Land Surface Albedo Validation

TOWER data

- Need to assess the spatial representativeness of each location for moderate resolution satellite products (200m – 1km+)
- "Homogeneously heterogeneous"
  - Depends on the height of the tower
  - Needs higher resolution imagery (Landsat or finer)
  - A tower may be perfectly situated for flux measurements (fetch) but not appropriate for a moderate resolution satellite pixel
- Need albedometers (paired pyranomters, radiometers) that are periodically calibrated (BSRN is every other year) and maintained (level, lense cleaned) frequently.
- Need to remember that a gridded MODIS 500m value of Albedo/BRDF is really representative of 800m or so.
- So you need to assess the homogeneity (spatial representativeness) of an area of 1km or 1.5km around a tower.
- Need measures of AOD to translate satellite BRDF to blue-sky albedo
  - Sun photometer (Cimel etc)
  - Portable sun photometer

- Standard validation data sets
  - BSRN/Surfrad
  - Fluxnet
  - NEON, TERN,
  - Olive, Belmanip,
  - Pheno-networks?

Spatially Representative Sites
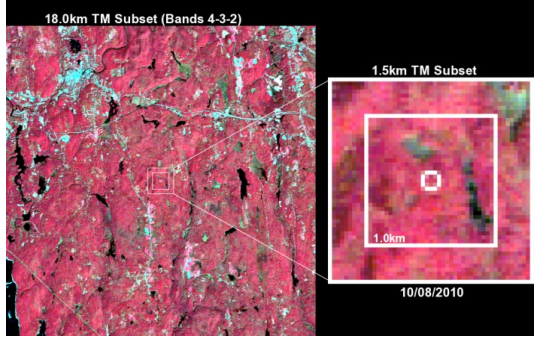
Harvard Forest 10/08/2010

NEON_01_h=10m - 10/08/2010

1.0 km (a=211.50m, var=2.904e-4, c=2.938e-4, c0=5.599e-6) *
1.5 km (a=315.31m, var=3.064e-4, c=2.955e-4, c0=1.664e-5) ◊
2.0 km (a=246.50m, var=2.837e-4, c=2.769e-4, c0=9.837e-6) □
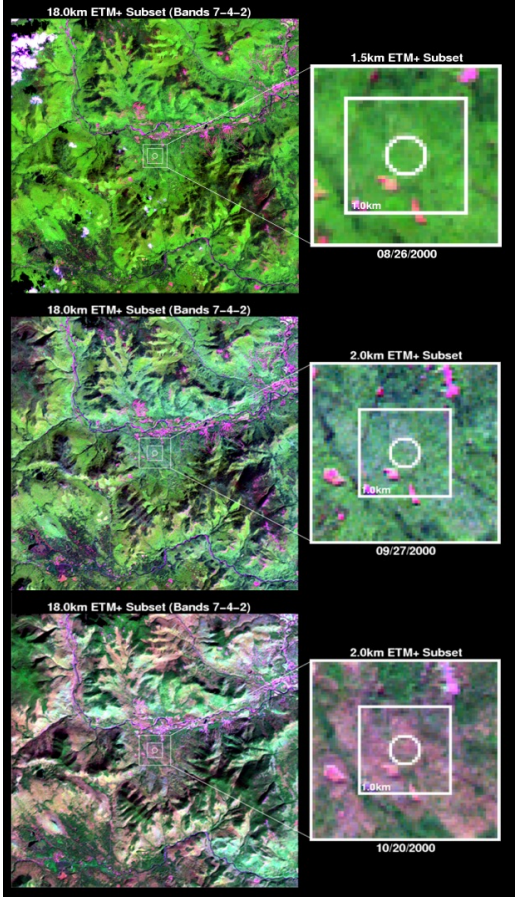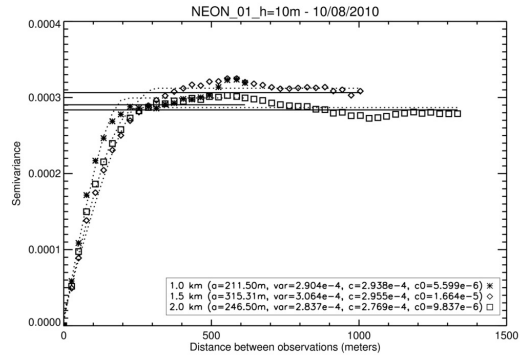
Seasonal variation (Aug, Sep, Oct 2000) in Landsat values (Bartlett Experimental Forest tower, Bartlett, NH (mixed forest)
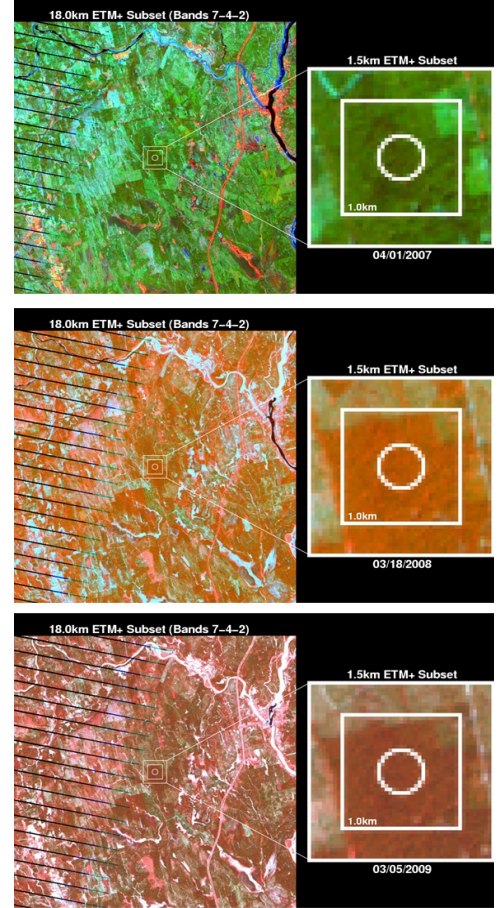
Variation in Landsat values over time (2007, 2008, 2009) due to clearcuts in the areas surrounding Howland Experimental Forest west tower, Howland, ME

