Sinusoidal Vs. Geographic Projection

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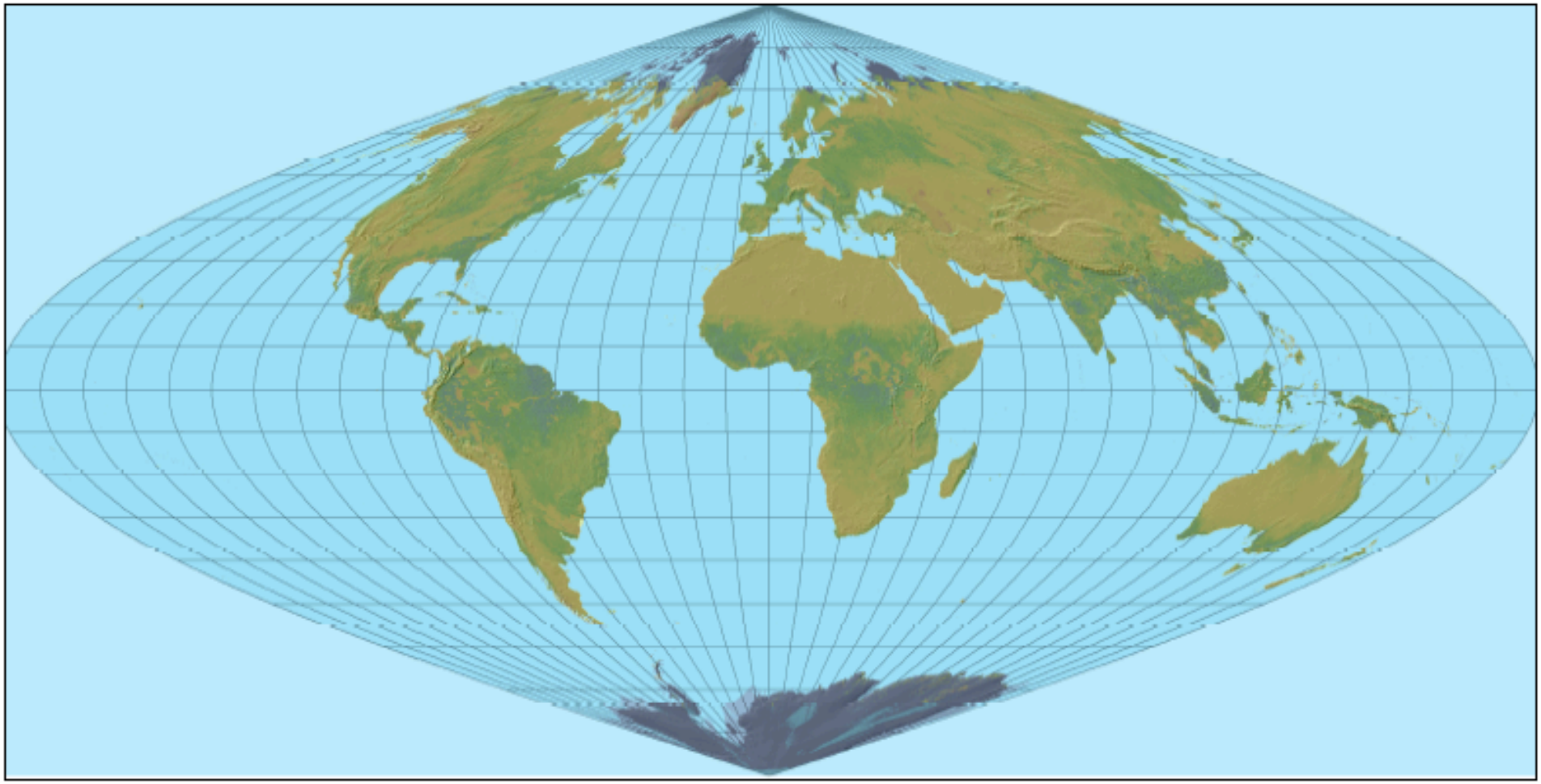
Introduction

- Sinusoidal projection was adopted…
  - It was recommended by climate modelers
  - It preserves the area
  - There is less distortion over tropical areas
  - There is less computation over high-latitude areas

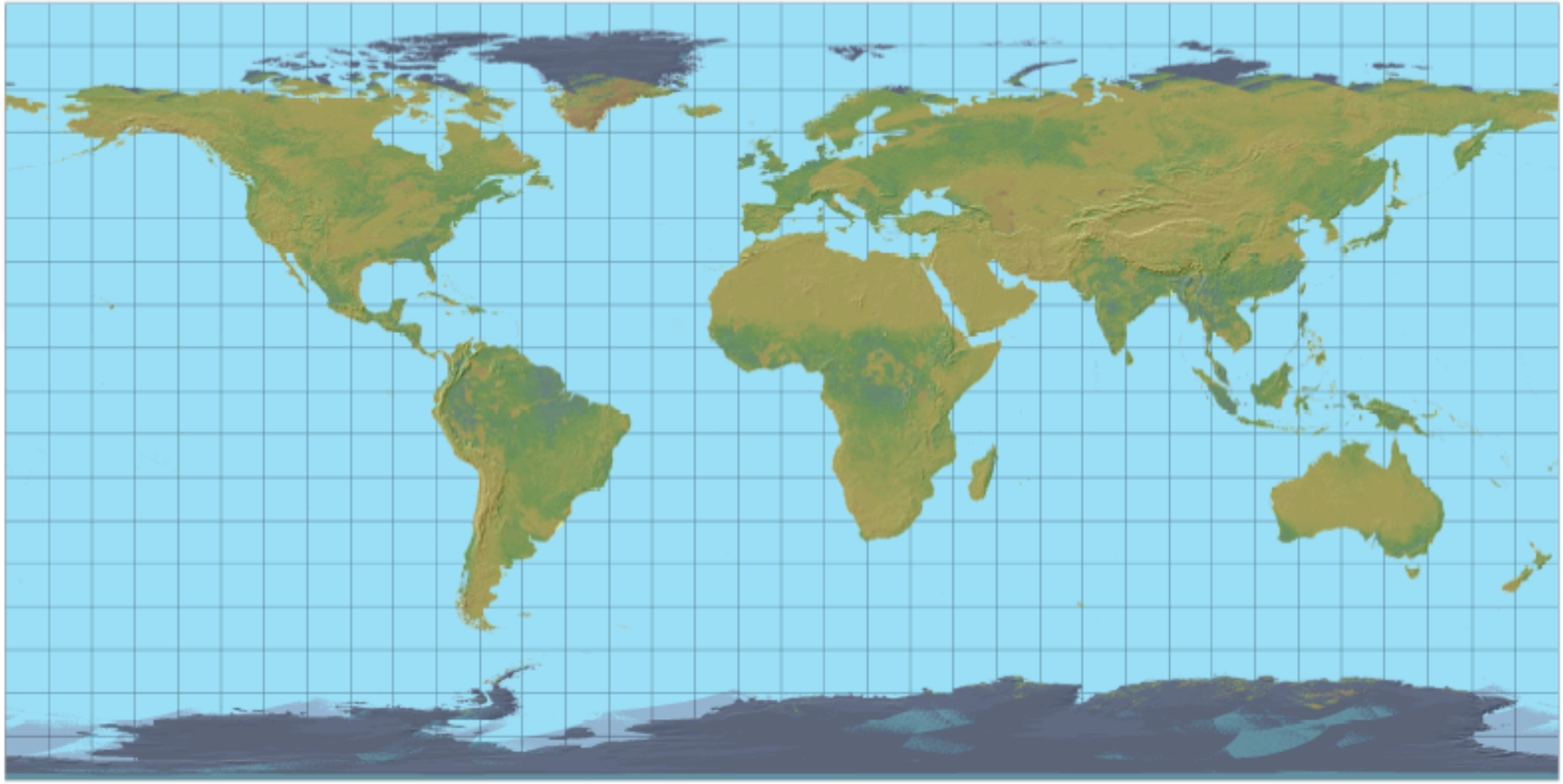
- Geographic projection, on the other hand, facilitates easier integration with various geo-visualization tools available nowadays

