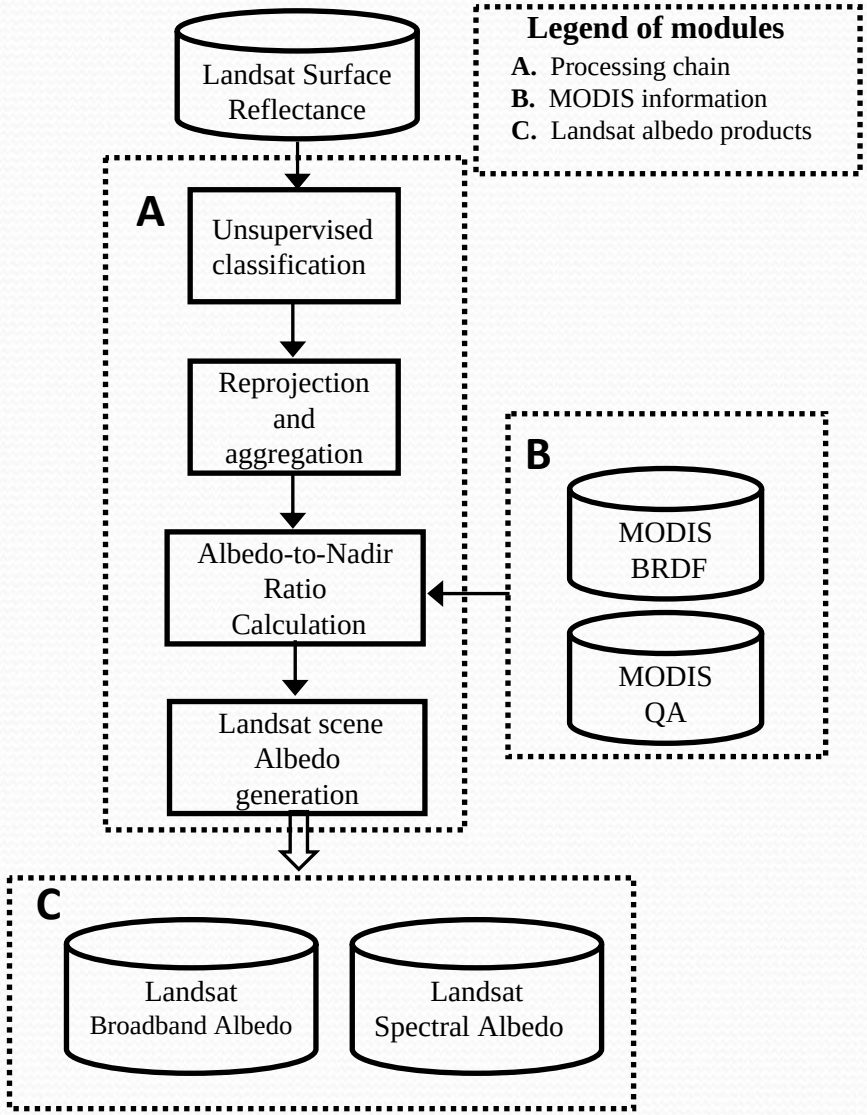
Update Landsat Albedo

Yanmin Shuai, Jeffrey G. Masek, Feng Gao, Crystal B. Schaaf. (2010). An Algorithm for the Retrieval of 30-m snow-free albedo from Landsat surface reflectance and MODIS BRDF , submitted to RSE under reviewing

