Improving Data Quality and Utilization of JPSS CrIS Using VIIRS

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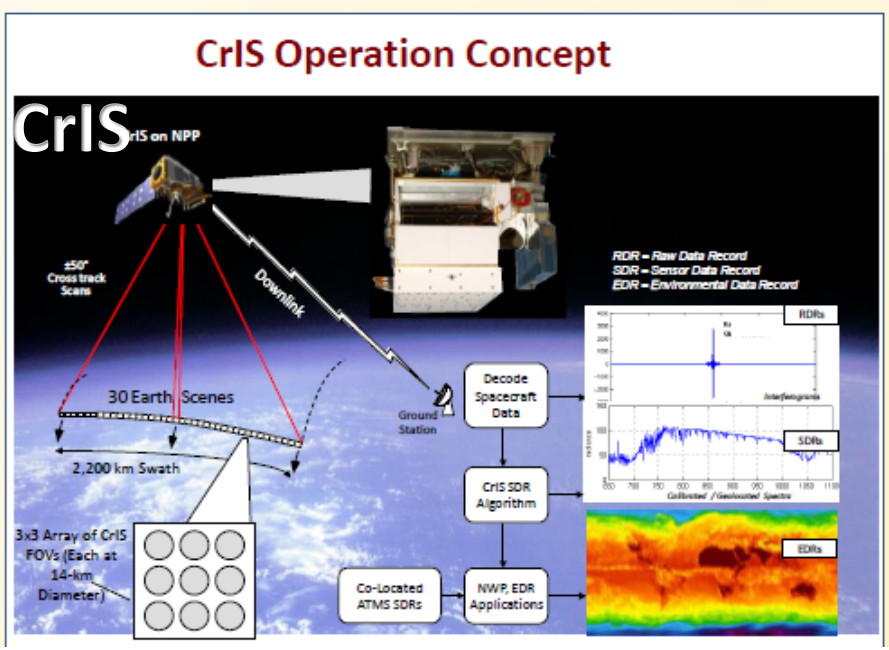
- ESSIC/Univ. of Maryland, College Park, MD; wlikun@umd.edu

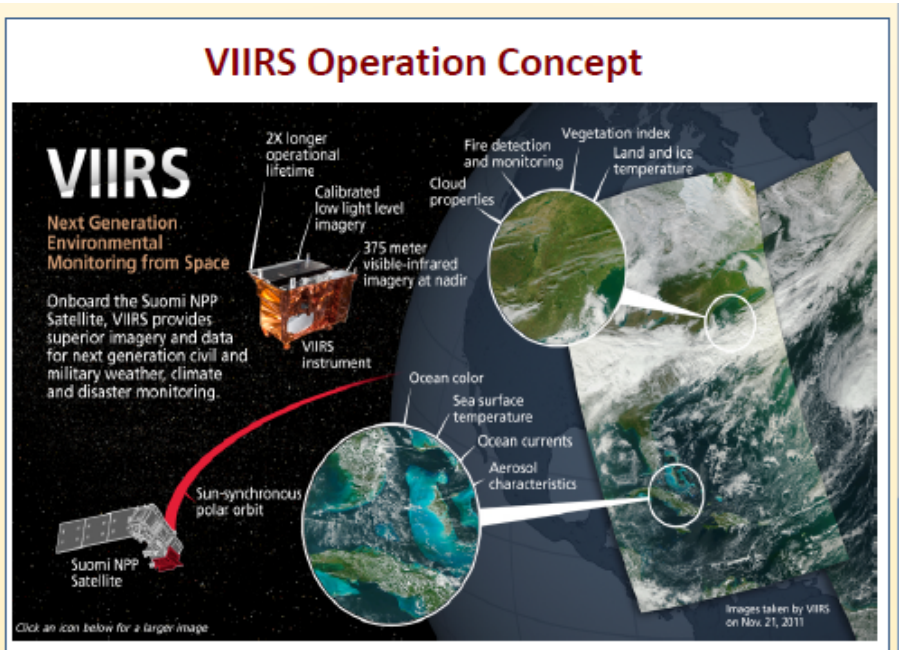
Acknowledgment CrIS SDR Team

Outline

- Benefits of collocating VIIRS with CrIS FOVs
- Line-of-sight (LOS) vector based fast and accurate collocation algorithm
- Geolocation assessments
- Scene characterization using VIIRS pixels
  - Linking SNPP and J1 CrIS
- Conclusion

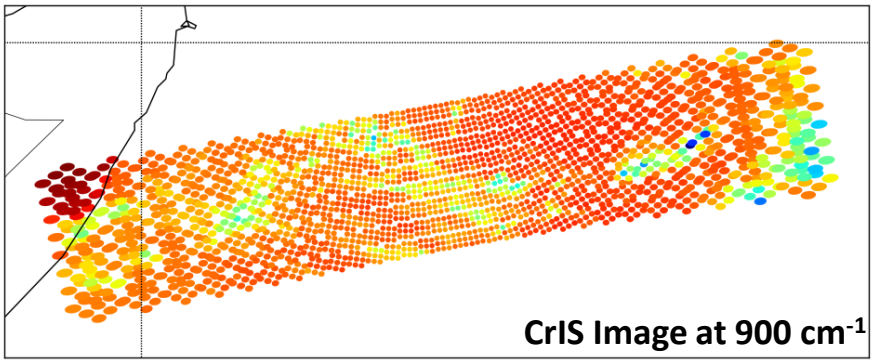
Sounder vs. Imager

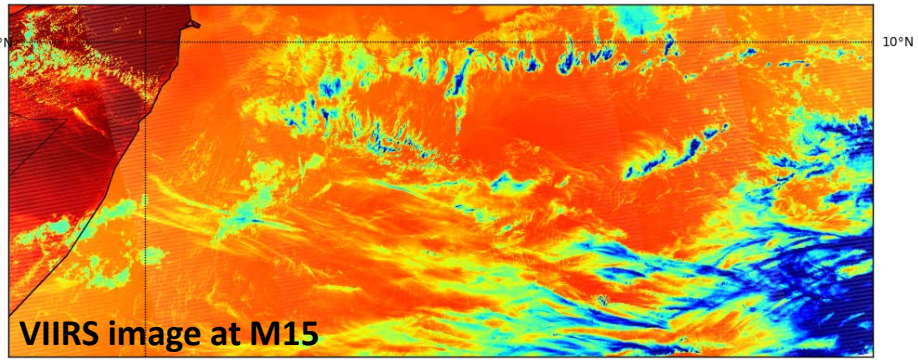


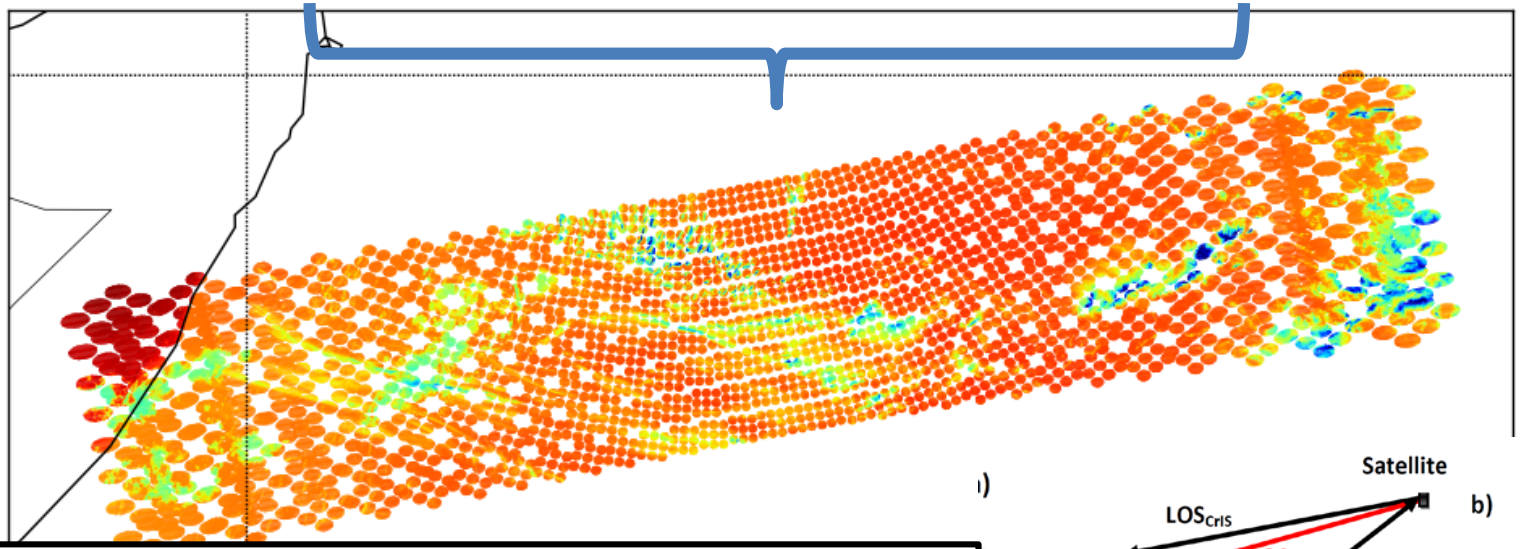


	CrIS (Sounder)	VIIRS (Imager)
Purpose	Atmospheric vertical profiles NWP data assimilation	Spatial images (land, cloud, aerosol, ocean …)
Channels	1305 (normal) or 2211 (full)	16 M-Bands, 5 I-Bands, 1 DNB
Spatial Resolution (nadir)	14.0 km	375m, or 750m
Spectral Range	IR	IR, VIS

