Atmospheric Correction_CT & AZ

Ziyan Chu

Comparison between ASTER and Landsat

Landst: 2001_0625; Aster: 2001_0610

	Mixed Forest		Deciduous		Grass		Urban	
	Landsat	Aster	Landsat	Aster	Landsat	Aster	Landsat	Aster
Albedo	0.1546	0.183	0.1792	0.2008	0.2003	0.2006	0.1474	0.1813
NDVI	0.7059	0.6664	0.7369	0.7134	0.6431	0.5977	0.31	0.2885
Ts	297.326	301.820	297.094	303.180	301.576	304.632	305.944	314.671
Delta T	2.367	6.395	2.628	7.971	6.244	9.369	10.762	19.553
K	240.388	87.840	208.795	68.431	84.114	57.883	52.581	28.046
Emissivity	0.95	0.968	0.95	0.967	0.95	0.953	0.95	0.938

Atmospheric correction

- Following Coll et al. (2010) we use the web-based atmospheric correction tool described by Barsi et al. (2007)

Enter the parameters for which you wish calculate atmospheric transmission and upwelling radiance:

Year: Month: Day:

GMT Hour: Minute:

Latitude: Longitude:

+ is North, - is South *+ is East, - is West*

- ○ Use atmospheric profile for closest integer lat/long *help*
- ◉ Use interpolated atmospheric profile for given lat/long *help*

- ○ Use mid-latitude summer standard atmosphere for upper atmospheric profile *help*
- ◉ Use mid-latitude winter standard atmosphere for upper atmospheric profile *help*

- ◉ Use Landsat-7 Band 6 spectral response curve
- ○ Use Landsat-5 Band 6 spectral response curve
- ○ Output only atmospheric profile, do not calculate effective radiances

Optional: Surface Conditions

(If you do not enter surface conditions, model predicted surface conditions will be used.
If you do enter surface conditions, all four conditions must be entered.)

Altitude (km): Pressure (mb):

Temperature (C): Relative Humidity (%):

Results will be sent to the following address:

Email:

Calculate

Clear Fields

Output

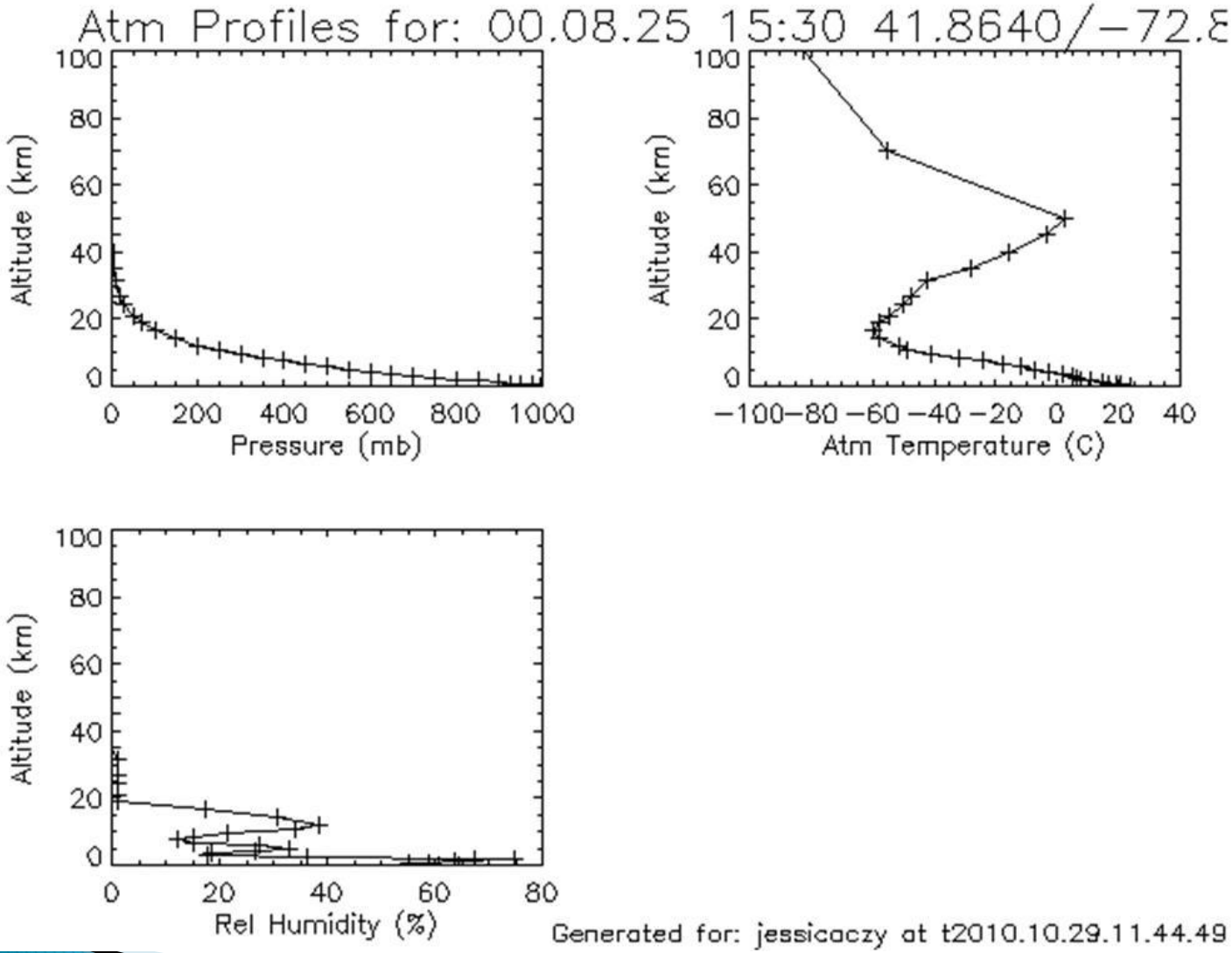
Input summary

Date (yyyy-mm-dd): 2000-08-25
Lat/Long: 41.864/ -72.830
GMT Time: 15:30
L5 Spectral Response Curve from handbook
Mid-latitude summer standard atmosphere
Using surface conditions from the model profile

Output summary

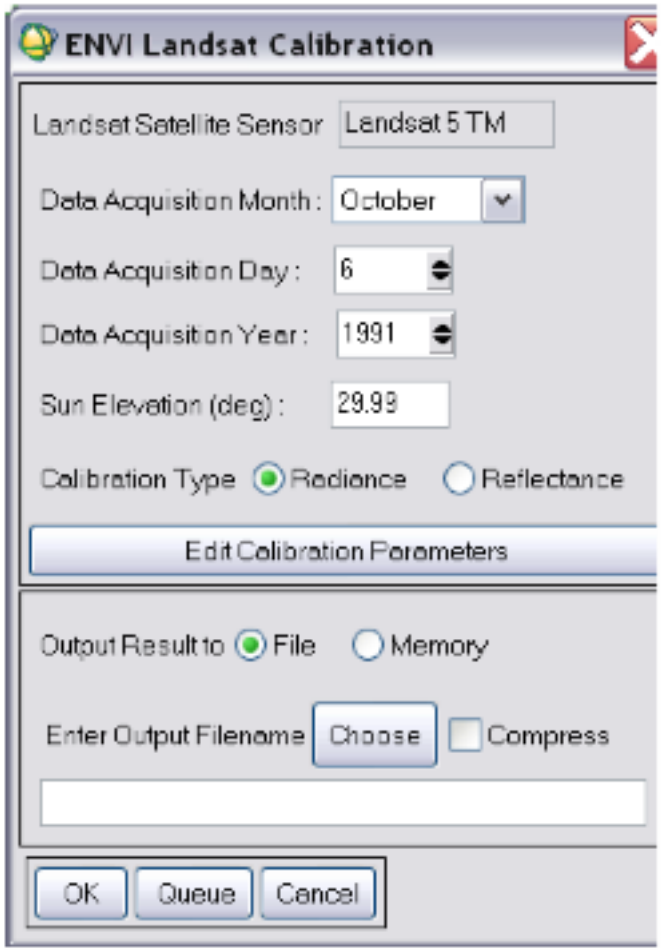
Band average atmospheric transmission: 0.71
Effective bandpass upwelling radiance: 2.16 W/m^2/sr/um
Effective bandpass downwelling radiance: 3.42 W/m^2/sr/um