Algorithm Review

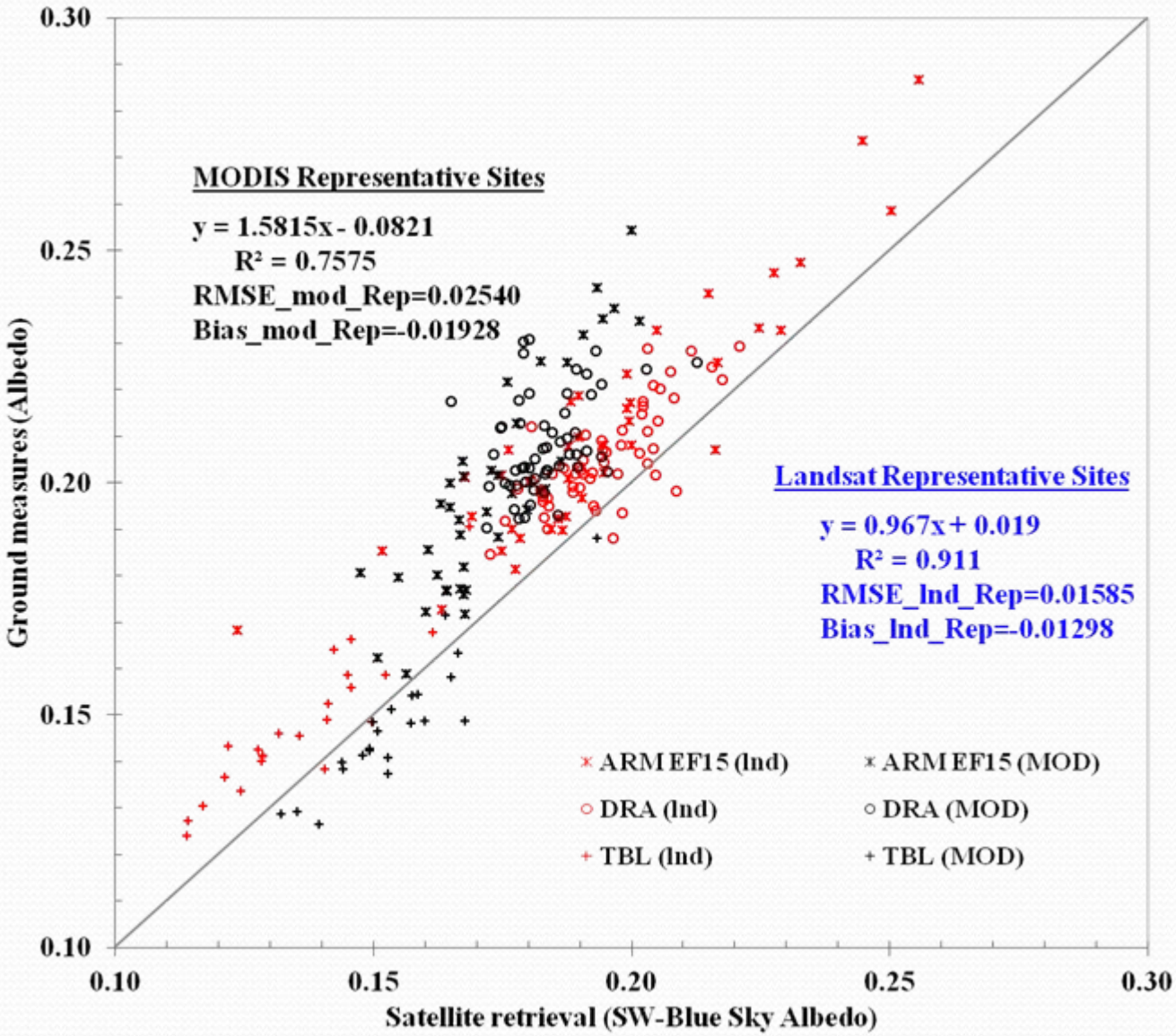
- Inputs:

  Landsat surface reflectance, MODIS BRDF parameters and QA
- Outputs: spectral/broadband albedo, nadir view reflectance
- Model: MODIS BRDF model (RossThick-LiSparse-R)

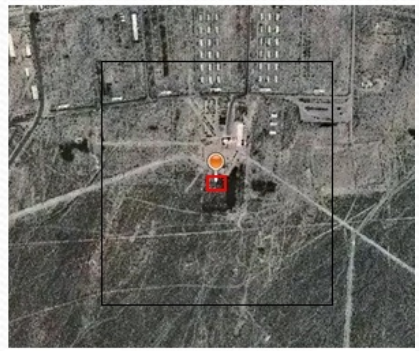


Validation Sites

Station Name	Network	Station ID#	(Lat, Long)	Major Land cover type	WRS-2 path/row	Scenes used
Extended facility station #15	ARM	EF15	36.431°N, 98.284°W	Grassland	28/35	54
Desert rock station	SURFRAD	DRA	36.62320°N, 116.01962°W	Sparse vegetation	40/35	69
Table mountain	SURFRAD	TBL	40.12557°N, 105.23775°W	Sandy with exposed rocks, sparse grasses and shrubs	34/32	27
Bondville	SURFRAD	BON	40.05155°N, 88.37325°W	Agriculture	23/32	46
Goodwin creek	SURFRAD	GWN	34.2547°N, 89.8729 °W	Pasture grass and sparsely distributed deciduous trees	23/36	57
Penn state university	SURFRAD	PSU	40.72033°N, 77.93100 °W	Agriculture Research field	16/32	17



ARM Extended Facility #15 (EF15)



Desert Rock (DRA)

