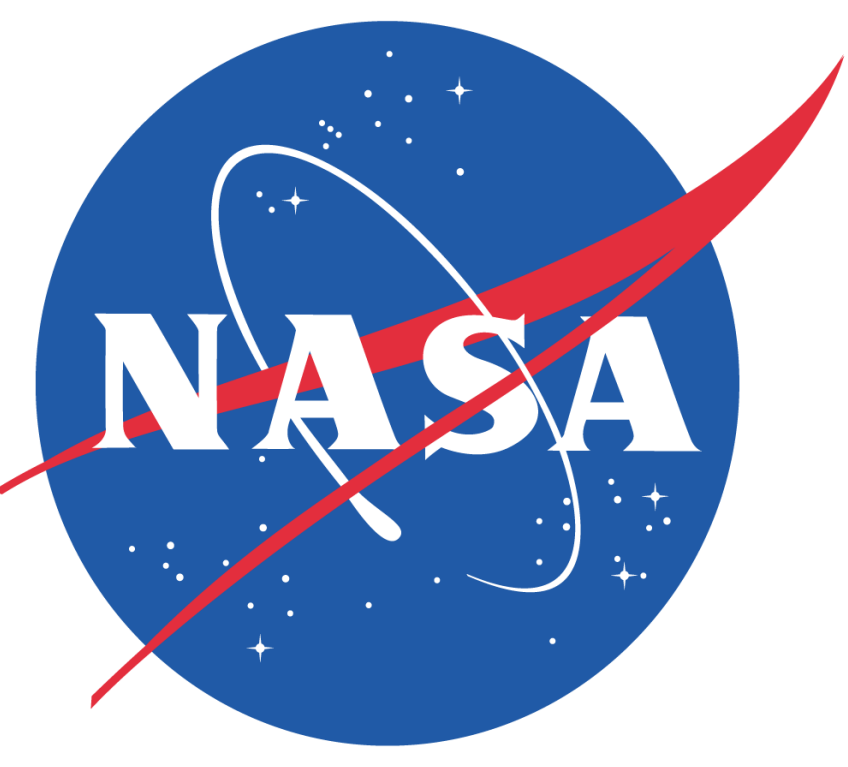




Oceanic Validation of IMERG V07B Precipitation Using the GPM Validation Network



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Aims

- To **validate Version 07B** of the Integrated Multi-satellite Retrievals for the Global Precipitation Measurement (GPM) mission (IMERG; Huffman et al. 2023) at instances of GPM Microwave Imager (GMI) overpasses (i.e., **IMERG-GMI**) of **tropical, Alaskan, CONUS and Brazilian oceans** using the **GPM Validation Network (VN; Gatlin et al. 2020)**.
- To **trace errors** from the Level-3 **IMERG-GMI V07B** product **back through** to the input Level-2 Goddard Profiling Algorithm climate (**GPROF-CLIM**) **GMI V07** product.
- To assess the **differences between IMERG V07B & V06B** caused by **algorithm upgrades** including new GPM V07 inputs, the gridded offset correction (Watters et al. 2024), SHARPEN (Tan et al. 2021), etc.

Overview

- What: Oceanic evaluation of IMERG-GMI V07B & V06B
- When: GPM Pre-Boost Era (June 2014 to July 2023 [V07B] / Sept. 2021 [V06B])
- Why: **First IMERG-GMI V07B oceanic validation**
- How: GPM Validation Network Version 2.4 (comparison with ground radars)

