What Happens When Radiances Leave Home: Precipitation

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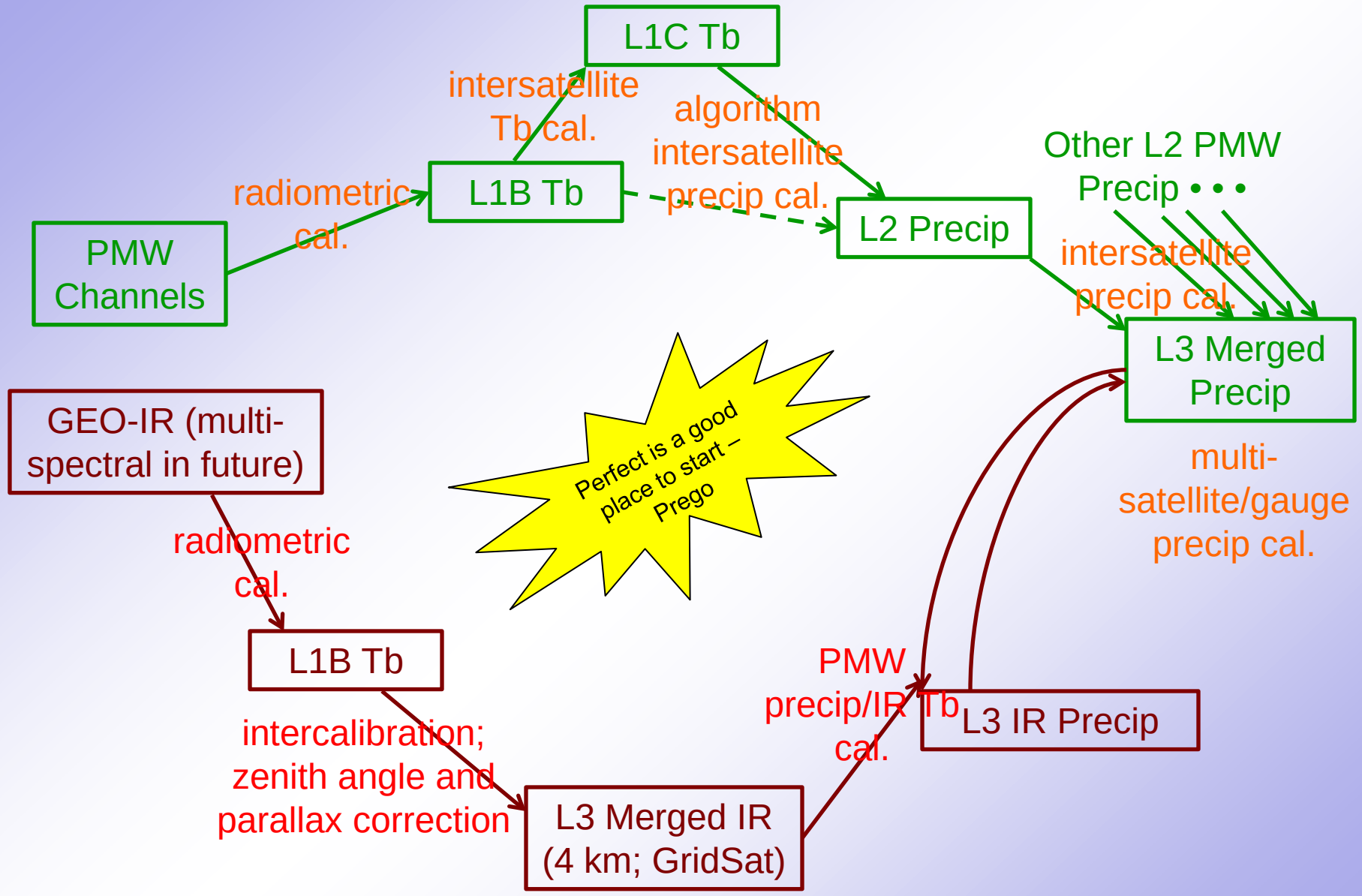
Getting to Precipitation Involves Multiple Calibrations