UMASS BOSTON
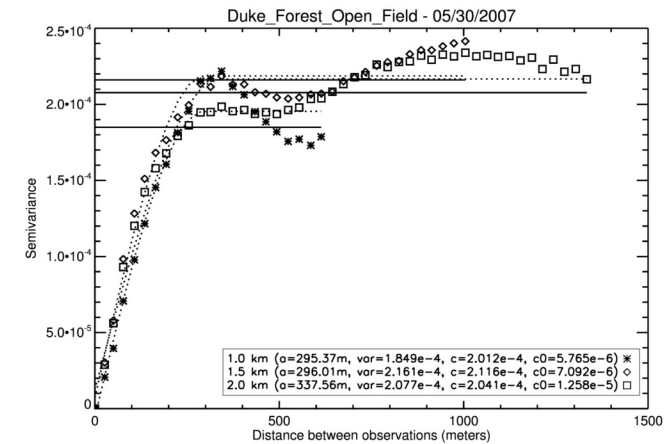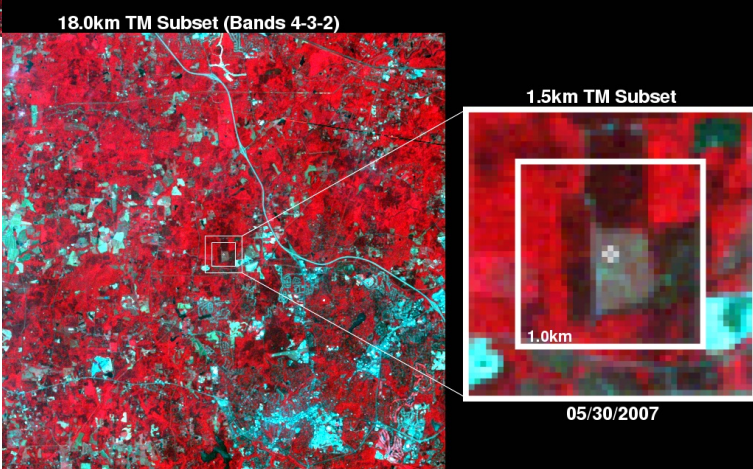
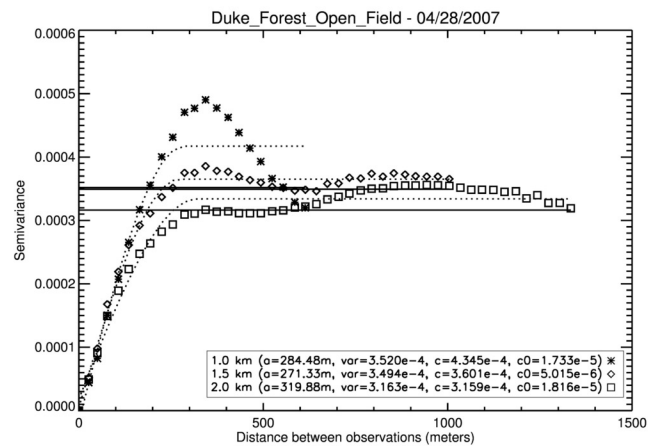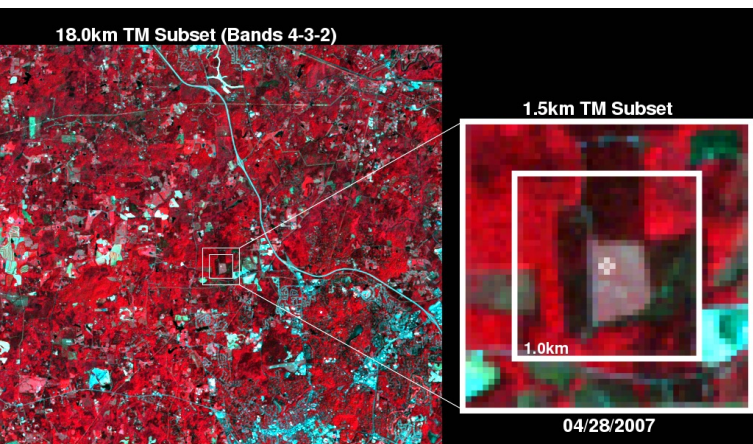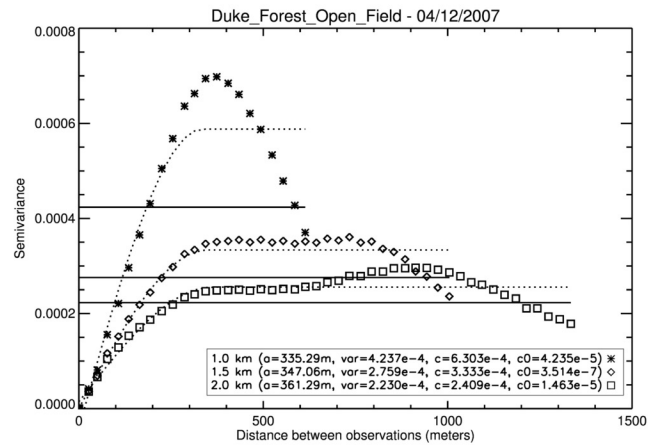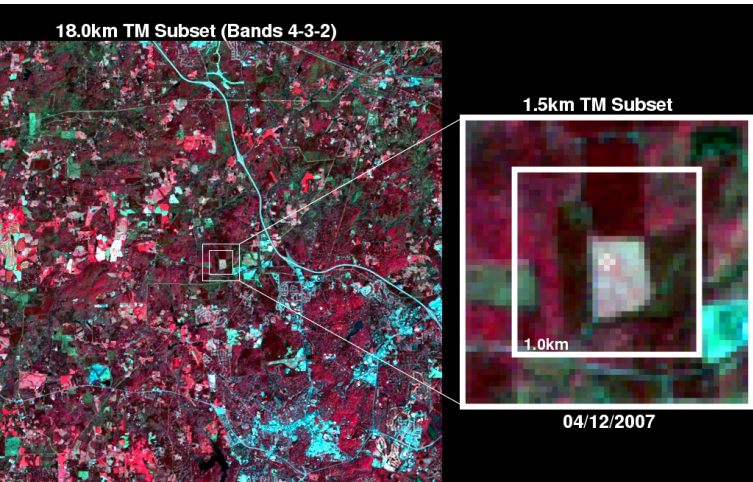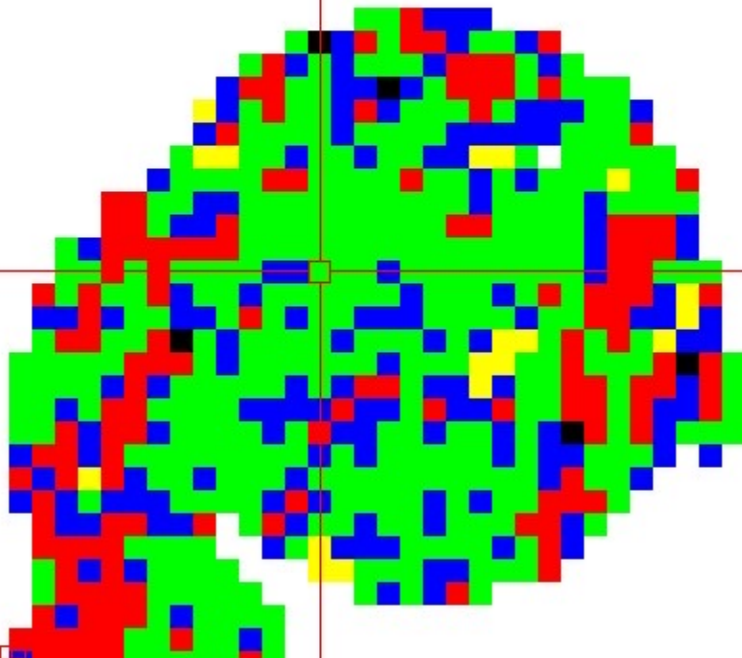|	C	D	E	F	G	H	I	J	K	L	M	N
1	Country	State	Site_ID	Lat	Lon	Tower_H	Footprint	Notes	Leaf-on Rcv(%)	Leaf-on Rse(%)	Leaf-on Rsv(%)	Leaf-on Rst(%)
2	United States	AK		71.325	-156.4330556			Ground measurements, no				
3	Unite States	OK	CF01	36.605	-97.485	60	757.7		6.49%	24.92%	46.78%	-8.37%
4	Unite States	KS	E01	38.2	-99.31	10	126.3		-10.73%	65.71%	69.65%	-15.17%
5	Unite States	KS	E02	38.31	-97.3	10	126.3		27.35%	71.38%	95.15%	132.31%
6	Unite States	KS	E03	38.2	-95.6	10	126.3		-14.16%	71.06%	9.57%	-33.35%
7	Unite States	KS	E04	37.95	-98.33	10	126.3		-0.55%	72.05%	-17.94%	-14.63%
8	Unite States	KS	E05	38.11	-97.51	10	126.3		15.04%	71.65%	121.75%	69.64%
9	Unite States	KS	E06	37.84	-97.02	10	126.3		8.14%	48.15%	-19.02%	8.61%
10	Unite States	KS	E07	37.38	-96.18	10	126.3		31.75%	54.98%	93.73%	51.27%
11	Unite States	KS	E08	37.33	-99.31	10	126.3		-0.02%	57.13%	35.76%	-1.95%
12	Unite States	KS	E09	37.13	-97.27	10	126.3		-1.09%	56.47%	86.99%	15.89%