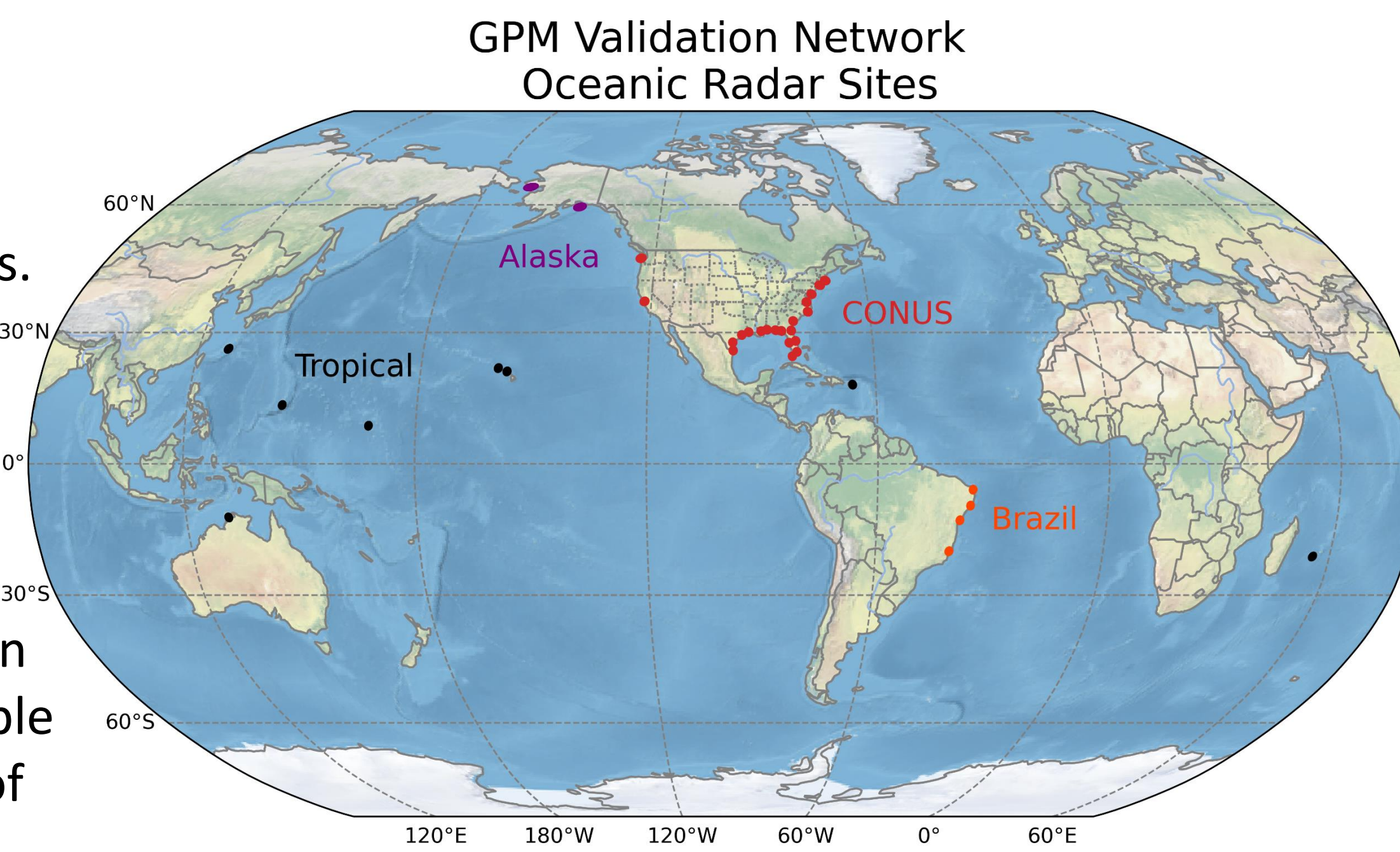
The GPM Validation Network

The GPM VN geometrically matches 3D precipitation retrievals from GPM Core sensors to 35 oceanic radars.

- Alaska: 2
- CONUS: 21
- Brazil: 4
- Tropical: 8

The diversity of precipitation climatologies assessed enable an analysis representative of the global oceans.

