Improvement in Flux Analysis Retrievals for Thin Cloud Optical Depths

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PNNL

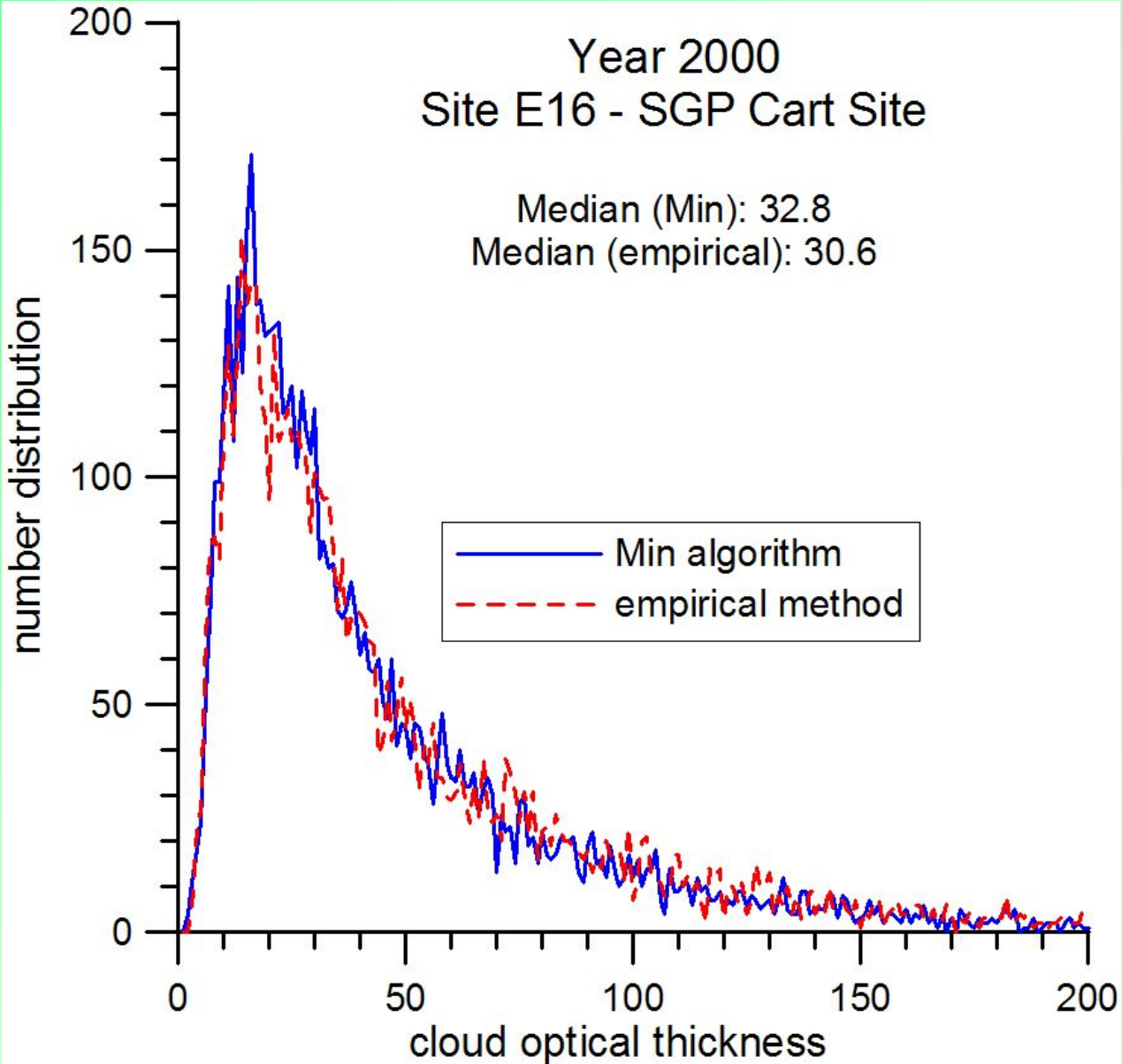
Flux Analysis Cloud Tau

- Original formula from Barnard and Long, 2004
  - Empirical fit to Min and Harrison 1996 MFRSR retrievals
- Later modified to more elegant formula implicitly including surface albedo and asymmetry parameter