LOS vector based collocation method

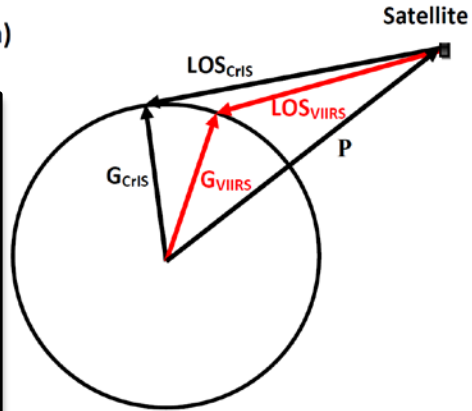


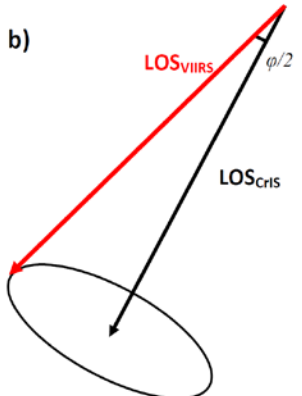




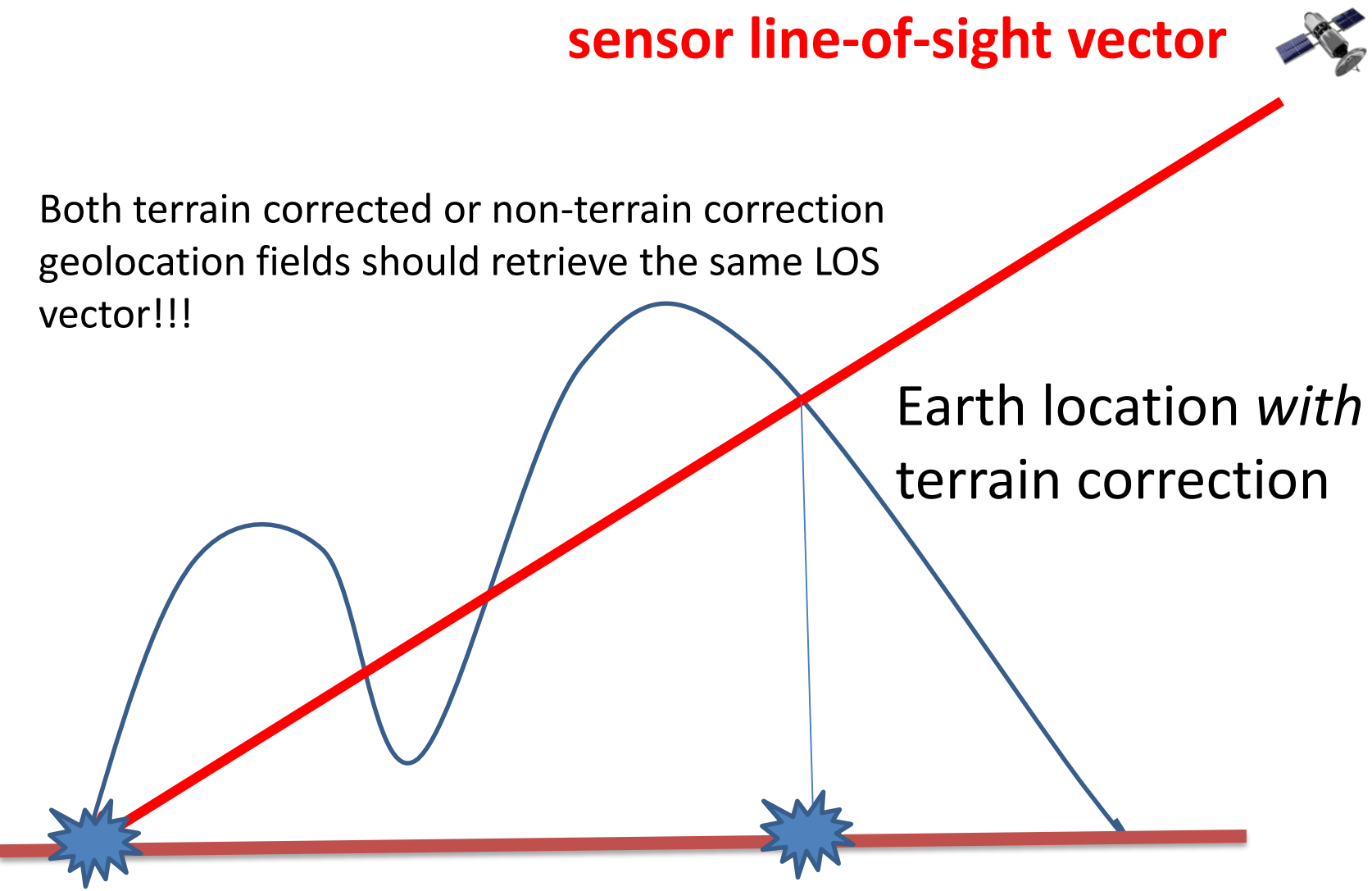
It is better to collocate CrIS and VIIRS in space instead of on the Earth Surface;

If we can retrieve line-of-sight vector of CrIS and VIIRS , the collocation of VIIRS and CrIS can be simplified as examining the angles between two vectors.

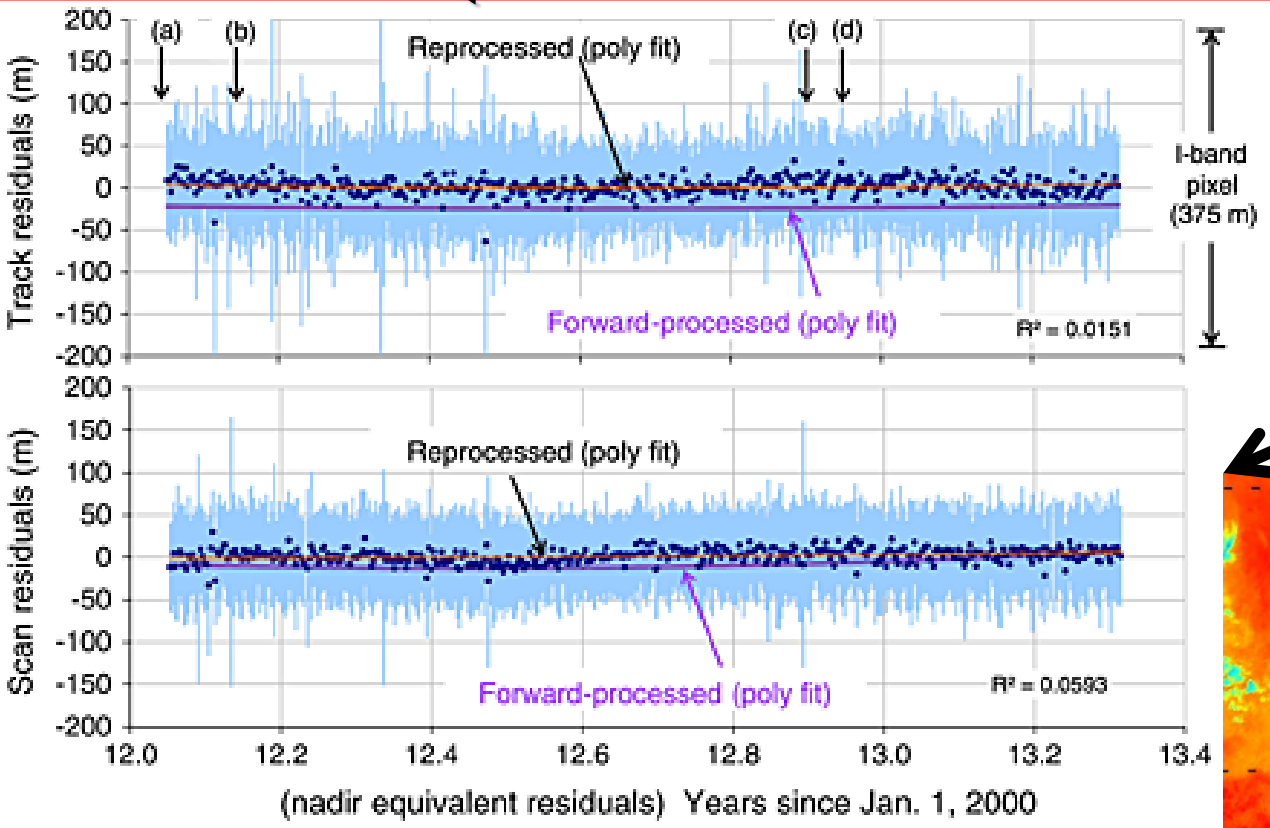


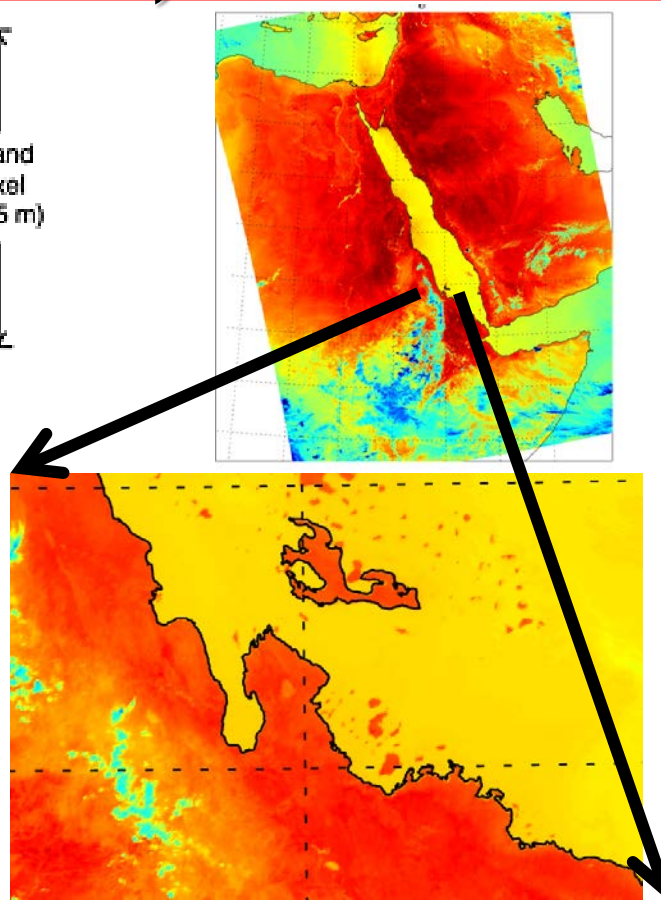


Collocation of Terrain-correction VIIRS Products



VIIRS Geolocation Very Accurate ! (I5 band: 375m resolution)