Sinusoidal Projection



Raster Mosaic Dataset from scaled EVI TOC, defined 'nodata', with underlying shaded relief DEM at 30 arcseconds (USGS)

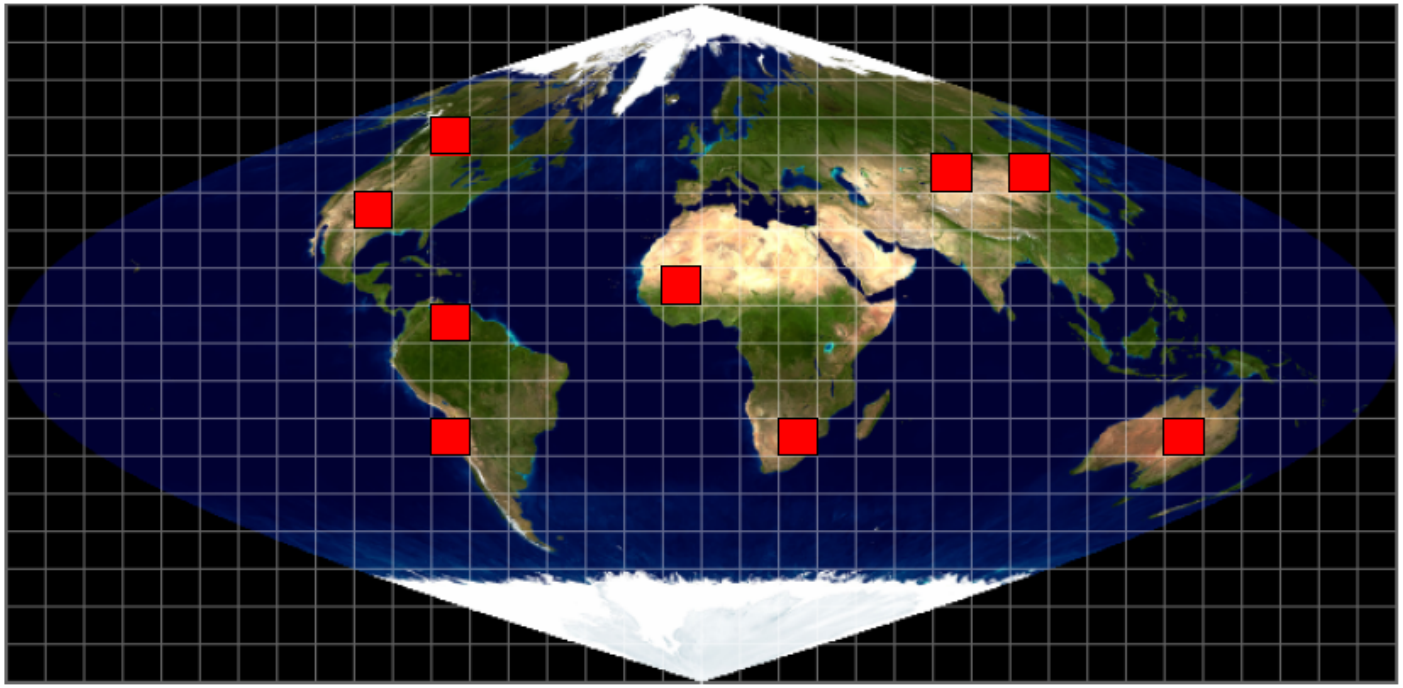
Geographic Projection



Raster Mosaic Dataset from scaled EVI TOC, defined 'nodata', with underlying shaded relief DEM at 30 arcseconds (USGS)

Objective

- Evaluate the impact of change in projection on Land Surface Reflectance and NDVI Products over “Golden Tiles”



Method: Simulate Daily MODIS/VIIRS Products

OLI-derived surface reflectance products

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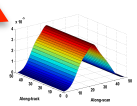
Scan OLI data according to VIIRS and MODIS
- Viewing geometries for one orbit cycle AND
- The Point Spread Functions



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Swath-level simulated MODIS and VIIRS products