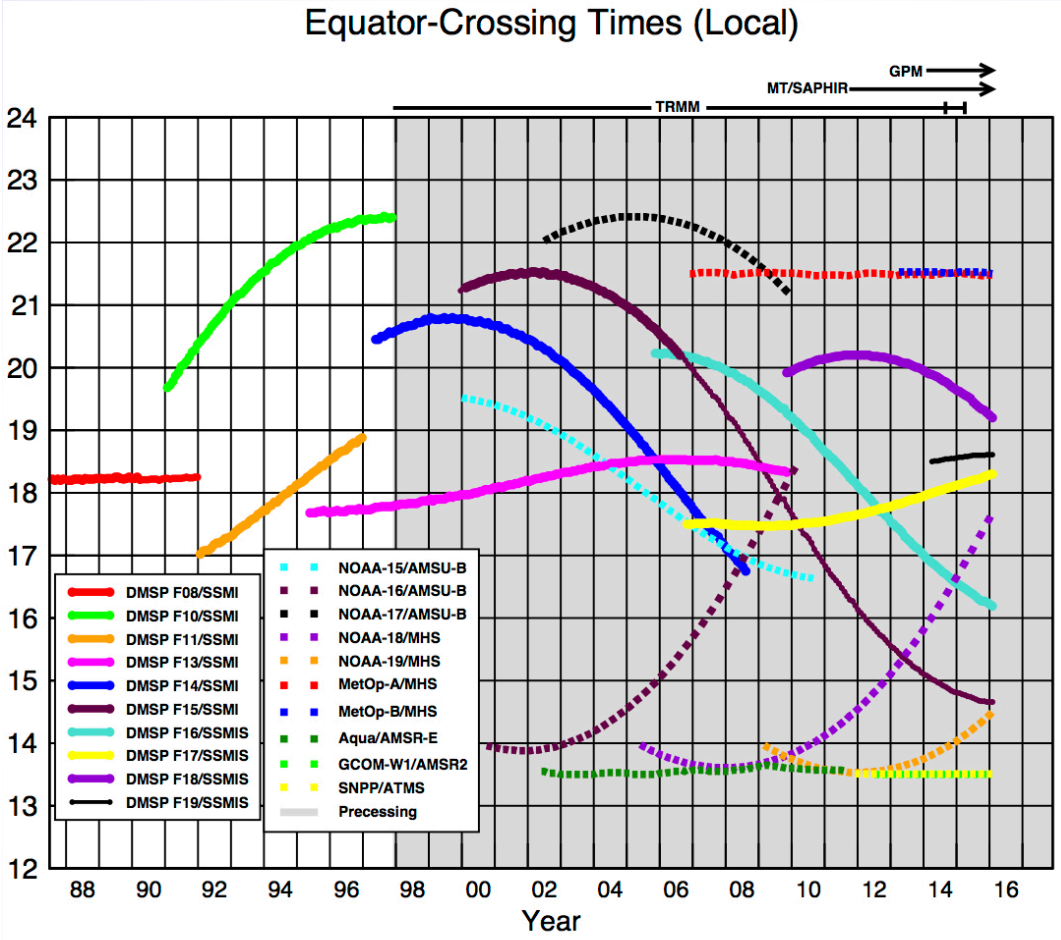
GPCP (CDR) vs. IMERG (HRPP)

Global Precipitation Climatology Project (GCP) Satellite-Gauge adheres to Climate Data Record (CDR) standards

- homogeneity at the expense of instantaneous skill
- 06/18 LST PMW calibrates GEO-IR (40° N-S, other approaches at higher latitudes)

Integrated Multi-satellitE Retrievals for GPM (IMERG) is a High Resolution Precipitation Product (HRPP)