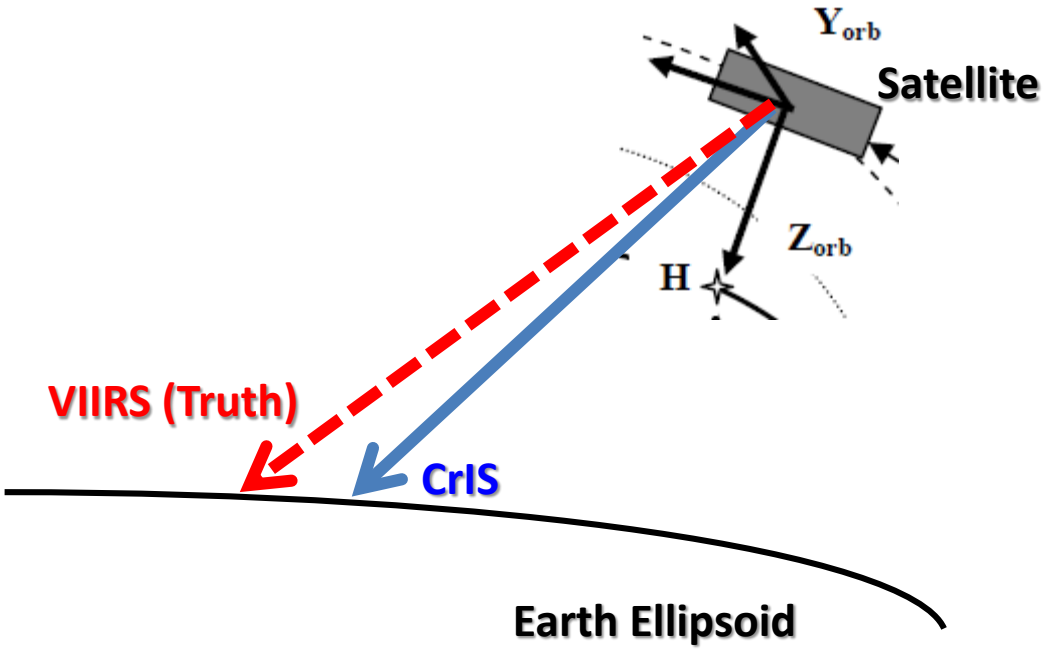
from Wolf et al. 2013

Table 2. VIIRS Geolocation Accuracy

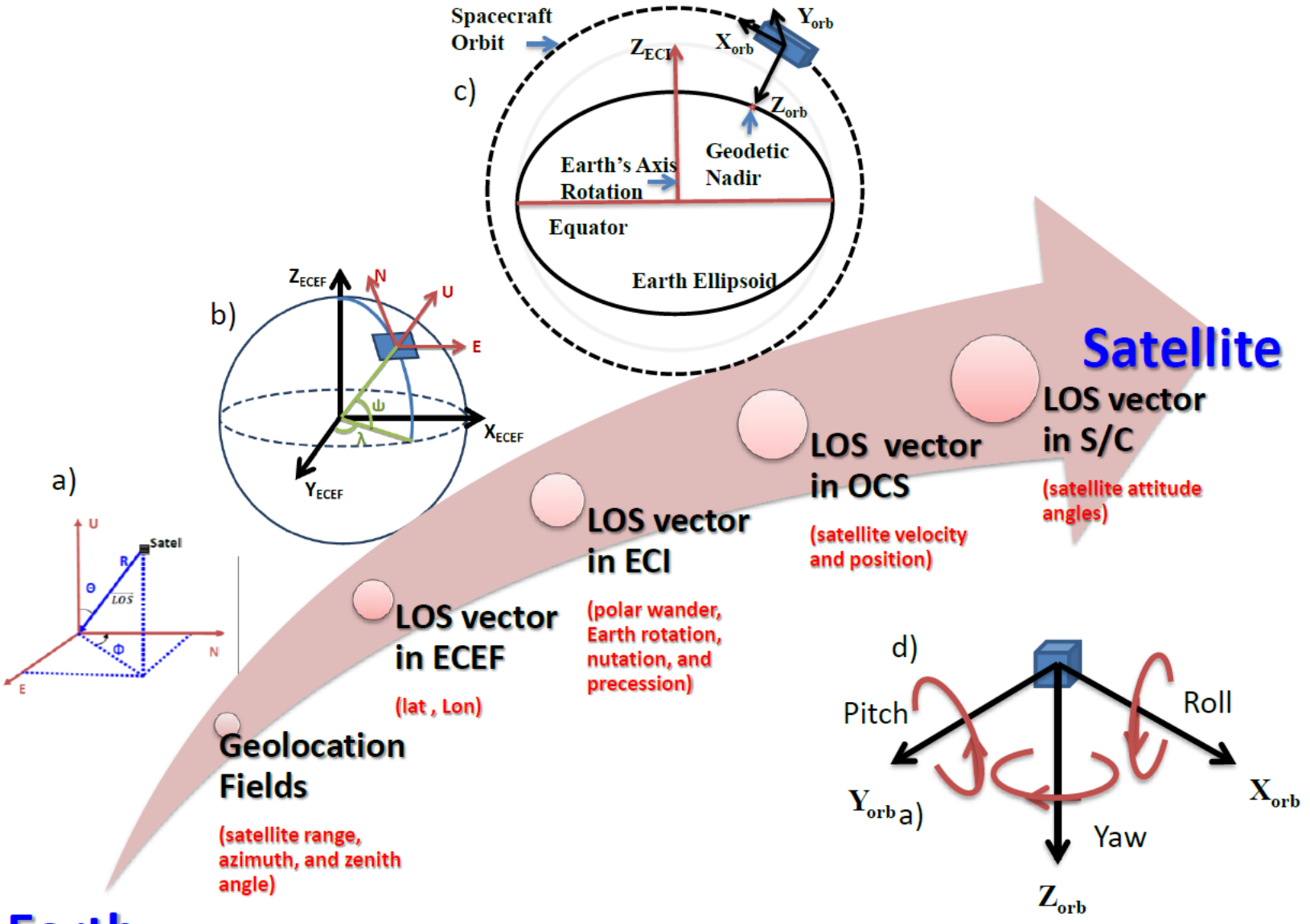
Residuals	First Update	Second Update
	23 February 2012	18 April 2013
Track mean	**–24 m, –7%**	**2 m, 1%**
Scan mean	**–8 m, –2%**	**2 m, 1%**
Track RMSE	**75 m, 20%**	**70 m, 19%**
Scan RMSE	**62 m, 17%**	**60 m, 16%**

CrIS Geolocation Assessment using VIIRS

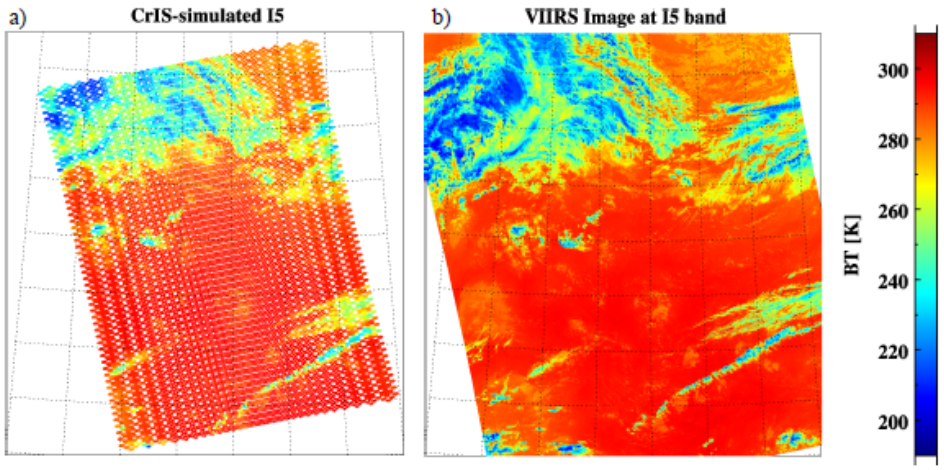
- The misalignment between CrIS and VIIRS can be caused by the CrIS geolocation error.
- Can we use VIIRS as a reference to check CrIS geolocation accuracy?
- The purpose is to identify the error characteristics of CrIS LOS pointing vector by comparing them with the truth.
- Furthermore, if the systematic errors are found, a new set of co-alignment parameters should be retrieved based on assessment results to improve the geolocation accuracy.