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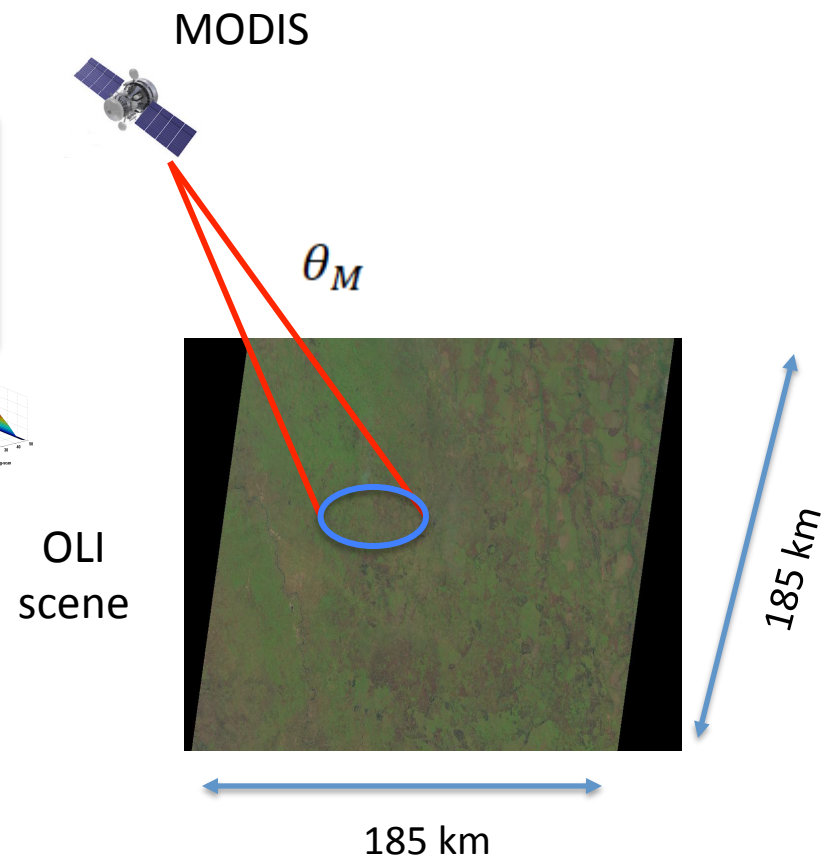
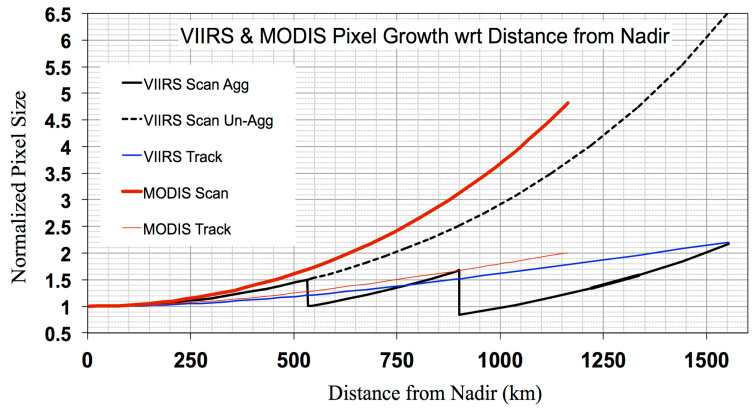
1km gridding (GEO VS. SIN)

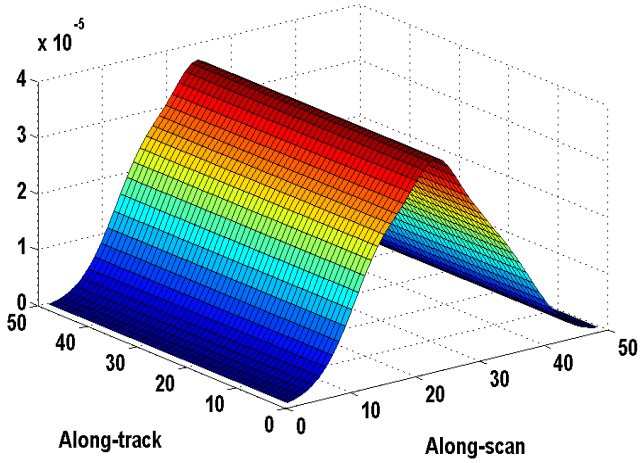
↓

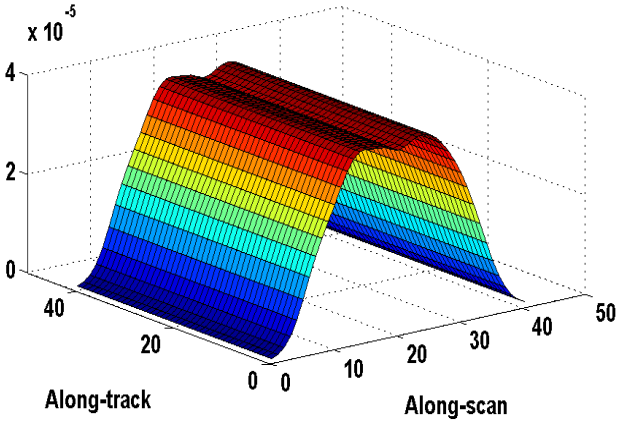
intercomparison



Spatial Sampling Used in Simulations







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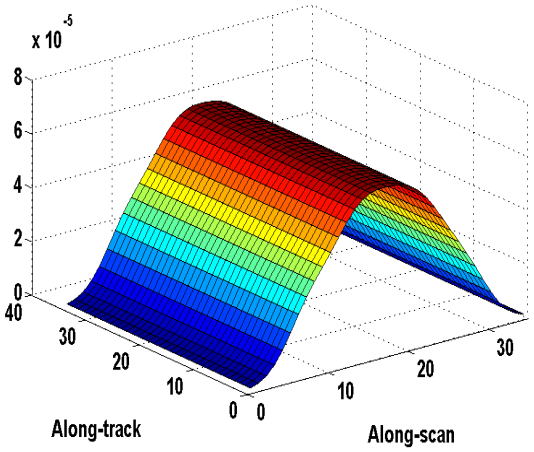

