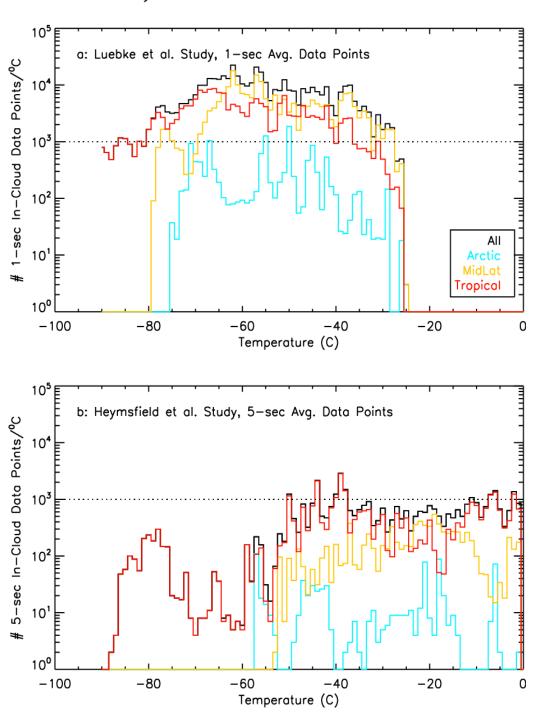
Dependence of the Ice Water Content and Snowfall Rate on Temperature, Globally

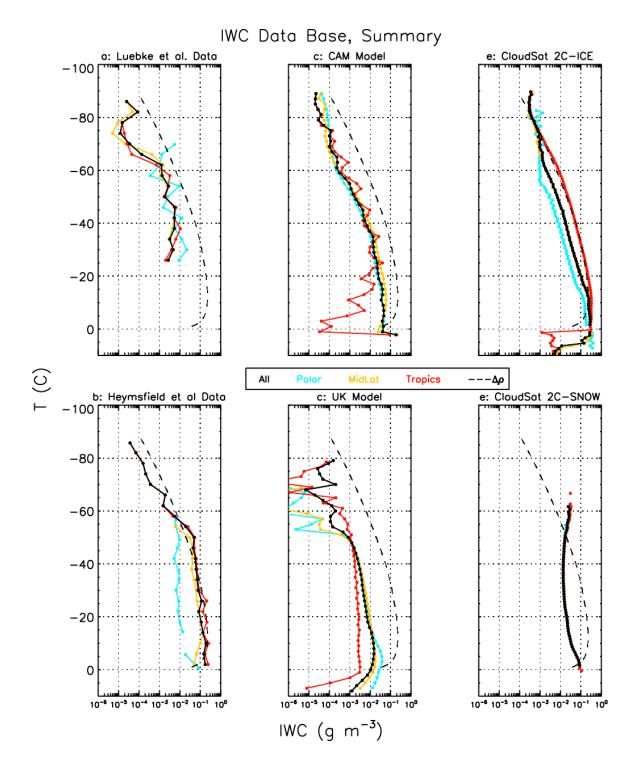
A. Heymsfield, M. Kramer, A. Gettelman, P. Field, N. Wood, G. Liu

Data Sources

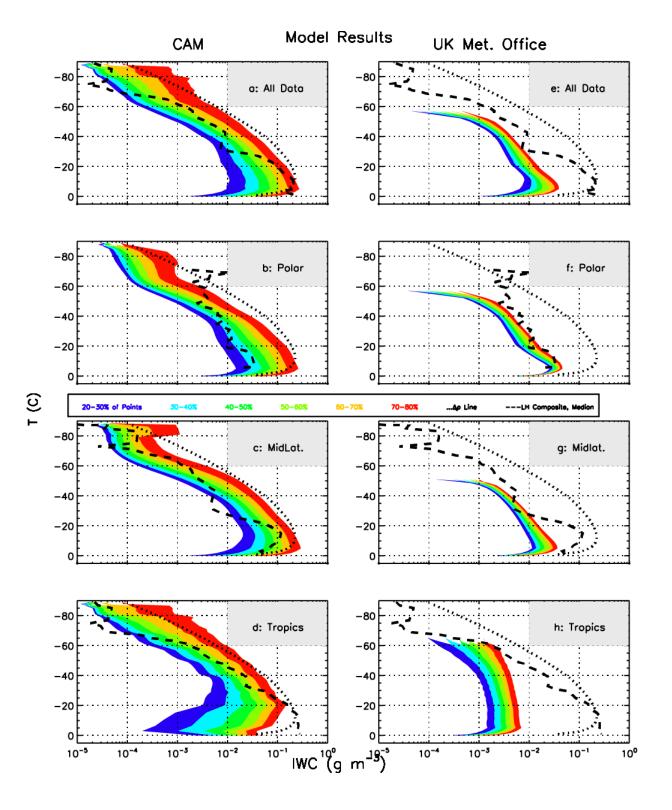
- Aircraft in-situ measurements from Arctic to Tropics
 - ~344,000 km of in-situ sampling
- CloudSat/CALIPSO data for 6 years, with retrievals
- GPM retrievals
- CAM5 runs, 3 years
- UK Met Office Unified Model runs, 1 year