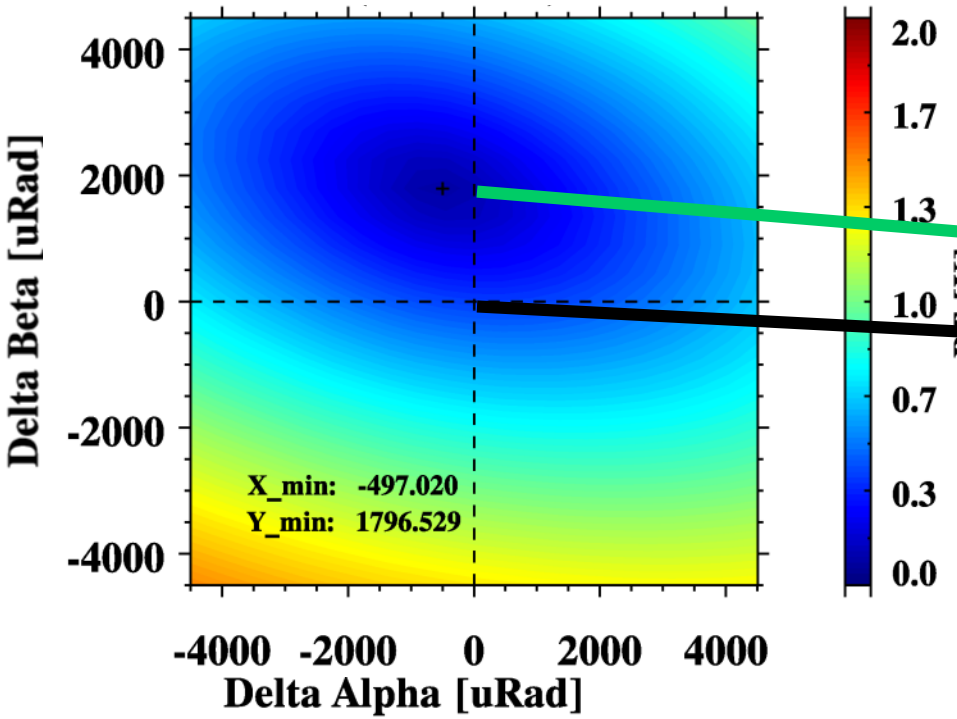


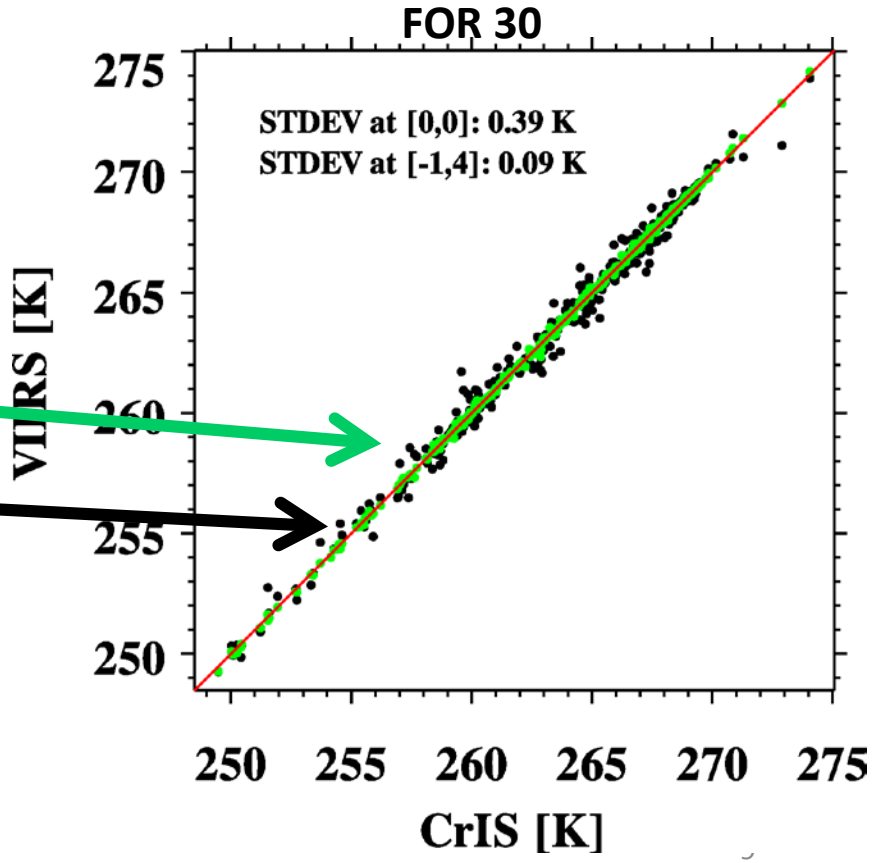
Inverse Geolocation Computation

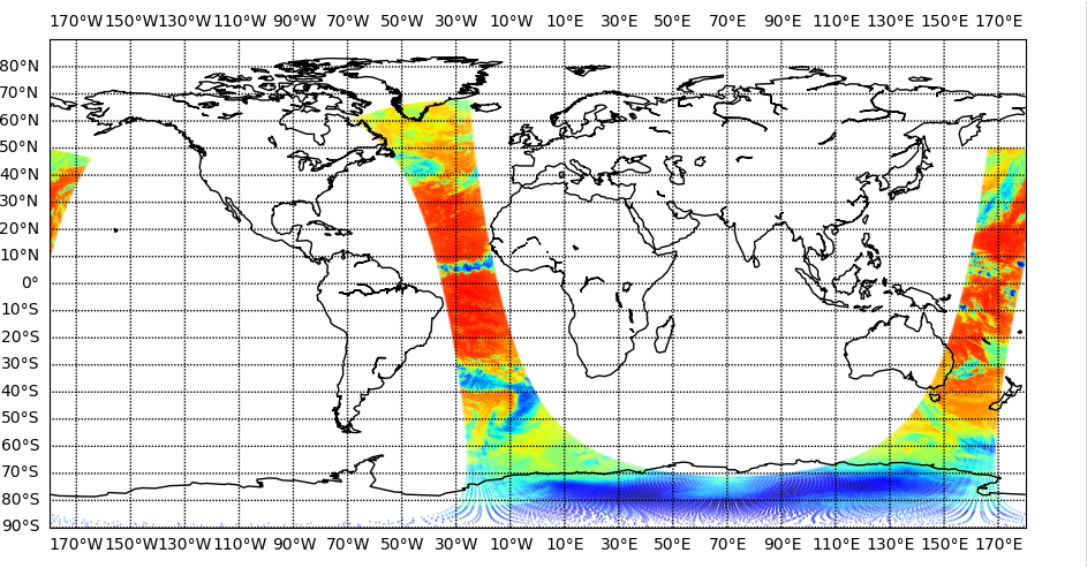


Using VIIRS to find best collocation position



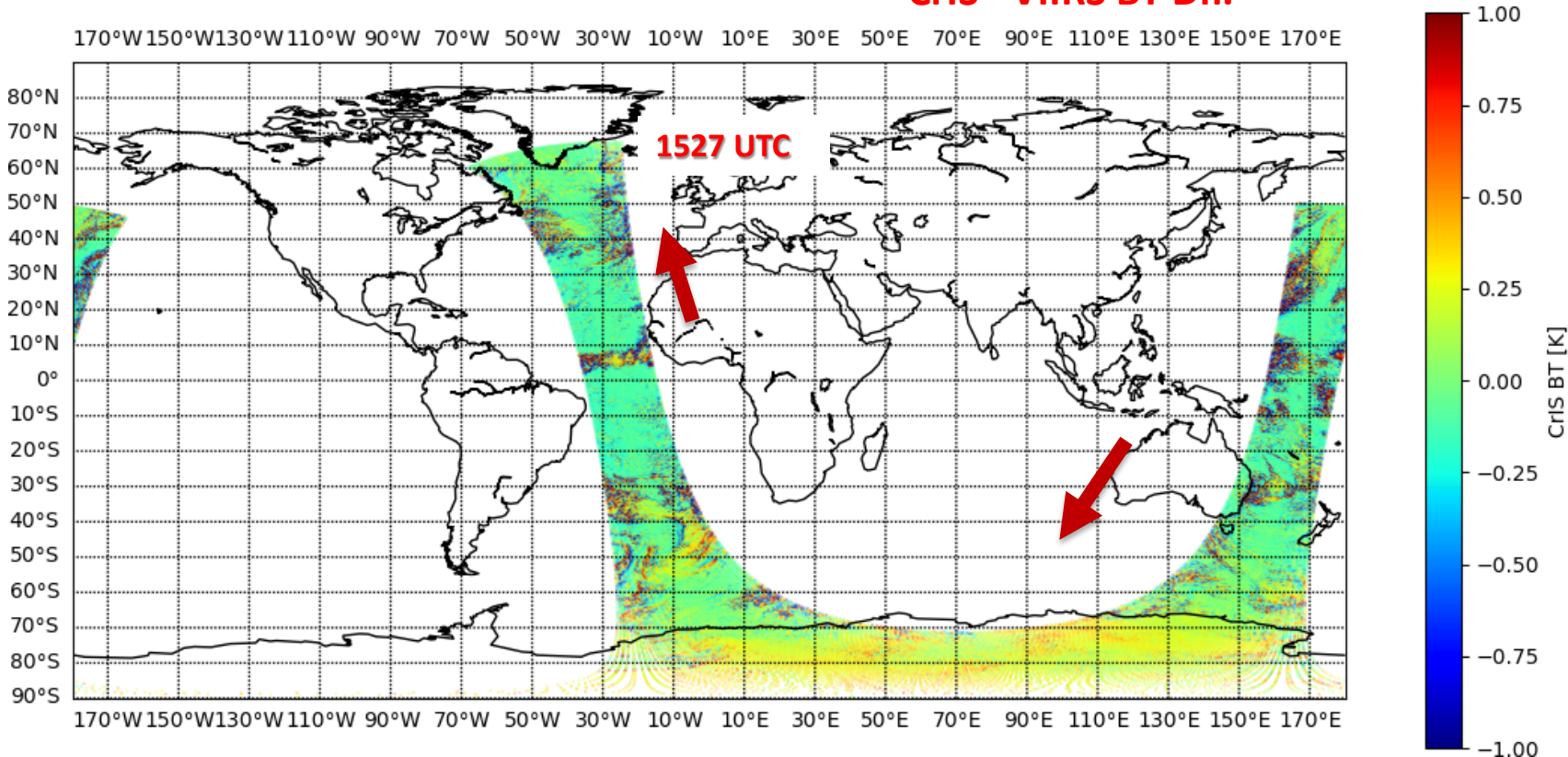


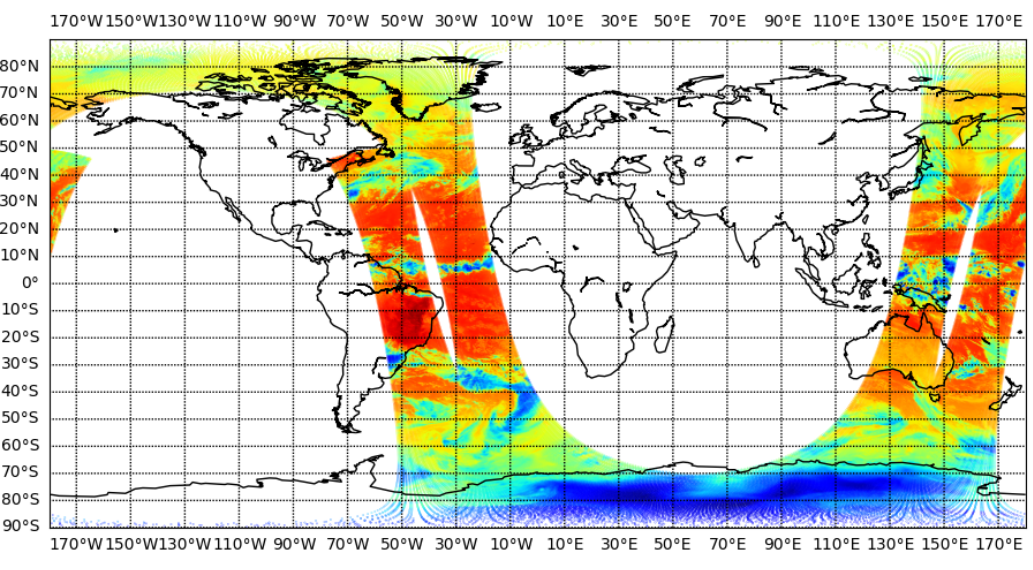




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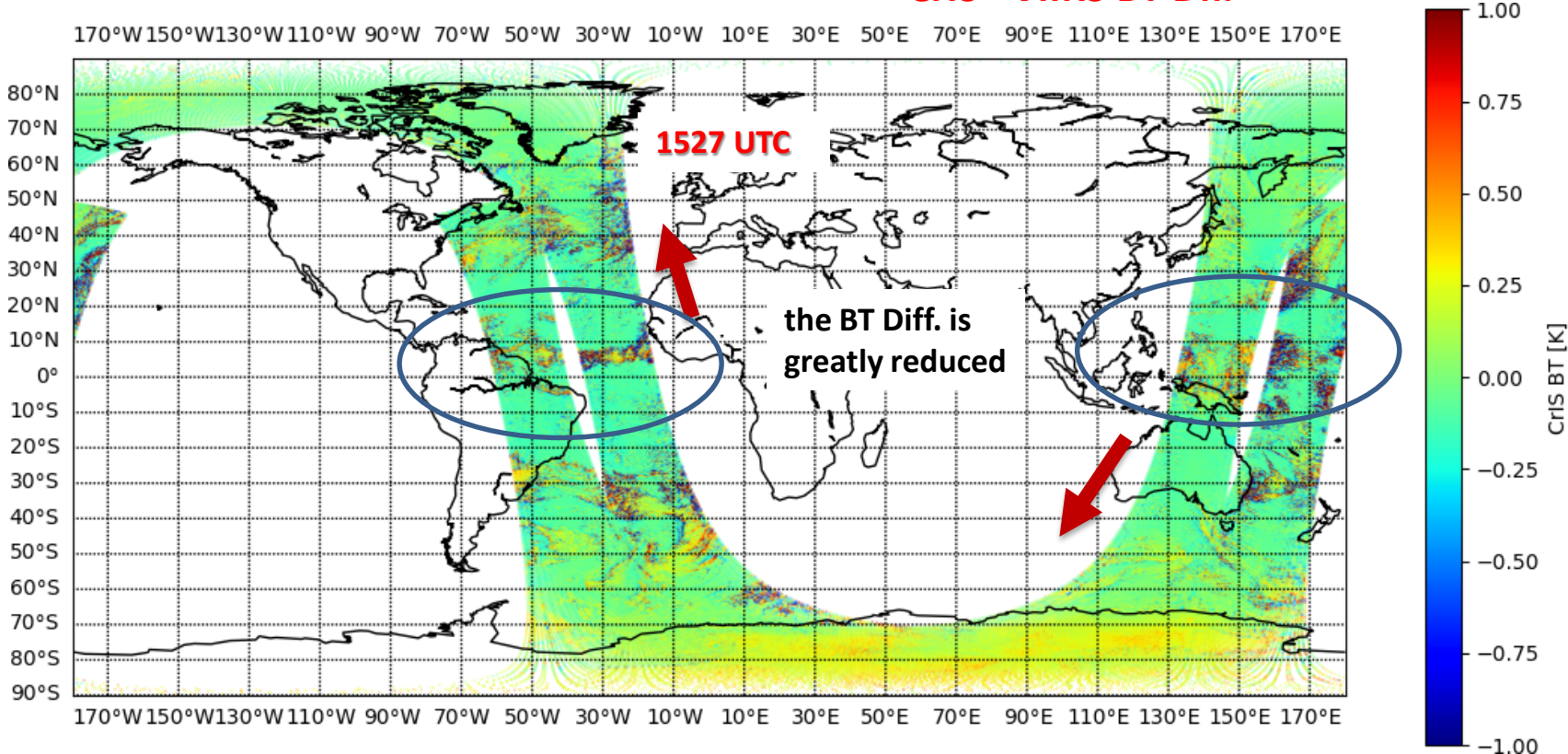
CrIS –VIIRS BT Dif.