Also, Atmospheric Profile Summary



Compute Corrected Temperature

- Step 1:
  Basic Tools > Preprocessing > Calibration Utilities > Landsat Calibration > Get Radiance



Compute Corrected Temperature

- Step 2

$$CV_{R2} = \frac{CV_{R1} - L\uparrow}{\varepsilon\tau} - \frac{1-\varepsilon}{\varepsilon} L\downarrow$$

Where:

CV_{R2} is the atmospherically corrected cell value as radiance
CV_{R1} is the cell value as radiance from Section 1
$L\uparrow$ is upwelling Radiance
$L\downarrow$ is downwelling Radiance
τ is transmittance
ε is emissivity (typically 0.95)

Compute Corrected Temperature

- Step 3

$$T = \frac{K_2}{\ln\left(\frac{K_1}{CV_{R2}} + 1\right)}$$

Where:

T is degrees Kelvin

CV_{R2} is cell value as radiance

	Landsat TM	Landsat ETM
K_1	607.76	666.09
K_2	1260.56	1282.71

After correction

Landst: 2001_0625; Aster: 2001_0610

	Mixed Forest		Deciduous		Grass		Urban	
	Landsat	Aster	Landsat	Aster	Landsat	Aster	Landsat	Aster
Albedo	0.1546	0.183	0.1792	0.2008	0.2003	0.2006	0.1474	0.1813
NDVI	0.7059	0.6664	0.7369	0.7134	0.6431	0.5977	0.31	0.2885
Ts	297.326	301.820	297.094	303.180	301.576	304.632	305.944	314.671
(Cal)	300.133		299.816		305.875		311.720	
Delta T	2.367	6.395	2.628	7.971	6.244	9.369	10.762	19.553
K	240.388	87.840	208.795	68.431	84.114	57.883	52.581	28.046
Emissivity	0.95	0.968	0.95	0.967	0.95	0.953	0.95	0.938

