A first look at the precipitation retrievals from the GPM dual-frequency precipitation radar (DPR)

Stephen W. Nesbitt

Department of Atmospheric Sciences, University of Illinois at Urbana-Champaign, Urbana, IL USA

Introduction

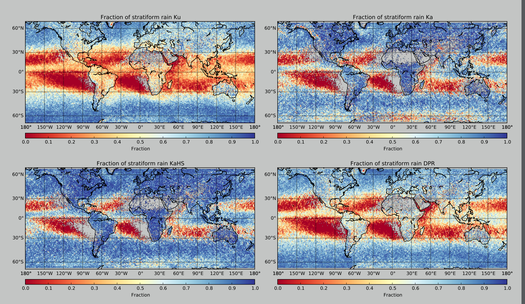
In this poster, I examine a 16-month climatology of precipitation retrievals from the Global Precipitation Measurement (GPM) mission dual-frequency precipitation radar (DPR). The DPR level 3 product produces a vast array of statistics from the four measurement/retrieval modes of the DPR:

- Ku swath (wide swath, Ku-only retrieval, $\Delta z = 125$ m) - 2x the sample!
- Ka swath (narrow swath matched with Ku footprints, $\Delta z = 125$ m)
  - Ka MS (Ka-only retrieval)
  - DPR (dual-frequency retrievals)
- Ka HS (high sensitivity, narrow swath, staggered footprints, $\Delta z = 250$ m)

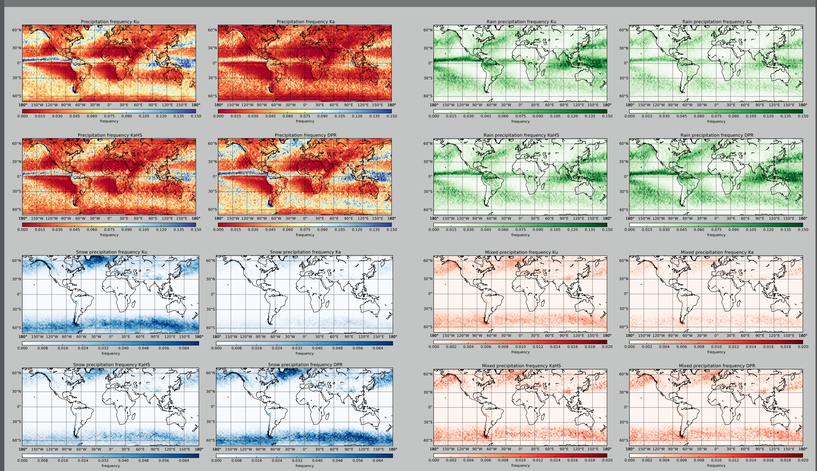
This poster examines data from the 0.25° x 0.25° monthly GPM level 3 products for the period 7 March 2014 - 30 June 2015.

Stratiform-Convective Separation

- The fraction of stratiform rain depends on the the algorithm used to perform the rain classification.
- Overall, the pattern appears similar to prior climatologies, which the highest stratiform fractions over oceans in the ITCZ high latitudes, with lower stratiform fractions over land and shallow precipitation zones over the oceans, however large differences exist in the tropics.

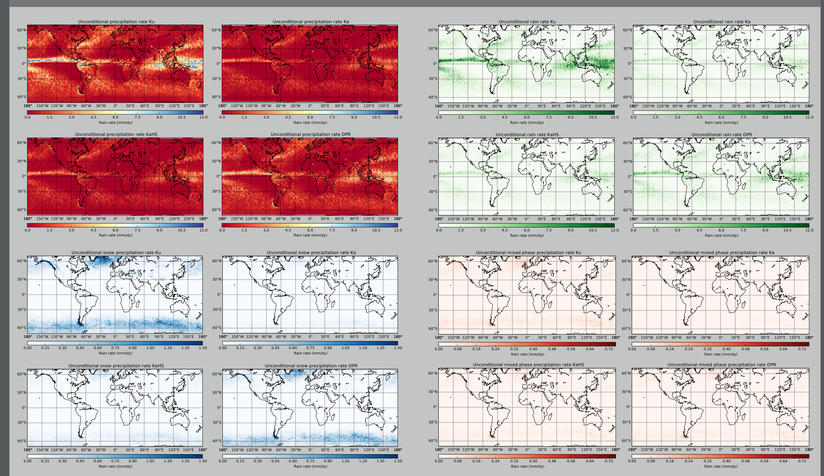


Near surface precipitation frequency



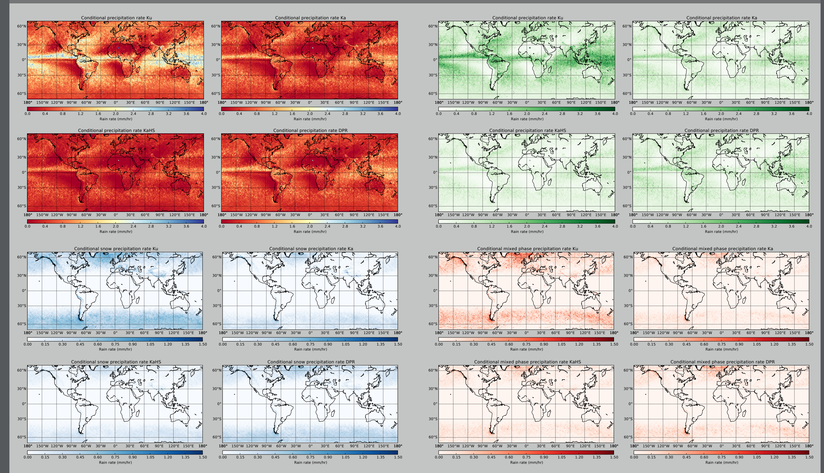
- The 0.25° x 0.25° precipitation frequency of all precipitation (upper left) and rain, snow, and mixed phase according to the DPR classification algorithm is shown for each swath mode.
- Note that the Ka MS mode has the lowest precipitation frequency globally, particularly for snow.
- The mid- and high-latitude oceans and select orographic regions show up as regions of highest snowfall frequency; mixed phase regions show up slightly equatorward (is this low-freezing level rain?).