$$r = D \Big/ \left(S_{clr} \mu_0^{\,0.25} \right)$$

$$\tau = \left(C/r - 1 \right) \Big/ (1-a)(1-g)$$

MFRSR/SWFA Comparison

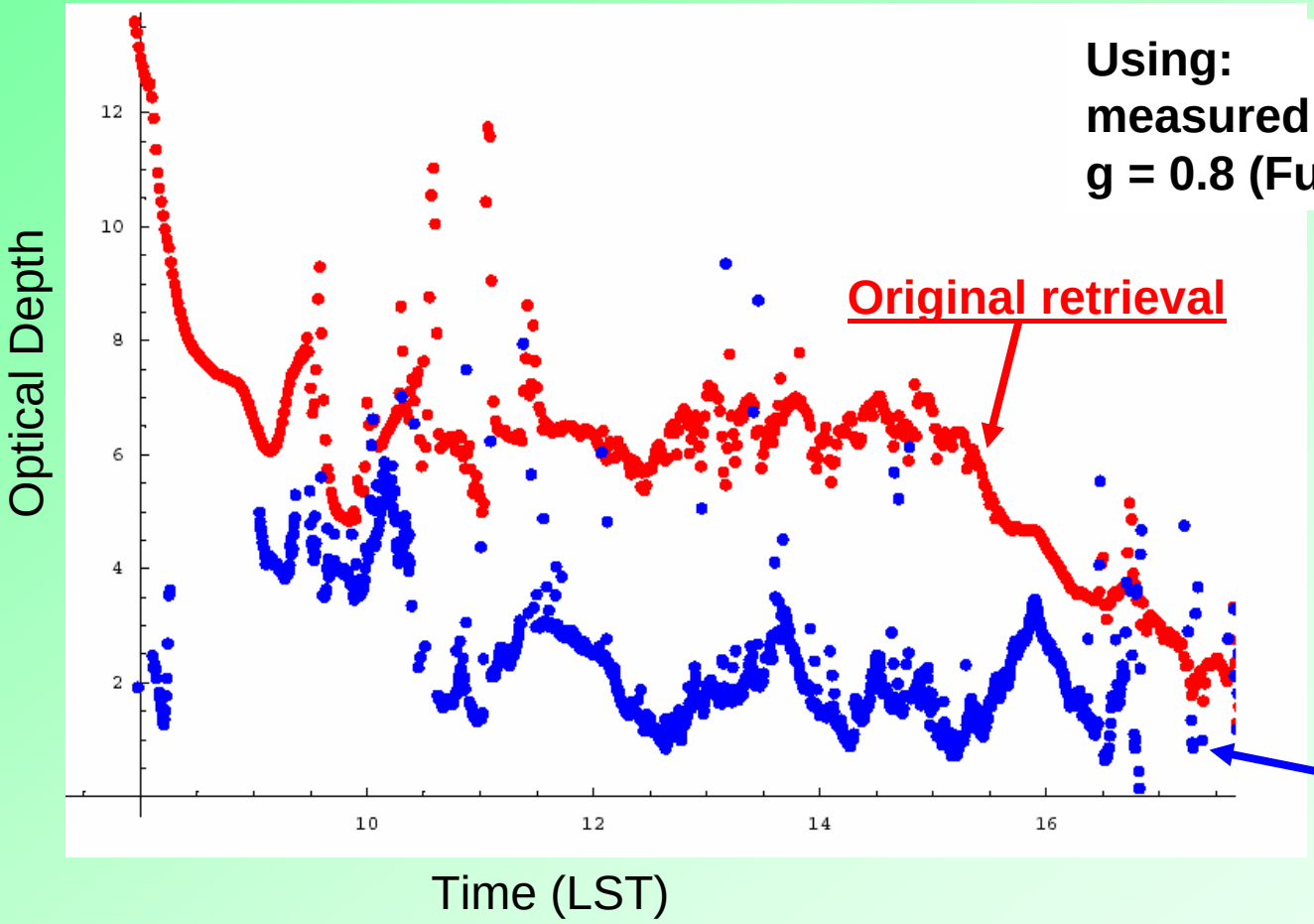


Overestimation for thin cloud

- Original CLOWD comparisons suggest MFRSR retrievals overestimate for small optical depths
  - Thus so does original Barnard and Long
- New MFRSR “direct beam” retrievals for thin cloud by Qilong Min
- Used to study how we might revise Barnard and Long formula