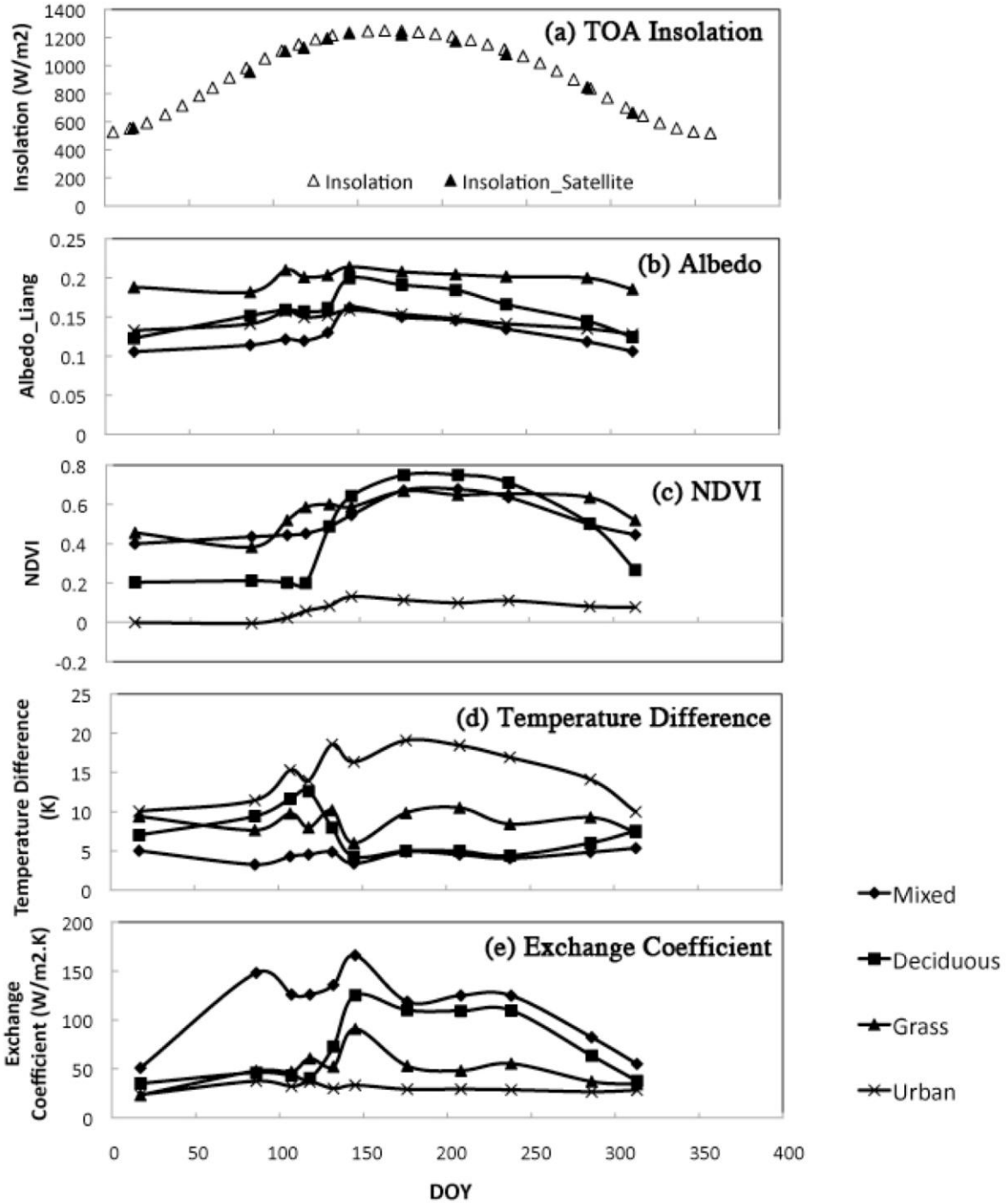
Results: CT

1. **Date Table_CT**

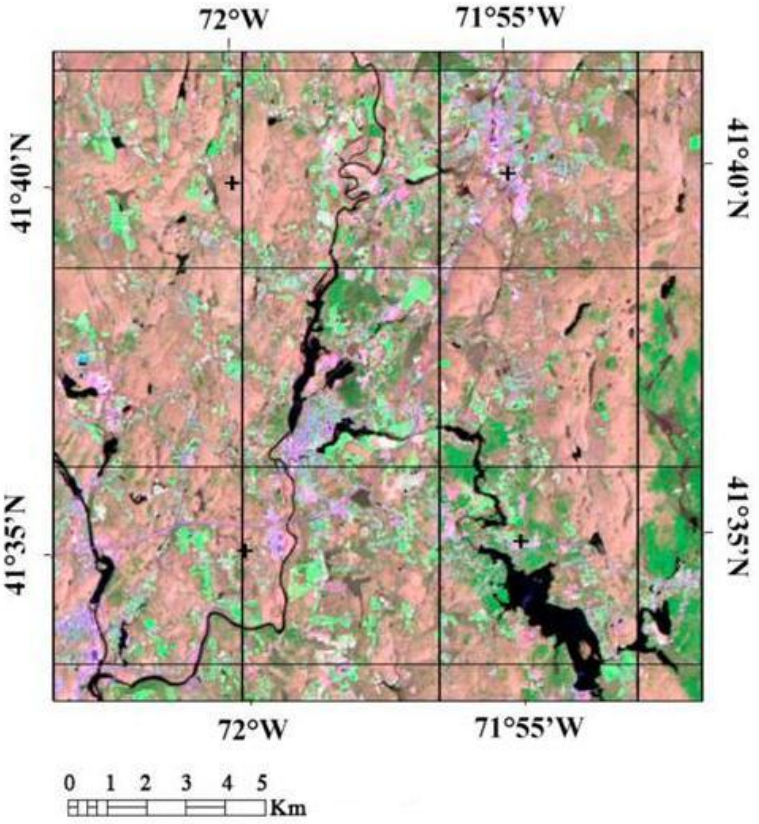
Calendar Day	DOY	T925 (°C)	T850 (°C)	Wind Speed (Knot) (925 hpa)	Dew Point (°C) (925 hpa)	atmospheric transmission	upwelling radiance	downwelling radiance
2007_0117	17	-16.467	-15.267	22.500	-21.817	0.97	0.12	0.21
2003_0327	86	3.000	-0.750	21.500	-7.167	0.92	0.52	0.87
2005_0417	107	12.067	6.867	17.333	-10.433	0.93	0.51	0.87
2003_0428	118	14.233	9.933	17.167	-5.600	0.87	0.89	1.51
2008_0511	132	8.600	5.033	12.833	-1.233	0.87	0.86	1.44
2007_0525	145	21.667	15.633	15.500	10.500	0.72	2.18	3.51
2001_0625 (clouds)	176	16.267	12.733	9.833	11.000	0.71	2.09	3.45
2001_0727	208	11.367	6.567	16.167	2.867	0.85	1.05	1.74
2000_0825	238	14.833	10.900	12.167	9.067	0.71	2.16	3.42
2006_1013	286	1.700	-1.633	17.000	-7.800	0.94	0.33	0.57
2004_1108	313	-1.433	-6.600	29.167	-9.267	0.94	0.34	0.59

Calendar Day	DOY	T925 (°C)	T850 (°C)	Wind Speed (Knot) (925 hpa)	Dew Point (°C) (925 hpa)	atmospheric transmission	upwelling radiance	downwelling radiance
2000_0716	198	16.07	12.2	9.5	12.57	0.54	3.39	5.07
2001_0716	197							
2002_0716	197	16.83	10.77	16.33	9.17	0.75	1.86	3.01
2003_0716	197	17.67	14.7	25.17	12.67	0.42	4.36	6.16
2004_0716	198	16.2	11.57	16.67	12.88	0.52	3.41	5.13
2005_0716	197	20.07	16.47	10.83	18.07	0.45	4.31	6.19
2006_0716	197	22.07	16.93	16.67	15.83	0.56	3.58	5.36
2007_0716	197							
2008_0716	198	19.73	14.27	5.67	10.57	0.75	2.02	3.23
2009_0716	197	19.27	14.73	19	13.73	0.49	3.84	5.65
2010_0716	197	22.17	17.6	22.33	18.05	0.53	3.88	5.73

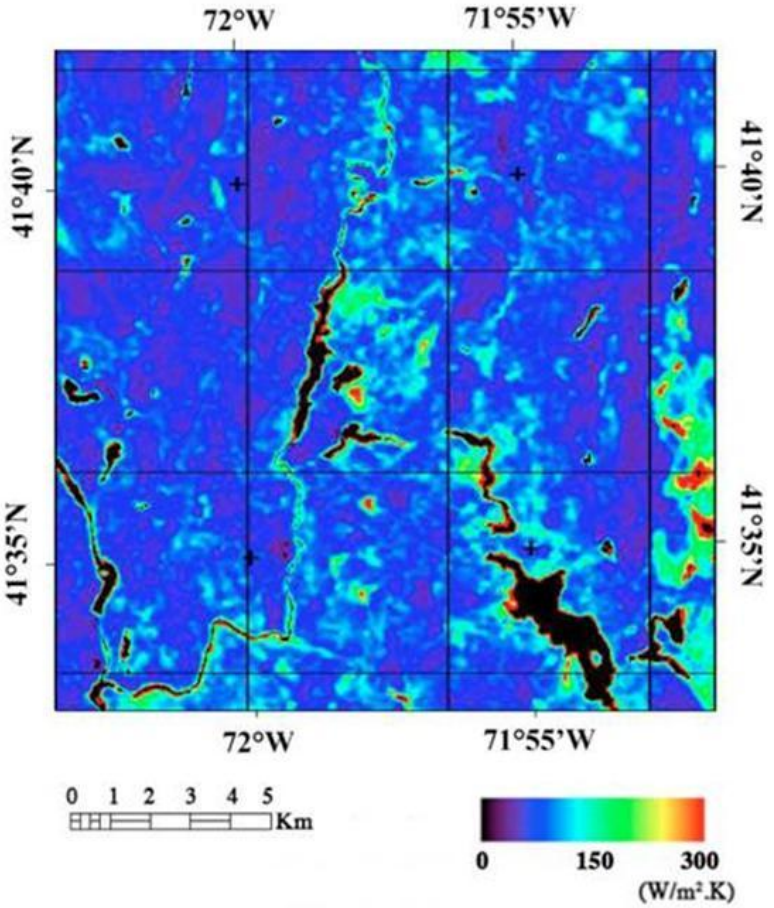
Results: CT


(a) TOA Insolation
Insolation (W/m2)
Insolation
Insolation_Satellite
(b) Albedo
Albedo_Liang
(c) NDVI
NDVI
(d) Temperature Difference
Temperature Difference (K)
(e) Exchange Coefficient
Exchange Coefficient (W/m2.K)
DOY
Mixed
Deciduous
Grass
Urban

