BRDF/Albedo/NBAR: Extending MODIS to VIIRS

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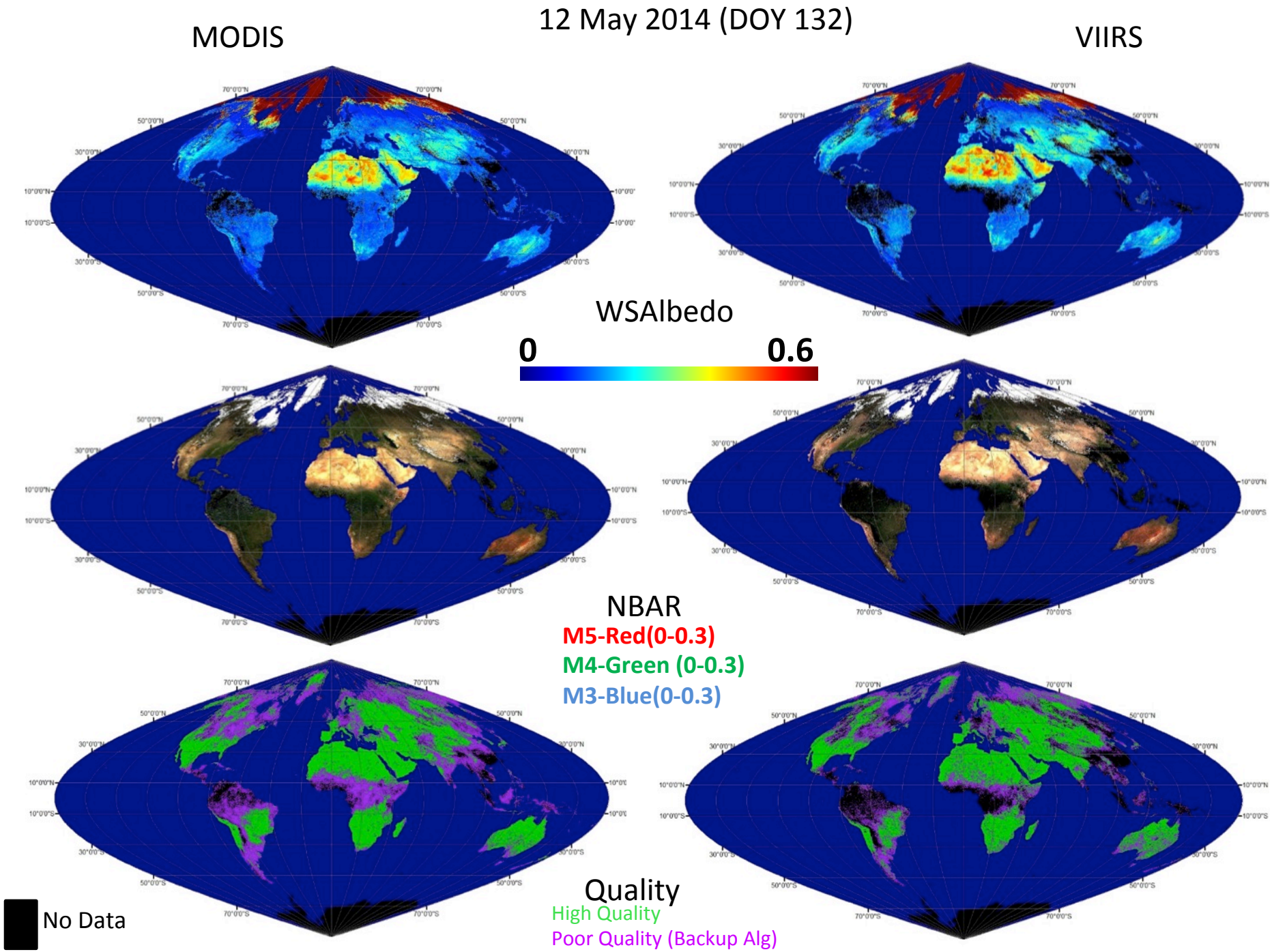
MODIS and VIIRS Products

- MODIS V006
  - Terra AND Aqua (morning and afternoon)
  - DAILY BRDF, Albedo, NBAR (Nadir BRDF Adjusted Reflectance)
    - NBAR-vegetation indices used in phenological research
  - 500m Tiles, 30arc-second CMG
  - 7 bands, 3 Broadbands
  - QA, uncertainty measures

- VIIRS
  - Suomi NPP only (afternoon)
  - DAILY BRDF, Albedo, NBAR
  - 500m Tiles (3 I-Bands), 1km (9 M-Bands, 3 Broadbands)
  - QA, uncertainty measures

- LANCE NRT products delivered


12 May 2014 (DOY 132)
MODIS
VIIRS
WSAlbedo
0
0.6
NBAR
M5-Red(0-0.3)
M4-Green (0-0.3)
M3-Blue(0-0.3)
Quality
High Quality
Poor Quality (Backup Alg)
No Data

