Cloud thermodynamic phase and ice cloud microphysics record for Aqua AIRS, Suomi NPP, and JPSS

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Ice cloud amount in decline in extratropics & ice CER increasing globally

Evidence from AIRS (Kahn et al. 2018) & climate models (e.g., Zhu & Poulsen, 2019)

Examine mechanisms using radiative-convective equilibrium (RCE) with RAMS

– Are observed trends in CER reproduced in CRMs of convection?
– Does the CER increase relate to convective storm strength?
– Is CER increasing from convective organization, aggregation, or cloud morphology with time?
– Is CER increasing from changes in ice microphysics & ice species below the cloud top?
– How will CER change in a warming climate?

Objectives/Deliverables

Extend Aqua AIRS cloud thermodynamic phase (ice, liquid, undetermined) to CrIS on SNPP, NOAA-20, and JPSS-2

Extend Aqua AIRS ice cloud properties (CER, COT, CTT & error estimates) to CrIS on SNPP, NOAA-20, and JPSS-2

Make products publicly available through the Sounder SIPS, document algorithms in an ATBD, publish in literature

Comparisons to current day/future RCE; examine physical causes of CER increase

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AIRS/MODIS and CrIS/VIIRS collocations available at JPL for SNPP (NOAA-20 soon)

Some MODIS and VIIRS continuity product data in hand

Less concerned about absolute precision & accuracy; more interested in ability to resolve small-scale variability

<u>MODIS & VIIRS play essential role in establishing hyperspectral IR cloud product continuity via algorithm testing</u>

Ice crystal model consistency between imagers & sounders is desired

Use of MODIS/VIIRS data

General approach follows Kahn et al. (2015) JGR, Guillaume et al. (2019) AMT, & Yue et al. (2022) AMT

Examine CrIS and AIRS footprint overlaps as function of cloud type, sub-footprint heterogeneity, single vs. multi-layered cloud, phase mixtures, viewing geometry, and so on

Quantify similarities/differences, inform AIRS & CrIS ice microphysics & cloud phase algorithm adjustments