13	Unite States	KS	E10	37.07	-95.79	10	126.3		5.17%	62.41%	27.75%	12.96%
14	Unite States	OK	E11	36.88	-98.28	10	126.3		11.76%	52.07%	70.00%	-2.59%
15	Unite States	OK	E12	36.84	-96.43	10	126.3		19.54%	70.39%	114.79%	88.35%
16	Unite States	OK	E15	36.43	-98.28	10	126.3		4.88%	62.51%	-5.66%	12.98%
17	Unite States	OK	E16	36.06	-99.13	10	126.3		-12.98%	68.72%	-19.58%	-36.18%
18	Unite States	OK	E18	35.69	-95.86	10	126.3		2.90%	50.55%	35.40%	3.46%
19	Unite States	OK	E20	35.56	-96.99	24	303.1		-11.60%	57.38%	35.24%	-5.47%
20	Unite States	OK	E21	35.62	-96.06	10	126.3		183.50%	58.43%	69.12%	581.86%
21	Unite States	OK	E22	35.35	-98.98	10	126.3		4.57%	62.00%	49.12%	5.06%
39	Australia		AU-Wac	-37.429	145.18725	110	1389.025		7.00%	0.00%	-3.72%	14.83%
40	Australia		AU-Tum	-35.6557222	148.152083	70	883.925		8.46%	0.02%	-1.87%	20.30%
41	South Africa		ZA-Kru	-25.0197000	31.4969000	16	202.040		16.52%	40.09%	69.99%	50.76%
42	Botswana		BW-Ghg	-21.51	21.74	2	25.255		5.51%	92.21%	203.23%	60.14%
43	Botswana		BW-Ghm	-21.2	21.75	8	101.020		25.83%	66.04%	24.54%	62.78%
44	Botswana		BW-Ma1	-19.9165	23.5603	13.5	170.471		4.00%	14.81%	-4.63%	-2.33%
45	Brazil		BR-Sa3	-3.0180293	-54.9714350	10	126.275		-4.71%	18.54%	3.52%	0.16%
46	Brazil		BR-Sa3	-3.01	-54.582	65	820.8		-1.86	0	5.48	4.21