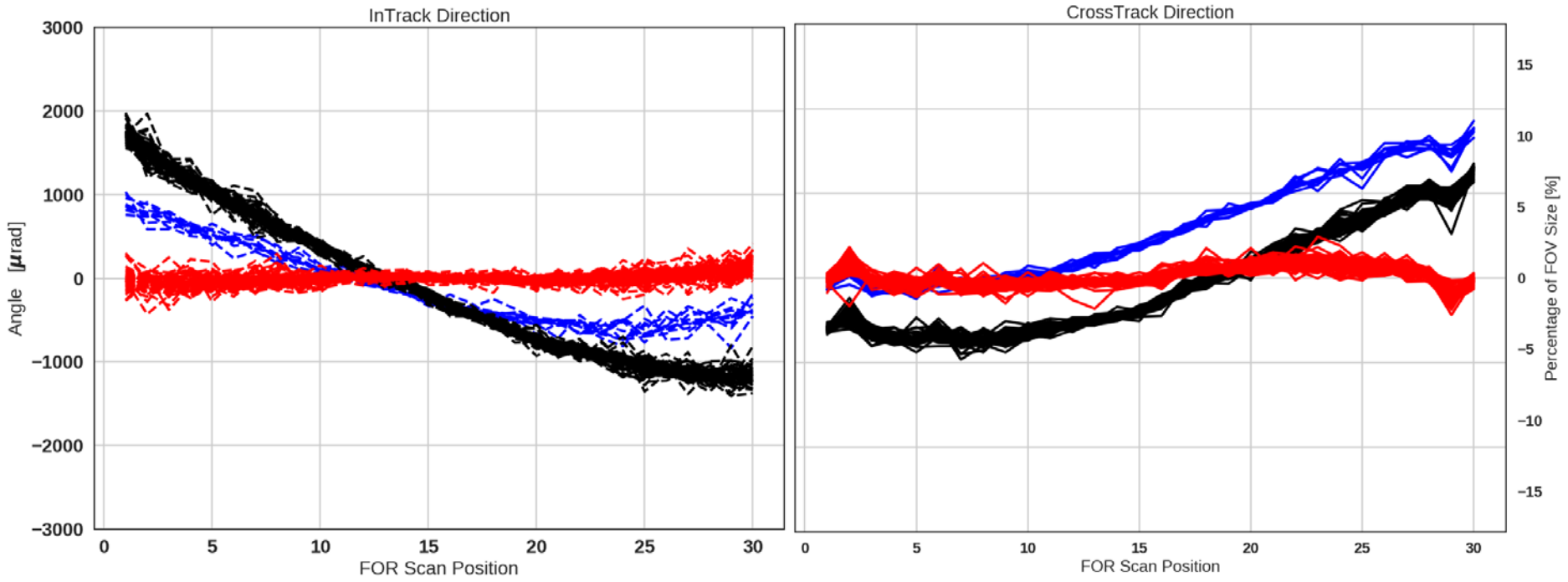


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CrIS –VIIRS BT Dif.



Geolocation accuracy relative to VIIRS



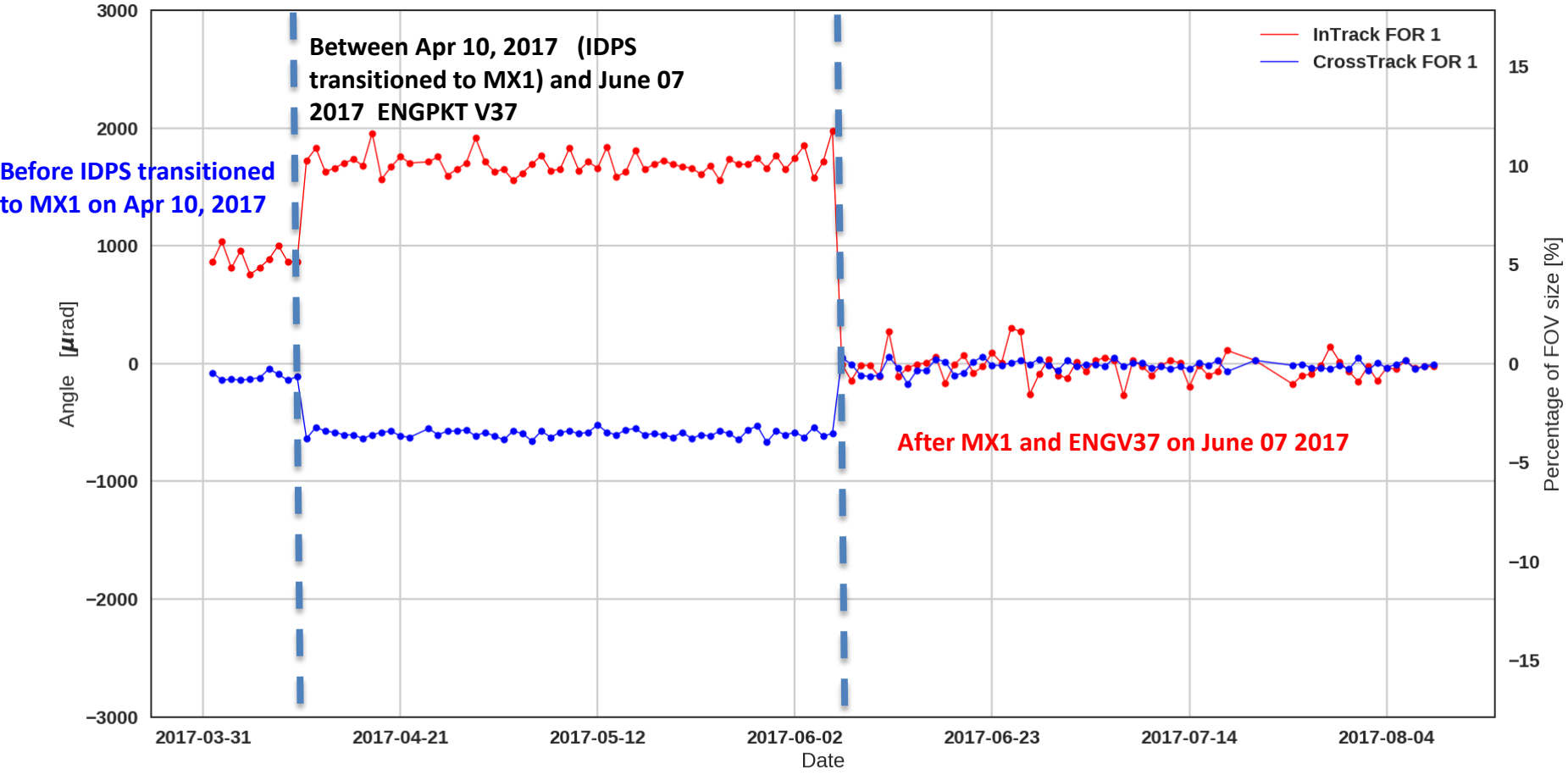
Blue lines: Before IDPS transitioned to MX1 on Apr 10, 2017

Black lines: Between Apr 10, 2017 (IDPS transitioned to MX1) and June 07 2017 ENGPKT V37

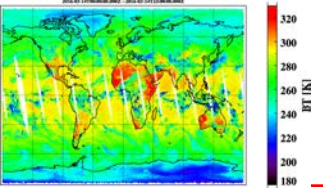
Red lines: After MX1 and ENGV37 on June 07 2017

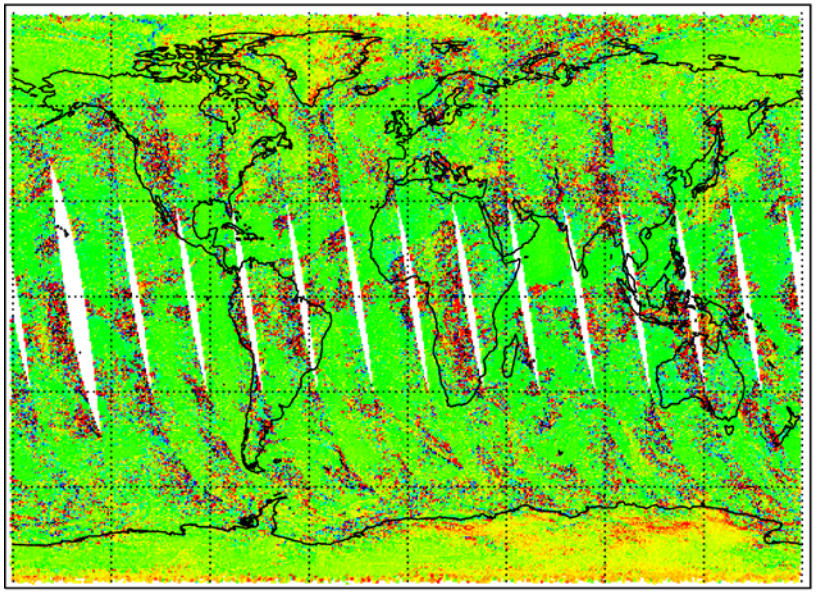
The FOV size is 16808 µrad, 1000 µrad ≈ 850 m at nadir