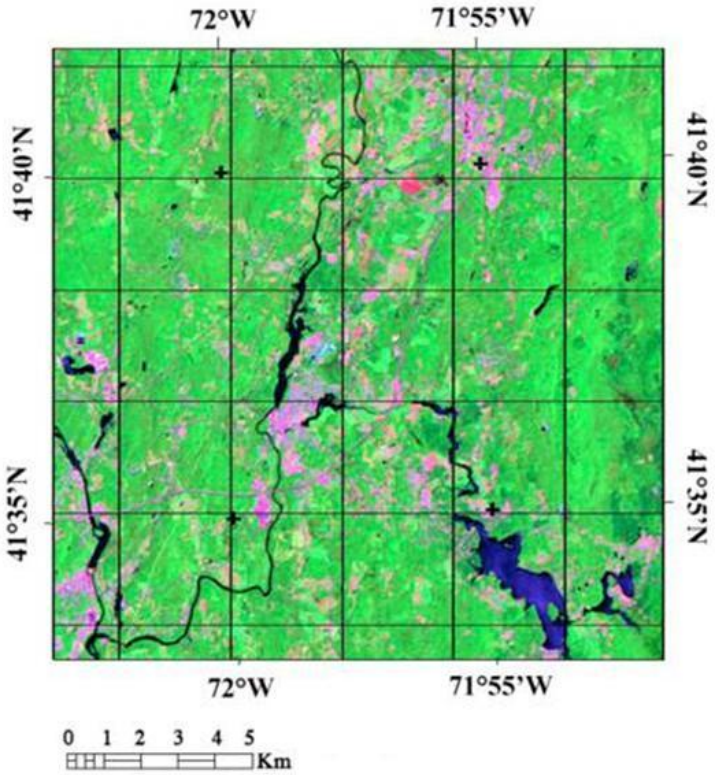
CT: 7-4-1 RGB (20030428)



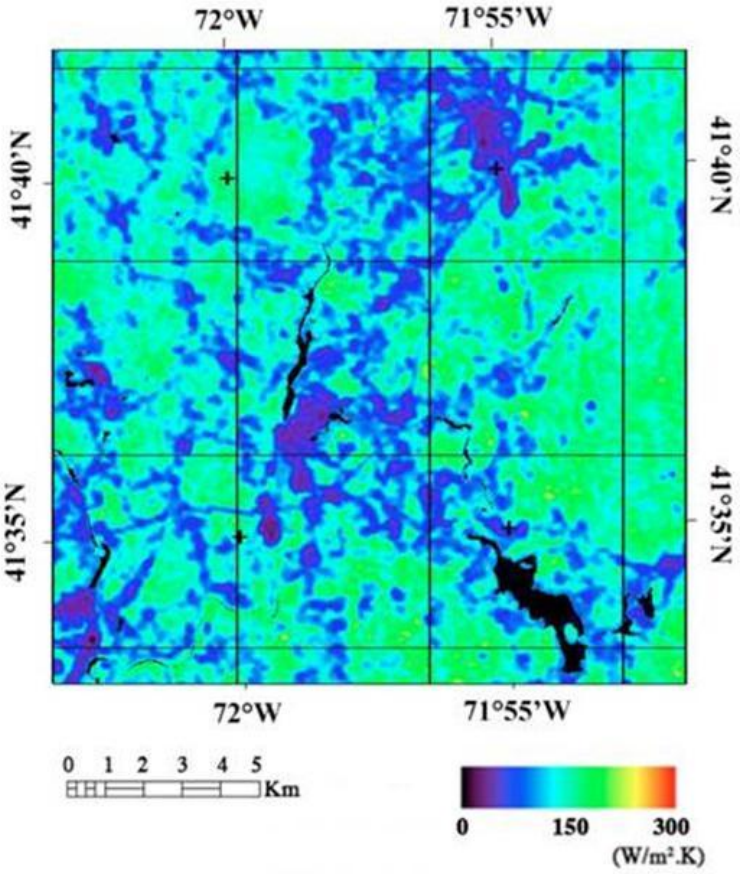
CT: Exchange Coefficient (20030428)

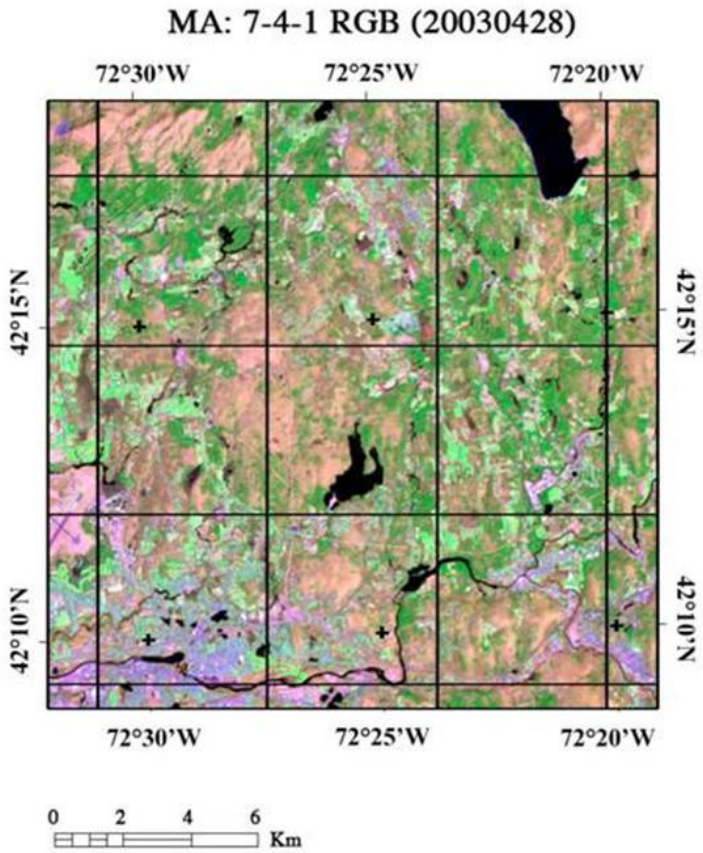


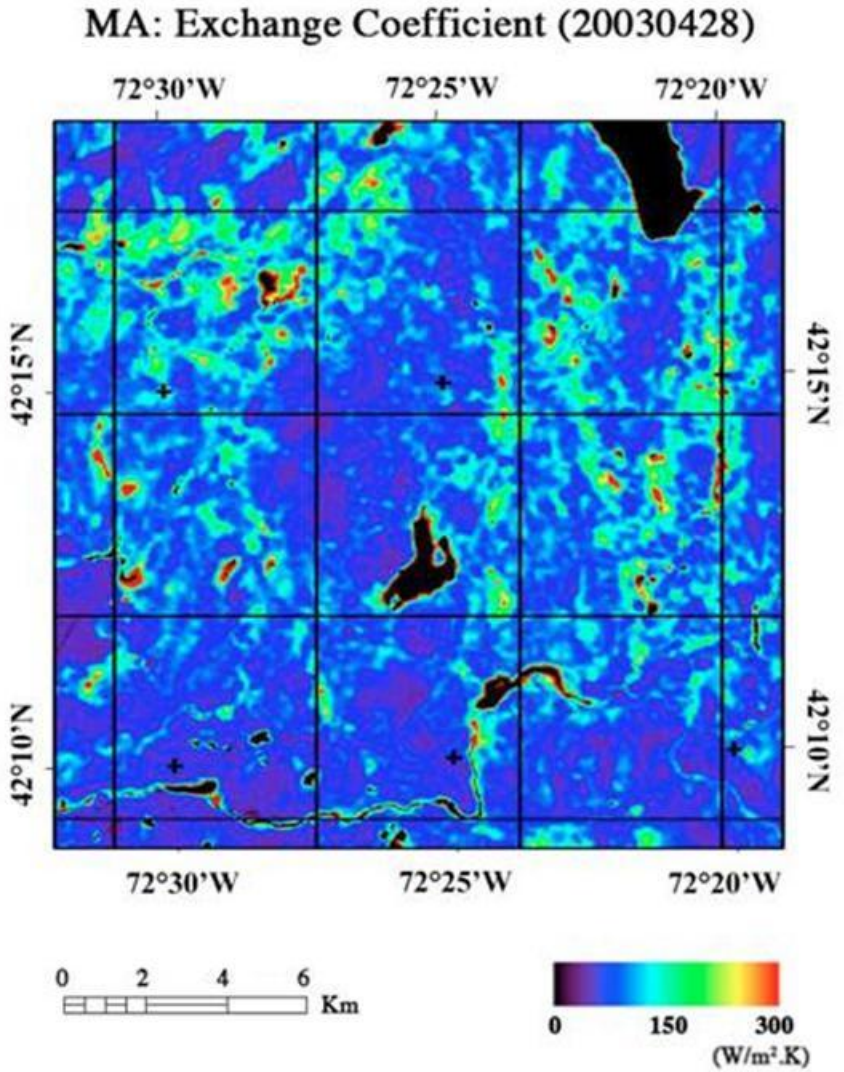
CT: 7-4-1 RGB (20010727)



