



Seasonal Variability of Warm Boundary Layer Cloud and Precipitation Properties in the Southern Ocean as Diagnosed from A-Train and Ship-based Remote Sensing Measurements

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The extensive cloudiness and resulting high albedo of the Southern Oceans (SO) are predominantly due to the occurrence of widespread marine boundary layer (MBL) clouds. Recent work finds correlations between biogenically enhanced cloud condensation nuclei concentrations and cloud droplet number concentrations derived from passive satellite data. The active remote sensors in the A-Train have created a unique and long-term record of these clouds that include vertical profiles of radar reflectivity and microwave brightness temperature from CloudSat that can be combined with solar reflectances from MODIS. We examine this data record to infer warm-topped cloud and precipitation properties. We find seasonal variations in cloud properties where summer season clouds demonstrate higher cloud droplet number concentrations on average and require higher liquid water contents to produce similar precipitation rates. We compare the properties and processes implied by the A-Train data with a unique cloud and precipitation remote sensing data set collected on board the Australian RV Investigator during March and April, 2016 during a 5-week voyage into the Southern Ocean.