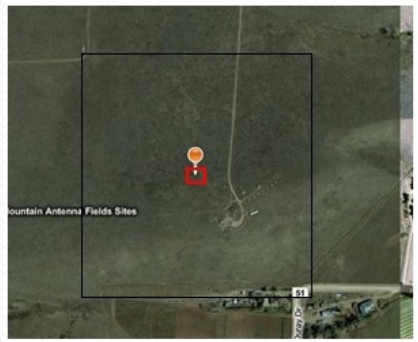
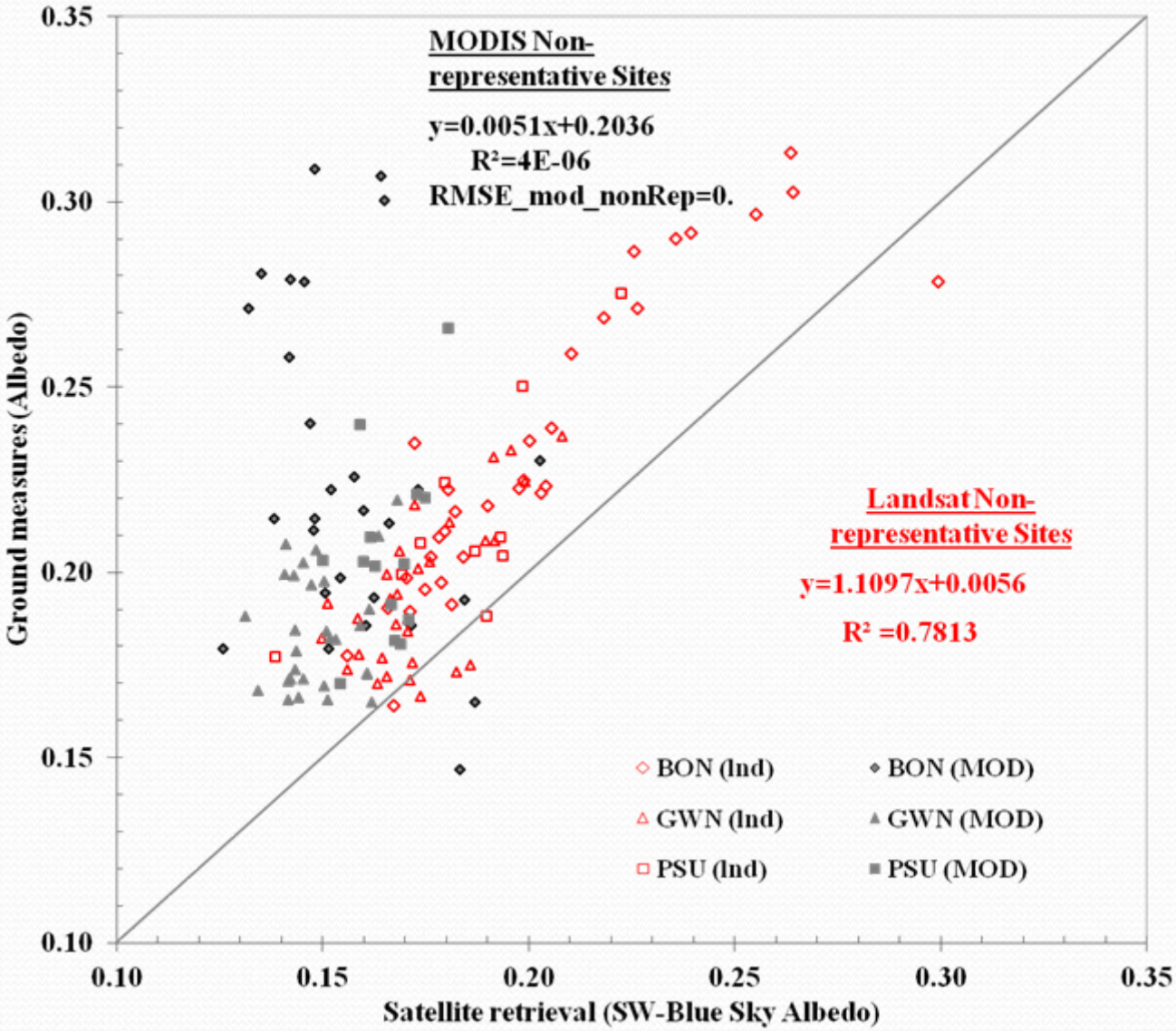
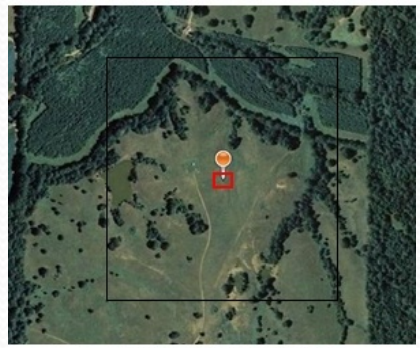