Total near surface precipitation rate



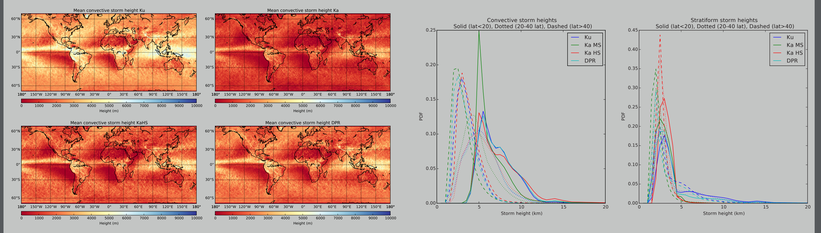
- The 0.25° x 0.25° conditional precipitation rate (total rain volume/number of precipitating pixels) shows the distribution of total precipitation and by phase (rain, snow, mixed phase).
- The tropics (ITCZ, Amazon) shows up as where the heaviest total rain rates exist, along with the mid-latitude storm tracks (high latitudes have light rain).
- The North Atlantic and Southern Ocean have the heaviest total snowfall rates, although they are much lower in the Ka than Ku radar. Even tropical orographic regions show up in snow accumulation also, although mountains in North America and Europe seem low (resolution?).

Conditional near surface precipitation rate



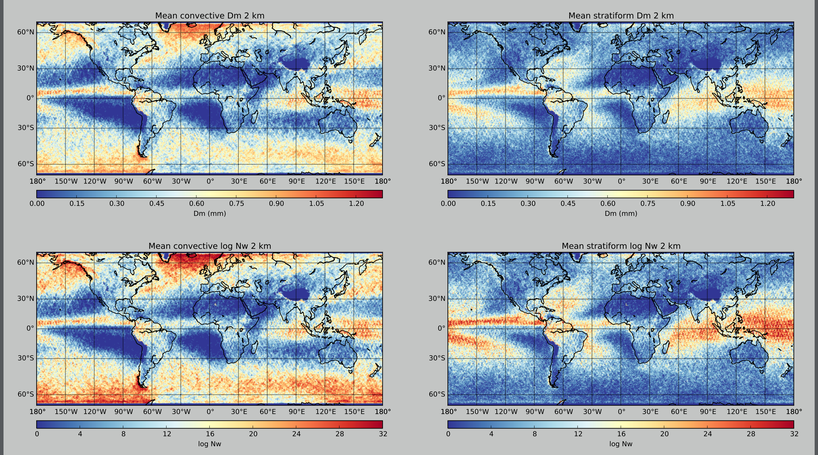
- The 0.25° x 0.25° conditional precipitation rate (total rain volume/number of precipitating pixels) is shown.
- The tropics (ITCZ) shows up as where the heaviest conditional rain rates exist, along with the mid-latitude storm tracks, however the latitudinal gradients in conditional rain rate are less than total rain rate.
- The North Atlantic and Southern Ocean again have the heaviest conditional snowfall rates, although the maxima in conditional rain rates don't stand out like total snowfall (frequency variations?).
- Mixed phase precipitation rates are similar to snowfall, but contribute insignificantly to the total precipitation climatology because it is rare.

Storm Heights



- Mean storm height distributions (left) show that the Ku radar has the highest mean storm height distributions, PDFs of storm height distributions (right) by latitude and DPR scanning mode suggest that the Ka band radar is more sensitive in convective regions than stratiform regions (Mie scattering and high dual frequency ratio (DFR) in large aggregates?).
- What is going on over Greenland?

PSD Parameters



- Gamma DSD parameters from the DPR algorithm are shown at 2 km height for convective (left) and stratiform (right) pixels in D_m (top) and log N_w (bottom).
- High latitude oceans have high values of retrieved convective D_m and N_w, while they are smallest at high-latitudes in stratiform precipitation (evaporation?).
- Physical behavior in trade wind regimes vs ITCZ?

Conclusions

- Initial climatology of DPR Level 3 data is promising for science
- Differences between Ku and Ka algorithms in:
  - stratiform-convective classification
  - precipitation frequency, total and conditional rain rates
  - storm heights: who to trust? (convolvement of minimum detectable signal, Mie scattering, and sampling)
- PSD parameters show interesting regional variability; relation to cloud microphysical properties and kinematics?
- LOTS OF VALIDATION CHALLENGES!
  - Need additional data and field campaigns over high latitude oceans (OLYMPEX may help, but transition to snow may also be a large problem).

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Contact: snesbitt@illinois.edu