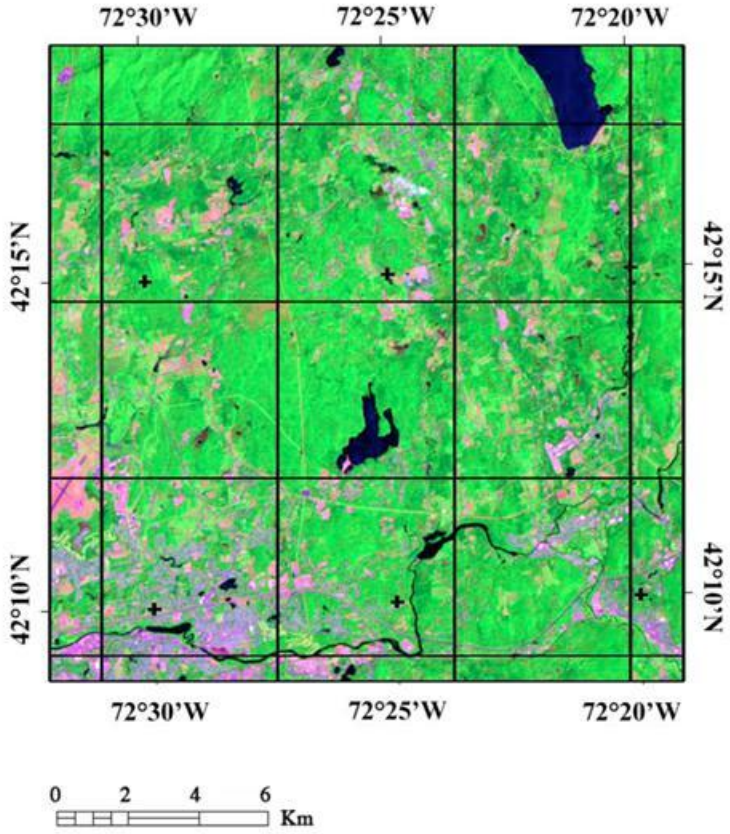
CT: Exchange Coefficient (20010727)



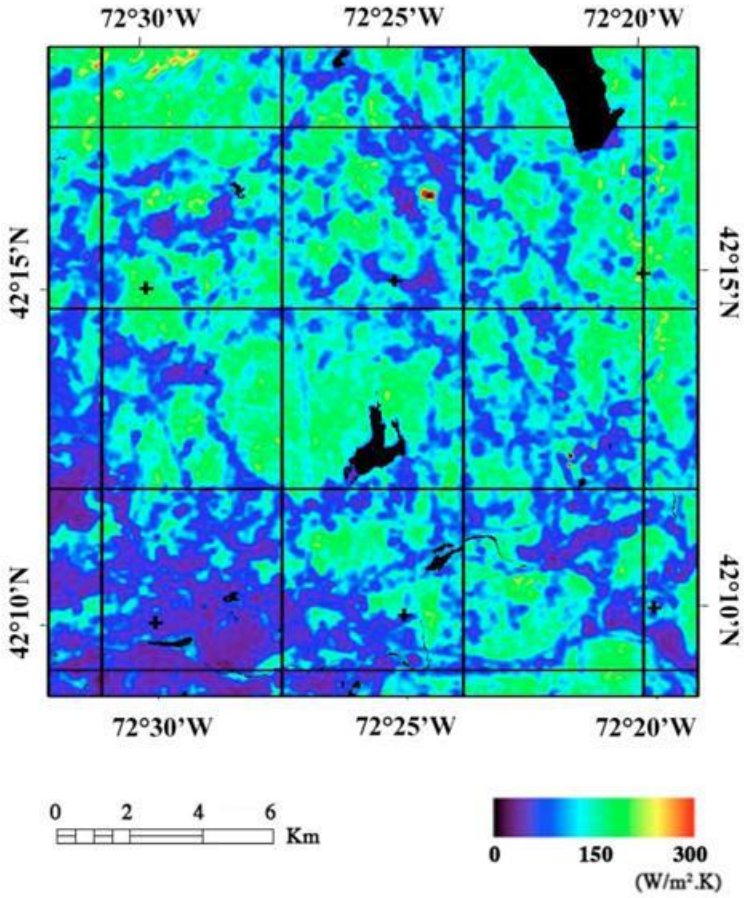

MA: 7-4-1 RGB (20030428)
72°30'W
72°25'W
72°20'W
42°15'N
42°10'N
0 2 4 6
Km


MA: Exchange Coefficient (20030428)
72°30'W
72°25'W
72°20'W
42°15'N
42°10'N
0 2 4 6
Km
0 150 300
(W/m².K)

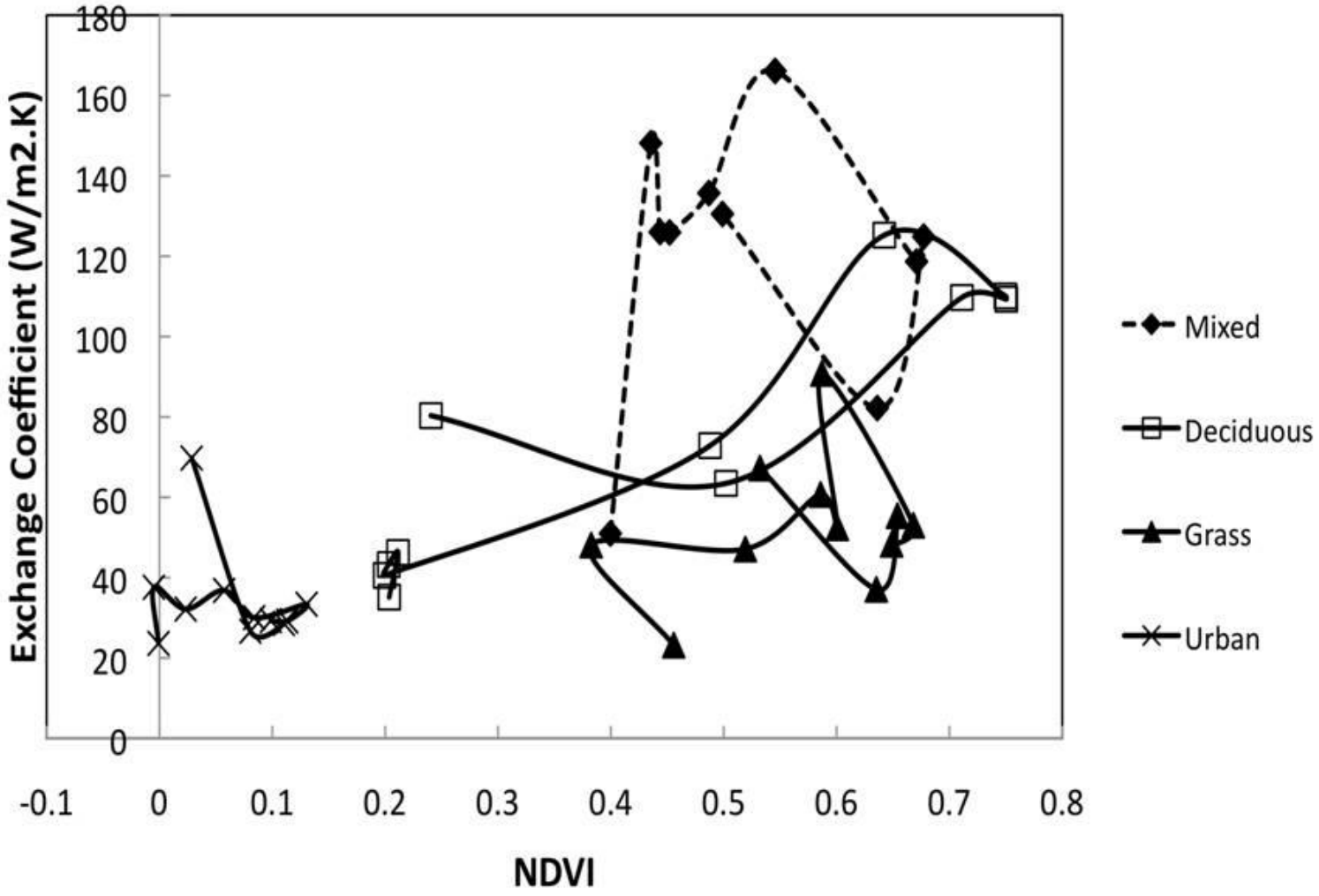
MA: 7-4-1 RGB (20010727)