47	Brazil		BR-Cax	-1.7197194	-51.458983	51.5	650.316		0.82%	11.30%	-2.26%	10.83%
48	French Guyana		GF-Guy	5.2816667	-52.912222	55	694.513		26.64%	12.73%	-17.47%	44.18%
49	Unite States	AZ	US-Aud	31.5907	-110.5092	4	50.510		25.74%	70.83%	53.05%	187.62%
50	Unite States	AZ	US-SRM	31.82143	-110.86611	6.4	80.816		34.10%	79.70%	142.21%	130.12%
51	Unite States	AZ	US-Fuf	35.0890000	-111.7620000	23	290.433		22.22%	15.90%	92.04%	50.04%
52	Unite States	AZ	US-Fmf	35.133	-111.728	23	290.4		4.31	13.73	18.4	14.72
53	Unite States	AZ	US-Fmf	35.1426000	-111.7273000	23	290.433					
54	Unite States	TN	US-ChR	35.931	-84.332	60	757.7		23.14	8.08	22.8	38.68
55	Unite States	TN	US-WBW	35.959	-84.287	40	505.1		17.21	3.43	23.01	41.28
56	Japan		JP-Mas	36.053972	140.026917	2.5	31.569		-2.54%	82.49%	-4.10%	-7.56%
57	China		CN-Yuc	36.829	116.5704	39.59611	500					
58	Korea		KR-Kw1	37.7486066	127.162525	40	505.100		0.70%	2.88%	43.83%	14.98%
59	Portugal		PT-Esp	38.6393833	-8.6018	32	404.080		38.12%	40.80%	2.37%	106.49%
60	Unite States	MO	US-MOz	38.7441100	-92.2000090	30	378.8		-3.80%	22.56%	31.54%	-10.33%
61	Spain		ES-ES2	39.2755278	-0.315222	1.6	20.204		-0.46%	92.90%	22.27%	-7.68%
62	Unite States	IN	US-MMS	39.3231500	-86.4131390	48	606.1		3.95%	0.20%	8.31%	-4.21%

