

Table 1: Standard CloudSat products

Product	Description
Calibrated Radar Reflectivities	Radar power with appropriate calibration factors
Cloud Geometric Profile (radar only)	Cloud mask applied to Z profile based on SNR and spatial and vertical continuity considerations; Convert to cloud top classification using ECMWF pressure and temperatures; assigns MODIS Scene characterization, variability, and cloud fraction designation
Cloud Geometric Profile (radar + lidar)	Merge data streams to give base and tops of up to 5 layers and to estimate the fraction of the radar resolution volume that is cloud filled
Cloud Classification (radar only)	Cloud type (St,Sc,Cu,Nb,Ac,As,deep convective, or high cloud) is determined using the cloud mask and is based upon empirical relations of Zmax vs temperature for different cloud types, height above ground, spatial persistence, height of Zmax, cloud thickness, cloud top temperature
Cloud Classification (radar + lidar)	Use radar+lidar cloud mask supplemented with 6 MODIS channels in a fuzzy logic approach.
Precipitation Occurrence	Zmax in lower radar gate and path integrated attenuation Z max threshold for precipitation (note in polar region it is acknowledged that this does not work effectively)
Optical Depth	Uses radar profile, upwelling TOA radiance measurements by several channels of MODIS, and surface albedo to retrieve reff and τ . Radar profile information is then used to produce a profile of τ vs. height in the column.
Cloud Liquid Water Content	Uses Z profile to estimate LWC and cloud droplet effective radius In daytime portion of orbit, uses Z profile and optical depth to estimate LWC, cloud droplet number density, and cloud droplet effective radius Assumes Rayleigh scattering and lognormal distribution of droplets
Cloud Ice Water Content	Uses Z profile to estimate IWC and cloud particle effective radius In daytime portion of orbit, uses Z profile and optical depth to estimate IWC, cloud number concentration, and cloud particle effective radius Assumes a modified gamma distribution of ice crystals Accounts for Mie scattering and ice density
Fluxes and Heating Rates	Uses profiles of IWC/LWC, ECMWF state variables, surface albedos to calculate upwelling and downwelling longwave and shortwave flux profiles at discrete levels of the atmosphere. Corresponding heating rates are inferred from these fluxes.