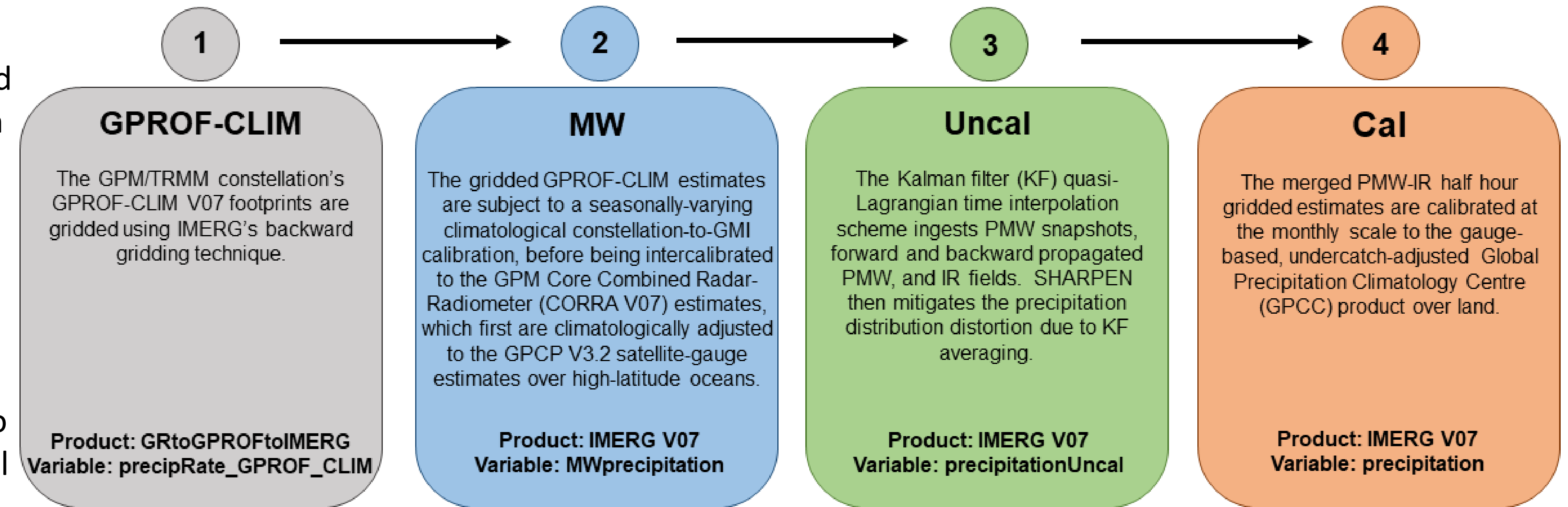
The VN's GR-to-GPROF matchups can be gridded to validate IMERG against the GR data, and enable error tracing from IMERG-GMI back through to GPROF-GMI.