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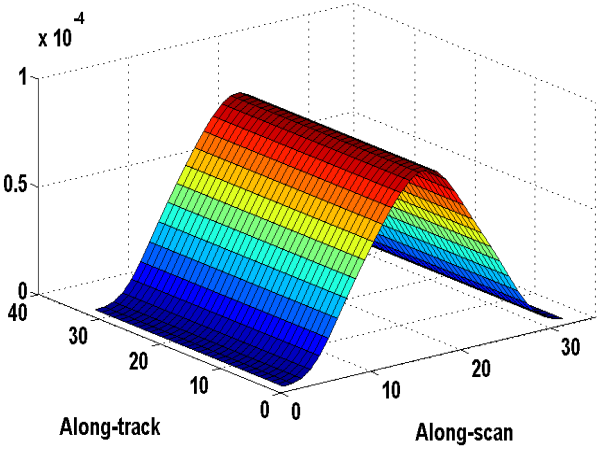
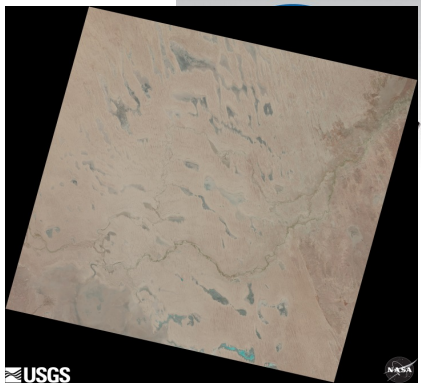
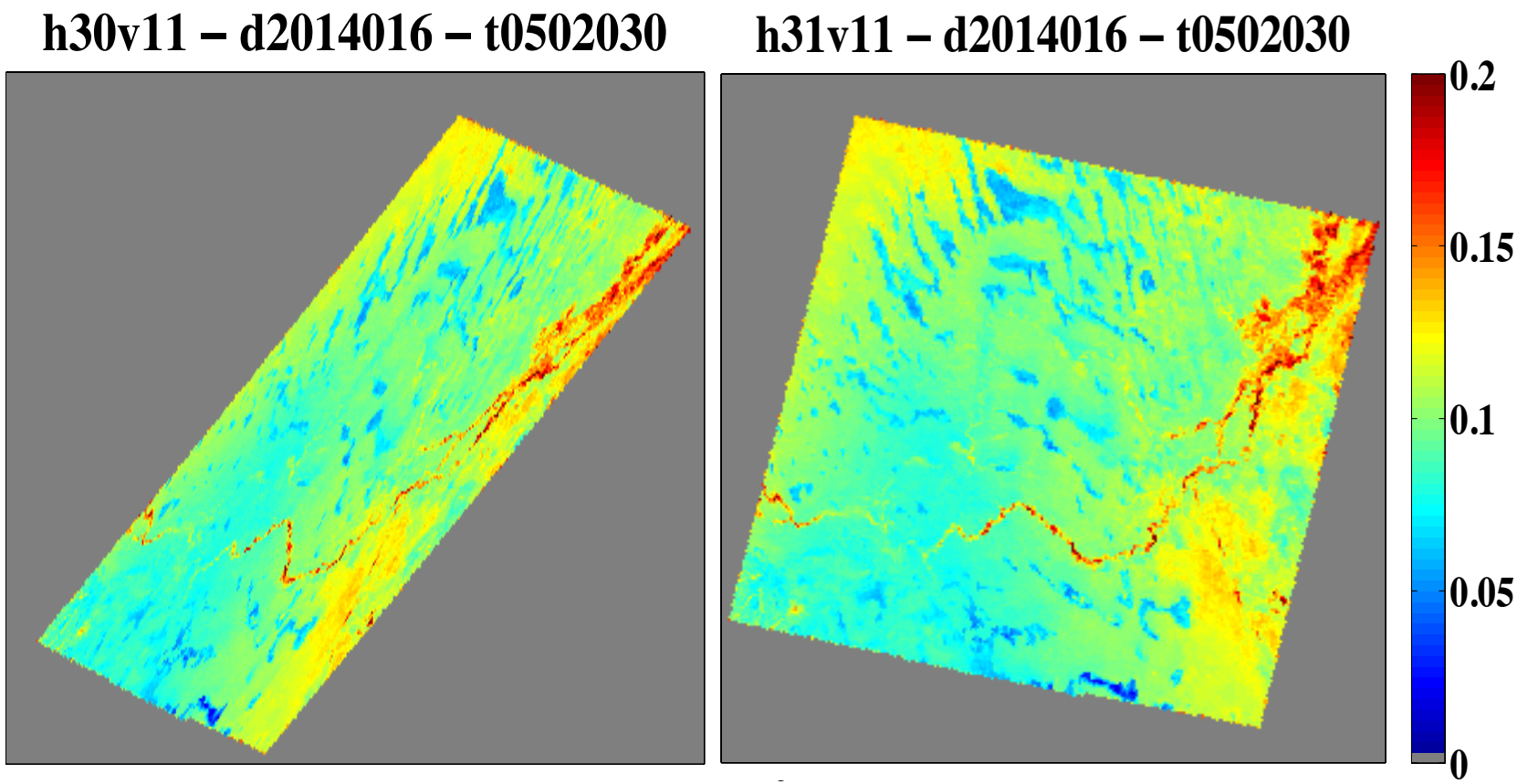


Agg. 1X1

More details on the method in Pahlevan, N, Sarkar, S., Devadiga, S., Wolfe, R. E., Román, M. O., Vermote, E., Lin, G., and Xiong, X. (2016). Impact of Spatial Sampling on Continuity of MODIS-VIIRS Land Surface Reflectance Products: A Simulation Approach. *Submitted to IEEE Transactions of Geoscience and Remote Sensing (under review).*

Sample Simulated NDVIs (SIN Vs. GEO)