MA: Exchange Coefficient (20010727)



CT: K vs NDVI

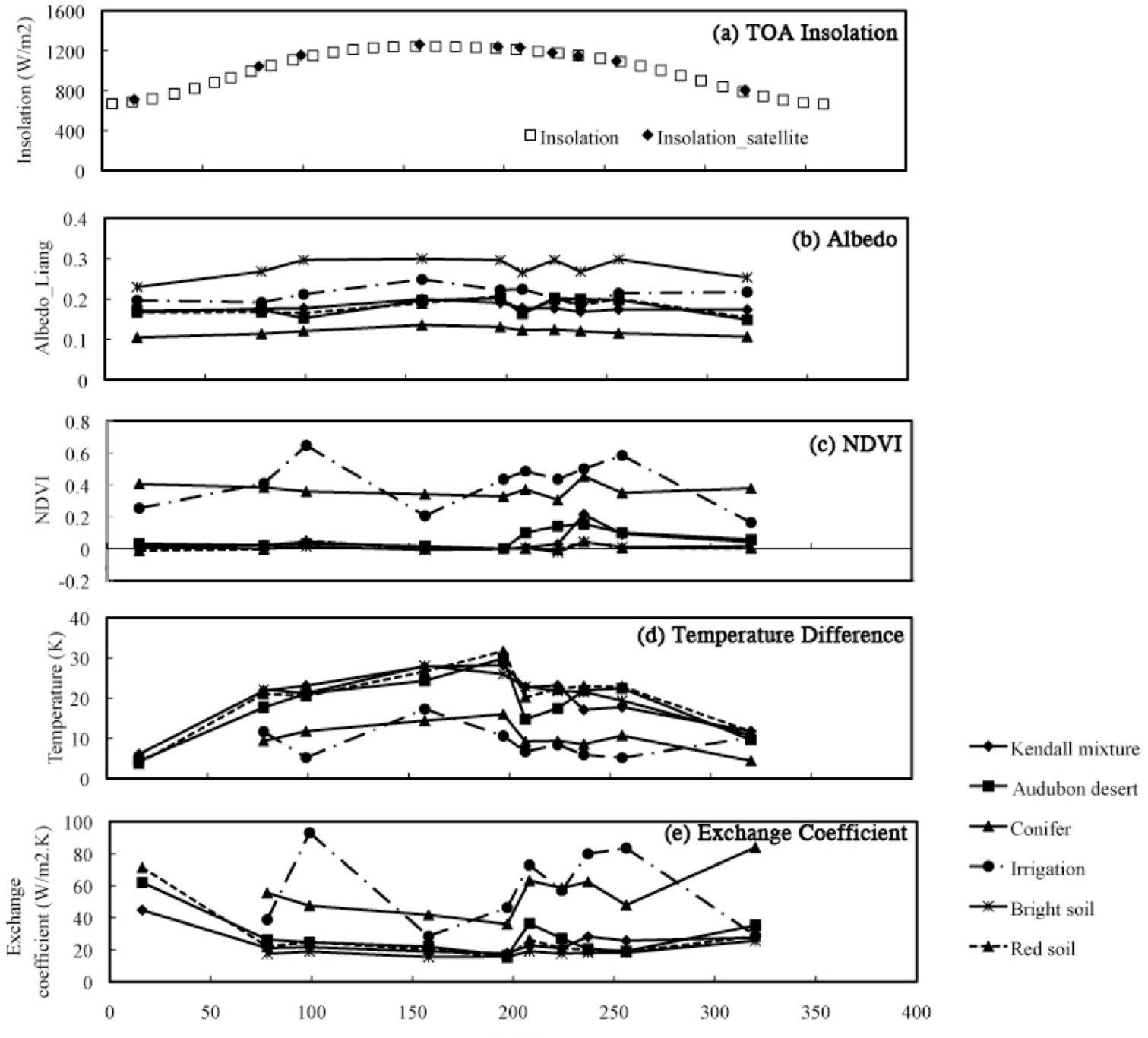

Exchange Coefficient (W/m2.K)
180
160
140
120
100
80
60
40
20
0
-0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
NDVI
Mixed
Deciduous
Grass
Urban