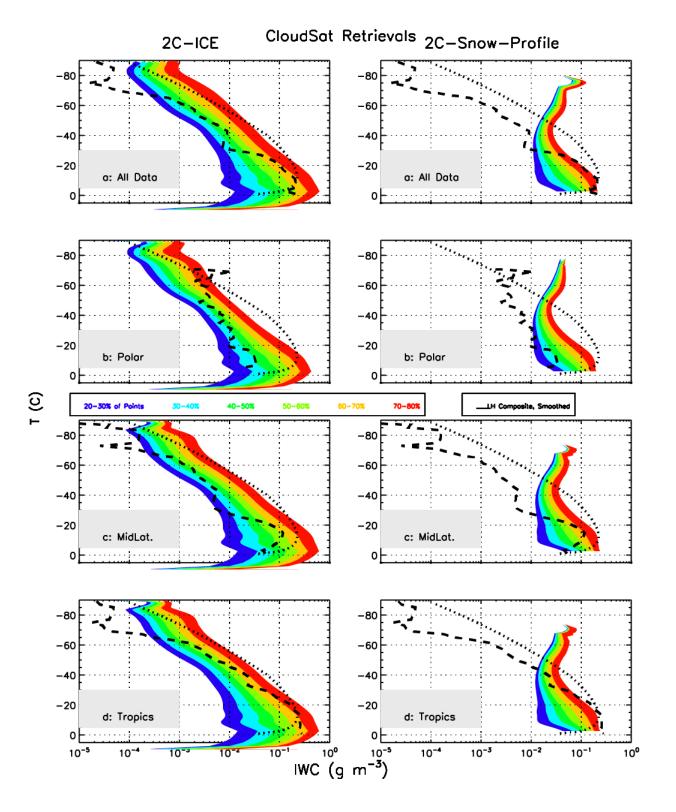
Summary of Cirrus In—Situ Data Collected





IWC Comparison All Convective and Stratiform Clouds a: All Data c: Midlat. Data -80 -80 -60-60⊙ ⊢ -40 () -40 -20 -20 0 0 HWZ $10^{-6}10^{-5}10^{-4}10^{-3}10^{-2}10^{-1}10^{0}$ $10^{-6}10^{-5}10^{-4}10^{-3}10^{-2}10^{-1}10^{0}$ Luebke IWC $(g m^{-3})$ IWC $(g m^{-3})$ --2C-ICE --2C-SNOW b: Polar Data d: Tropical Data CAM UK $--\Delta \rho$ -80 -80 -60 -60() -40 T (C) -40 -20 -20 0 0 $10^{-6}10^{-5}10^{-4}10^{-3}10^{-2}10^{-1}10^{0}$ IWC (g m⁻³) $10^{-6} 10^{-5} 10^{-4} 10^{-3} 10^{-2} 10^{-1} 10^{0}$ IWC (g m⁻³)





Snowrate Data Base, Summary a: Luebke et al. Data c: CAM Model e: CloudSat 2C-ICE, 2C-SNOW -100-80 -60-40 -20 \bigcirc ΑII Polar MidLat Tropics b: Heymsfield et al Data d: UK Model f: GPM -100 -80 -60-40 -20 10⁻⁶ 0.0001 0.01 10⁻⁶ 0.0001 0.01 10⁻⁶ 0.0001 0.01

Snowrate (mm hr⁻¹)

Summary and Conclusions

- For the retrievals snowfall rates, both the 2C-SNOW_PROFILE and GPM retrievals show unrealistic snowfall rates that increase when the temperature decreases below about -25C
- For a given temperature the retrieved snowfall rates are about an order of magnitude higher for GPM than 2C-SNOW-PROFILE, presumably because CloudSat has a lower reflectivity detection threshold than GPM.
- The Unified model exhibits IWCs and snowfall rates that are about a factor of 3 below those of CAM5
- For tropical regions, the snowfall rate for CAM5 increasingly decreases as temperature increases above -25C.