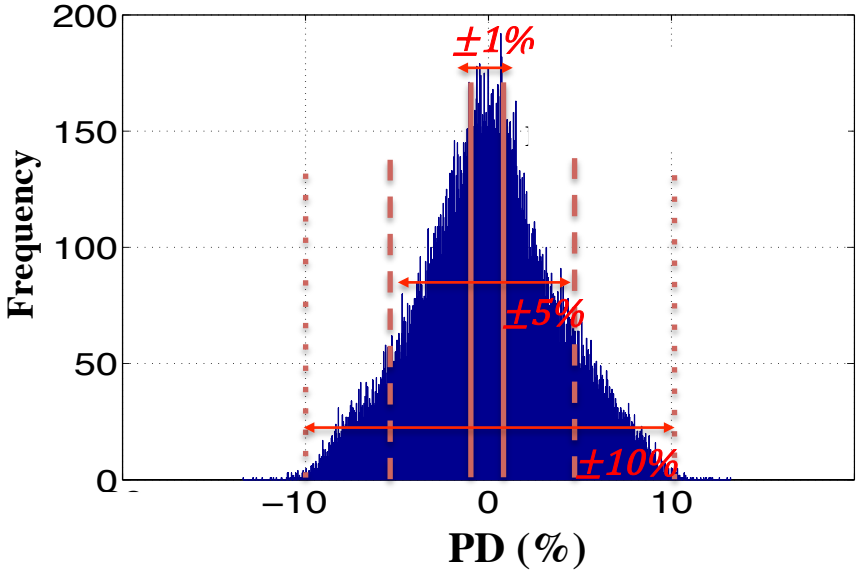


Metrics

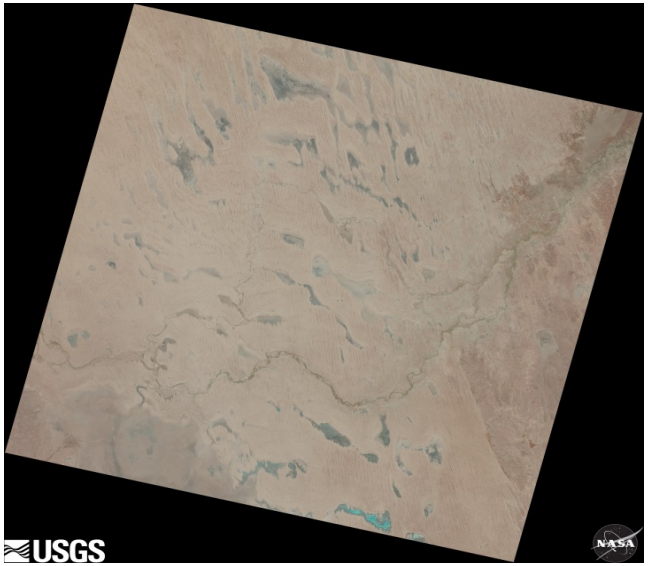
- Histogram-based analysis of difference grids of SIN and GEO for LSR and NDVI
  - Per-pixel (i): Percent Difference (PD) and Absolute PD (APD)

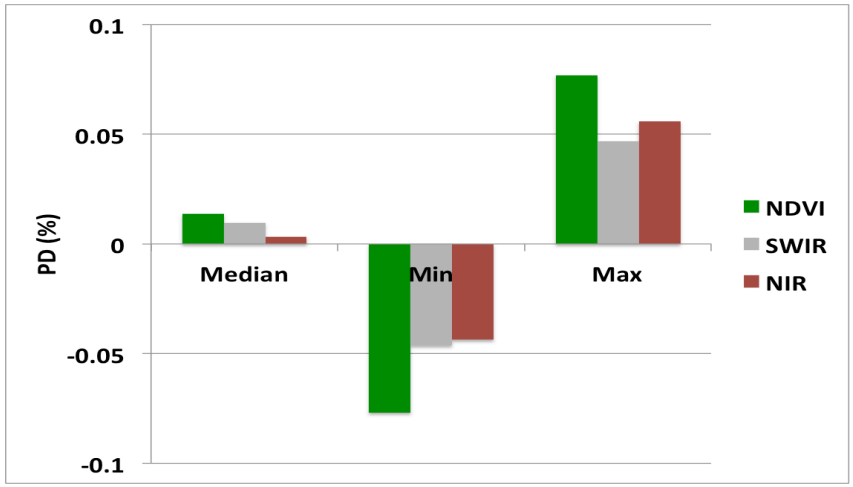
$$PD_i = (NDVI_{SIN} - NDVI_{GEO})/((NDVI_{SIN} + NDVI_{GEO})/2) \quad \times 100$$

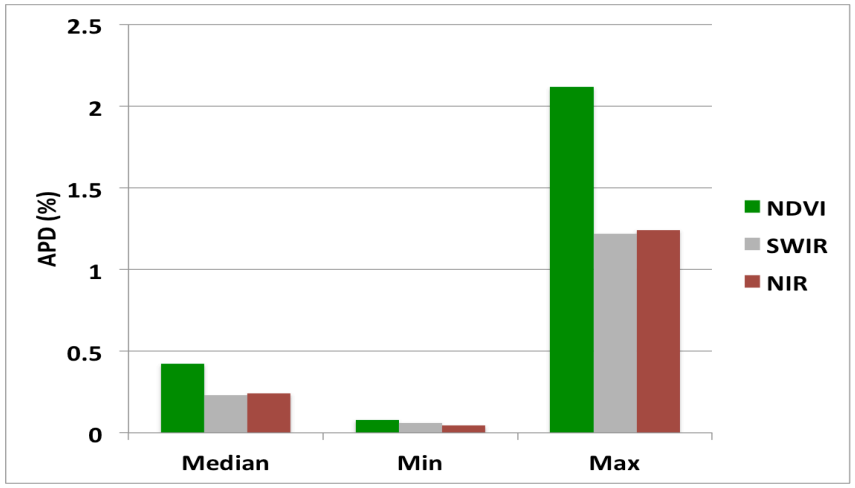
  - Per-area: histogram mean (PD & APD) and RMSD
  - Median/min/max of mean values (multiple SIN-GEO)

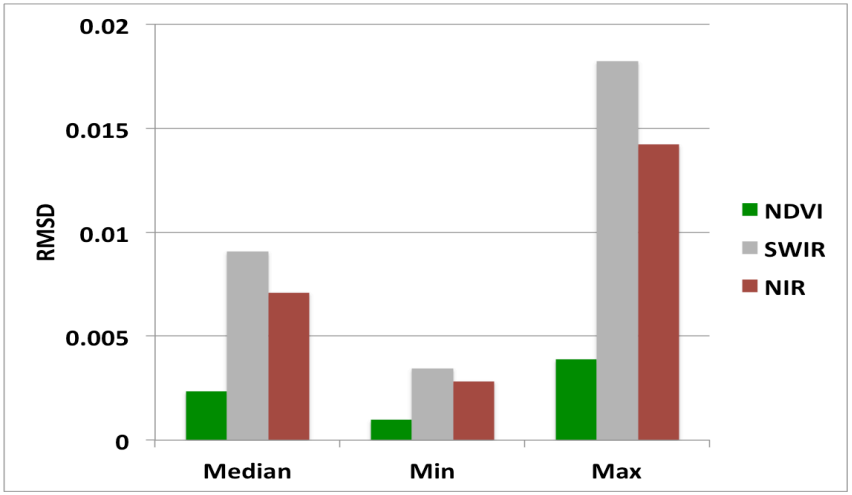


Australia (barren)