Results: AZ

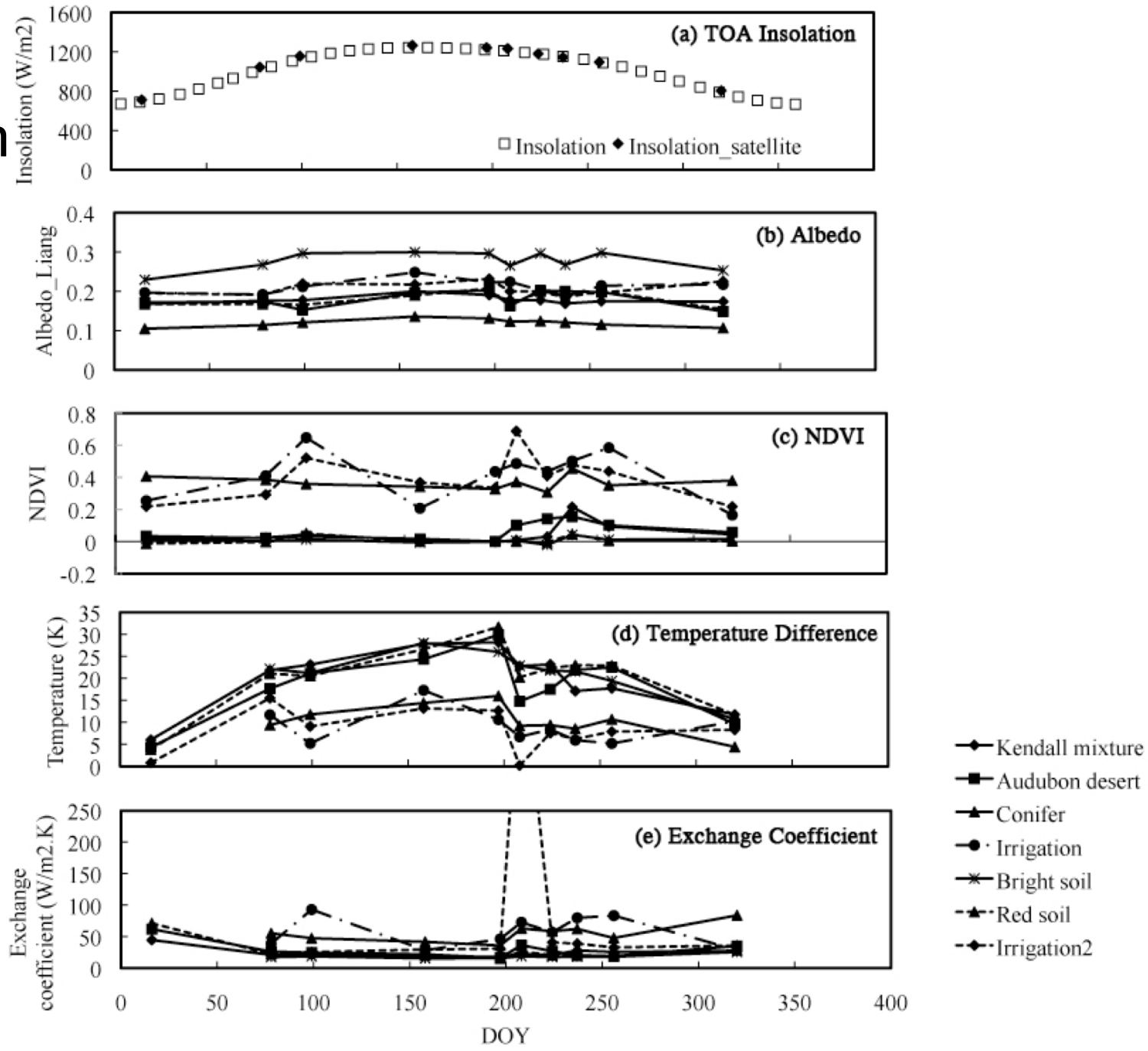
1. **Date Table_AZ**

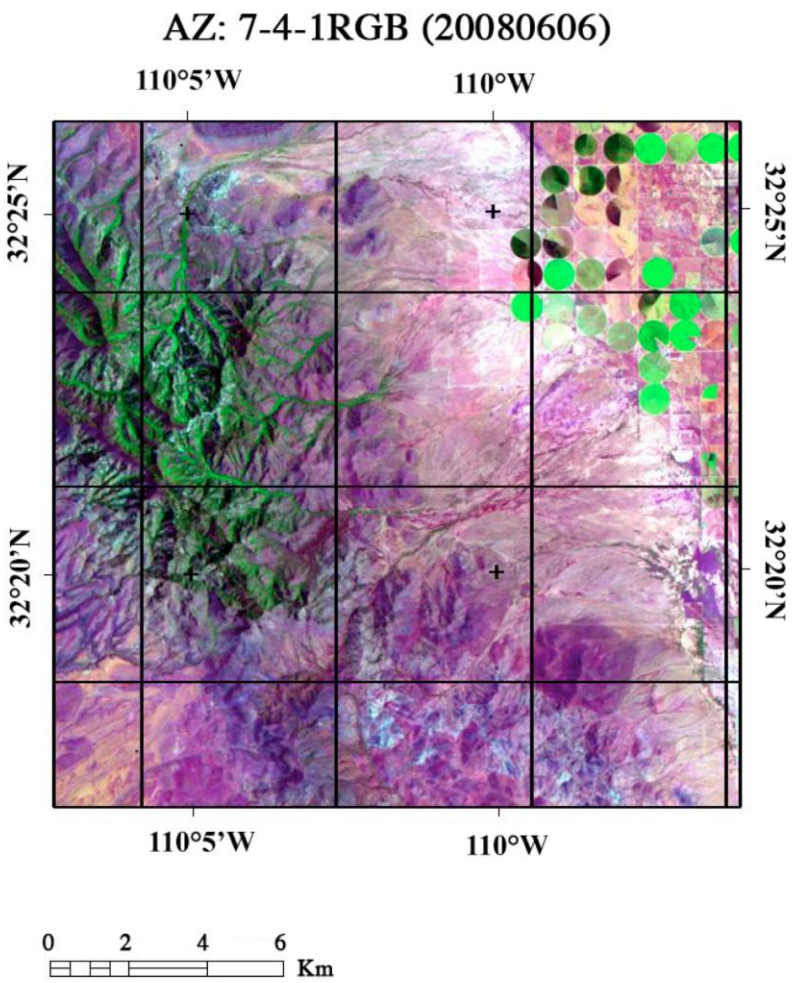
Calendar Day	DOY	T850 (°C)	Wind speed (Knot) (850 hpa)	Dew Point (°C) (850 hpa)	atmospheric transmission	upwelling radiance	downwelling radiance
2009_0116	16	15.7	10.5	-22.8	0.96	0.24	0.42
2008_0318	78	7.1	11	-5.4	0.96	0.26	0.46
2010_0409	99	17.9	7	-25.1	0.96	0.24	0.43
2008_0606	158	22.3	7.5	-8.2	0.94	0.44	0.79
2005_0716	197	29.7	11.5	9.2	0.68	2.41	3.97
2009_0727	208	29.7	14	2.7	0.73	2.10	3.45
2003_0812	224	29.5	7.5	10	0.71	2.23	3.66
2002_0825	237	28.7	8.5	6.2	0.85	1.10	1.90
2003_0913	256	25.8	5.5	0.3	0.86	1.10	1.85
2009_1116	320	12.2	15	-21.8	0.97	0.18	0.31

