

**Final Report for
"Cloud microphysics and absorption validation"
NAG5-11529**

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Summary of Work

Vertical distributions of particle size and habit were developed from in-situ data collected from three midlatitude cirrus field campaigns (FIRE-1, FIRE-2, and ARM IOP). These new midlatitude microphysical models were used to develop new cirrus scattering models at a number of wavelengths appropriate for use with the MODIS imager (Nasiri et al. 2002). This was the first successful collaborative effort between all the investigators on this proposal.

Recent efforts have extended the midlatitude cirrus cloud analyses to tropical cirrus, using in-situ data collected during the Tropical Rainfall Measurement Mission (TRMM) Kwajalein field campaign in 1999.

We note that there are critical aspects to the work:

- a. Improvement in computing the scattering and radiative properties of ice crystals.
- b. Requirement for copious amounts of cirrus in-situ data, presented in terms of both particle size and habit distributions
- c. Development of cirrus microphysical and optical models for various satellite, aircraft, and ground-based instruments based on the theoretical calculations and in-situ measurements.
- d. Application to satellite data.

Development of midlatitude cirrus microphysical and optical models for MODIS

A graduate student working towards her Ph.D. at the University of Wisconsin, Ms. Shaima Nasiri, has been actively involved with the effort of using the midlatitude in-situ measurements to build new cirrus scattering models. Towards this end, she worked closely with the investigators to merge the actual in-situ measurements with the theoretical scattering properties for individual ice crystals. Separate Matlab modules were developed to (a) read in the various in-situ measurement spectra from FIRE-1, FIRE-2, and ARM IOP field campaigns, (b) integrate these individual spectra to derive microphysical models. From these new cirrus microphysical models, Matlab code was developed to read in the various single-scattering property files and develop new cirrus scattering models at selected MODIS wavelengths. A journal article from this work was published in the Journal of Applied Meteorology in 2002.

References:

Nasiri, S. L., B. A. Baum, A. J. Heymsfield, P. Yang, M. Poellot, D. P. Kratz, and Y. Hu, 2002: Development of midlatitude cirrus models for MODIS using FIRE-I, FIRE-II, and ARM *in-situ* data. *J. Appl. Meteor.*, **41**, 197-217.