

CLARREO Pathfinder & Benefits to Terra/Aqua MODIS Extension

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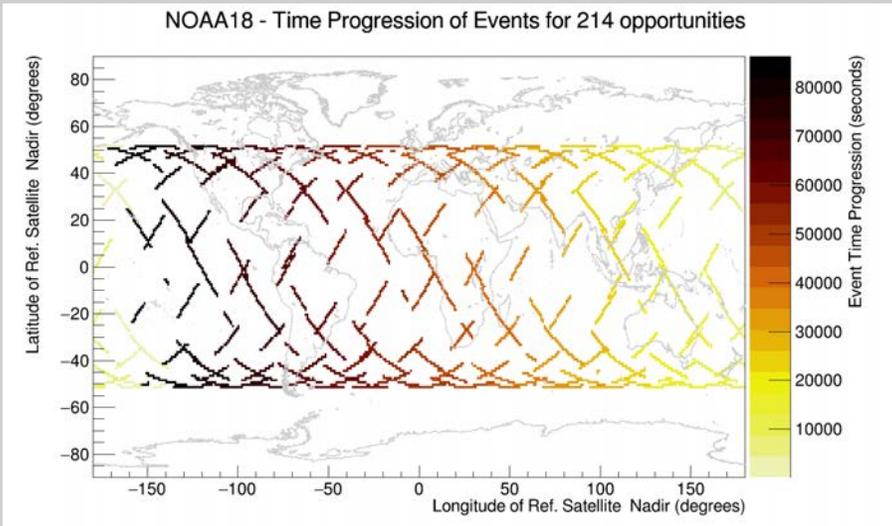
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- CPF consists of a highly accurate reflected solar spectrometer (350 nm – 2300 nm) that will take reflectance measurements within 0.3% (1-sigma) uncertainty from ISS.
- CPF will nominally showcase its intercalibration capability with space, time, spectral, and angle matched observations across the full scan width CERES and VIIRS – achieving 0.3% intercal methodology uncertainty
- Continuation of Terra and Aqua provides unique opportunity to place RS bands of CERES, VIIRS, *and MODIS* on a consistent radiometric scale with CPF as reference.
- This will improve the accuracy of their climate data records, impacting a wide span of geophysical variables (e.g. clouds, aerosols, radiative budget)
- CPF to begin science operations in early 2024, and primary operations is 1 year, but potential (within senior review process or equivalent) for extended operations up to end of ISS lifetime (~2030).

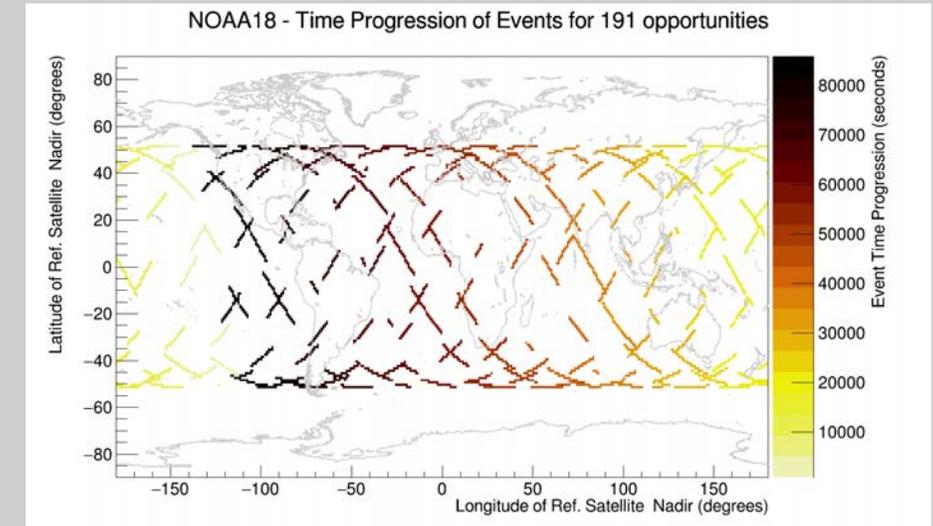
CPF/ISS-NOAA18
Intercalibration
Opportunities
over 60-day
periods