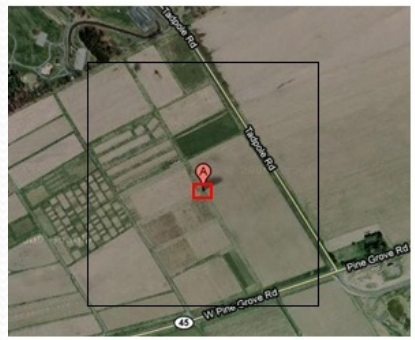
Table Mountain (TBL)



Bondville (BON)



Goodwin Creek (GWN)

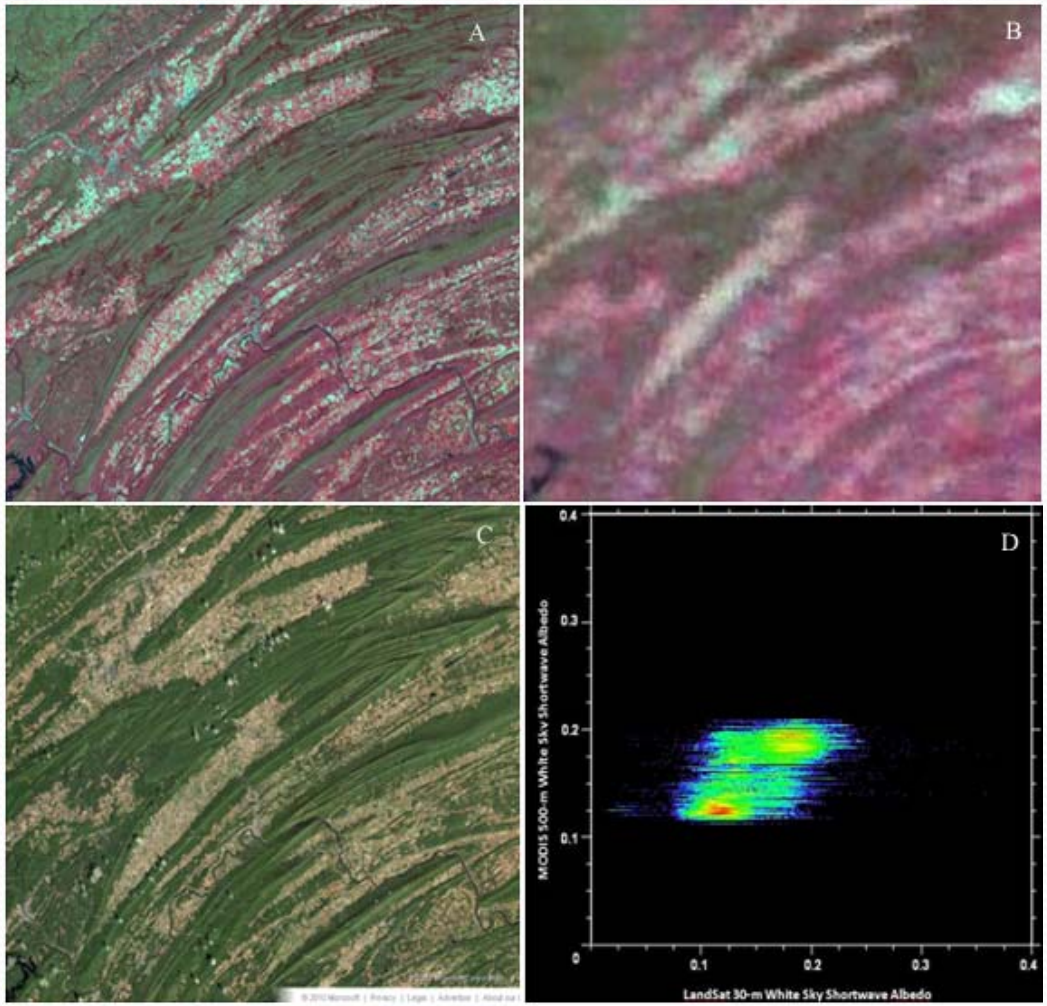


Penn State University (PSU)

PSU Albedo

Upperleft: Land surface white-sky albedo composite (NIR, Red, and Green bands to RGB)
Upperright: MODIS white-sky albedo composite
Lowerleft: Google Maps
Lowerright: scattering plot between Landsat (X-axis) and MODIS (Y-axis) albedo