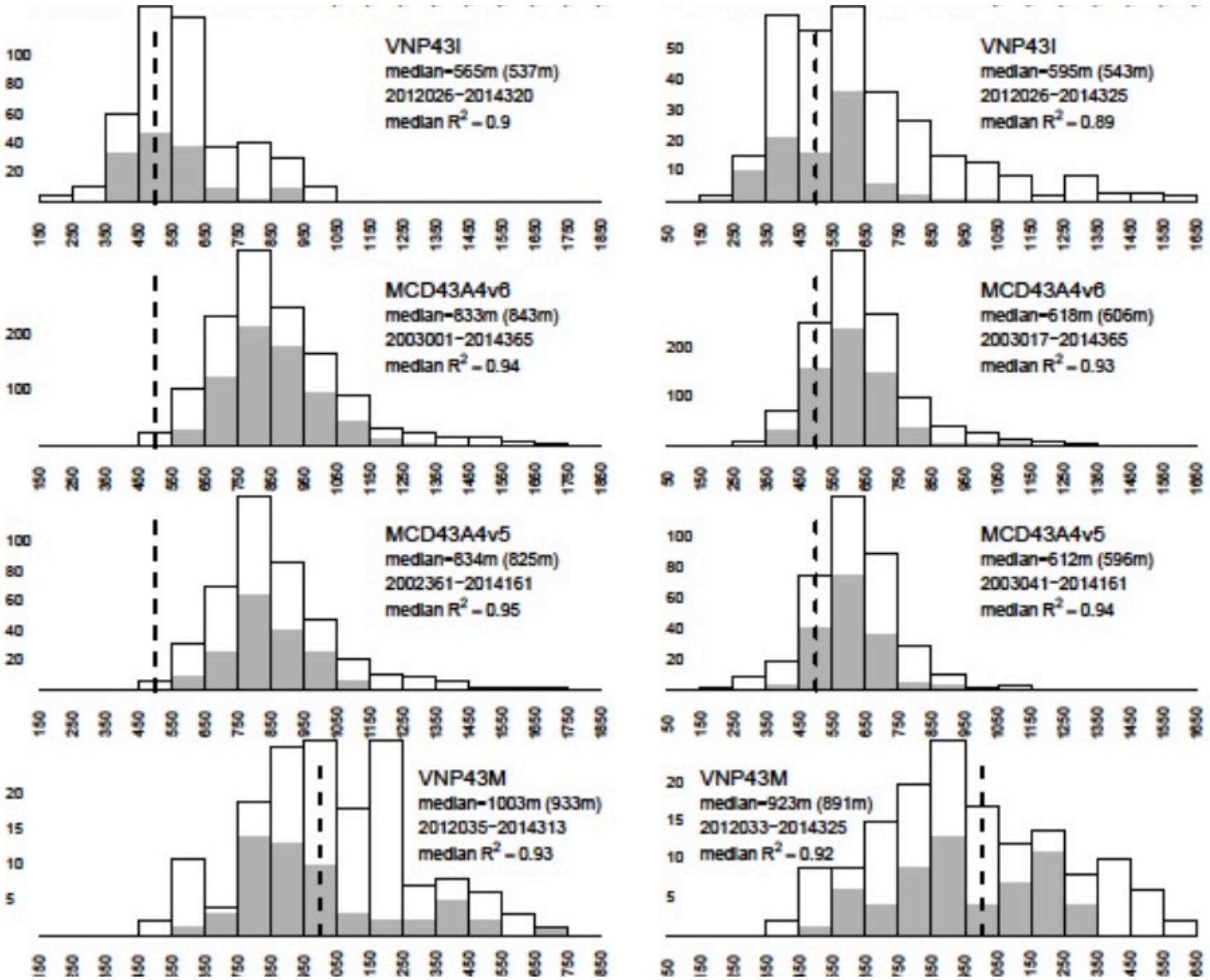
Efforts Underway

- Incorporation of Upstream Enhancements
- VIIRS and MODIS effective spatial resolutions
  - Campagnolo, M. L., Sun, Q., Liu, Y., Schaaf, C. B., Wang, Z., & Román, M. O. (2016). Estimating the Effective Spatial Resolution of the Operational BRDF, Albedo, and Nadir Reflectance Products from MODIS and VIIRS. Remote Sensing of Environment, 175, 52–64.
- VIIRS and MODIS Aqua combined
  - What happens when Terra finally ends….
- VIIRS N2B
  - Narrow spectral to broadband albedo conversions
  - Land surface types and snow covered
- Evaluation/validation of MODIS and VIIRS over spatially representative field sites

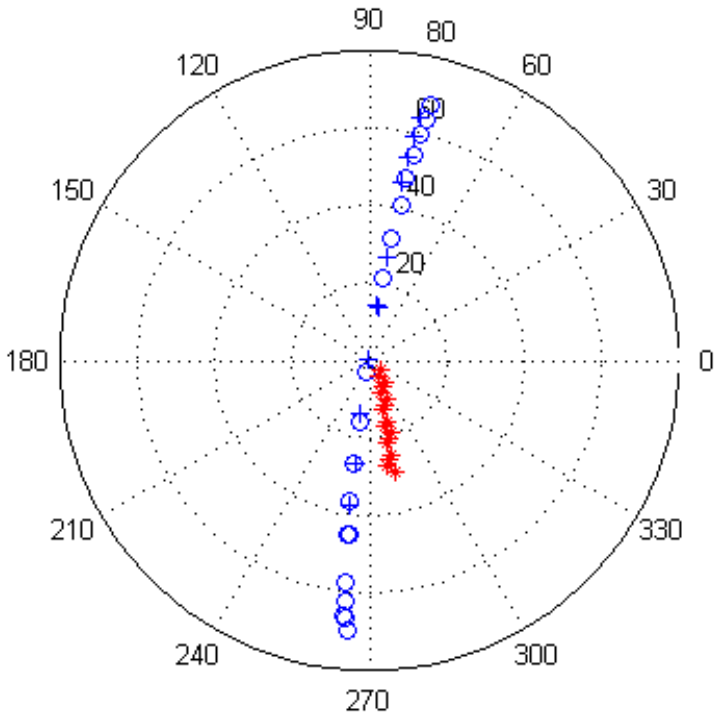
MODIS VIIRS effective resolution

Along E-W estimated resolution (m)

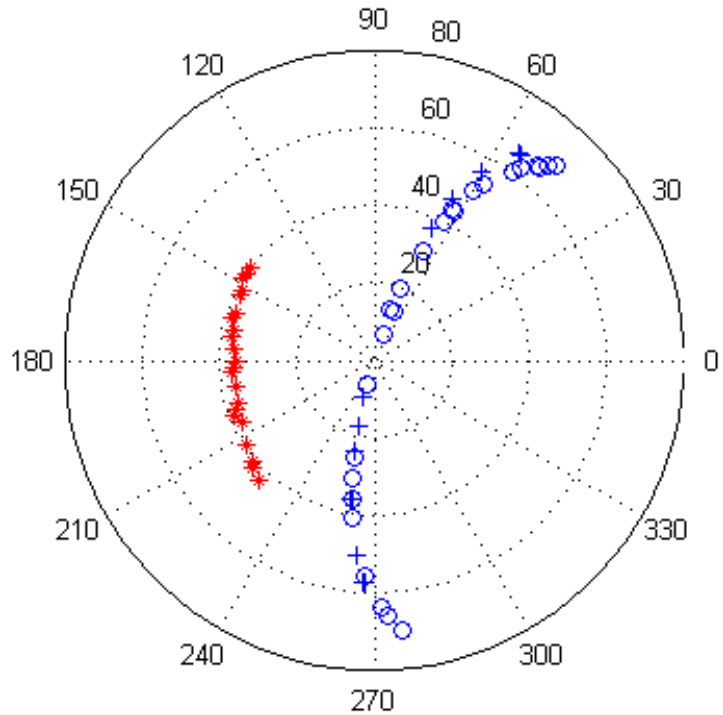
Along N-S estimated resolution (m)