Sheet1

Land Surface Albedo Validation

Aircraft data

▸ CAR (cloud absorption radiometer)

▸ AirMSPI

▸ Old ASAS

240m Harvard Forest

60m

BAND4

Reflectance vs View zenith angle

Legend:
- Evergreen forest (red)
- Deciduous forest (green)
- Grass (yellow)
- Mixed (blue)
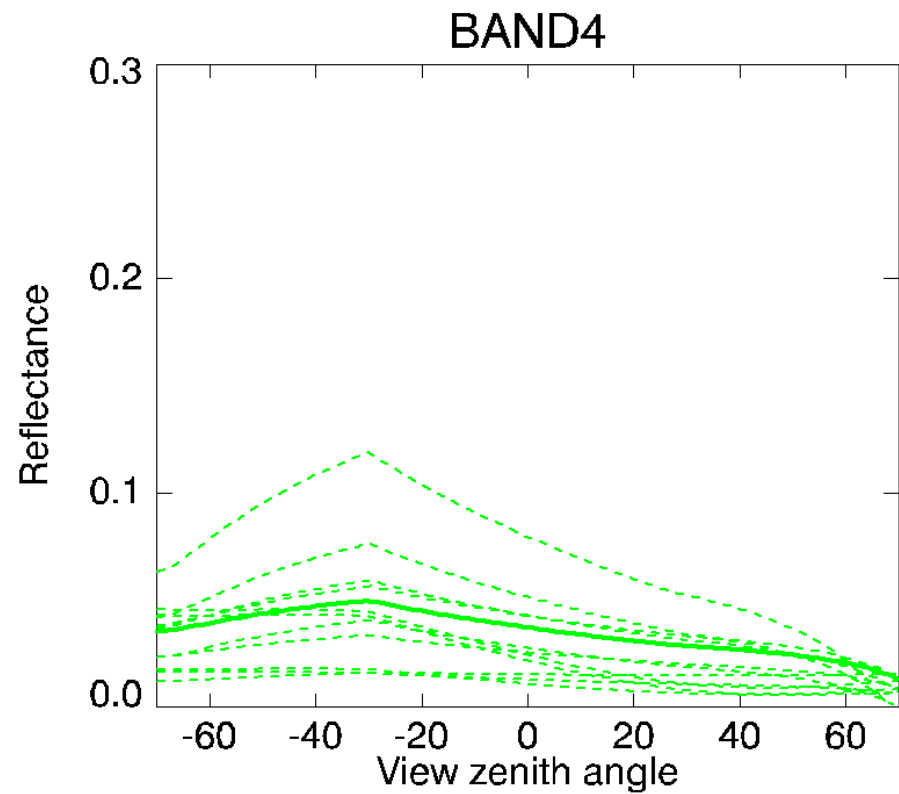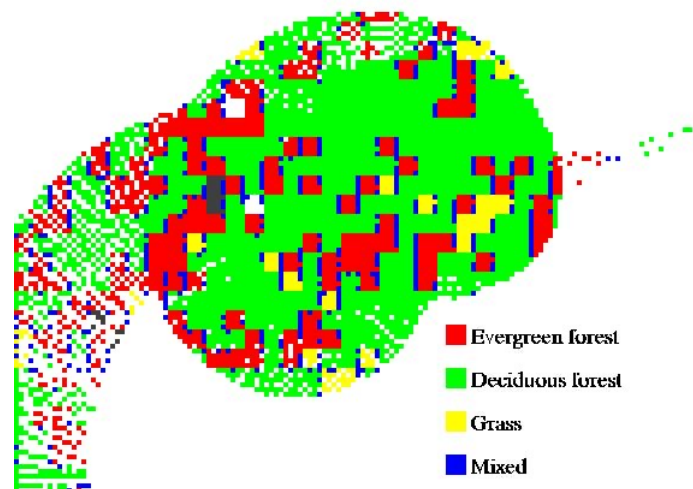
Land Surface Albedo

▶ Protocol

▶ Paper on this list of spatial representativeness sites

▶ Future Needs
  ▶ More support for tower networks
  ▶ PAR?
  ▶ PAR of understorey and within canopy
  ▶ Pheno cams ??

▶ Average Validation status
  ▶ MODIS (stage-3 just barely)
  ▶ Probably stage-2 on average

Stage 1 Validation	Product accuracy is assessed from a small (typically < 30) set of locations and time periods by comparison with in-situ or other suitable reference data.
Stage 2 Validation	Product accuracy is estimated over a significant set of locations and time periods by comparison with reference in situ or other suitable reference data. Spatial and temporal consistency of the product and consistency with similar products has been evaluated over globally representative locations and time periods. Results are published in the peer-reviewed literature.
Stage 3 Validation	Uncertainties in the product and its associated structure are well quantified from comparison with reference in situ or other suitable reference data. Uncertainties are characterized in a statistically robust way over multiple locations and time periods representing global conditions. Spatial and temporal consistency of the product and with similar products has been evaluated over globally representative locations and periods. Results are published in the peer-reviewed literature.
Stage 4 Validation	Validation results for stage 3 are systematically updated when new product versions are released and as the time-series expands.