1. The Instrument.

CoSMIR (Conical Scanning Millimeter-wave Imaging Radiometer) is an airborne total power radiometer that measures radiation at nine frequencies of 50.3, 52.8, 89 (dual-polarized), 165 (dual-polarized), 183.3±1, 183.3±3, 183.3±7 GHz. Signals at each frequency are sampled in 10-msec intervals. The scan geometry is software programmable; i.e., the instrument can be programmed to perform conical scan (between the observational angles of 0-53.6 degrees), across-track scan, or a combination of both, depending on the needs of science/engineering objectives. Two close-coupled external calibration targets, one maintained at about 328 K and another at an ambient temperature of about 250 K at the NASA DC-8 aircraft cruising altitude of ≈ 11 km provide calibration of the radiometric measurements. The antenna beamwidth is frequency-independent and is about 4.3º, which, at the ER-2 cruising altitude of ~20 km, gives a surface footprint of ~0.8 km at nadir, and ~1.2 km x 2.5 km at 53.6º scan angle. For the GCPEx (?) field campaign, the instrument is programmed to operate in the hybrid mode with equal weight in conical and across-track scans; i.e., in a 10-sec cycle, it collects 3.33 sec of conical-scan data (at incidence angle θ = 53.6º) in the forward (or aft) 120º sector, as well as 3.33 sec of cross-track-scan data (θ between ±53.6º). The remaining 3.34 sec of a given cycle is used for the scan head to travel to various positions, and to view the hot and cold targets twice each. The 10-msec scene radiometric signals in each scan are calibrated and Gaussian-averaged to 51 equal-spaced pixels, each equivalent to slightly more than 60 msec integration time, which, with the aid of aircraft navigation data, are geo-located for final output.

2. CoSMIR Data Acquisition.

There were a total of 14 flights and thus 24 data files for both conical and cross-track scans. After the first flight on January 19, 2012, both the horizontally polarized channels (H) at 89 and 165 GHz were found to be noisy. These noises appeared intermittently throughout the entire GCPEx; segments of data that were deemed questionable were entered with -99.9. For the flights on January 26, 28, and 30, 2012, the 165 GHz H channel was almost useless. Some segments of data from these days might be salvaged after some tedious screening; these data files will be updated then. Additionally, the 183.3±7 GHz channel still experienced some RFI (Radio Frequency Interference) problem even after the original IF filter was replaced by a new narrower and more efficient one in the fall of 2011 (note: the RFI problem in this channel was found after an initial couple of flights during MC3E in spring 2011). The RFI source originated from the scan head and reflected from the aircraft frame back into the receiver. To minimize this noise source, the maximum scan angle was changed from 53.6° to 48.6°, after the flight on January 19. However, the data users are warned that the conical scan data might still contain some residual noise. For the cross-track scan, the measured values should be good within the scan angles of ±40°.