IMERG Error Tracing

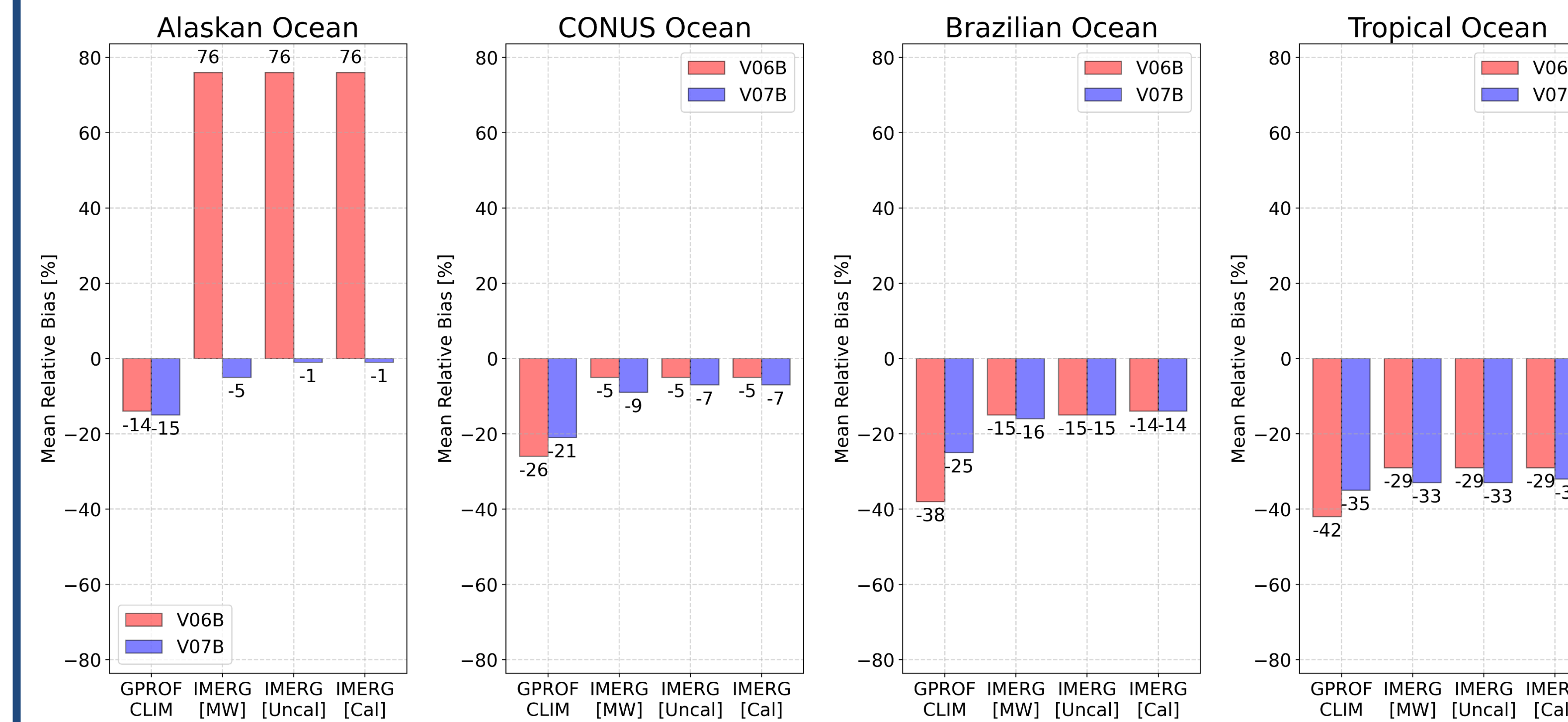
- The GPM VN enables full error tracing from GPROF-CLIM through to IMERG-GMI (Watters et al. 2024).
- The GPROF-CLIM GMI estimates are combined with propagated imager estimates over ocean in the Kalman filter, unlike in V06.
- The Global Precipitation Climatology Project V3.2 product only influences mid- and high-latitude oceanic precipitation retrievals in IMERG V07.
- The GPCP gauge analyses do not contribute to oceanic regions in IMERG, hence IMERG Uncal and Cal equate over ocean as expected.