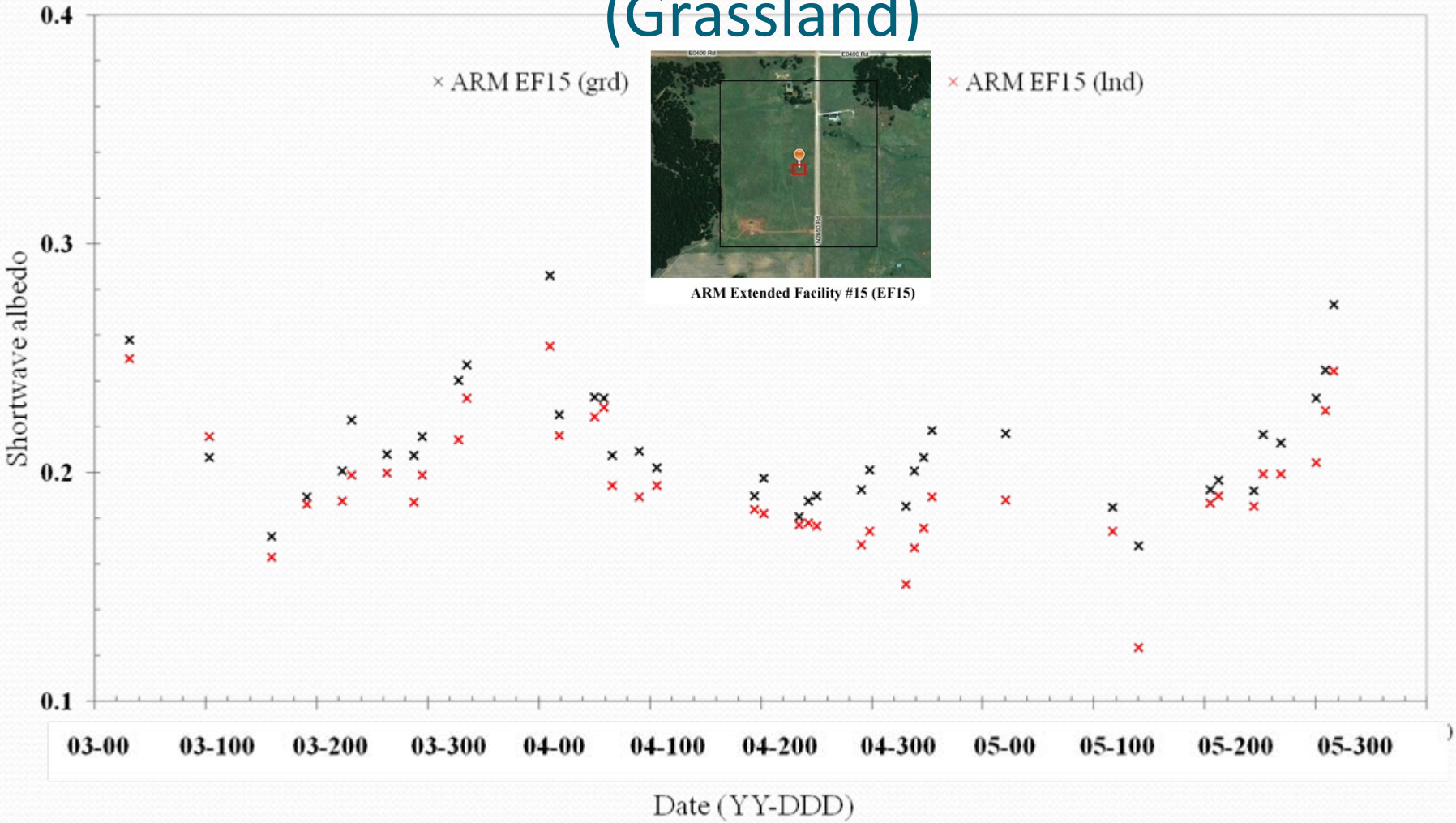
Area: 30km by 30km
WRS-2 path 16 and row 32 (PSU site)