MODIS and VIIRS Combined



h19v07



h12v03

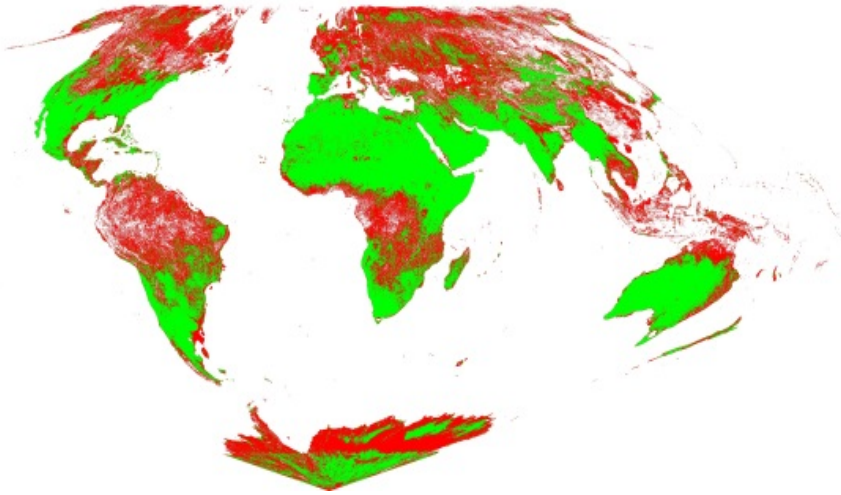
VIIRS observations

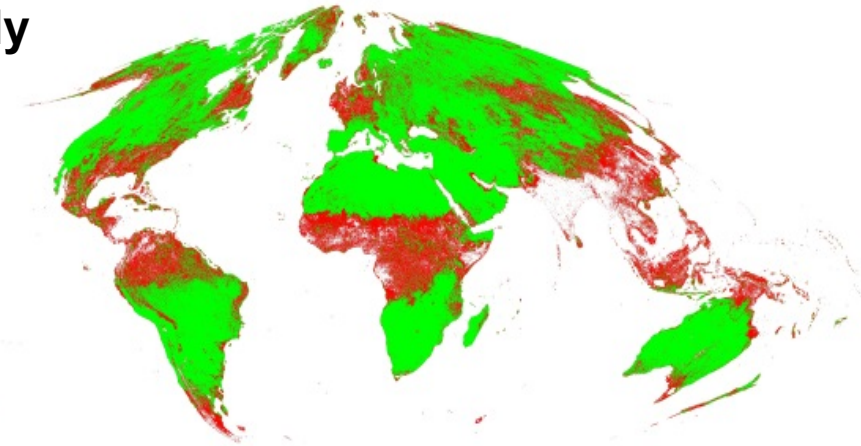
MODIS Aqua observations

Sun positions

Observations DOY
185-200, 2012

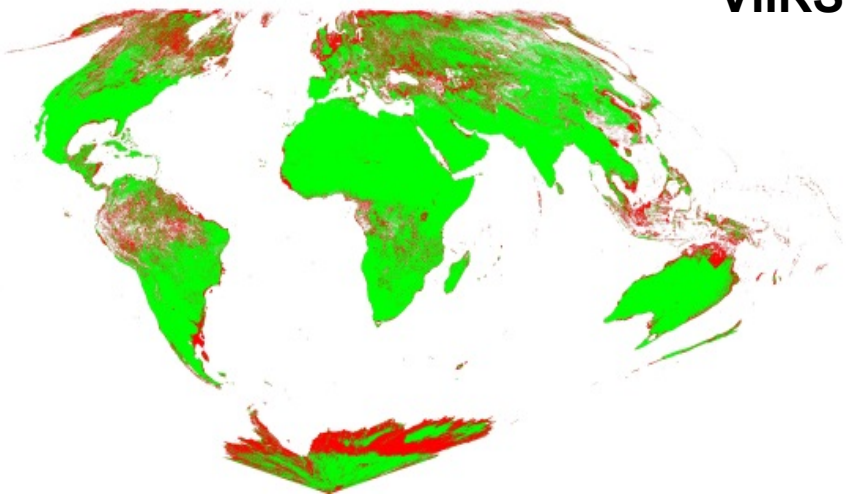
Aqua only

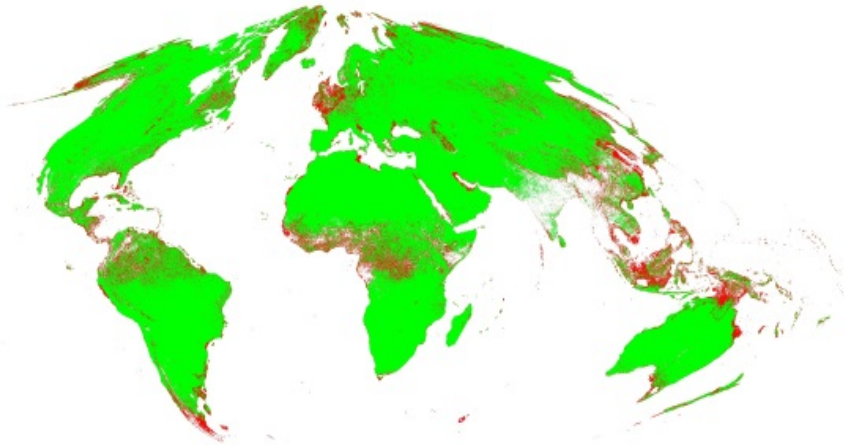




Green: high quality