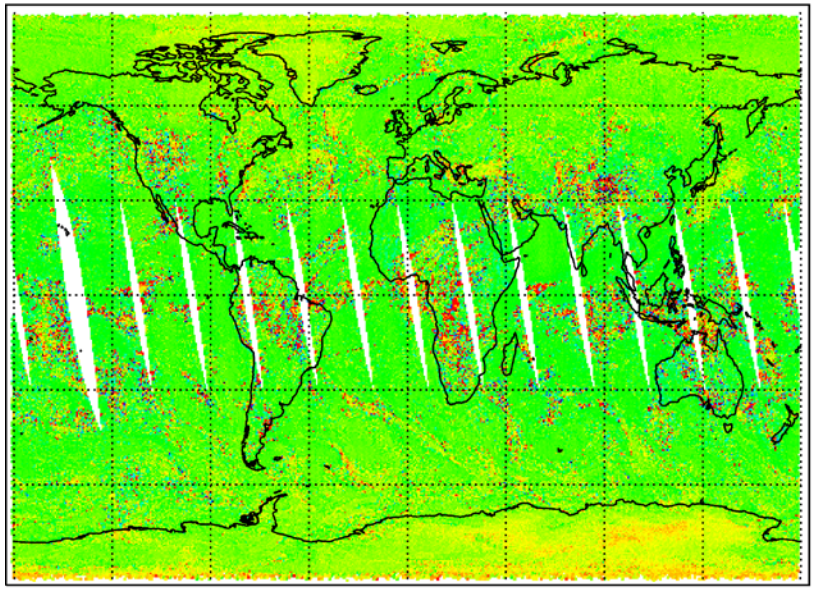
Time Series at the beginning of scan FOR Position 1

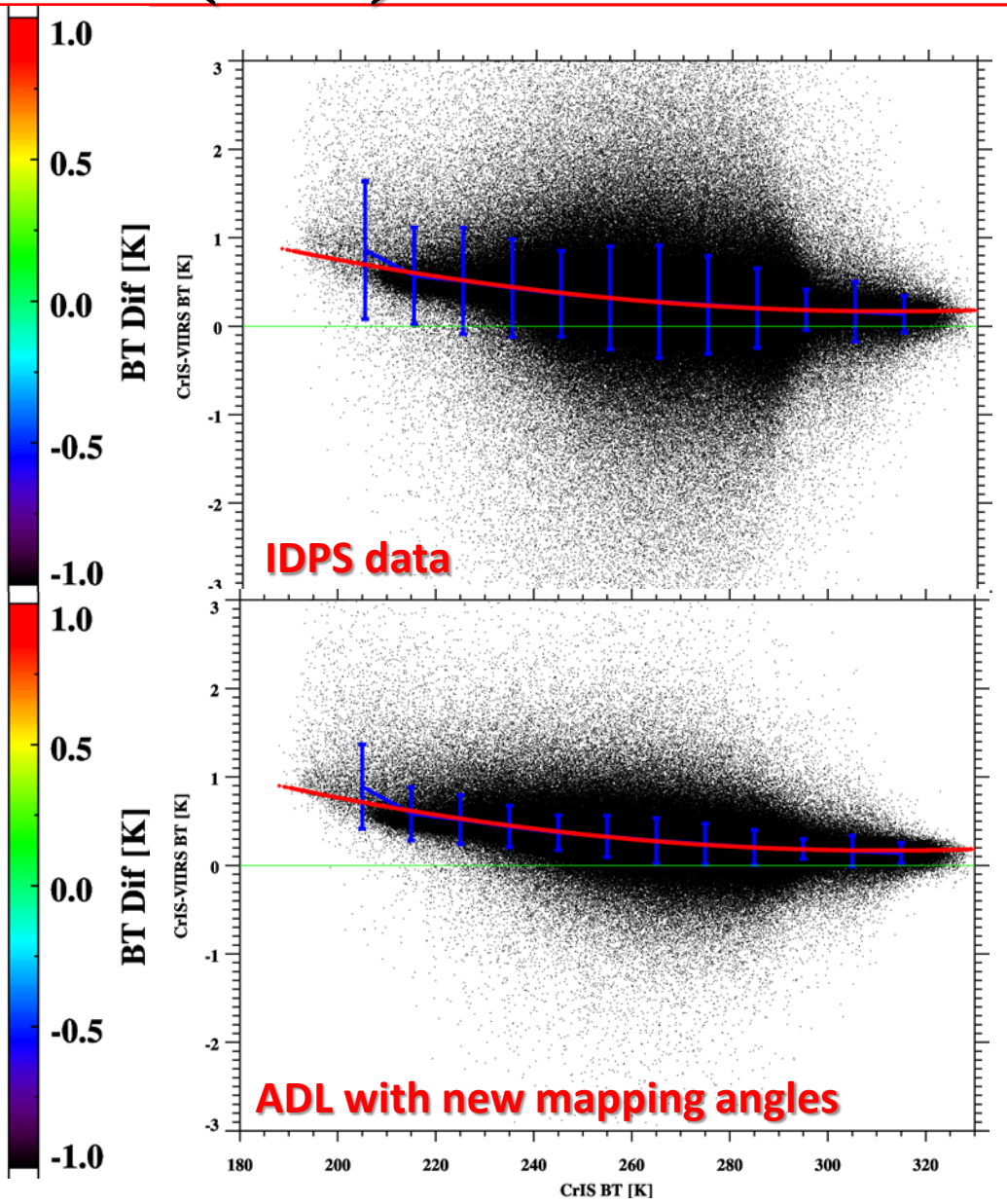


Effects of Geolocation Updates
CrIS-VIIRS (M15)