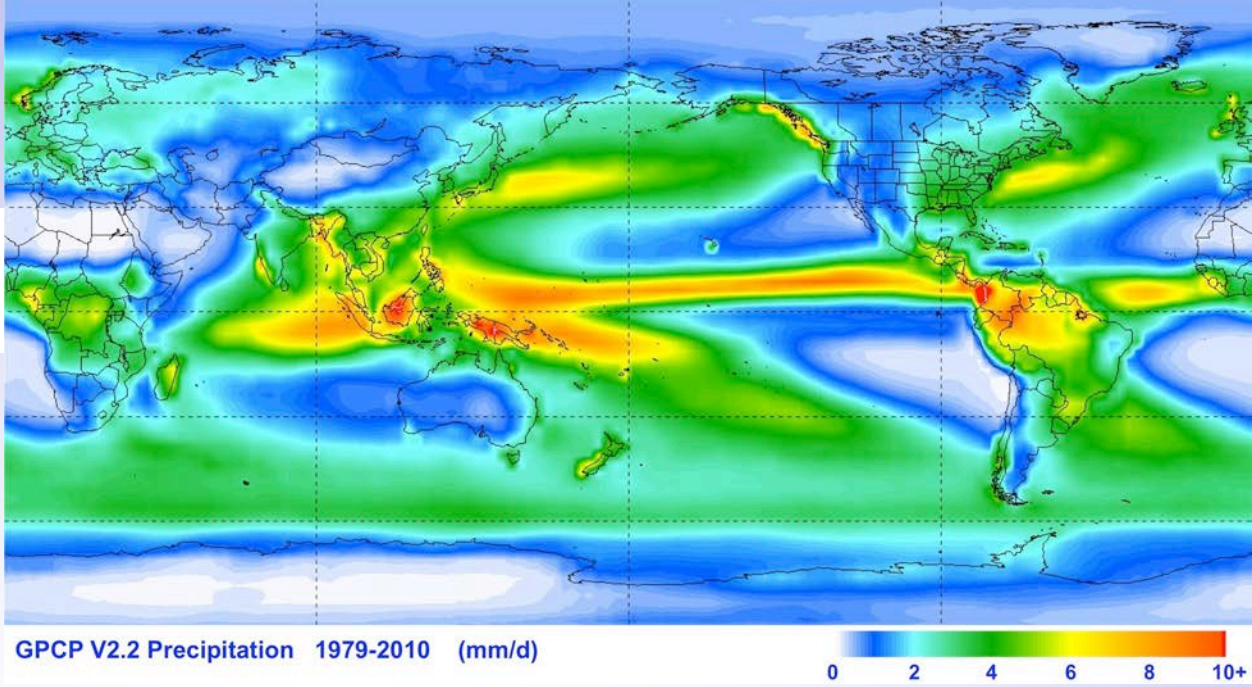
- instantaneous skill
- use “all” precip-relevant satellites
- potential for drift in the statistics as the constellation changes



Ascending passes (F08 descending); satellites depicted above graph precess throughout the day.
Image by Eric Nelkin (SSAI), 2 March 2016, NASA/Goddard Space Flight Center, Greenbelt, MD.