*NOAA 18 used as
proxy for Aqua*

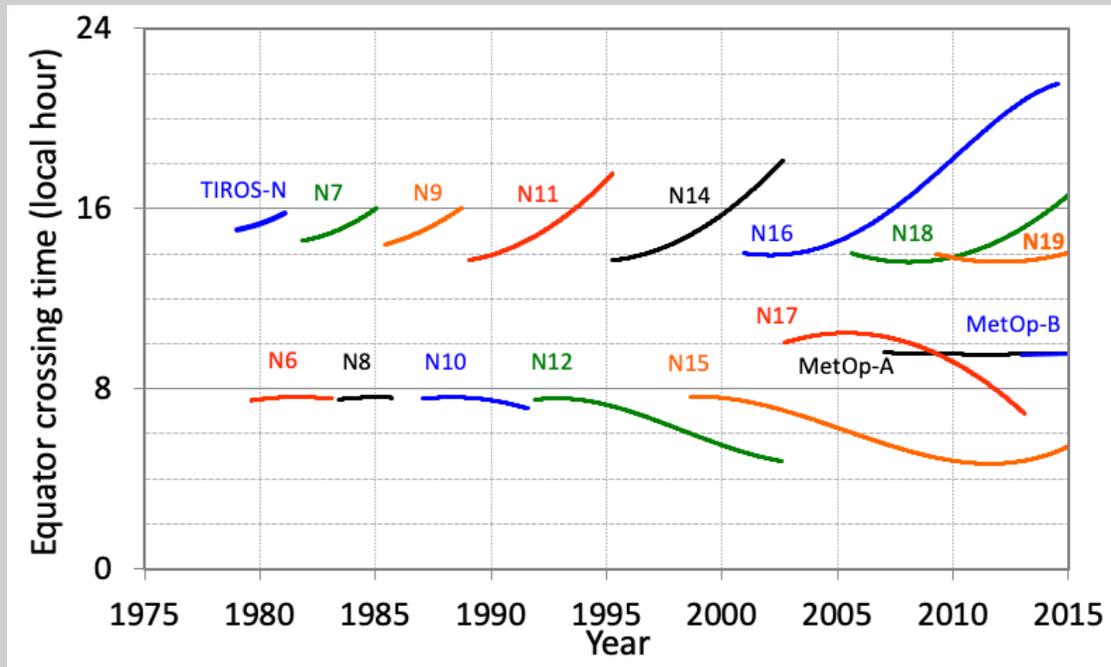
NOAA-18 ECT ~1:30PM



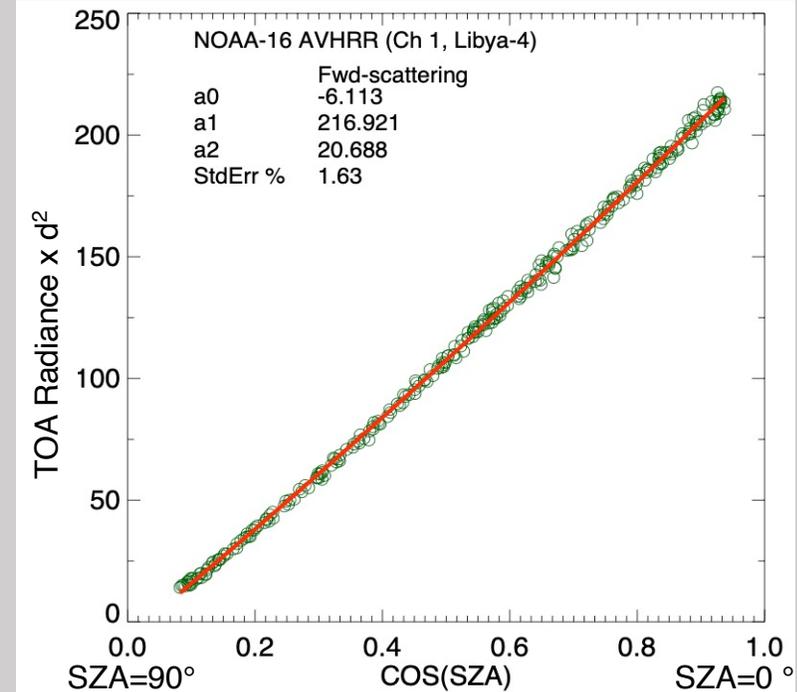
NOAA-18 ECT ~3:30PM



- CPF/ISS is in a precessing orbit: Intercal opportunities with sensors on Terra and Aqua, despite their drifting orbits, will be globally distributed with diversity in sun-view geo and surface types.
- Scaling MODIS to CPF's absolute radiometric reference, augments the value that Aqua MODIS has provided to countless other sensors over the past 20+ years
- **How much overlap with MODIS would be sufficient to improve their calibration?**
 - To assess MODIS response versus scan angle – it would be essential to collect sufficient observations within individual scan angle bins to meet data matching noise level needed to achieve ~1% intercal methodology uncertainty.
 - We estimate *at least 6 months* overlap between CPF and MODIS would be best for establishing confidence in achievement of intercal uncertainty goals



(Left) Changing ECT of NOAA satellites over time due to orbital drift.



(Right) Earth-sun distance corrected clear-sky TOA radiances ($Wm^{-2}\mu m^{-1}sr^{-1}$) derived from near-nadir ($VZA < 10^\circ$) NOAA-16 AVHRR visible channel measurements over the Libya-4 PICT as a function of cosine of SZA.

- Drifting orbits of Terra/Aqua provide opportunity for expanded seasonal and diurnal characterization of PICTs using MODIS observations. – **Further improvement with MODIS calibration, including RVS, scaled to CPF reference.**
- Enhanced PICTs models (referenced to CPF absolute calibration) can be applied to improve the radiometric quality of the 40-year climate data record from AVHRR instruments.
- Current DCC calibration method is valid for SZA up to 60 degrees. Observations from MODIS as it drifts provide opportunity to enhance DCC calibration method for larger SZAs (better with MODIS tied to CPF as reference).