Magenta: poorer quality

Aqua + VIIRS



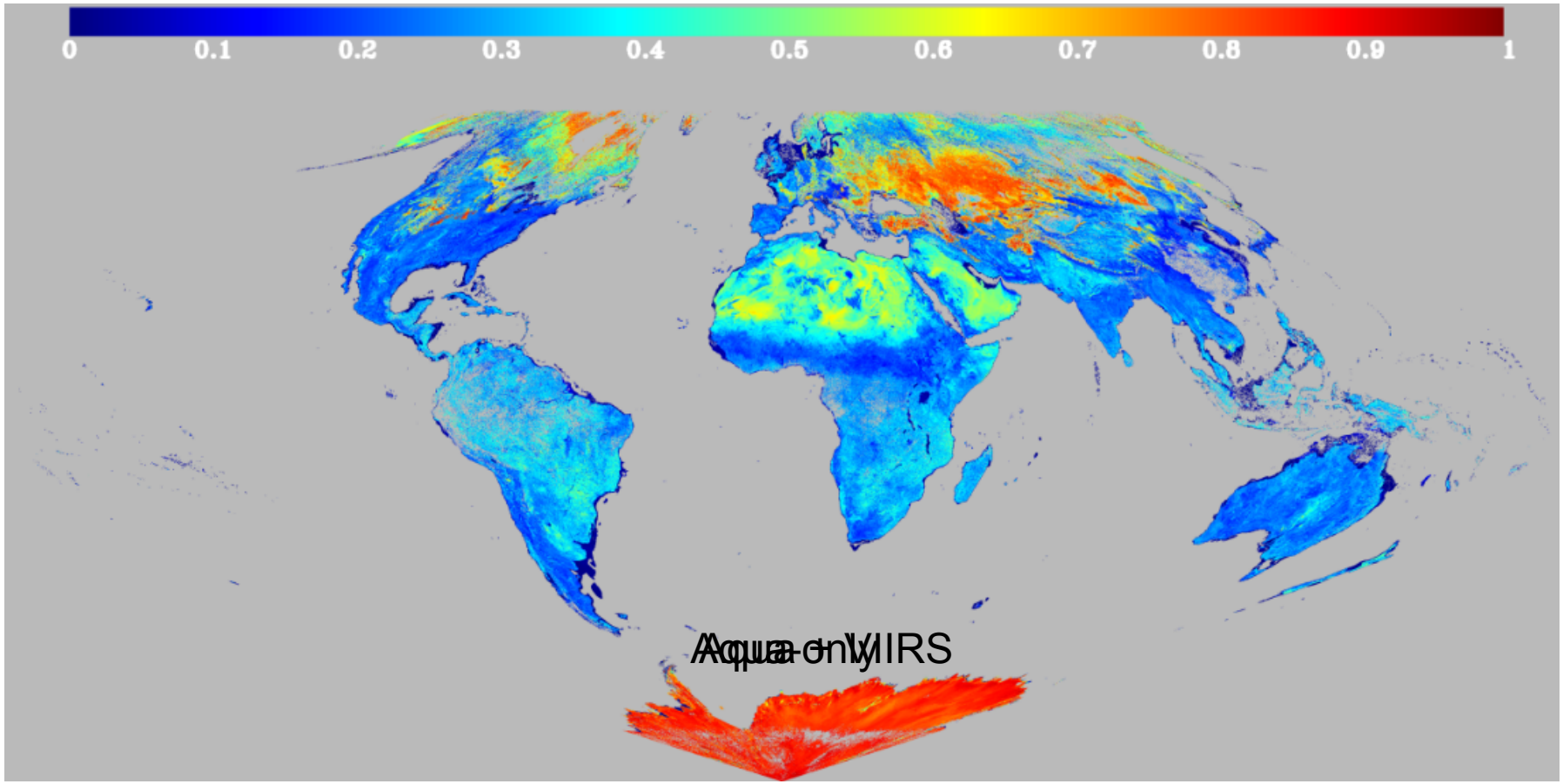


DOY 025 **DOY 185**

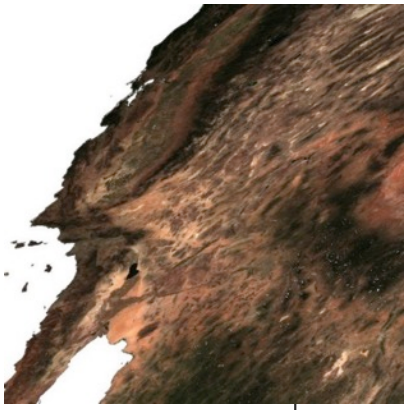
red (vis) band

MODIS and VIIRS

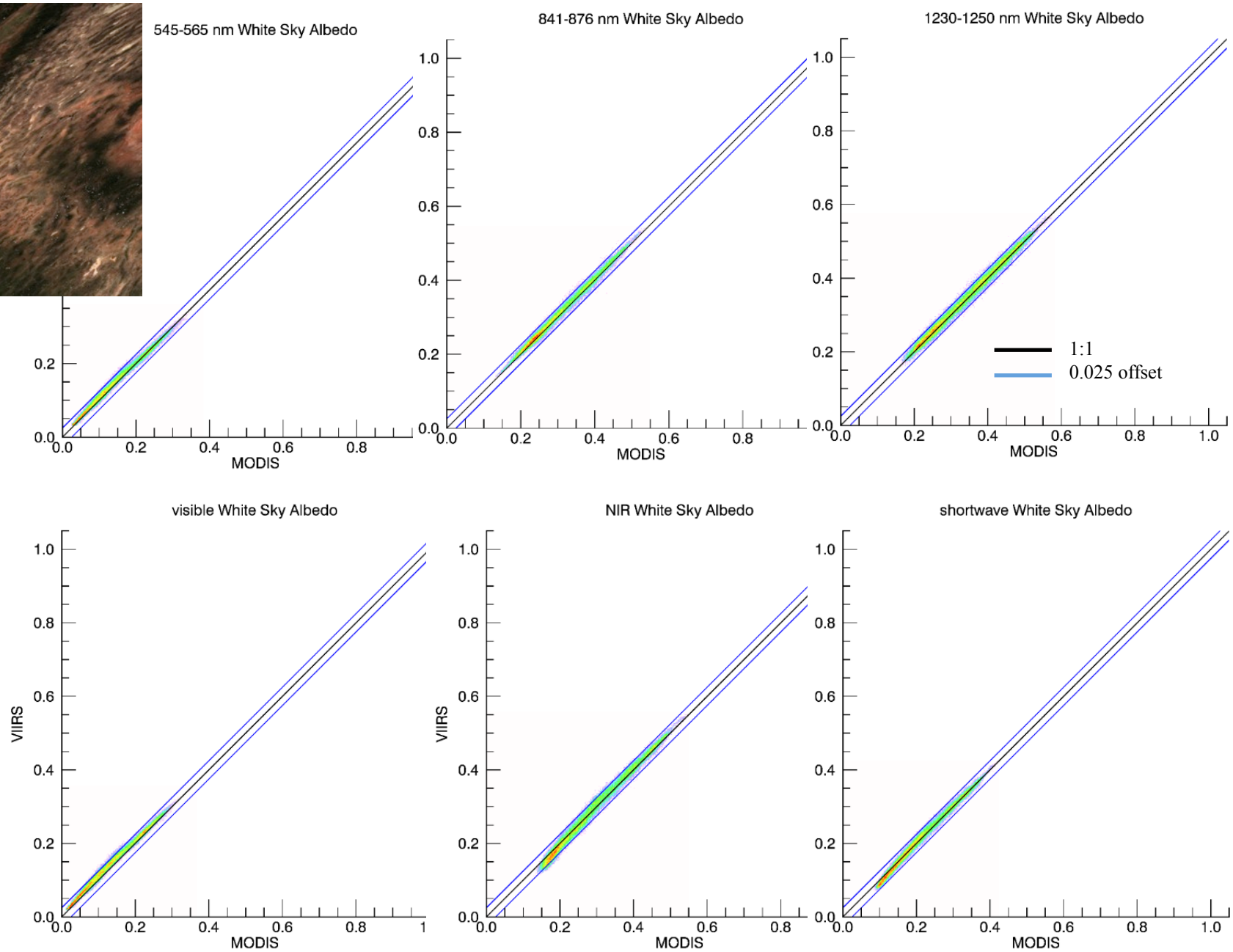
WSA NIR 025, 2012



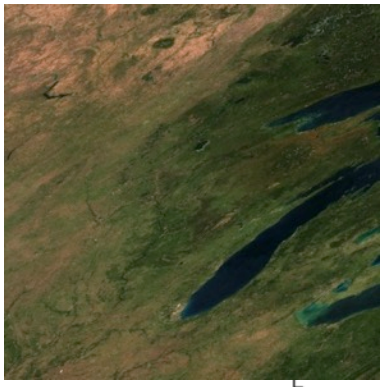
Land cover: Shrub, grass, barren or sparsely vegetated