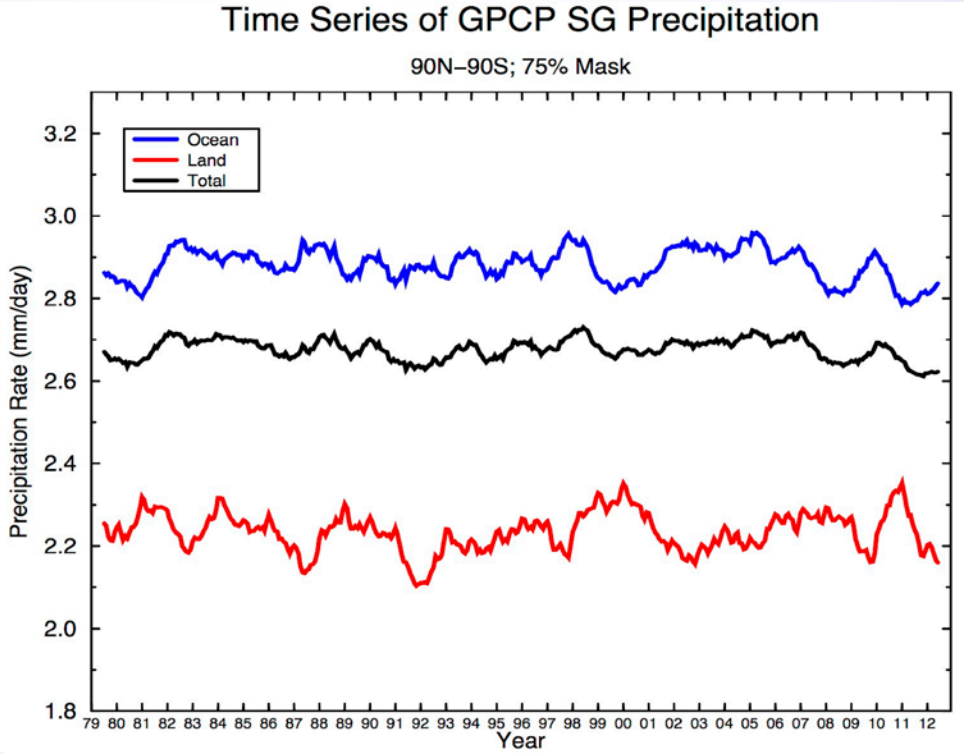
Example: GPCP V2.2 Climatology

2.5˚ x2.5˚ grid is smoothed in this representation

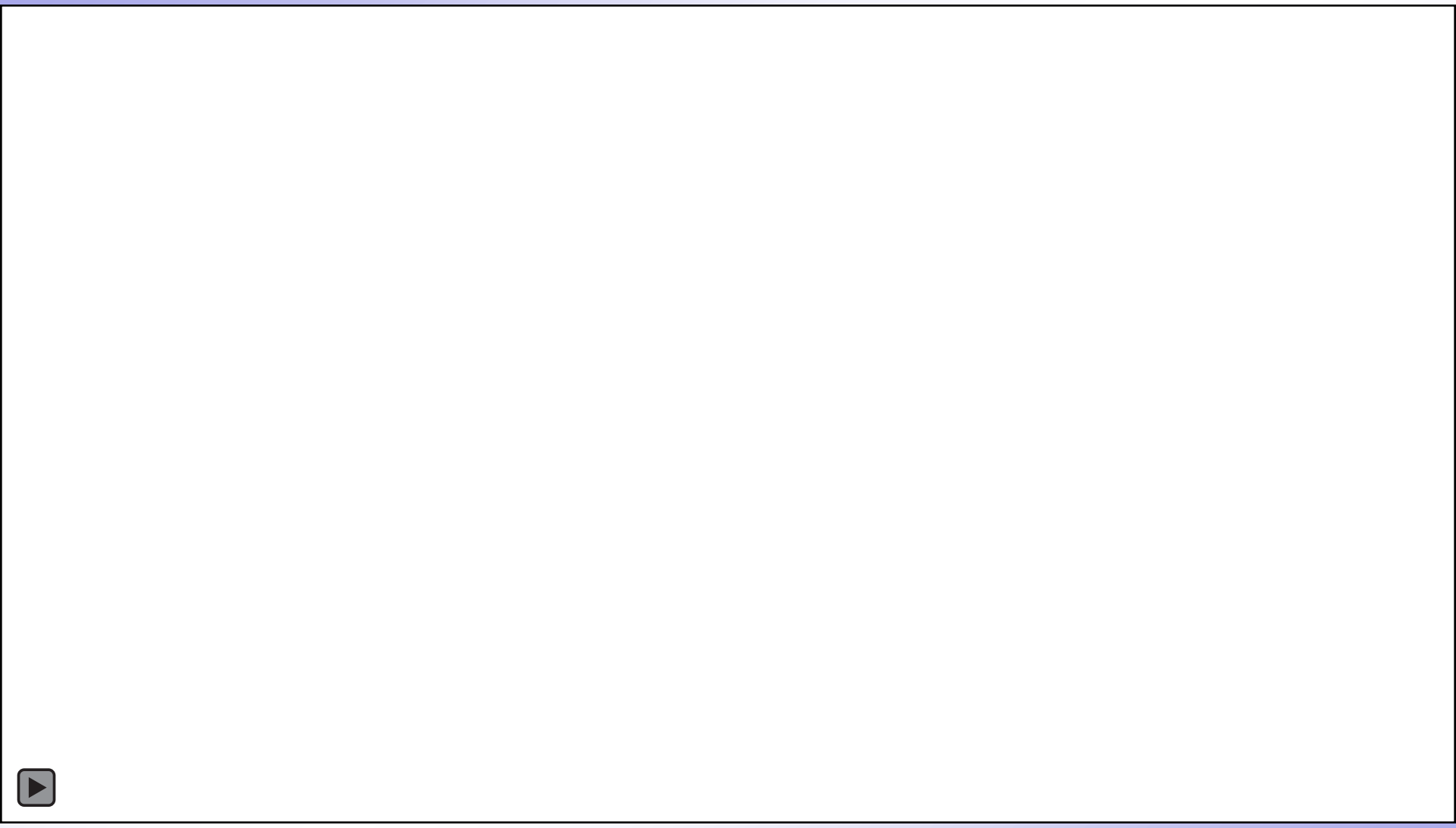


To zero order, anti-correlations in land and ocean yield a nearly flat global time series

- bias shifts within and between satellites are a concern
- sag at the end is now explained by shift from SSMI to SSMIS and associated sensor/algorithm issues



Example: Last Week of V3 IMERG Near-Real-Time



0.1° x0.1° , half-hourly

- precip phase is diagnostic
- puts a premium on overpass-to-overpass consistency

How the GSICS Calibration Strategy Supports Satellite Precipitation Products (1/2)

Tie satellite measurements to absolute references and standards

- we absolutely depend on the experts to do this!

Inter-calibrate operational satellite instruments

- we absolutely depend on the experts to do this!
- PMM (TRMM+GPM) funded the Cross-Calibration Team (XCal) to do this across all PMW sensors to (help) ensure consistency
  - this extends to sensors in both the TRMM and GPM eras
- the current state of algorithms only requires Tb within, say, 1K in most channels, but
  - the algorithm developers are ratcheting down the tolerances
  - the new emphasis on light precip and snowfall requires study, and will likely result in tighter tolerances for some channels
- information on the occurrence of sun glint, solar intrusion, RFI, etc. is also key

How the GSICS Calibration Strategy Supports Satellite Precipitation Products (2/2)

Monitor instrument performance

- I need to be better plugged in to this activity
- within GPM the first inkling of the recent DMSP F17 37V problem came when the near-real-time IMERG animations started showing bad swaths of data
- we don't currently have automated quality controls on inputs or outputs

Recalibrate archived data

- this is a "modern best practice"
- it is a non-trivial exercise that requires resources from the responsible agency