IMERG V07 Final Run Algorithm



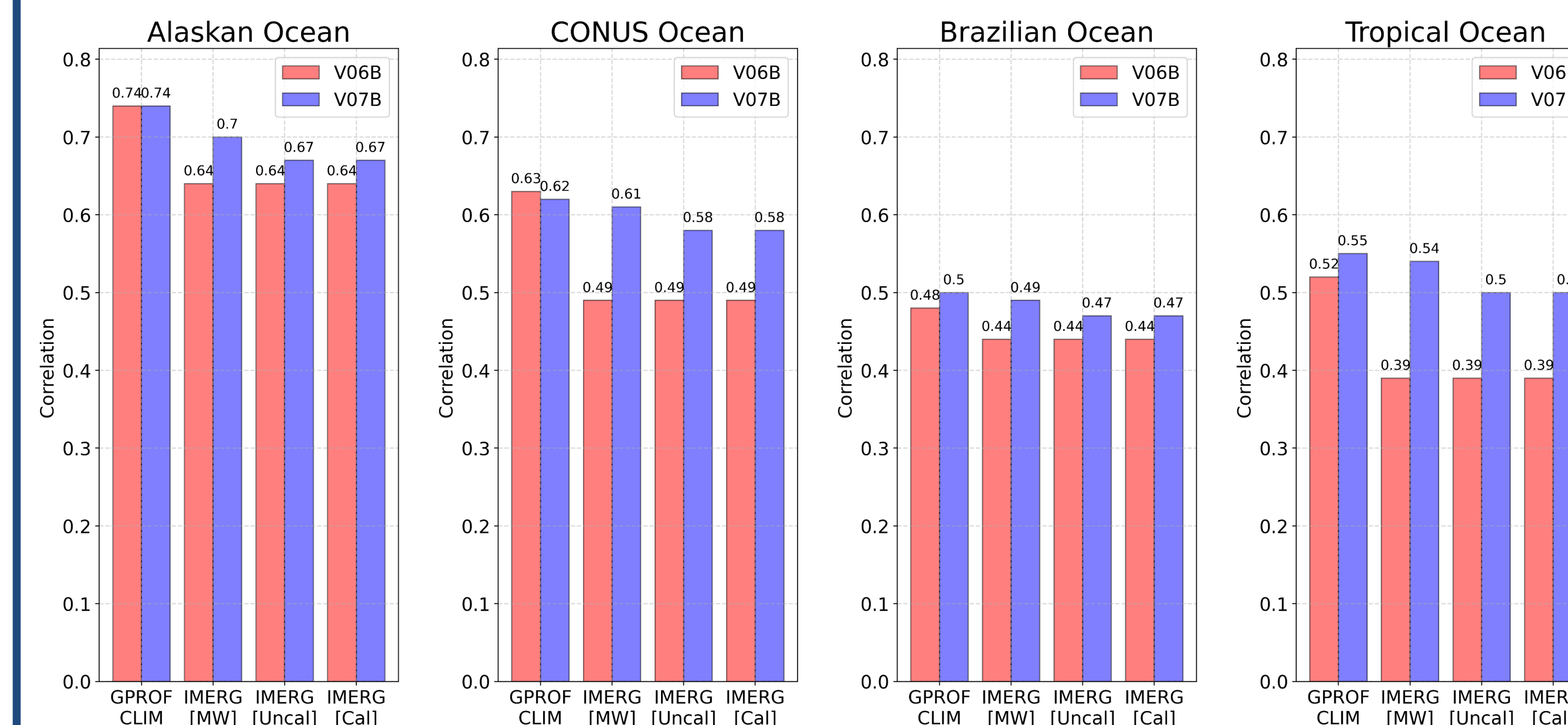
Results

Mean Relative Bias

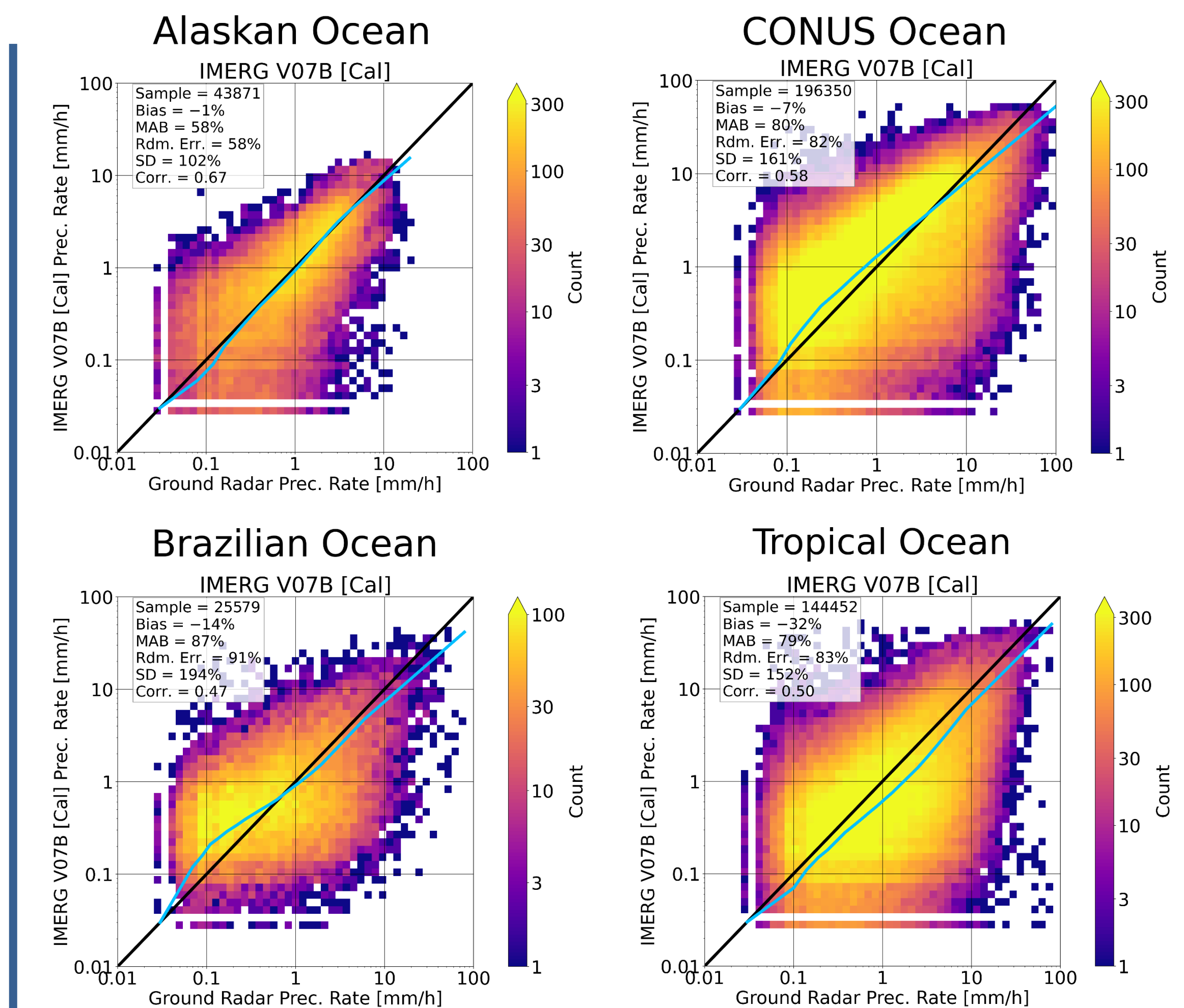


- IMERG-GMI tends to underestimate oceanic precipitation on average.**
- Successive IMERG algorithm steps generally decrease oceanic GMI biases.
- Outside of Alaskan waters, biases in IMERG-GMI are greater in V07B than V06B.