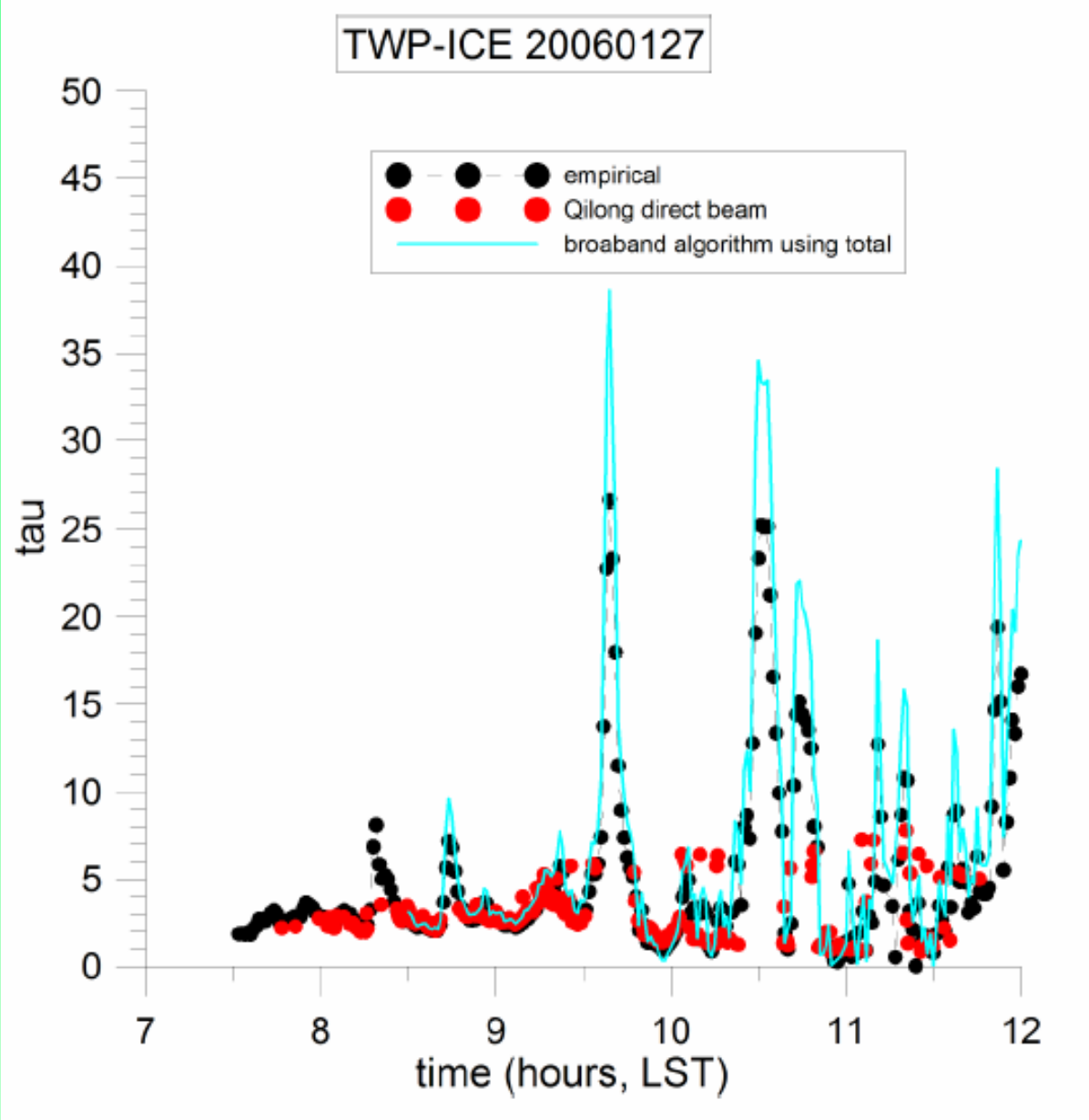
TWP-ICE Case, Jan. 27, 2006

- Thin overcast cirrus case over Darwin



Using:
measured surface albedo
g = 0.8 (Fu et al., 1996)

