

# Cornerstones for a more resilient future

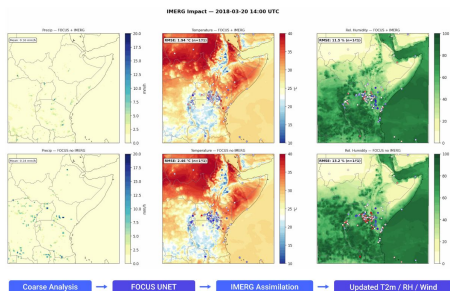
## A commercial perspective on NASA Precipitation Science

### What advances in precipitation science excite us?

1. **Continued improvements in L1-L3 GPM products:** These are used as calibration reference standards and training data for a wide array of products and applications (*below: IMERG improves downscaled ERA5 T2m and RH reanalysis*)
2. **Upcoming missions INCUS and PoLSIR:** Demonstrating the science value and applications of rapid-revisit radar and sub-mm measurements.

#### IMPROVES T2M AND RH ANALYSES

IMERG precipitation assimilation produces physically consistent improvements in FOCUS temperature and relative humidity fields.



#### Why This Matters

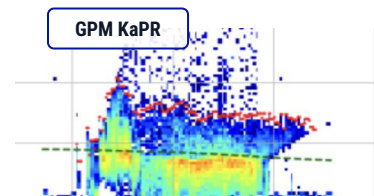
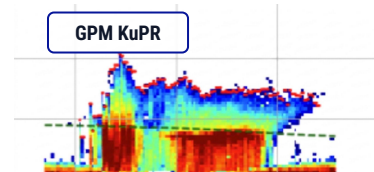
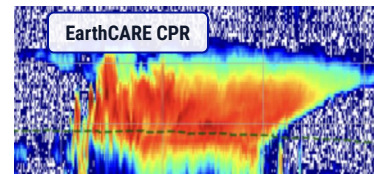
1. **Physically consistent response**  
IMERG assimilation suppresses spurious precipitation and updates nearby temperature and humidity fields.
2. **Lower temperature error**  
RMSE improves from 2.46 °C without IMERG to 1.94 °C with IMERG.
3. **Lower humidity error**  
RMSE improves from 13.2% without IMERG to 11.5% with IMERG.
4. **Reduced precipitation noise**  
Mean precipitation decreases from 0.24 mm/h to 0.16 mm/h, indicating a cleaner precipitation analysis.

#### KEY TAKEAWAY

FOCUS is performing on par with baseline models while enabling station and satellite precipitation assimilation to produce consistent, physically plausible reductions in error and bias.

### Where do we need to go?

1. **Higher-resolution estimates:** 5 km (DPR) is insufficient to resolve convective cores. High-resolution satellite estimates are critical.
2. **Multi-frequency radar (including G-band):** Even narrow swath missions help to better constrain ice microphysics and riming processes -> *critical for aviation applications*, and can be used as training targets for other sensors.
3. **Modeling & AI:** Long-duration, high-resolution nature runs to develop AI-based convective-scale DA and forecast models.



**What are the science questions that commercial missions can address?**