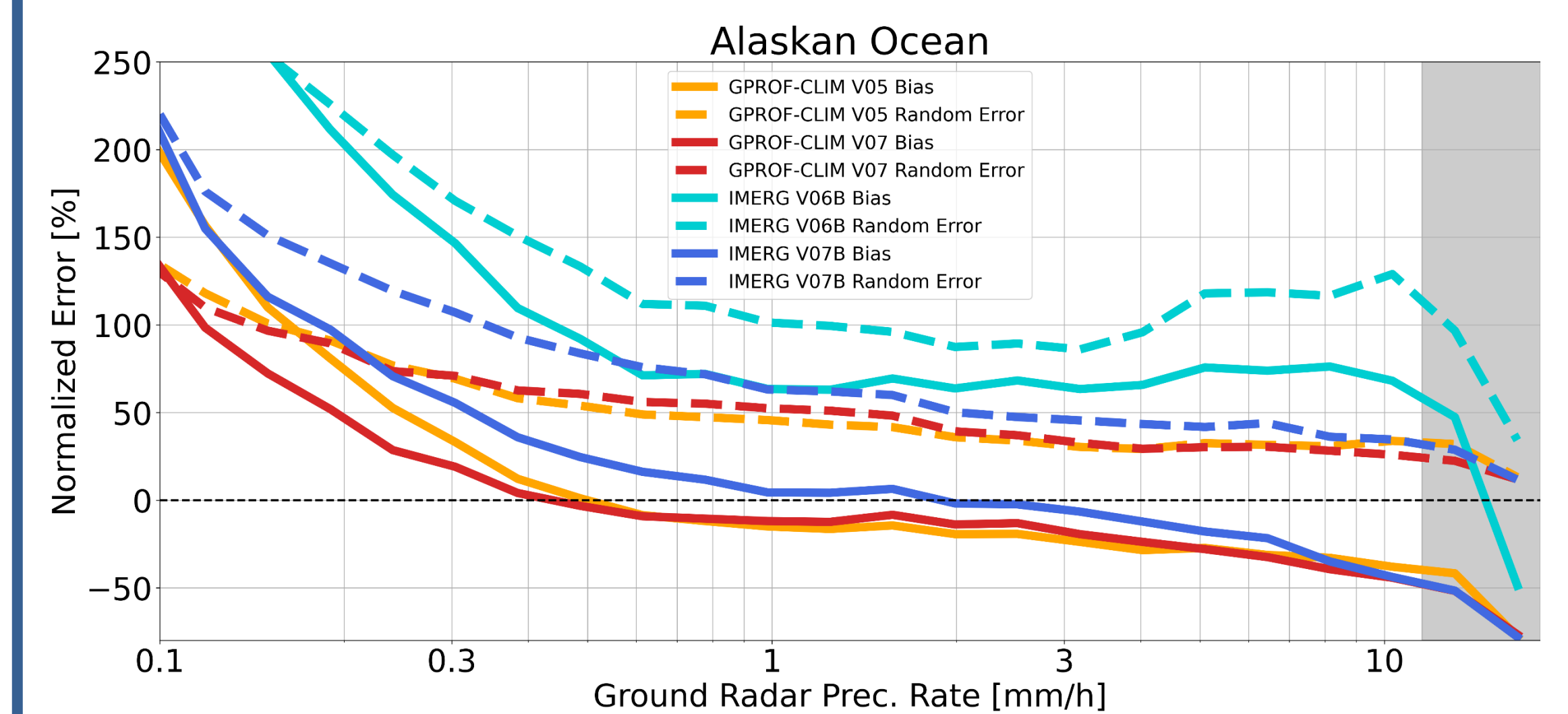
Correlation



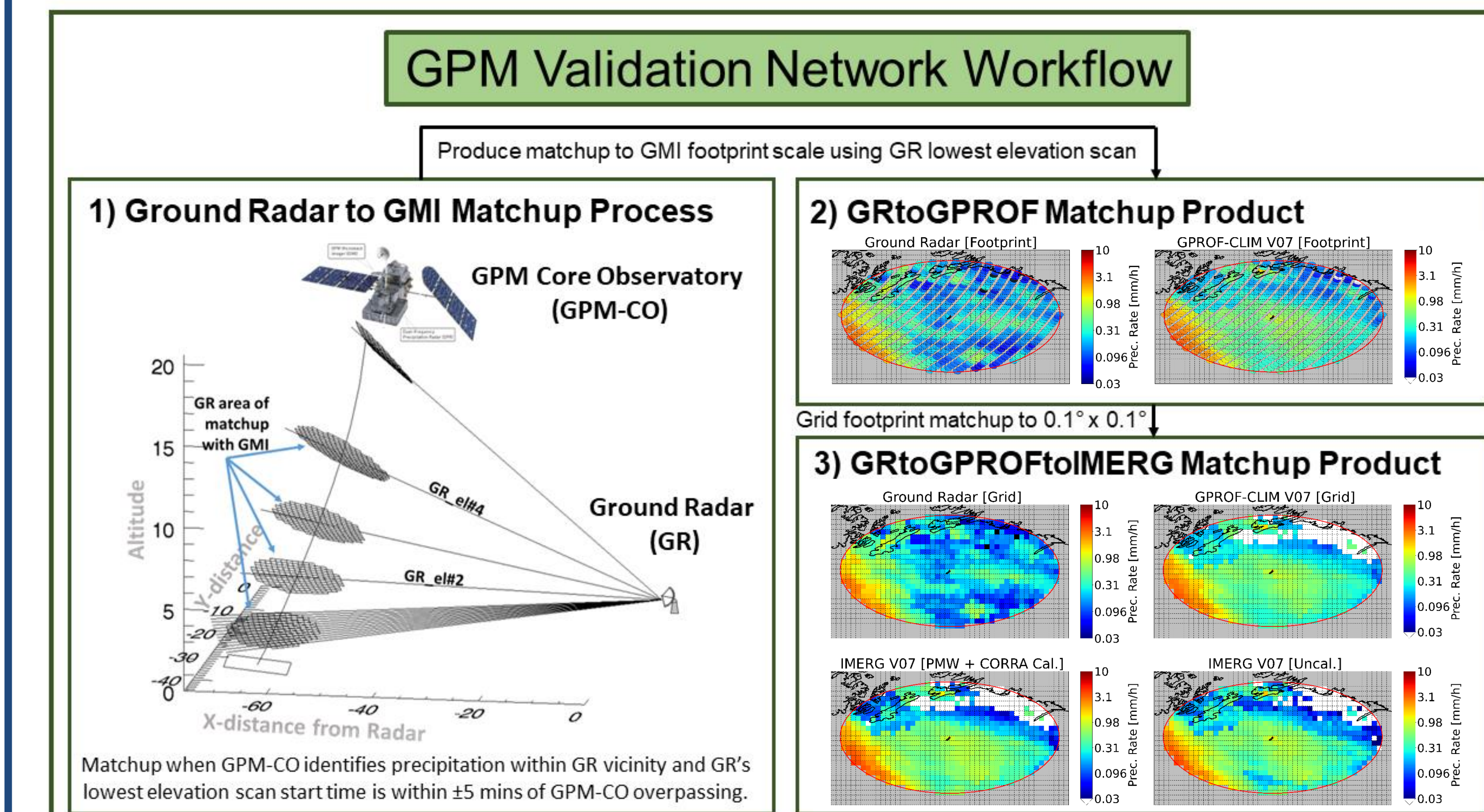
- IMERG-GMI improves upon oceanic correlations from V06B to V07B.**
- IMERG-GMI's oceanic correlations decrease with successive algorithm steps.



- IMERG-GMI exhibits the lowest oceanic random error over Alaskan waters in V07B, a reversal of V06B results.



- IMERG-GMI and GPROF-CLIM tend to overestimate light precipitation and underestimate heavy precipitation.**
- IMERG-GMI tends to increase the precipitation rates from the input GPROF-CLIM product across the spectrum of Alaskan precipitation intensities.



References

Gatlin et al. (2020). The GPM Validation Network and Evaluation of Satellite-Based Retrievals of the Rain Drop Size Distribution. Atmosphere, <https://doi.org/10.3390/atmos11091010>.
Huffman et al. (2023). NASA IMERG Version 7 – Algorithm Theoretical Basis Document. Technical report, NASA, <https://gpm.nasa.gov/resources/documents/imerg-v07-atbd>.
Tan et al. (2021). SHARPEN: A Scheme to Restore the Distribution of Averaged Precipitation Fields. JHM, <https://doi.org/10.1175/JHM-D-20-0225.1>.
Watters et al. (2024). Oceanic Validation of IMERG-GMI Version 6 Precipitation Using the GPM Validation Network. JHM, <https://doi.org/10.1175/JHM-D-23-0134.1>.

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