TWP-ICE Case, Jan. 27, 2006



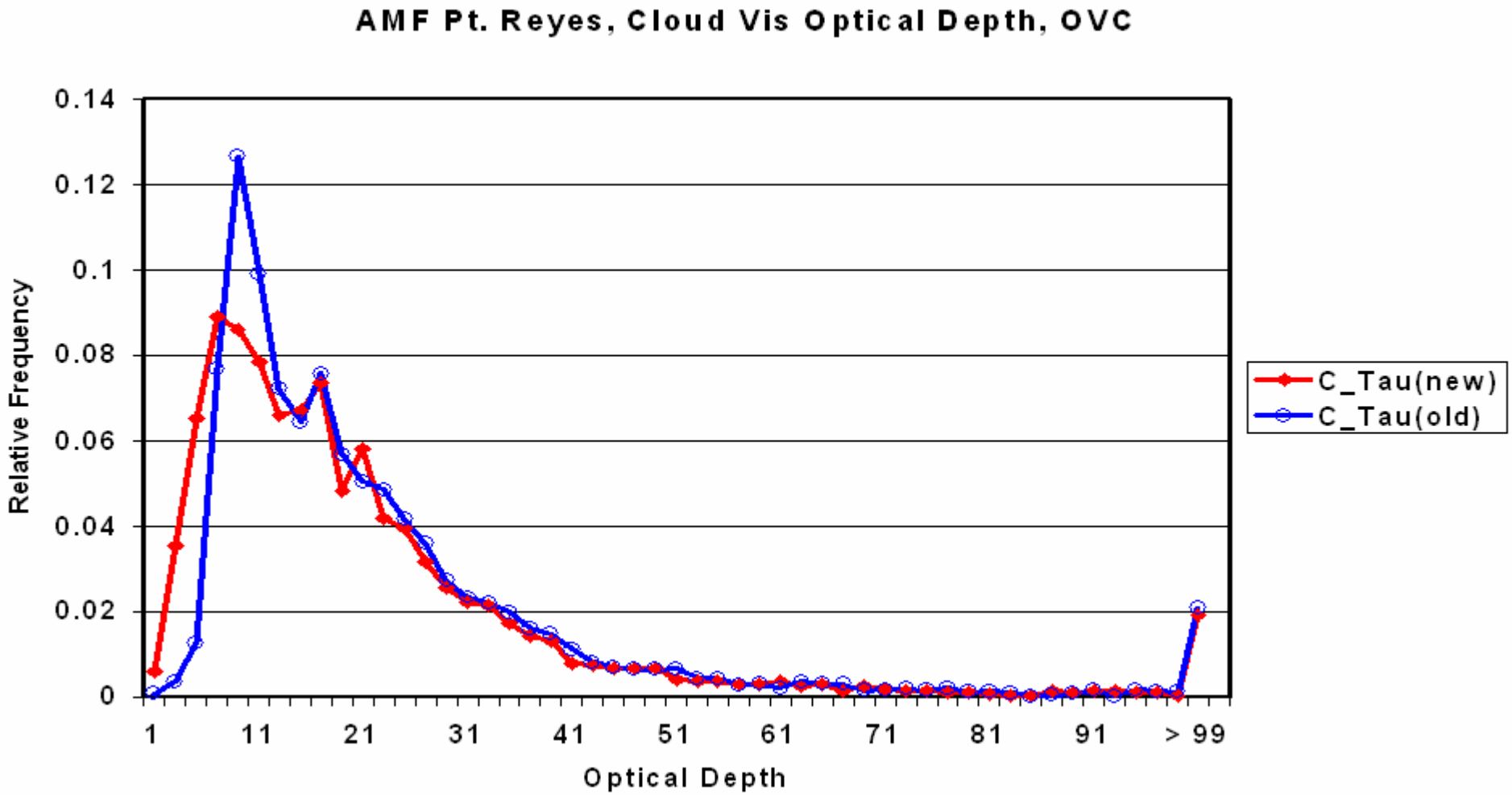
New formula uses total SW rather than diffuse SW.

