Space Science Week
Committee of Earth Science and Applications from Space (CESAS)

Panel: Non-Government Providers of Earth Science Data

20 March 2024

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- How can we establish confidence in non-government data for which long, consistent time series are needed?
- Should NASA/NOAA/USGS play roles beyond buyers, such as centralized validation?

Characterization of Stability vis-à-vis Essential Climate Variables

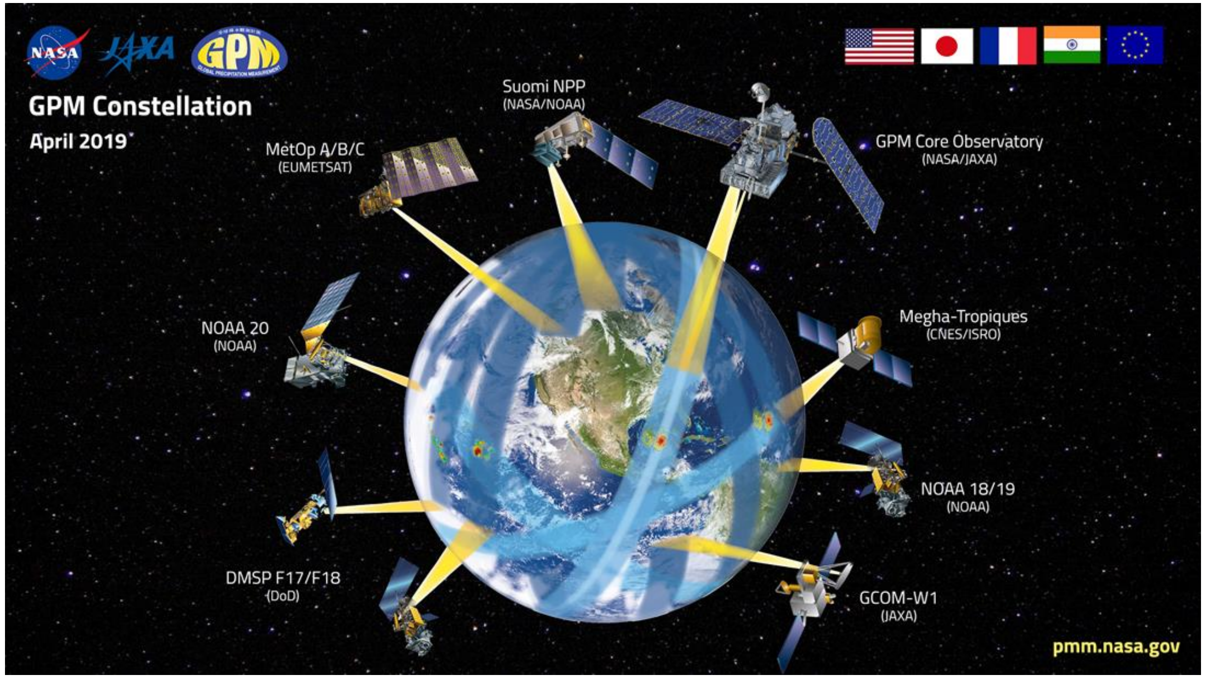
- **Absolute stability** is the actual stability of a measurement and its derived ECV
  - Example: long term trending of a stand-alone Level 2 science data product
- **Relative stability** is the stability of the difference between one measurement or derived ECV and another
  - Example: common mode calibration errors and drifts in a constellation of sensors often have a stable difference
- **Stability control** implies adjustments to the sensor making the measurement to maintain some level of stability
  - Example: Active temperature control of a sensor to maintain calibration accuracy
- **Stability knowledge** implies tracking of the instability in the sensor (presumably to correct for it in post processing)
  - Example: Tracking of on-orbit temperature changes + knowledge of temperature dependence of calibration accuracy

Design, Characterization and Performance Considerations

- Design for stability
  - Sensor: Include control of calibration stability in the design
  - Platform: Support sensor accommodation requirements for stability (often more mass, power, volume)
  - Constellation: Choose orbits for absolute stability (e.g. solar angle) or knowledge (e.g. non-sun synchronous elements of constellation for temporal coincidence)
- Characterize for stability
  - Sensor(1): Extensive pre-launch characterization of dependence of calibration accuracy on X-Y-Z
  - Sensor(2): Share sensor design details (especially on-board calibration scheme) with ECV community
- Performance for stability
  - Share on-orbit characterization of stability with ECV community

NASA Global Precipitation Measurement (GPM) XCAL Calibration Bootstrapping with a "Gold Standard"

- Science Objective: Consistent rainfall retrievals from different sensors in GPM constellation requires the basic sensor radiance measurements (brightness temperature, Tb) to be consistently inter-calibrated
- The GPM Microwave Imager (GMI) serves as a radiometric transfer standard for the passive microwave sensors on other constellation satellites
- This GPM inter-satellite calibration process is referred to as XCAL



Some Thoughts

- **The ideal ECV collection of satellites would have the necessary design, characterization, and stability control so that its demonstrated on-orbit characterization of absolute stability meets the ECV requirements**
- **The ideal ECV collection of satellites is not affordable in any reasonable estimate of future Earth Science budgets at NASA, NOAA, USGS, ESA, …**
- **A Hybrid Space Architecture (HSA) that includes private New Space smallsats will provide many more on-orbit platforms and sensors in a cost-capped environment**
- **Producing ECV-quality observations in an HSA environment will require**
  - **"Gold standard" reference observations**
  - **Visibility into the private New Space sensor designs and pre- and post-launch perfomance**