It Cloud Absorption Radiometer (CAR) in ARCTAS: Instrument Description and Science Goals

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Onboard NASA's P-3B aircraft, NASA's Cloud Absorption Radiometer (CAR) will be used to measure bidirectional reflectance distribution function (BRDF) of snow-covered and snow-free sea ice under a variety of conditions during Spring and Summer, 2008 at different sites and locations in the Arctic. These measurements will help to improve model parameterization of surface reflectance and address up-scaling needs for comparison with satellite measurements.

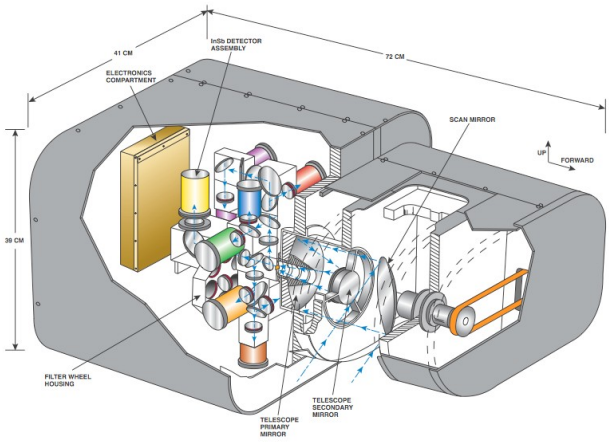

Fig. 1: The Cloud Absorption Radiometer (CAR)

The Cloud Absorption Radiometer (Fig. 1; King et al. 1986; car.gsfc.nasa.gov) has been used to acquire BRDF measurements of the ocean, sea ice, snow, tundra, savanna, smoke, vegetation, desert, and clouds between 0.34 and 2.301 μm. These measurements involved flights aboard the University of Washington C-131A and CV-580, and date from observations over the Kuwait oil fire smoke and nearby Saudi Arabian Desert and Persian Gulf in 1991, savanna in Brazil during SCAR-B experiment in 1995, salt pans, savanna, and marine clouds in southern Africa during SAFARI 2000 experiment, and over ocean surfaces with sunglint during CLAMS experiment (Gatebe et al. 2003; 2005). More recently the CAR participated in INTEX-B/MILAGRO and CLASIC Experiments in 2006 and 2007, respectively, aboard the Sky Research Jetstream 31.

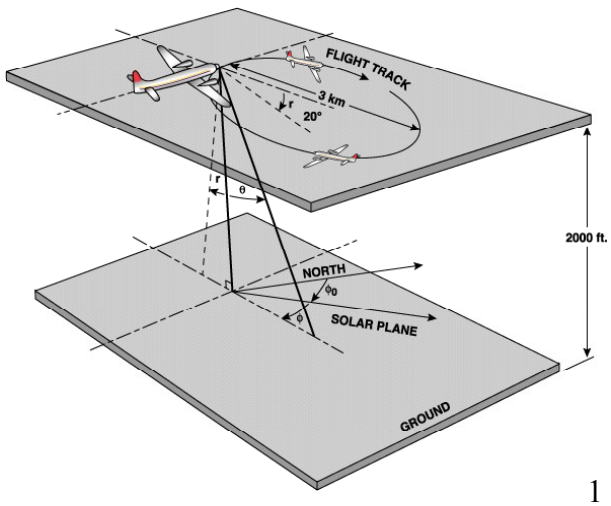

Fig 2: CAR BRDF Flight Track

Figure 2 shows a typical flight pattern whereby the aircraft, with the CAR in the nose cone, flies a clockwise circular pattern above the surface or cloud repeatedly, drifting with the wind, and scans the underlying surface and much of the transmitted solar radiation from above, and makes radiometric observations about every 1° in azimuth and better than 1° in zenith angle with an instantaneous field-of-view of 1°. Often, multiple

circular orbits are averaged together to smooth out the reflected solar radiation signal. From an altitude of 200 m above ground, the CAR has a spatial resolution of 4 m at nadir.

Figure 3 shows selected examples of the bidirectional reflectance observed over selected terrestrial surfaces, including Namibian stratus with a rainbow and glory, Etosha Pan, Namibia, and savanna vegetation at Skukuza, South Africa (Gatebe et al. 2003), and ocean reflectance with sunglint off the Virginia coast in the western Atlantic (Gatebe et al. 2005). Similar results are expected for the upcoming ARCTAS experiment and with some additional products on aerosol optical properties to be retrieved from combined data sets (CAR, AERONET & AATS).

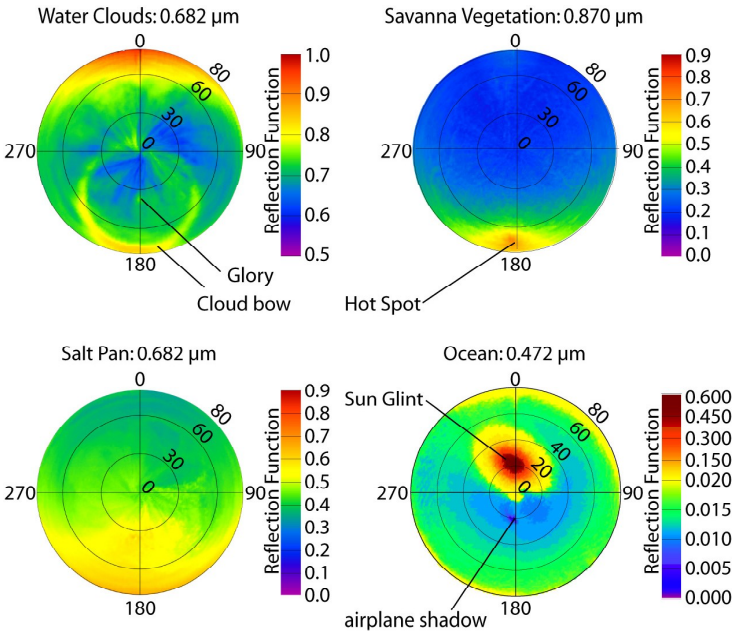

Figure 3: CAR BRDF of various natural surfaces

References

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