Project Report
Validation of CERES Cloud Retrievals Over the Arctic
with Surface-Based Millimeter-Wave Radar
Year 4

A data set has been developed describing Arctic cloud properties for the Barrow, Alaska DOE/North Slope of Alaska site based on a suite of retrieval techniques. The following objectives were outlined in the Year 4 Work Plan.

(1) We will use the GUI system to develop long time series of radar-radiometer based retrieved cloud parameters including cloud phase, particle sizes, concentrations, water content, vertical distribution of cloudiness with height and cloud top temperature and pressure. First priority will be to begin daily real-time processing in the summer of 2000. Second priority will be catch-up processing for the period since February, 2000 when TERRA was launched. Finally, the time period starting in February of 1998 when the radar came on line will be processed forward so a complete data set will be available from the North Slope of Alaska.

- The 2000 data set has been processed from March (date of TERRA launch) through December. It is expected that the data for January, February, March, and August of 2001 will be processed by September 15th of 2001. Unfortunately, much of the data from April, May, June and July of 2001 is of insufficient quality because of radar operating problems to perform reliable retrievals. The data from these months will be salvaged as possible
- The GUI system has been expanded to utilize a number of new retrieval techniques, most notably a radar only technique which can replace the radar-radiometer technique as needed. Classification for precipitation is also being implemented.

(2) We will develop an web site at NOAA/ETL which not only will provide access to the NSA retrieved data sets, but will also serve as an integrated front door to Arctic research activities at NOAA/ETL linking MTPE objectives to the NASA/FIRE-ACE program and the NSF/ SHEBA and SEARCH programs.

- A web site can be viewed at http://www.etl.noaa.gov/arctic . The data for the North Slope of Alaska site is found as one of the links under "Data Sites". This page also describes complementary NOAA/ETL Arctic cloud programs such as the NASA Fire/Arctic Clouds (ACE) Experiment an Surface Heat and Budget of the Arctic (SHEBA).

(3) A substantial effort will be made to initiate comparisons between the surface based radar data sets and the retrieved cloud products produced by the MODIS and CERES science teams. Comparisons will also be made between cloud fraction, cloud optical depth, and cloud top height/pressure/temperature to a number of existing satellite-based detection algorithms including CASPR, TOVS, and the AVHRR-based methods utilized by Patrick Minnis at NASA Langley. ISCCP data sets will be used to put the NSA data sets in

climatological perspective.

- Preliminary work has begun on creating surface data sets for TERRA (as well as NOAA-12, 14,15 and 16) specifically for TERRA overpasses with viewing angles less then 30 degrees.
- There has been no significant progress in actual comparisons to satellite retrievals, largely due to delays in satellite cloud products from TERRA over the Barrow, Alaska site. This item will be a major objective of year 5 work.

(**4) Using profiles of cloud microphysical properties from the radar-radiometer retrievals, we will perform preliminary radiative transfer calculations with a combination of the CSU/GCM radiation code and a STREAMER type code to assess the radiative importance of Arctic clouds. This activity will be focused on determining the impact of the complex layering and mix of liquid and ice clouds which are frequent in the Arctic. It is intended that this work will provide guidance on which areas of the complex mixed-phase problem will require the most emphasis.**

- The CSU-GCM radiative transfer scheme (BUGSRad), has been applied to several Arctic cloud cases from the SHEBA ice-camp cases. Cloud microphysical properties are determined from radar-radiometer measurements and the thermodynamic state of the atmosphere was interpolated from radiosondes. The surface albedos were determined from the surface measurements. An example is presented in Figure 1, which shows the ice water contents and net heating rate forcing (all-sky - clear-sky) for a 12 hour period on April 28, 1998. For this all ice cloud, we have assumed a constant effective radius, 30 micrometers, which is a typical assumption in most general circulation models. This methodology will be applied to DOE/North Slope of Alaska data sets for TERRA overpass times to determine radiative impacts of different cloud types, as well as to compare to TOA fluxes.

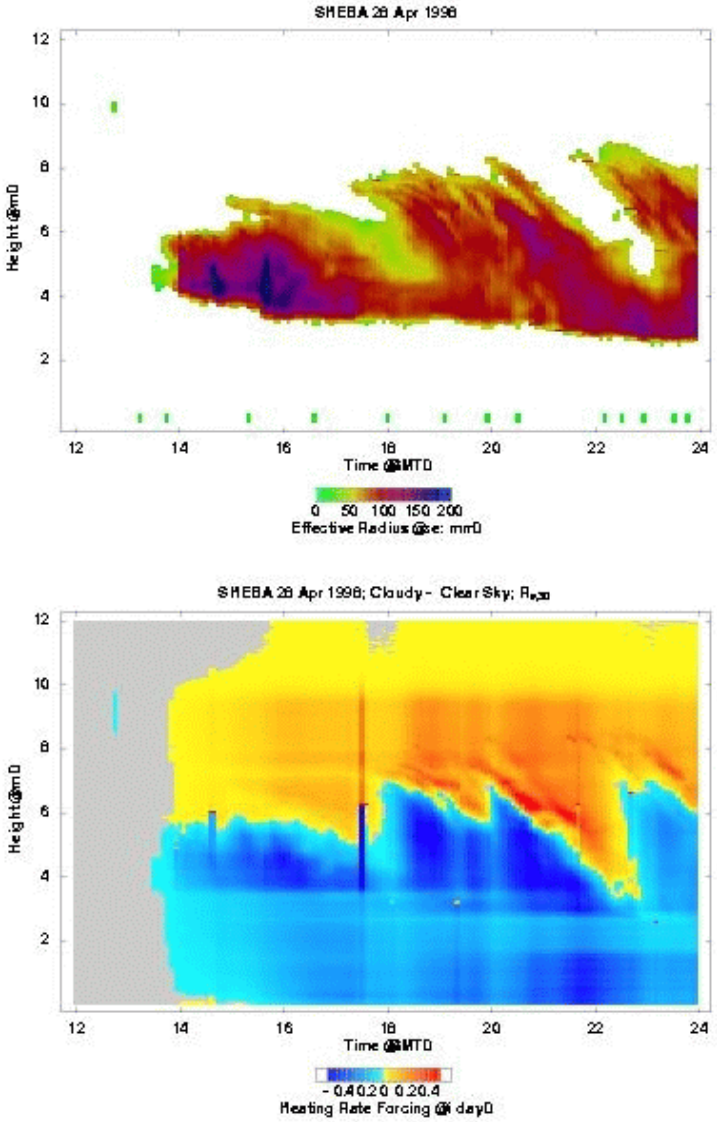
SHEBA 28 Apr 1998
12
10
8
6
4
2
Height (km)
12
14
16
18
20
22
24
Time (GMT)
0 50 100 150 200
Effective Radius (re: mm)
SHEBA 28 Apr 1998; Cloudy - Clear Sky; Rnet
12
10
8
6
4
2
Height (km)
12
14
16
18
20
22
24
Time (GMT)
- 0.4 0.2 0 0.2 0.4
Heating Rate Forcing (K day)

Figure 1