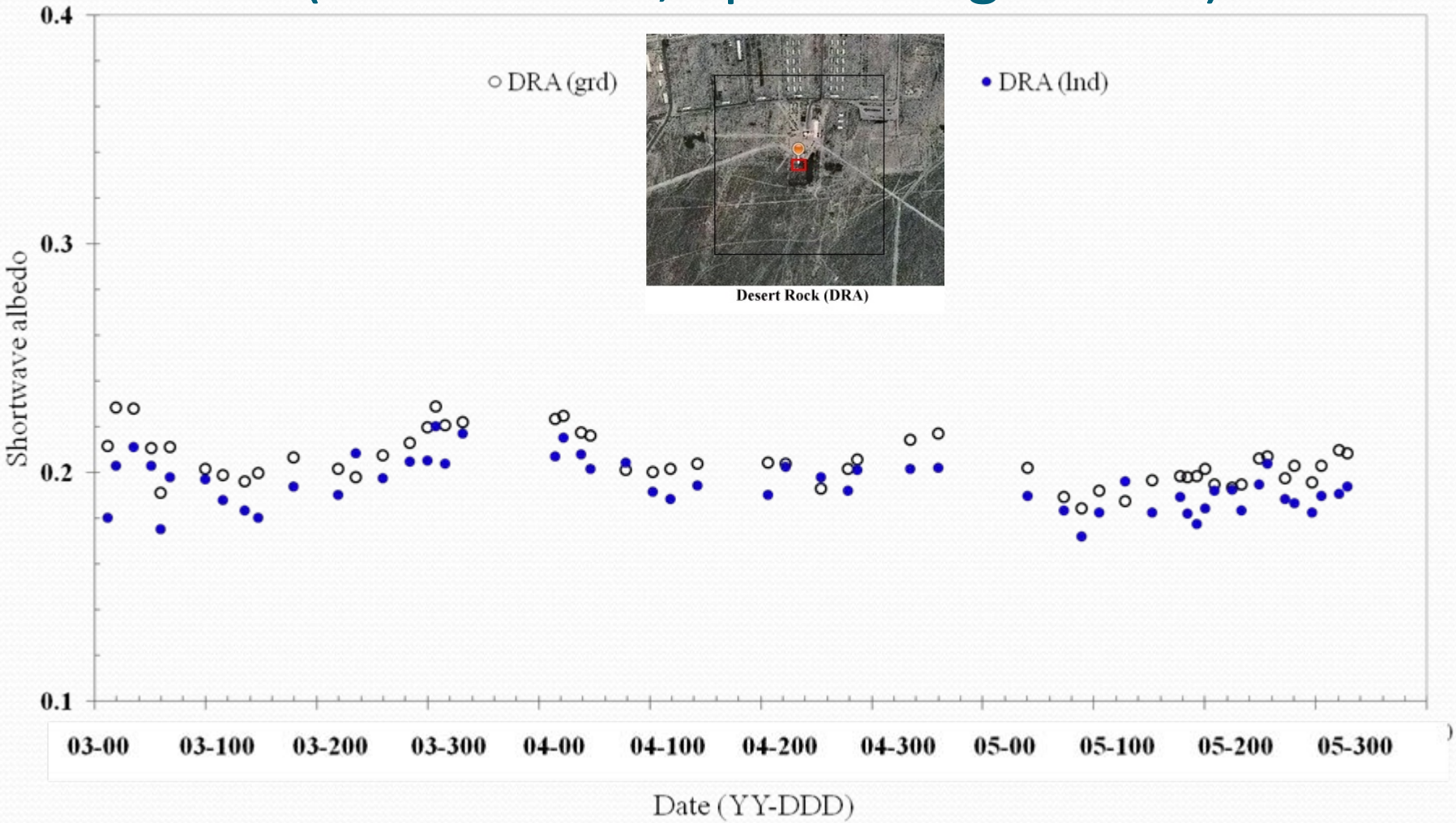
Site ID#		Landsat				MODIS			
		Mean bias	RMSE	* R^2	* Slope	Mean bias	RMSE	* R^2	* Slope
A	TBL	-0.01204	0.01383	0.8310	0.9474	0.00353	0.01530	0.8480	1.0019
	EF15	-0.01659	0.02015	0.8289	0.8929	-0.02557	0.02900	0.7751	1.5400
	DRA	-0.01075	0.01316	0.5814	0.7641	-0.02503	0.02739	0.1413	0.4979
[A] Representative sites		-0.01298	0.01585	0.911	0.967	-0.01928	0.02540	0.7575	1.5815
B	GWN	-0.02054	0.02579	0.4548	0.9736	-0.03529	0.03942	0.0484	0.3750
	PSU	-0.02977	0.03662	0.6115	1.0361	-0.03990	0.04745	0.1701	1.2666
	BON	-0.02869	0.03396	0.8126	1.0719	-0.06855	0.08769	***	***
[B] Non-Representative sites		-0.02853	0.03894	0.7813	1.1097	-0.04912	0.06302	***	***
All six sites		-0.0189	0.0266	0.7341	0.9617	***	***	***	***

•R^2 is a determination of the correlation coefficient from the linear regression using the “least square” method; Slope is the slope of regressed line.