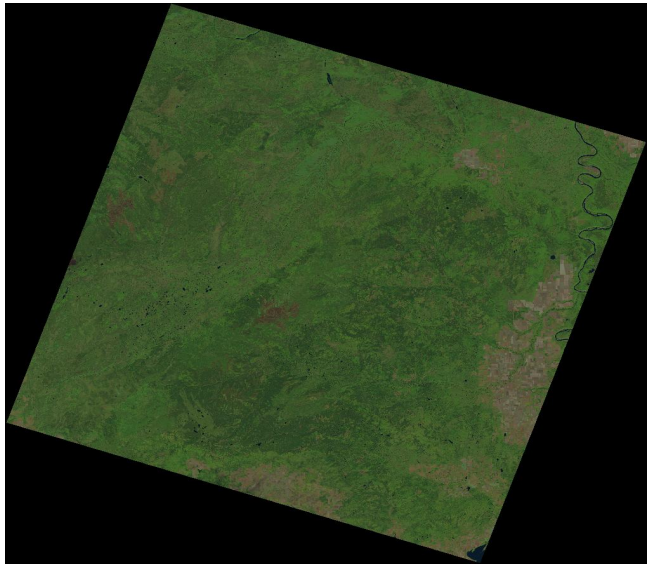


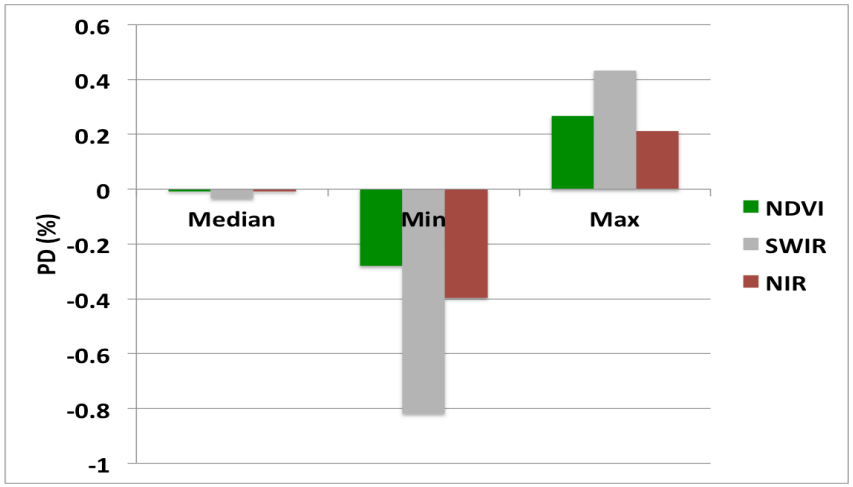


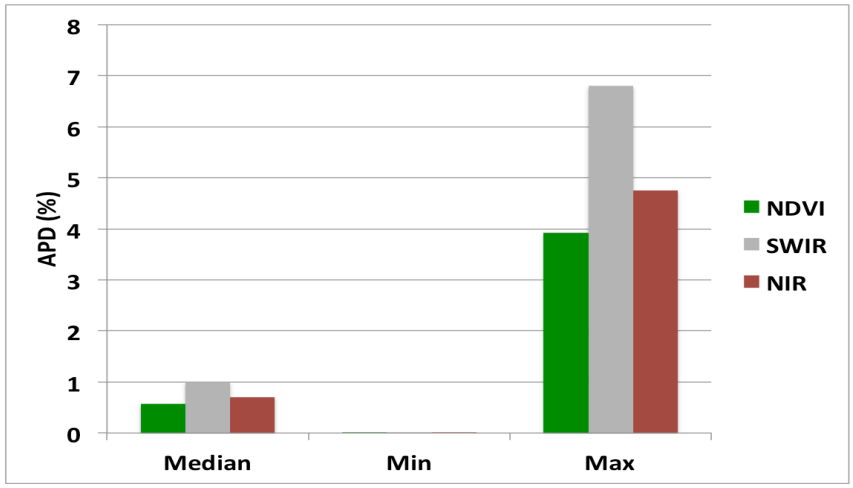


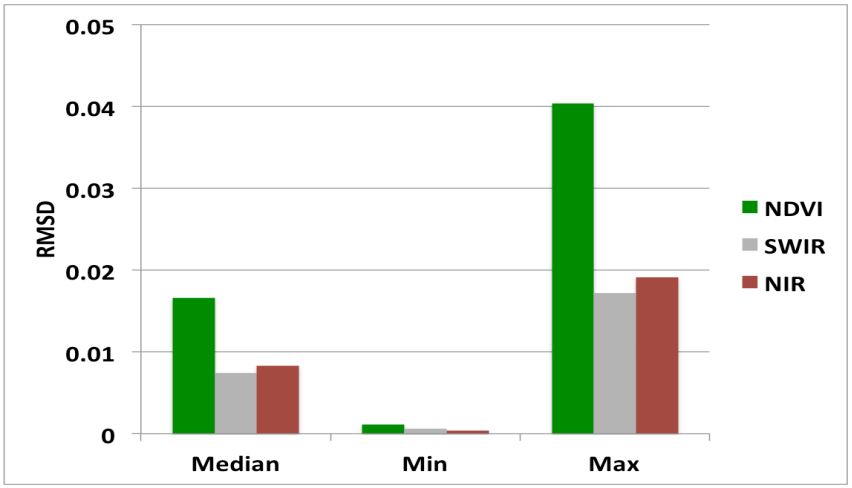


NW Canada (boreal)