Matches MFRSR direct beam retrievals well.

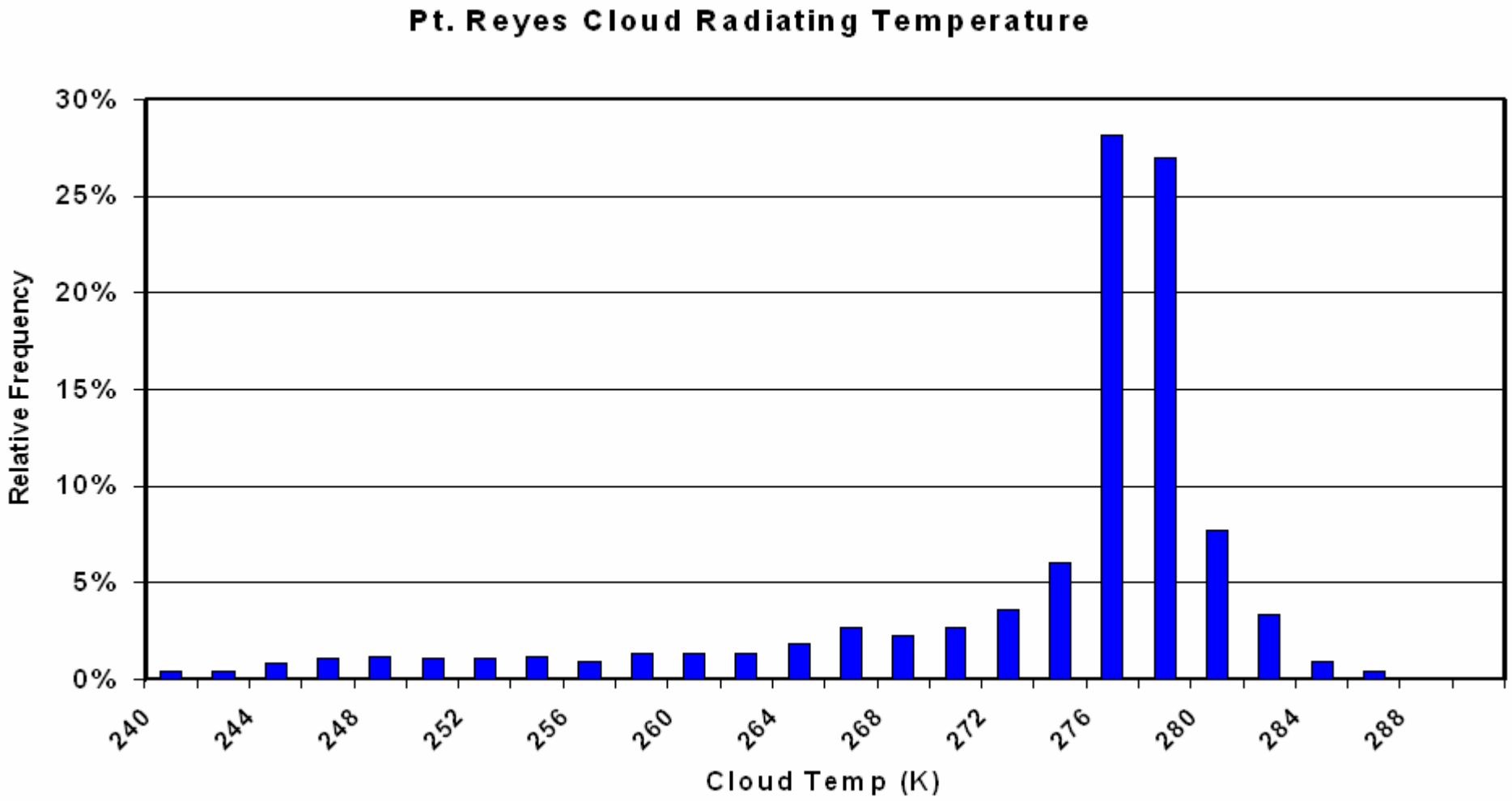
Also well matches SW model calculations using Jennifer Comstock and Evgueni Kassianov ice microphysics retrievals.