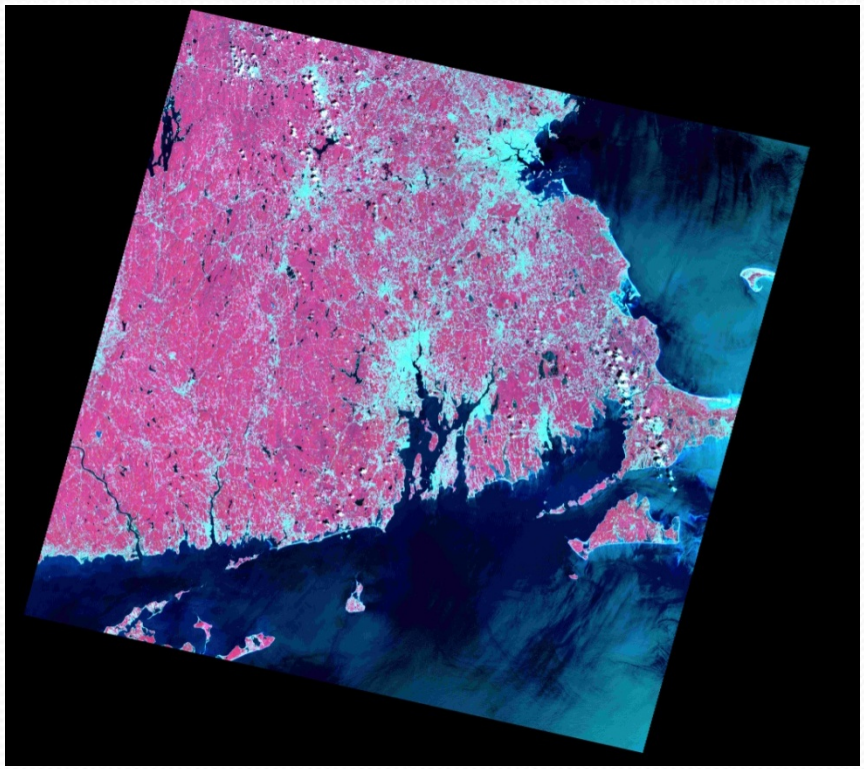
Temporal albedo over ARM EF15 site (Grassland)



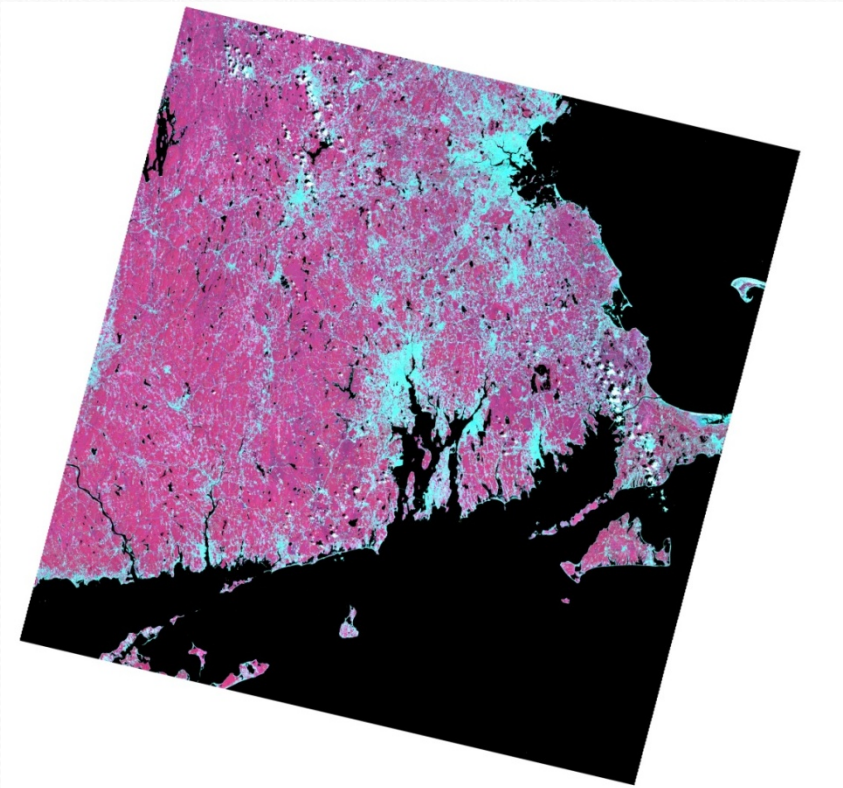
Temporal albedo over DRA site (Desert Rock, Sparse Vegetation)



Landsat Nadir BRDF-Adjustment Reflectance (NBAR)



