals and concurrently radiosondes are less than one degress Kelvin in clear and partly cloudy situations. Water vapor root mean square differences between the AERI retrieved profiles and Raman Lidar/Radiosondes are less then 10% in absolute water vapor. The DOE funding in support of AERI software development has allowed a new remote sensing technology for the atmosphere to develop into a robust operational automated instrument capable of providing valuable high time resolution information about atmospheric state. These retrievals are currently being investigated to drive the Single Column Models (SCM) necessary to validate General Circulation Model (GCM) climatological forecasts instead of using traditional radiosonde launches. Another important contribution of this grant this year was use of extended AERI data from the Surface Heat Energy Budget of the Arctic (SHEBA) campaign. The extended AERI data has been instrumental in developing an improved version of the water vapor continuum, CKD_2.4. This version includes changes from 400-600 cm-1 to the foreign-broadened continuum made necessary by the AERI data from SHEBA. The modifications made to the model were as a result of years of comparisons between AERI data and LBLRTM calculations. The results of AERI-LBLRTM QME continue to provide an important constraint on the behavior of the continuum, which includes restricting the use of certain candidate functions under consideration in the effort to derive a revised formulation for the continuum.

**DELIVERABLES:** Delivered an upgraded temperature and water vapor retrieval algorithm to Pacific Northwest National Labortory to allow automated retrieval of temperature and water vapor from AERI radiances. New Papers: Smith, W. L., W. F. Feltz, R. O. Knuteson, H. R. Revercomb, H. B. Howell, Harold H. Woolf, 1998: The Retrieval of Planetary Boundary Layer Structure Using Ground Based Infrared Spectral Radiance Measurements. Journal of Atmospheric and Oceanic Technology, 16, 323-333, March 1999.

**COLLABORATIONS:**

**OTHER:**