Frequency Comparison

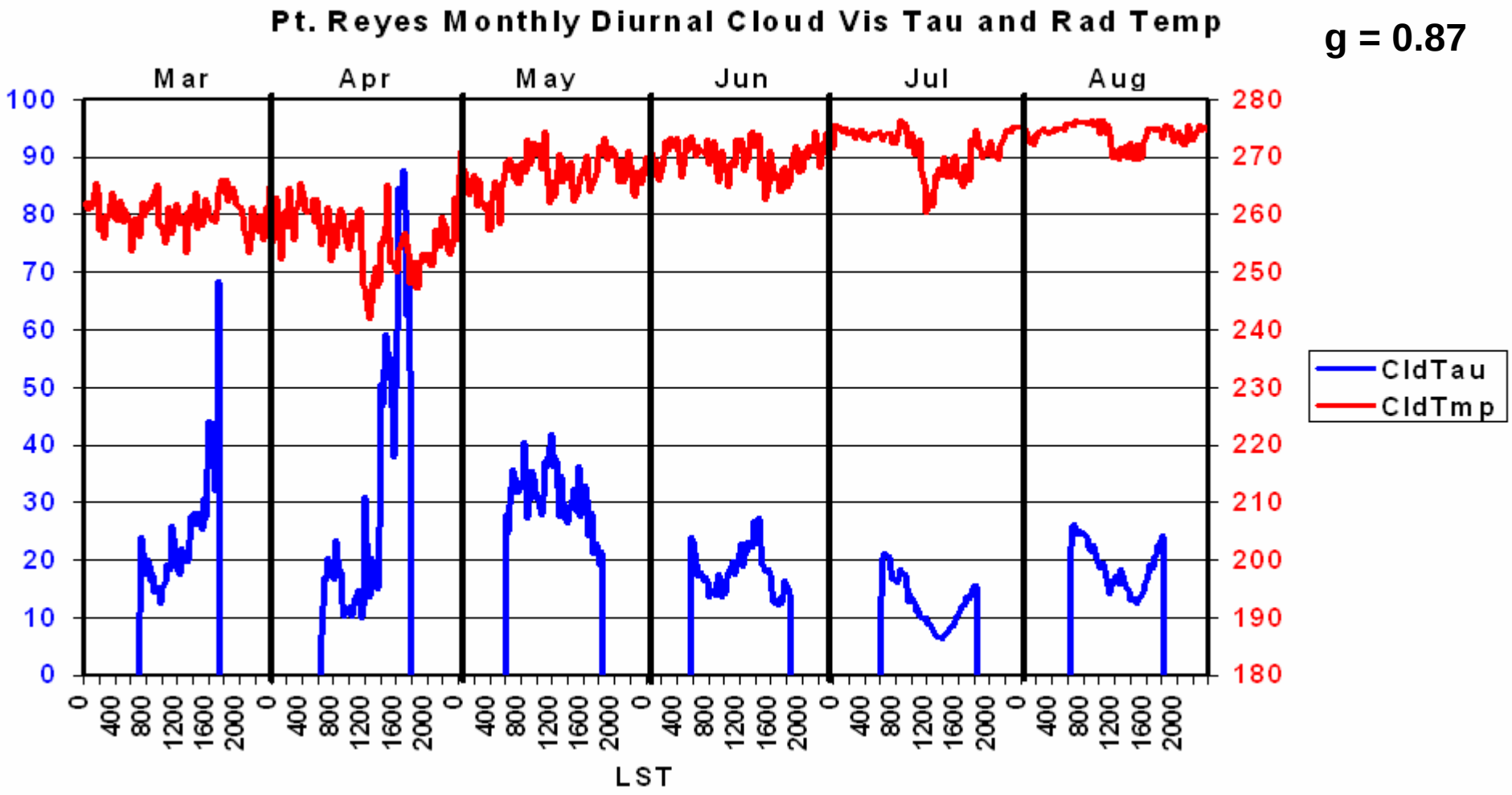
Using:
measured surface albedo
g = 0.87 (water clouds)



Cloud Radiating Temperature



Pt. Reyes Monthly Diurnal



Next:

- Further testing
  - MFRSR retrievals for Pt. Reyes
- Water/Ice separation for proper asymmetry parameter using cloud radiating temperature and transmissivity
- Partly cloudy skies?

Thank You