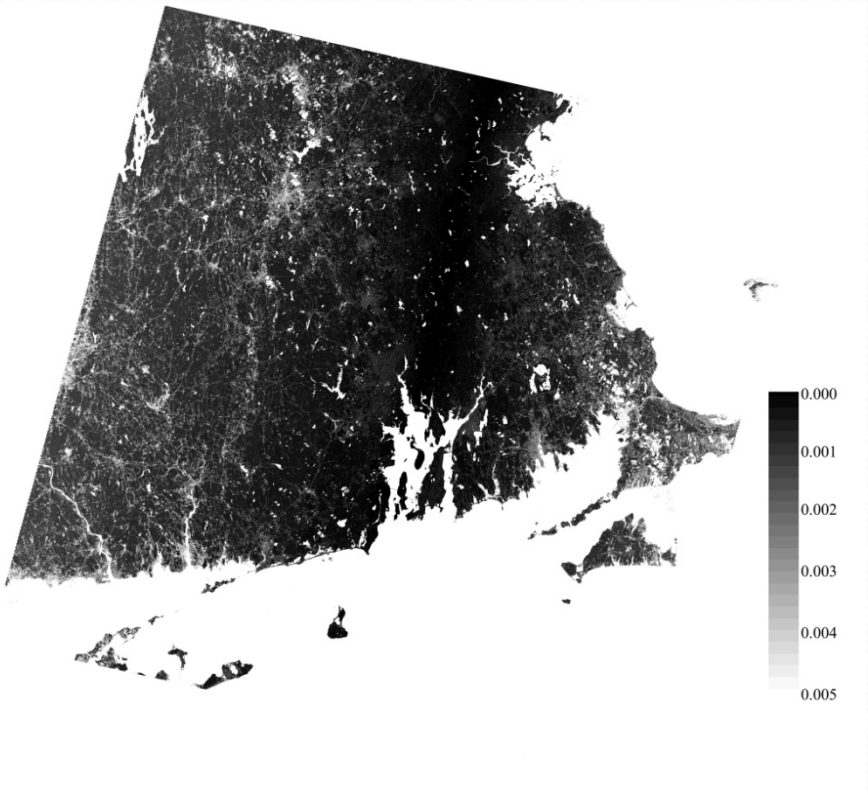
Landsat surface reflectance 4, 3, and 2 composite (Color enhancement: WRS-2 p012r031, 2002-07-31



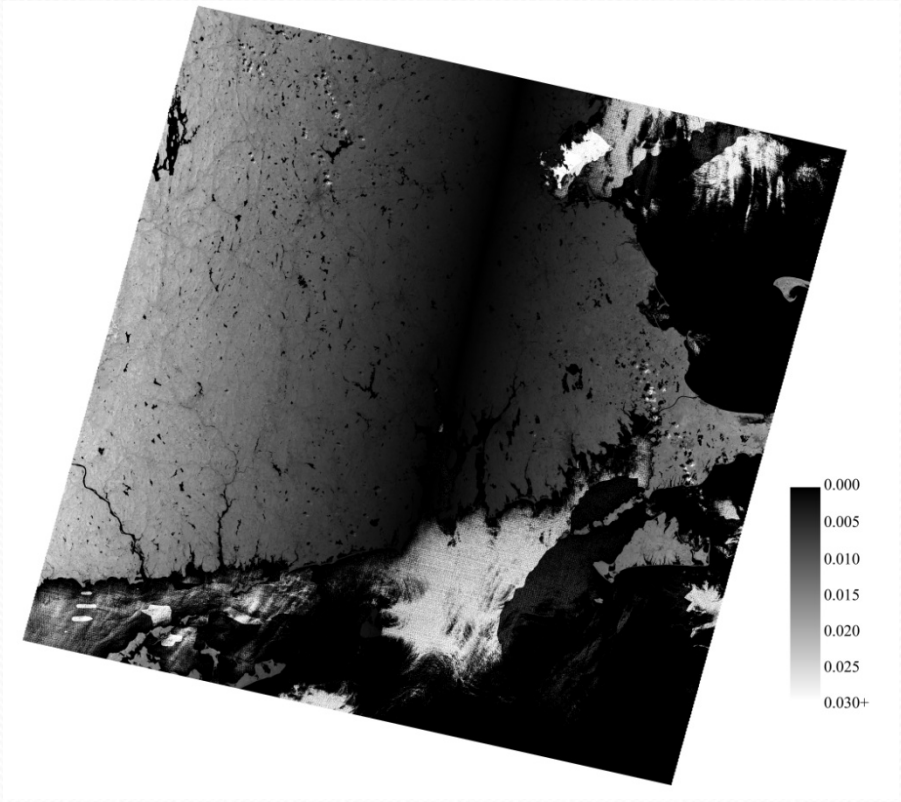
Landsat NBAR (band 4,3,2 combination) (Note: *no retrieval in the water region*)

NIR 0-0.5;Red 0-0.06; Green 0-0.006)

Difference between surface reflectance (directional) and nadir view reflectance



Difference between directional reflectance and NBAR for Red band



Difference between directional reflectance and NBAR for NIR band

Next …

- Snow-covered pixels (spatial extension)
- Beyond MODIS-era (temporal extension)

- BRDF shapes for snow-covered surface types
- BRDF shapes for typical surface types (surface type, date, NDVI, band, etc.)
- Compatible land cover classification
- Narrowband to Broadband conversion