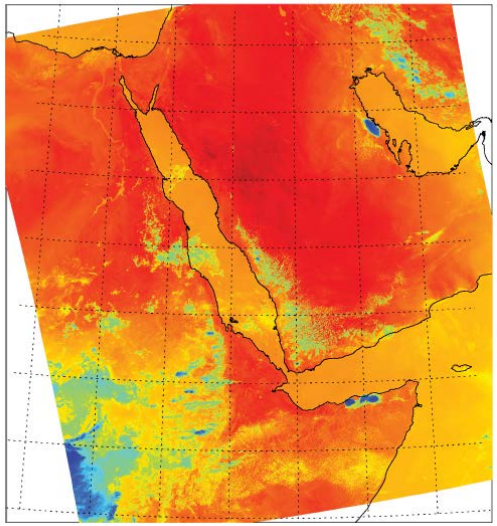


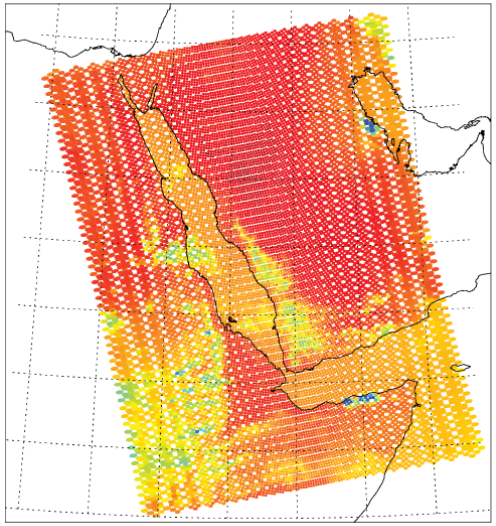




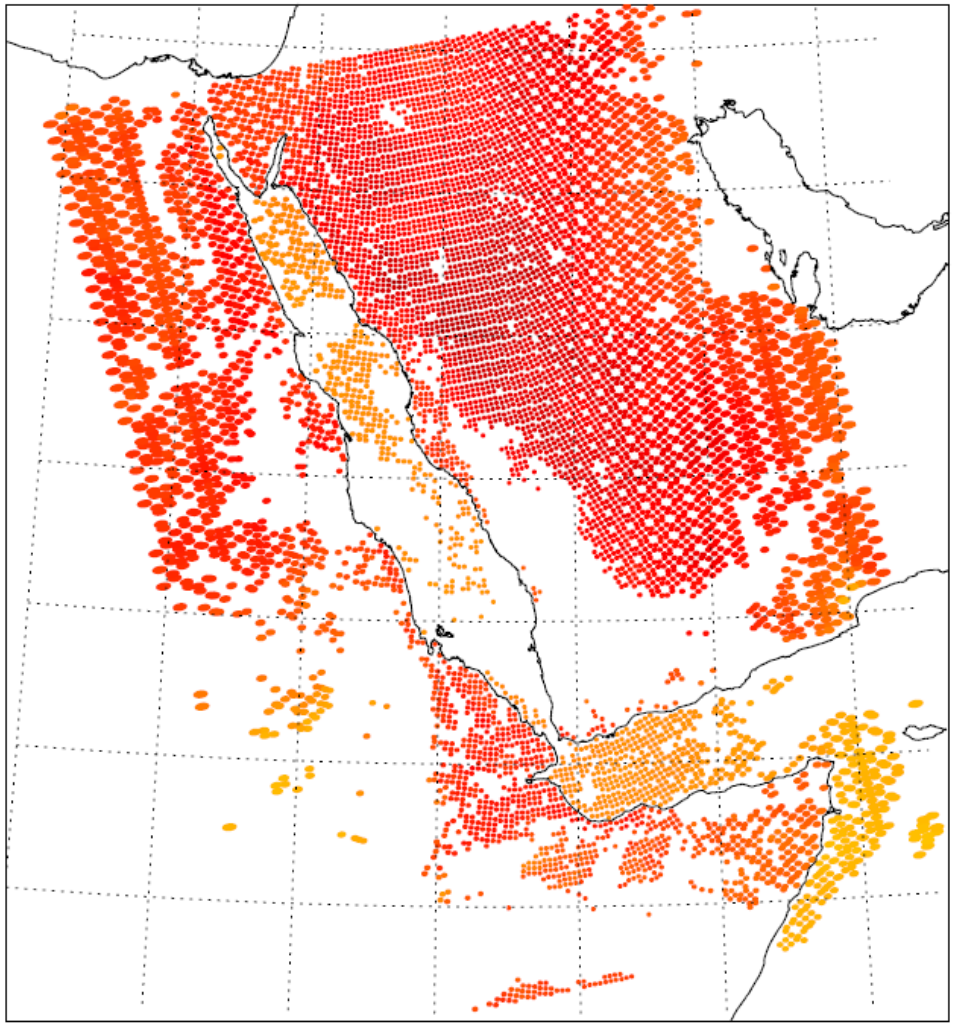
Clear Sky or Uniform Scene Detection

VIIRS Image at I5 band



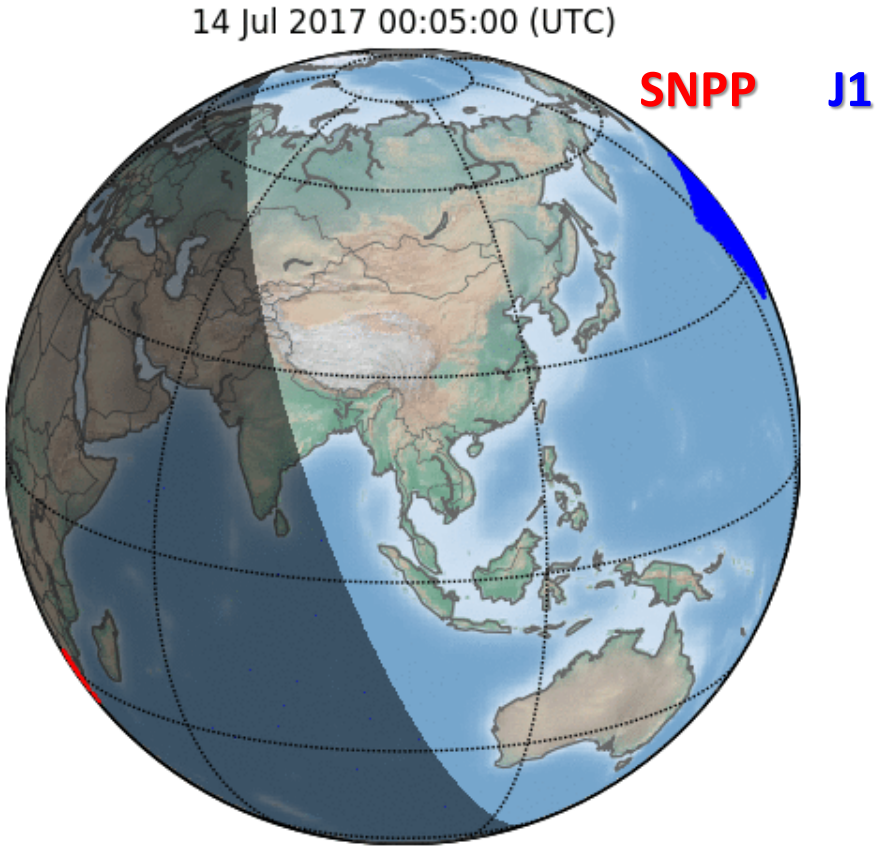


CrIS Clear Sky Pixels

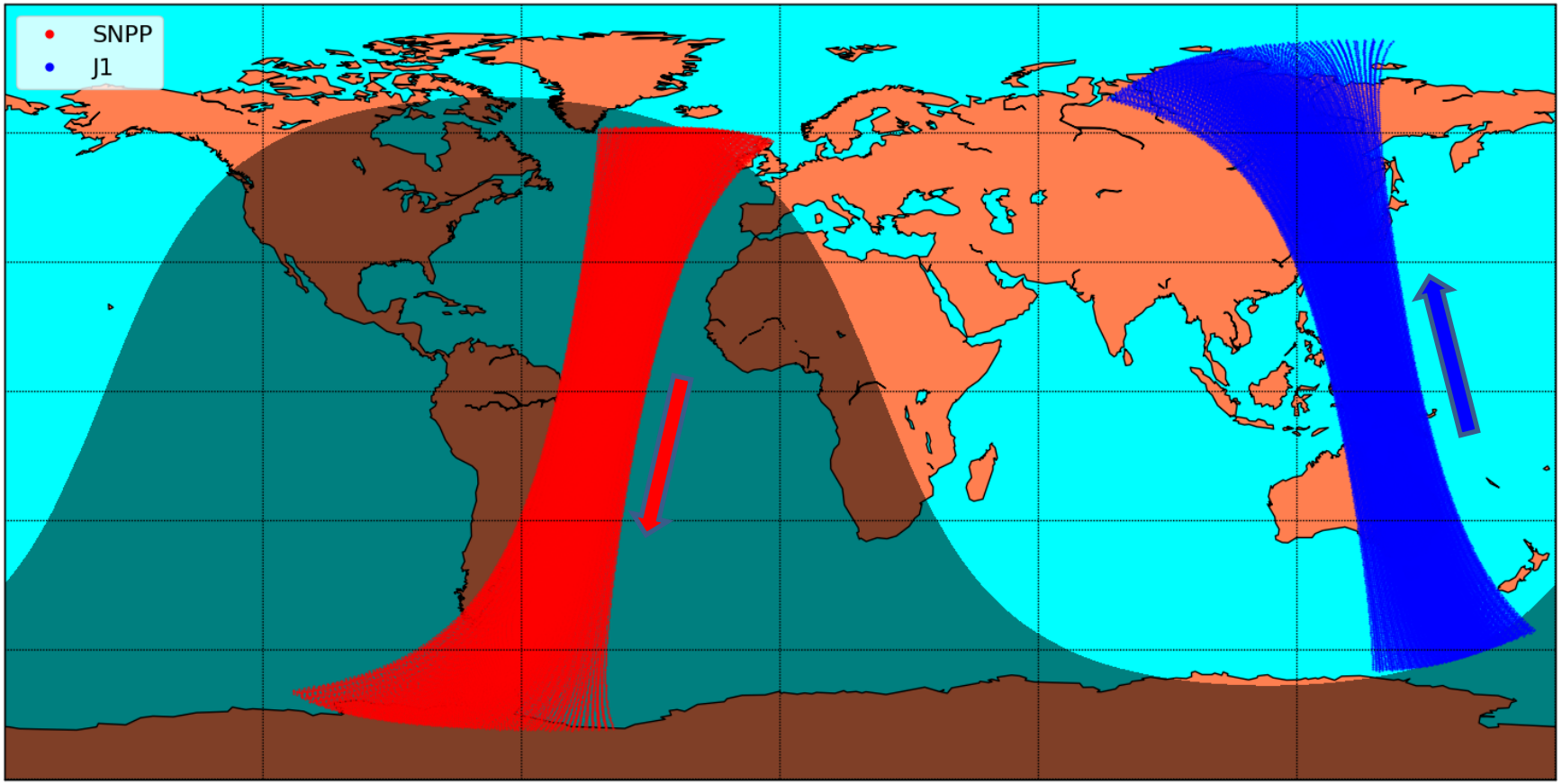


Inter-calibration of SNPP and J1 CrIS

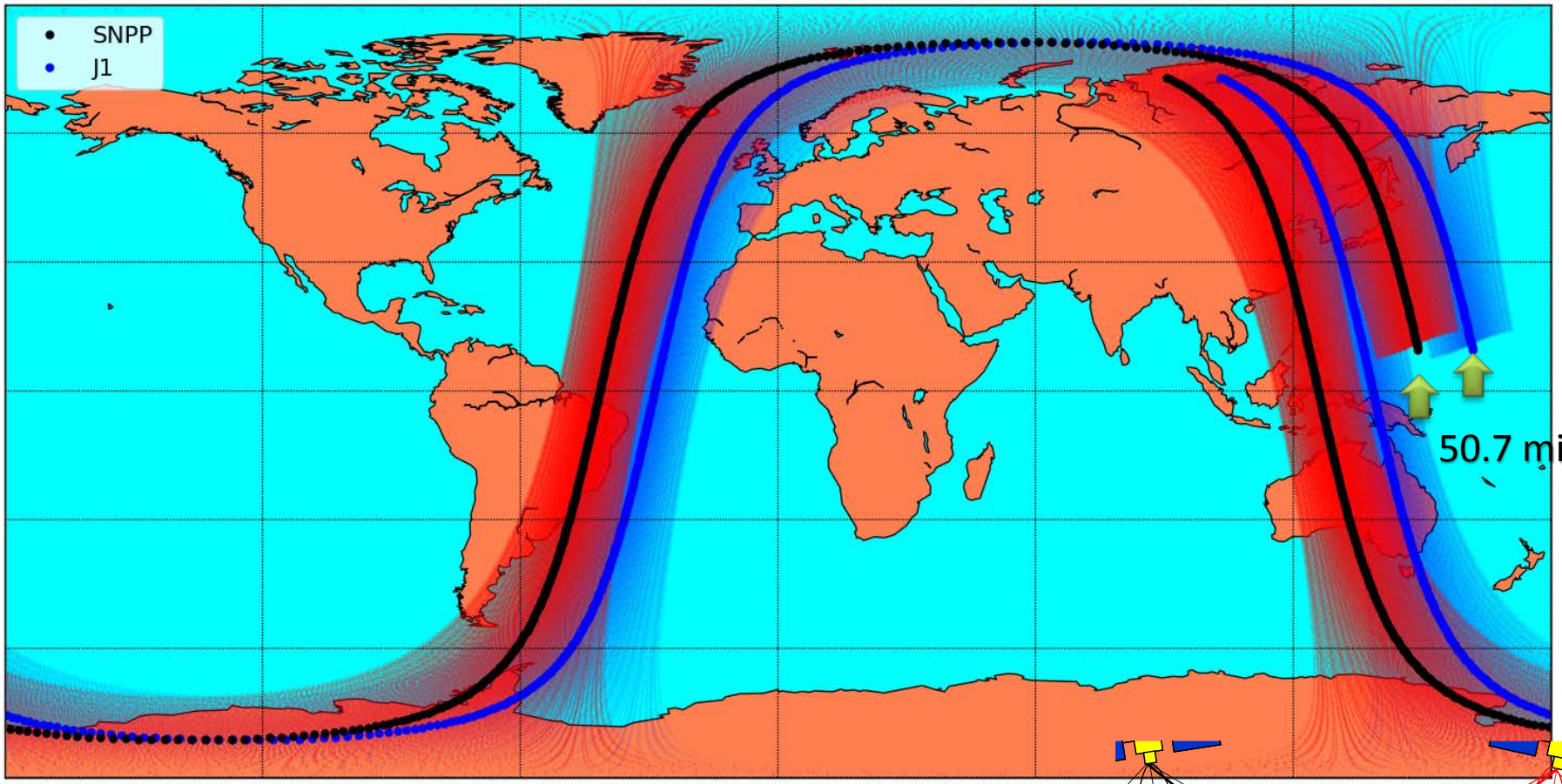
- Once J1 reaches in the final orbit, J1 will be the same orbit as SNPP except for the ½ orbit along track separation.
- SNO opportunities exist if instruments are turned on and collecting earth view data before orbit raising (Day 45).
- There will be **NO SNO**s between SNPP and J1 after it reaches final orbit.
- We need to explore the other ways to inter-calibrate J1 and SNPP CrIS.