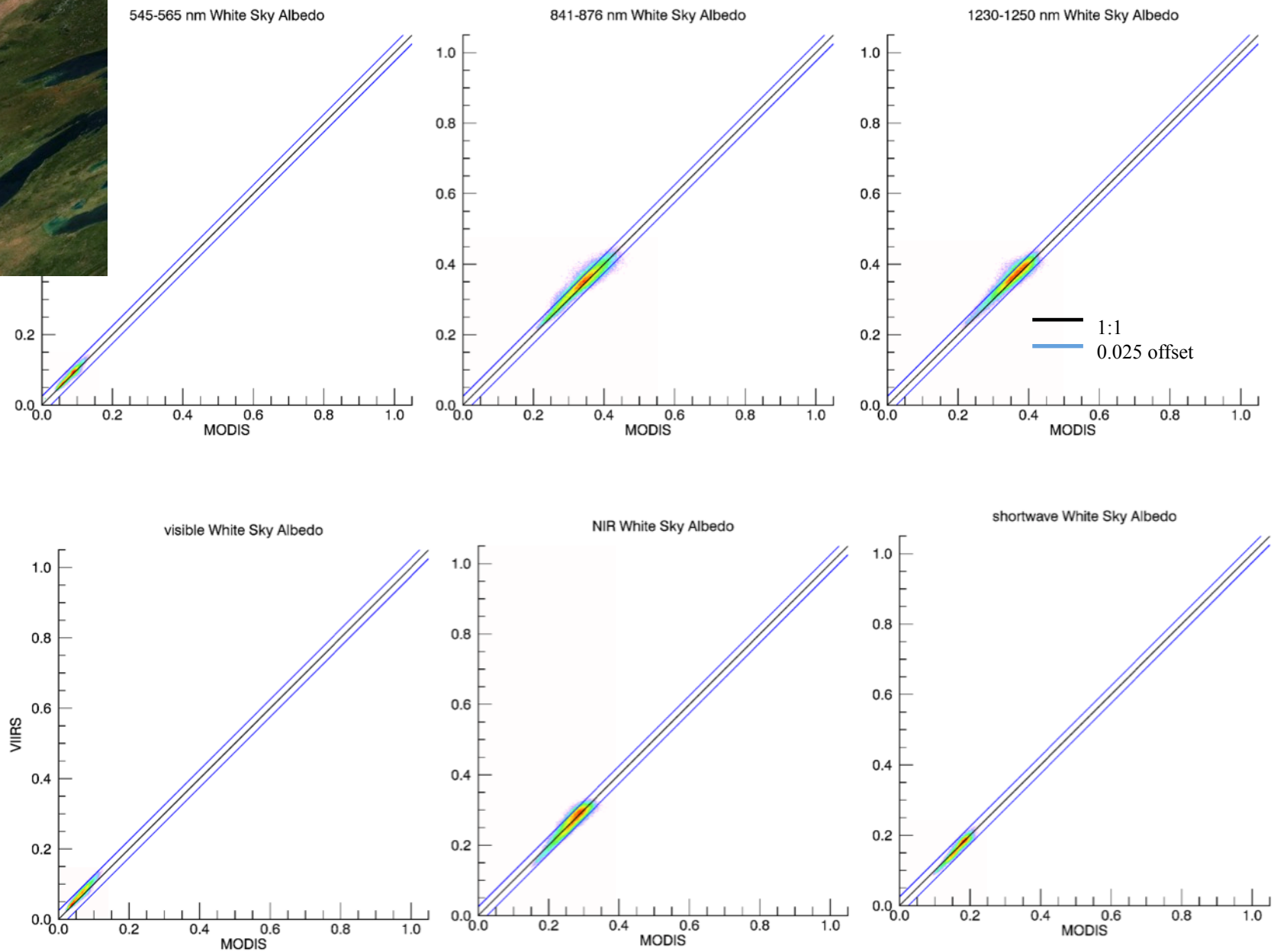
H08v05
2014267
R,G,B:0:0.4



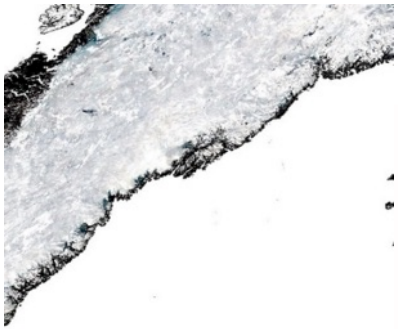
Land cover: cropland and forest



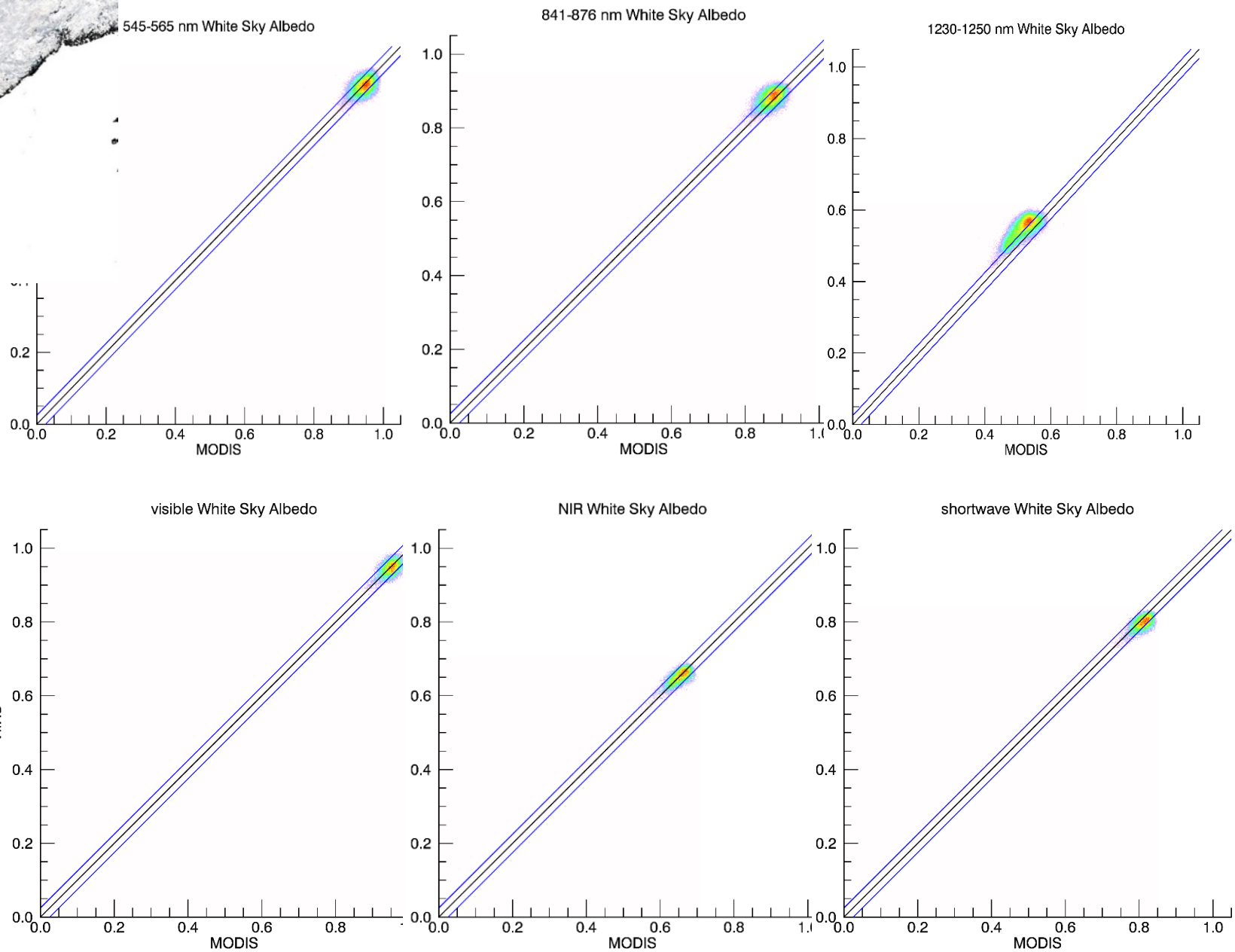
H11v04
2014267
R,G,B:0:0.2



Land cover: snow and ice

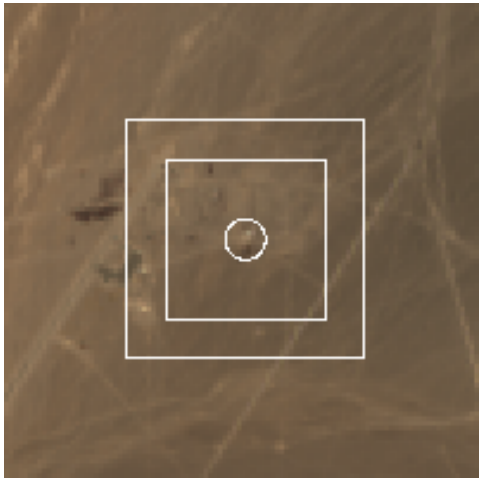


H16v02
2014267
R,G,B:0.5:1.0

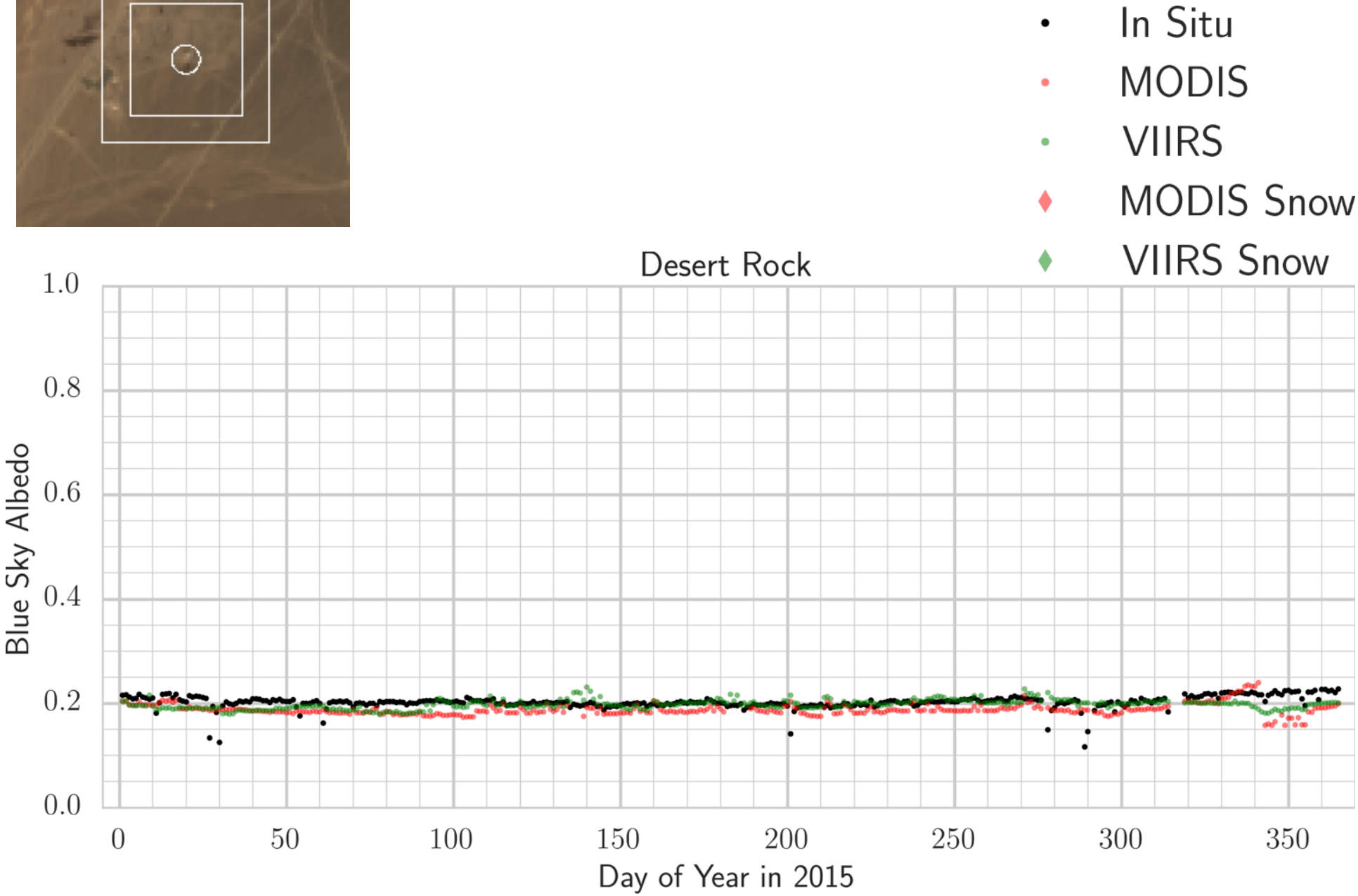


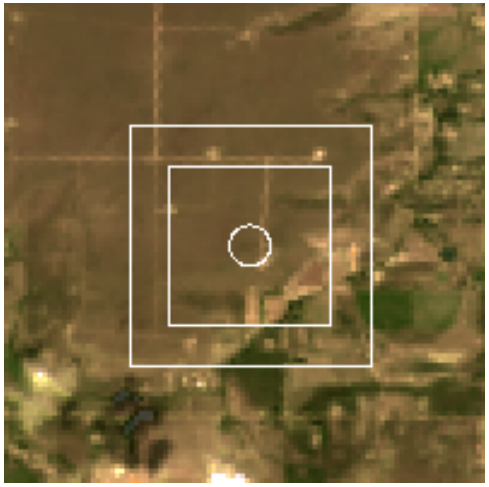
Land Product Validation/Evaluation

- CEOS/WGCV/Land Product Validation (LPV)
  - Albedo
    - Co-chair of LPV Radiation Subgroup
    - Baseline Surface Radiation Network (BSRN)
      - Gold Standard of Albedo Measures
      - SURFRAD (NOAA) US component of BSRN
    - Ameriflux (DOE)
    - NEON (NSF)
    - Fluxnet, TERN, Eumetsat/SAVS etc.
    - Use only spatially representative sites (Román et al., 2009)
  - BRDF
    - MALIBU: **M**ulti **A**ng**L**e Imaging Bidirectional Reflectance Distribution Function (**B**RDF) **U**nmanned aerial system Project
      - Participating in the MALIBU deployment over the Pawnee National Grasslands in Colorado in July