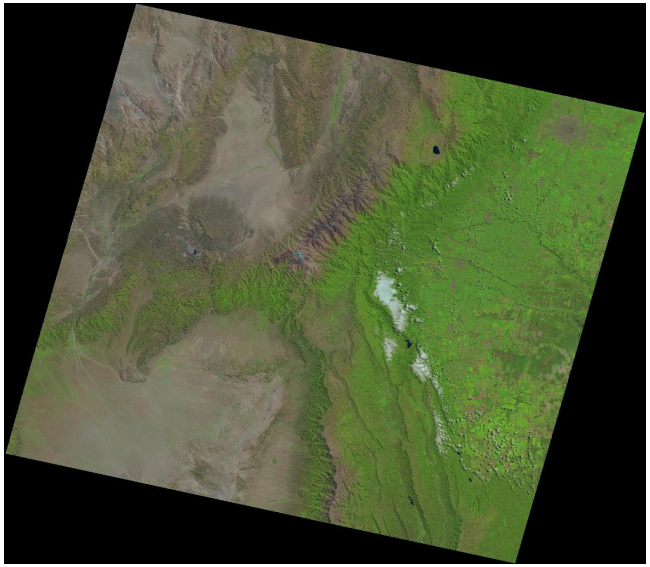


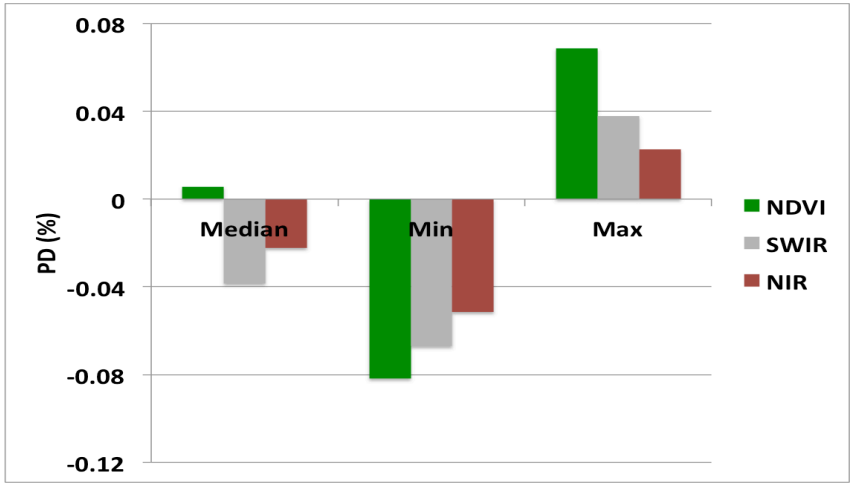


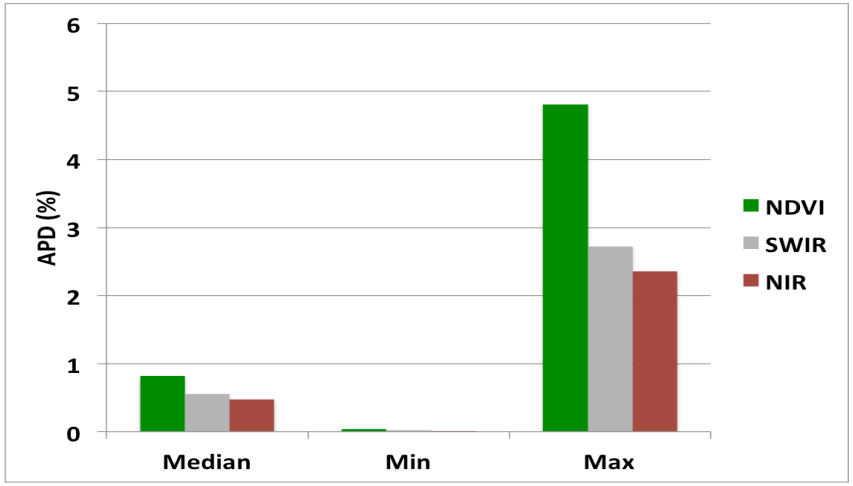


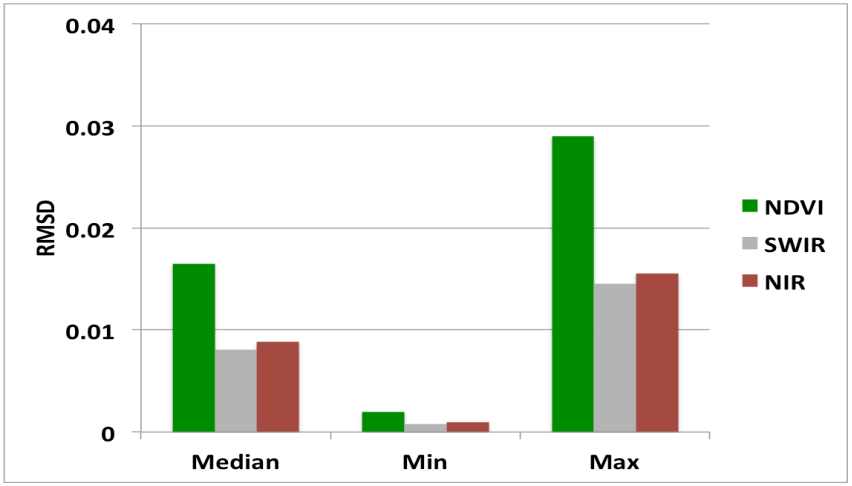


Northern Chile



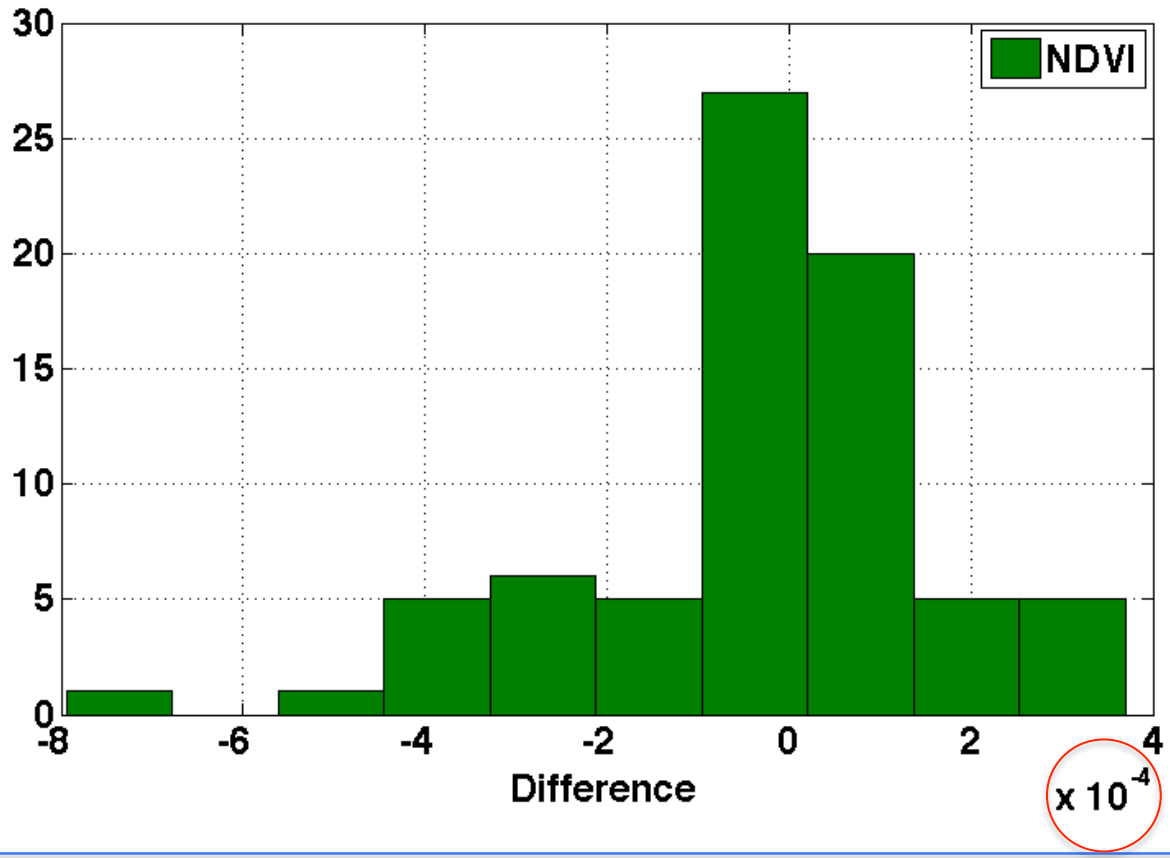






NDVI

- Ensemble of simulated difference images (various orbits and land covers)



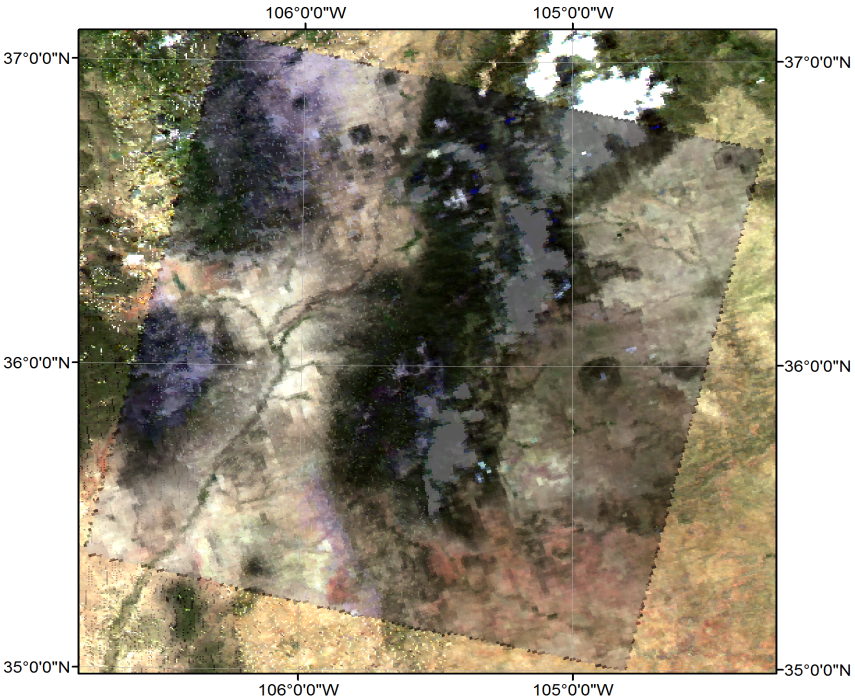
Conclusion

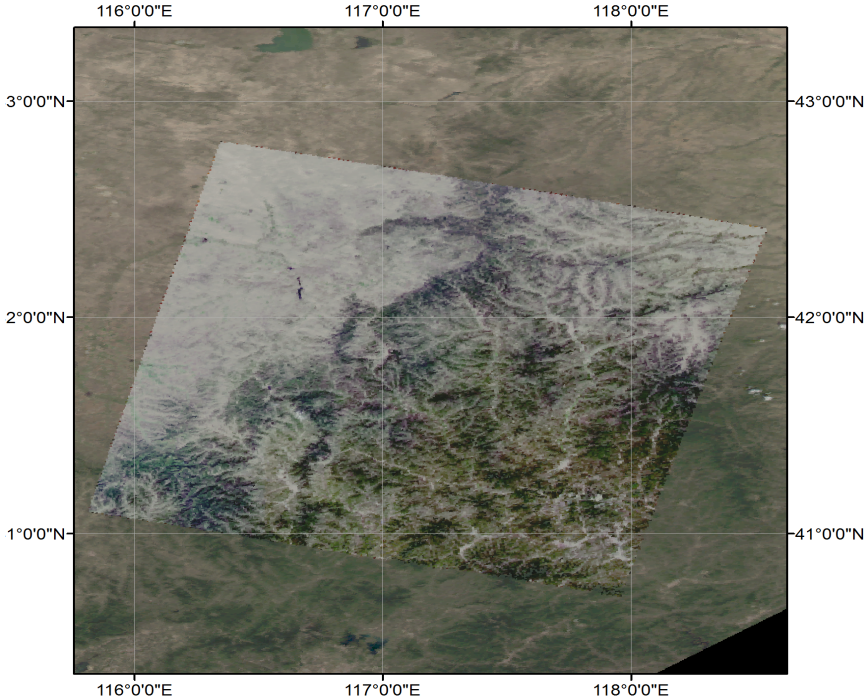
- **SIN > GEO yield, on average, insignificant differences (PD < 0.5% & difference < 1e-3) in LSR and NDVI products.**

- **Recommendation**
  - **Depending on user needs, it is possible to transition to geographic projection with very minimal impact on land products.**
  - **Further analyses of the impact can be done by science PIs (if needed)**

Backup

Sample Simulated Swaths





The simulated MODIS LSR swaths re-projected and overlaid onto gridded MODIS LSRs (MYD09) shown in RGB for the SW USA (left) and NE China (DOY = 247) sites. Courtesy of Pete Ma (NASA GSFC / SSAI).

More details on the method in Pahlevan, N, Sarkar, S., Devadiga, S., Wolfe, R. E., Román, M. O., Vermote, E., Lin, G., and Xiong, X. (2016). Impact of Spatial Sampling on Continuity of MODIS-VIIRS Land Surface Reflectance Products: A Simulation Approach. *Submitted to IEEE Transactions of Geoscience and Remote Sensing (under review).*