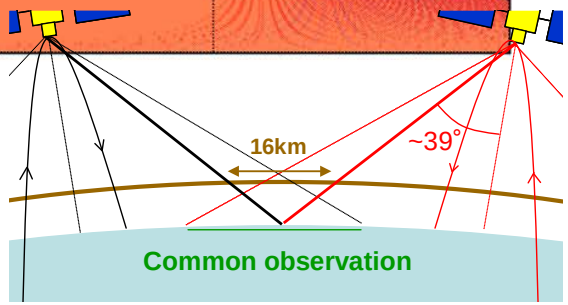
Same orbits with 180° shift



½ orbit along track separation

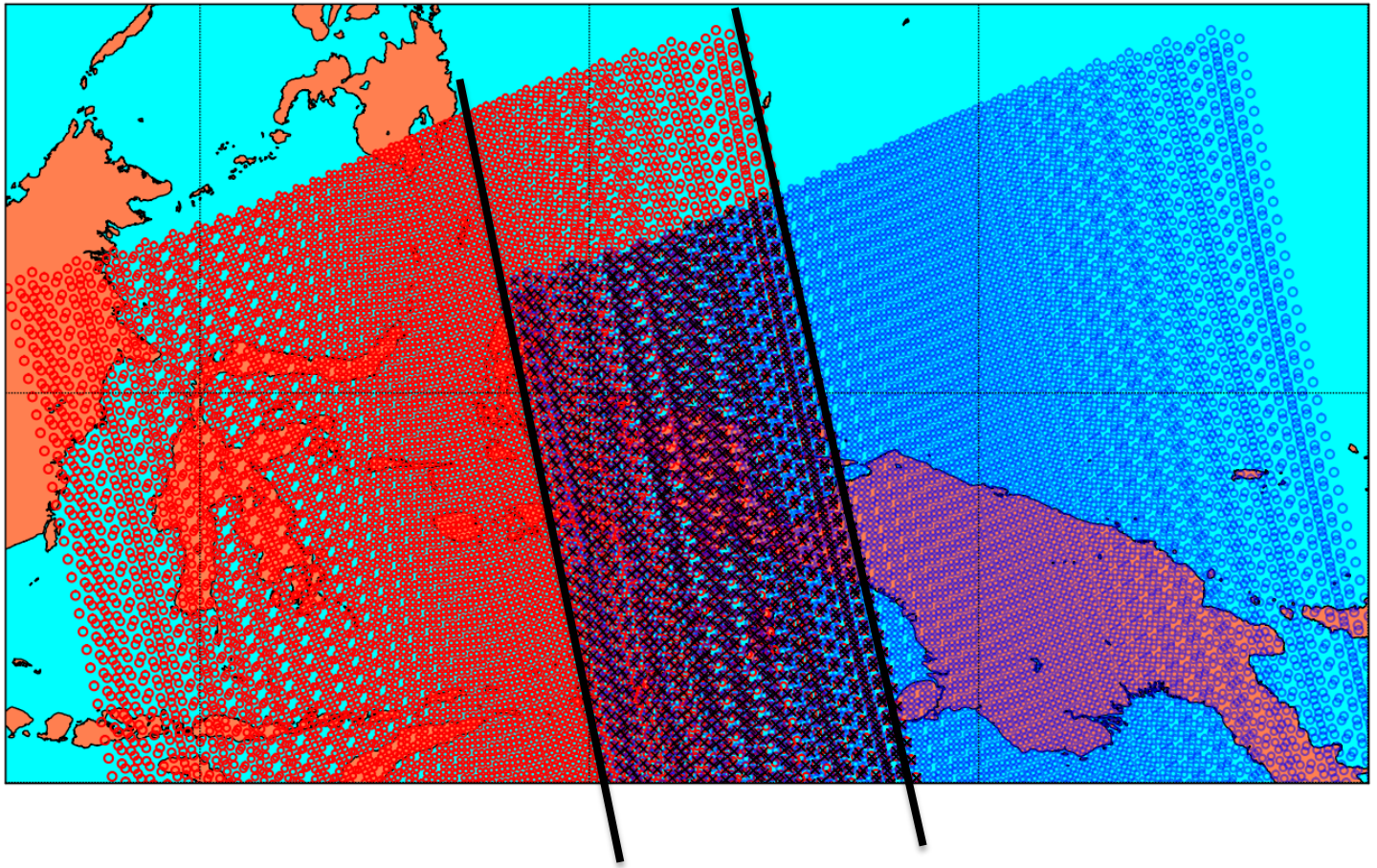


- For each SNPP orbit, with the J1 previous and following tracks
- Possible for all latitudes
- Off-nadir observations (nadir at the poles)
- 50.7 min time delay between J1 and SNPP



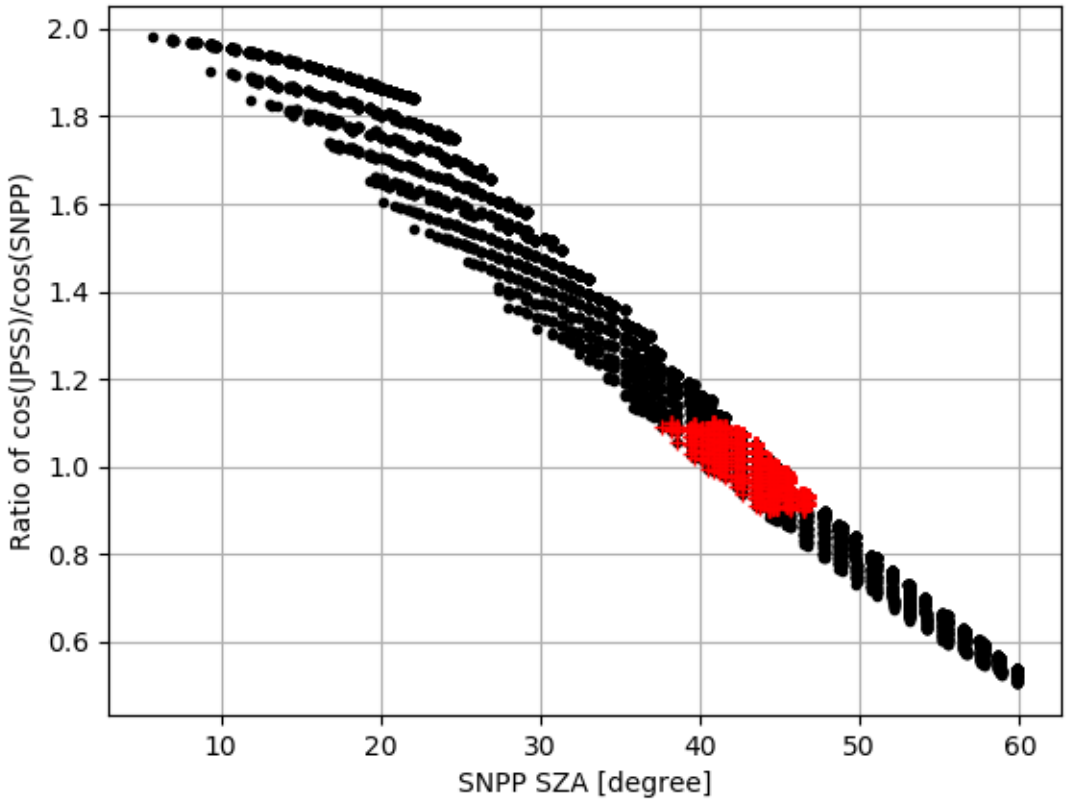
From Denis JOUGLET

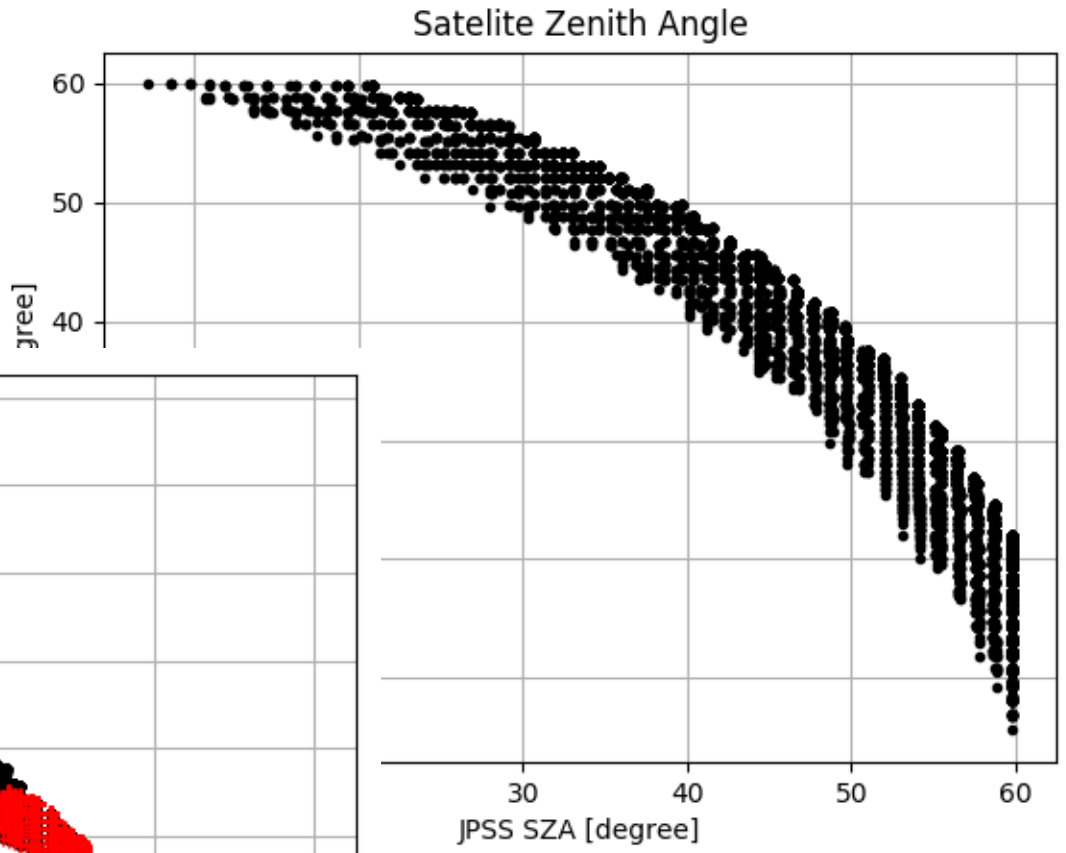
Overlapped regions with time delay



- Similar viewing absolute angles (same atmospheric thickness)
- Opposite scan positions
- homogeneous and stable scenes in 50.7 min
  - Collocated VIIRS

Satellite Zenith Angle for overlapped FOVs





Conclusion

	SNPP	JPSS-1
Collocation Method	IDL	Python (parallel)
	Non-terrain correction data	Non-terrain or terrain correction data
Geometric Assessment		Preliminary evaluation without J1/VIIRS
	Mapping angle Adjustment	Mapping Angle Adjustment
		Band-to-band registration
Scene characterization	Clear sky detection (VCM)	Clear sky detection (VCM)
		Cluster analysis
Inter-calibration of CrIS and VIIRS	Case by case	Daily Trending

QUESTIONS?