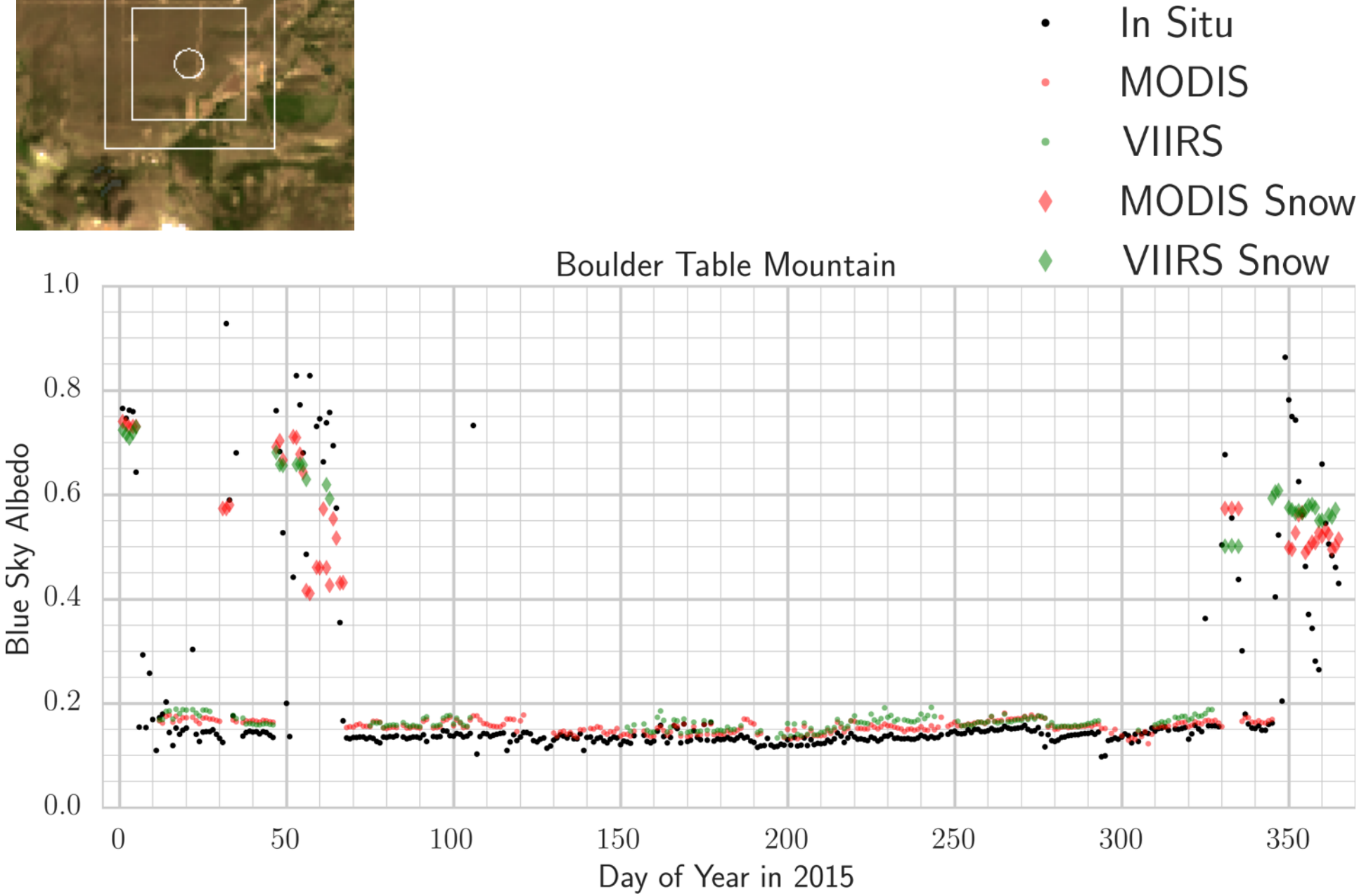


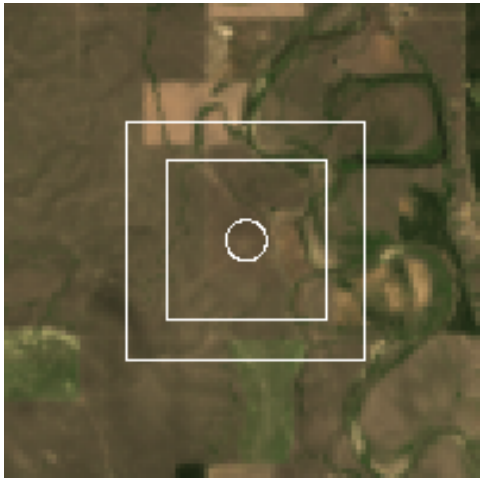
MODIS and VIIRS evaluation



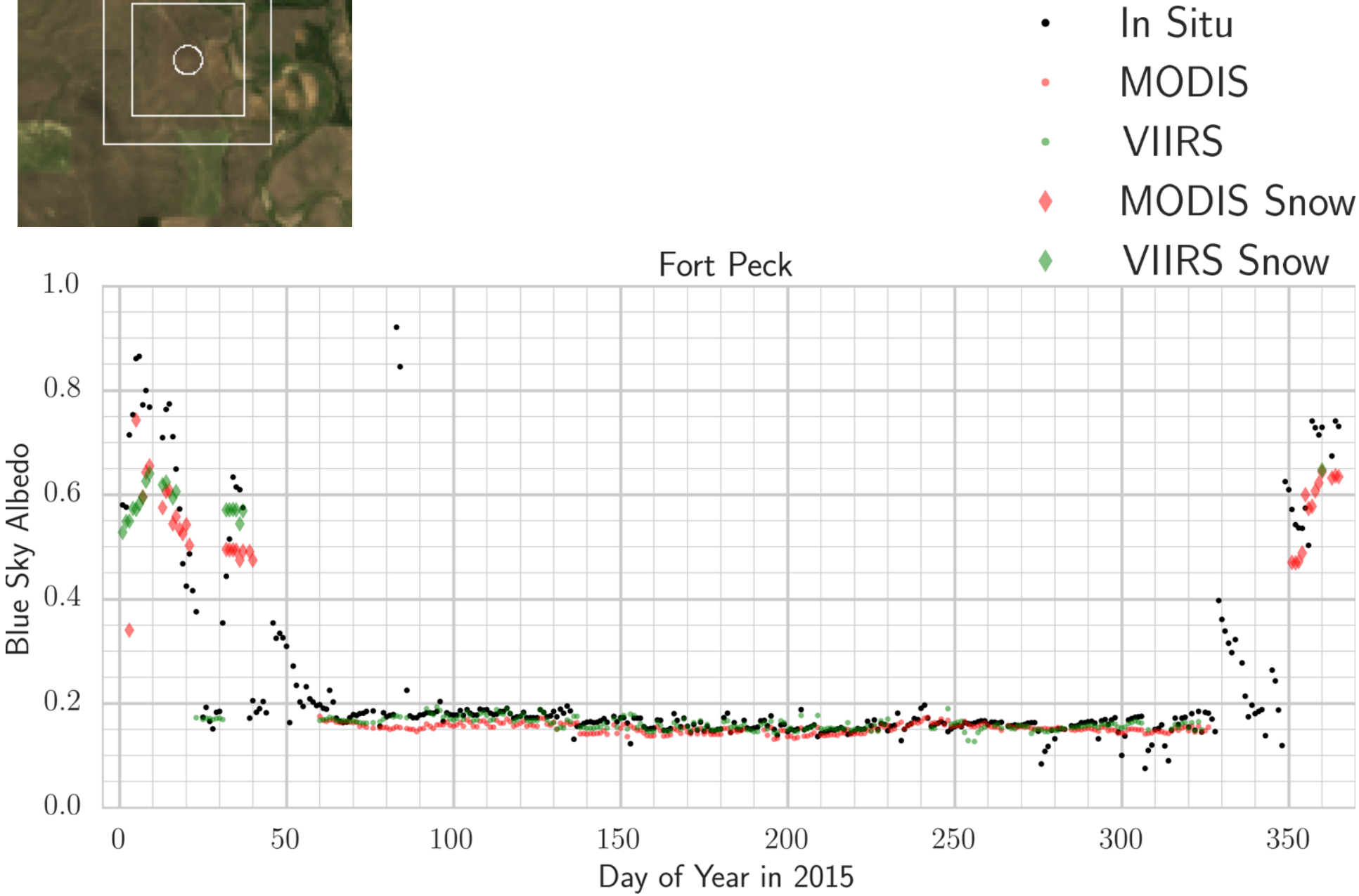


MODIS and VIIRS evaluation

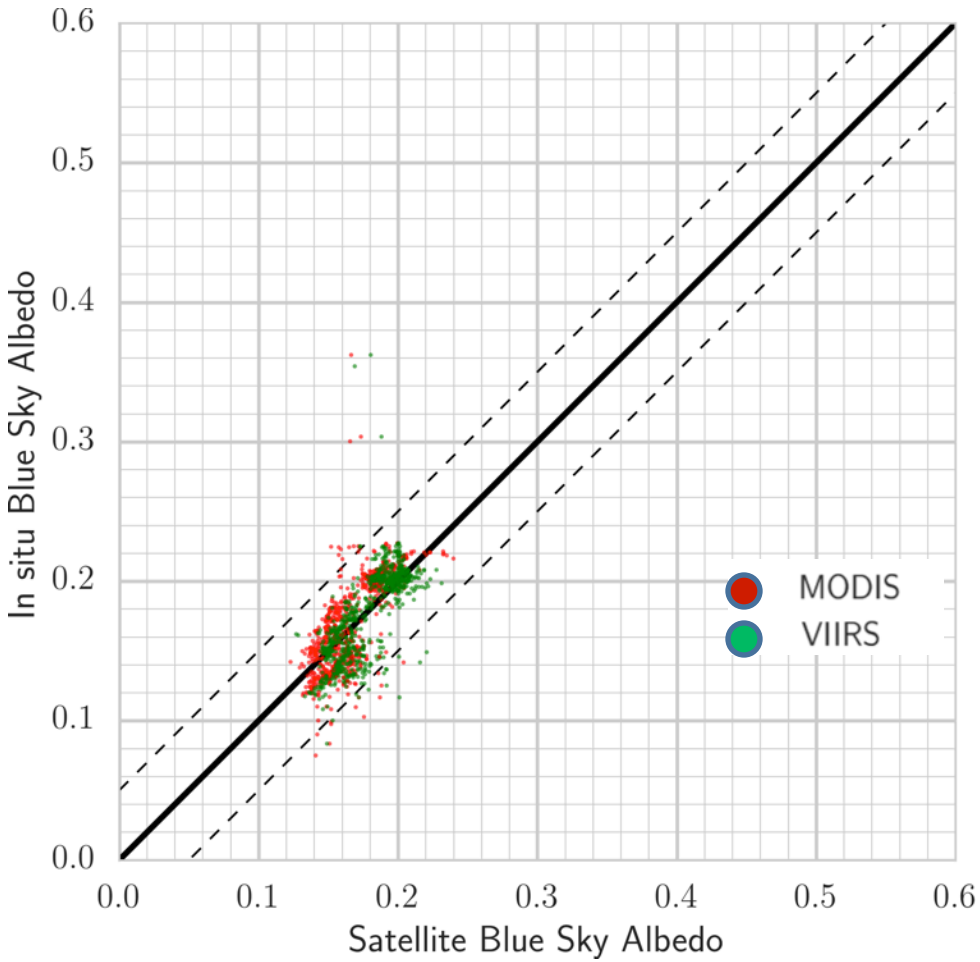




MODIS and VIIRS evaluation



Snow free
Spatially representative sites (Desert Rock, Table Mtn, Ft Peck)



Stats.	MODIS	VIIRS
# of Obs.	876	787
RMSE	0.022	0.021

BRDF/NBAR/Albedo MODIS to VIIRS

Summary

- MODIS
  - Collection V006 reprocessing up to DOY 56 2015
  - Excellent evaluations over representative tower sites
- VIIRS
  - Just received latest VNP09 (HDF5) to evaluate
  - Excellent initial evaluations over representative sites
  - Comparable to MODIS (long term continuity)