- note: changing standards of data archive practices (format, metadata, documentation) can be implemented at the same time
- what is the tie-in between the XCal Level 1C results and the individual agencies' state of processing for their own Level 1B?
- after Xcal's TRMM/GPM-era work, we need to go "all the way back", to DMSP F08 SSMI, and even SMMR
  - significant challenges with SMMR, but
  - success would provide a "live" precipitation calibrator for IR data back to the start of the operational LEO/GEO era (~1979)

GSICS Beyond PMW

Is there a consensus on calibrating the early NOAA LEO-IR sensors?

- at about the time of the last GPCP retrospective processing there were alternative data sets and no clear guidance

Is there a current or developing GSICS standard for correcting GEO-IR data?

- intersatellite calibration
- zenith angle correction
- parallax correction
- it would be helpful to have a considered review of current practices
  - CPC 4-km Merged Global IR
  - GridSat

There is a long-term need for precip from legacy and current GEO data

- the long record only provides thermal IR, water vapor, visible
  - but used together, these beat IR-only algorithms
- as we continue to upgrade all other aspects of the data record, a consistent record of these legacy channels is becoming important

Final Remarks

The precipitation community depends on the satellite specialist community to carry out the calibration strategy stated by GSICS

- consistency between satellites is becoming more important
  - other sources of error are being reduced
  - the lengthening record across increasingly more satellites can be used for climate studies if it is “sufficiently” homogeneous

Precipitation studies use satellite data beyond PMW

- GEO-IR continues to be used
- GEO multi-spectral is poised to be used
- further in the future, will radars and lightning detectors need attention as well?

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