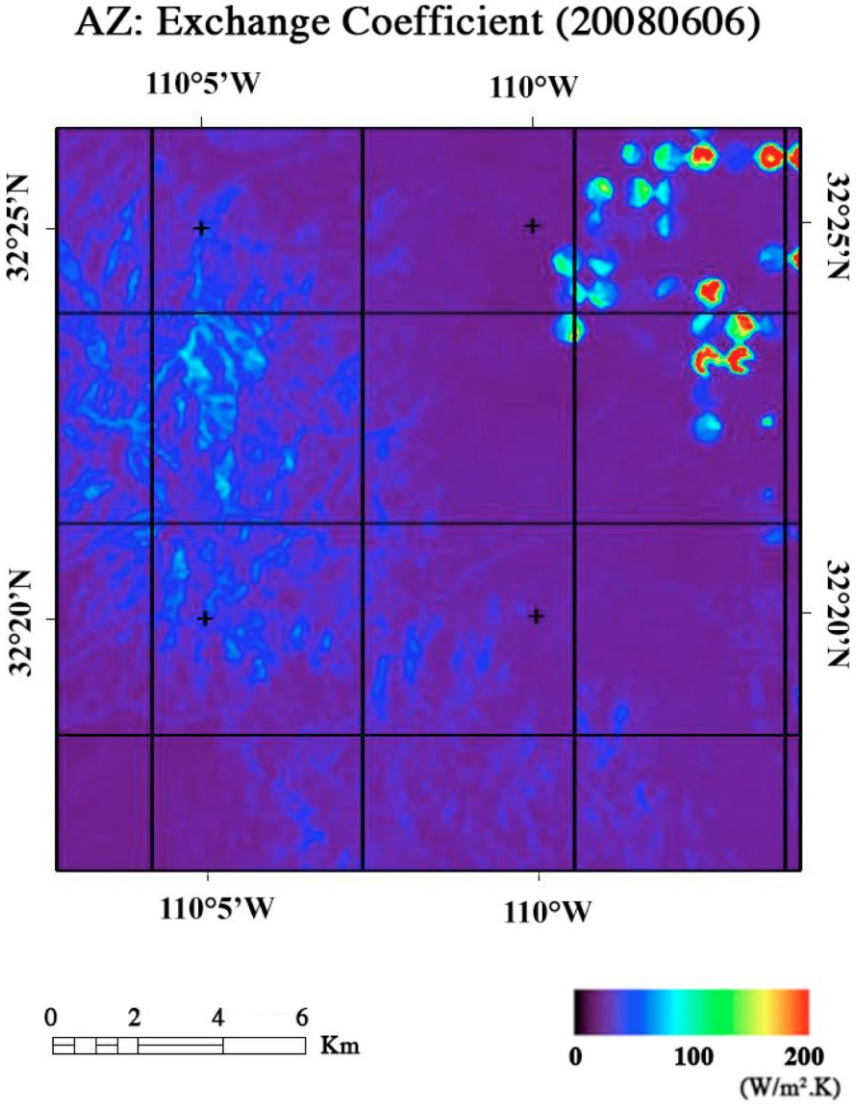
AZ

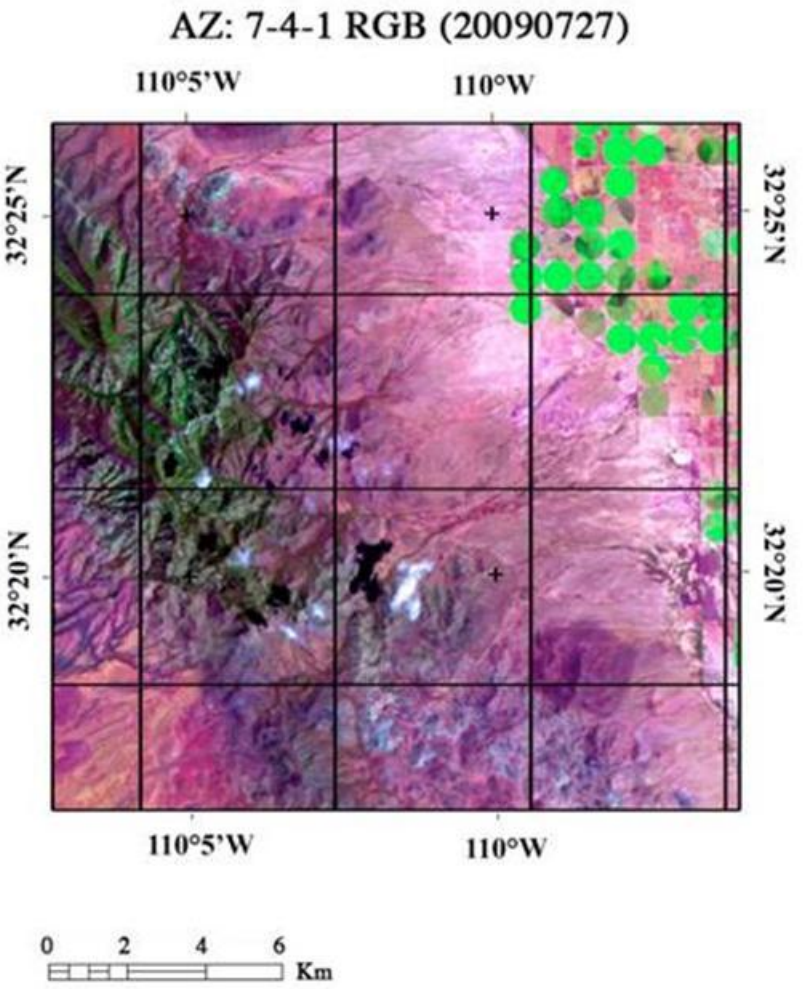

(a) TOA Insolation
Insolation (W/m2)
1600
1200
800
400
0
Insolation
Insolation_satellite
(b) Albedo
Albedo_Liang
0.4
0.3
0.2
0.1
0
(c) NDVI
NDVI
0.8
0.6
0.4
0.2
0
-0.2
(d) Temperature Difference
Temperature (K)
40
30
20
10
0
(e) Exchange Coefficient
Exchange coefficient (W/m2.K)
100
80
60
40
20
0
0
50
100
150
200
250
300
350
400
DOY
Kendall mixture
Audubon desert
Conifer
Irrigation
Bright soil
Red soil

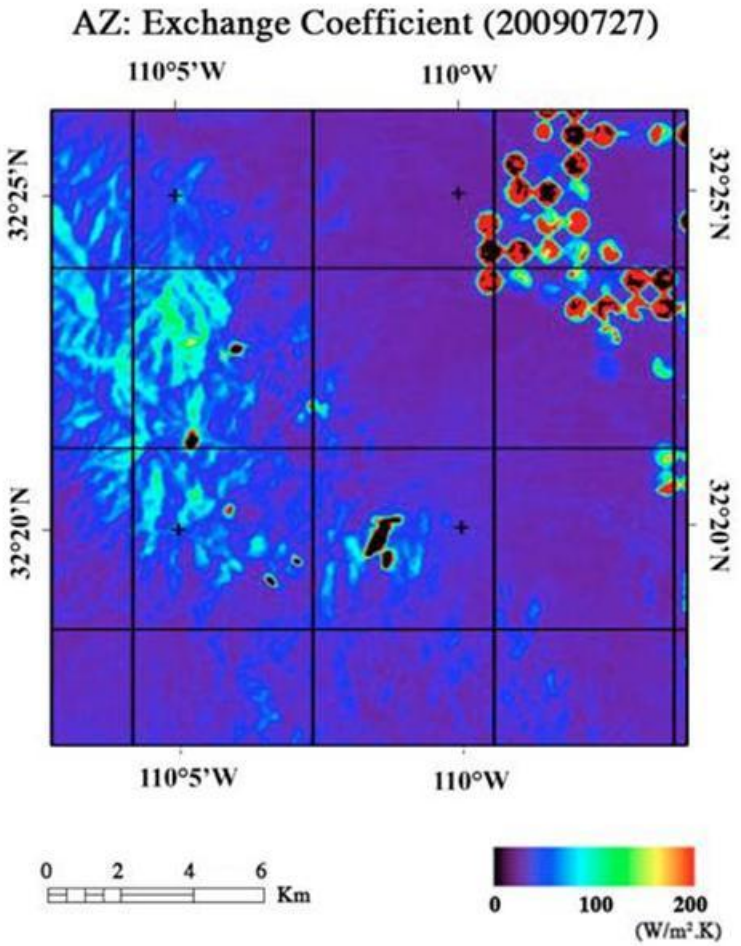
With More Irrigation circles



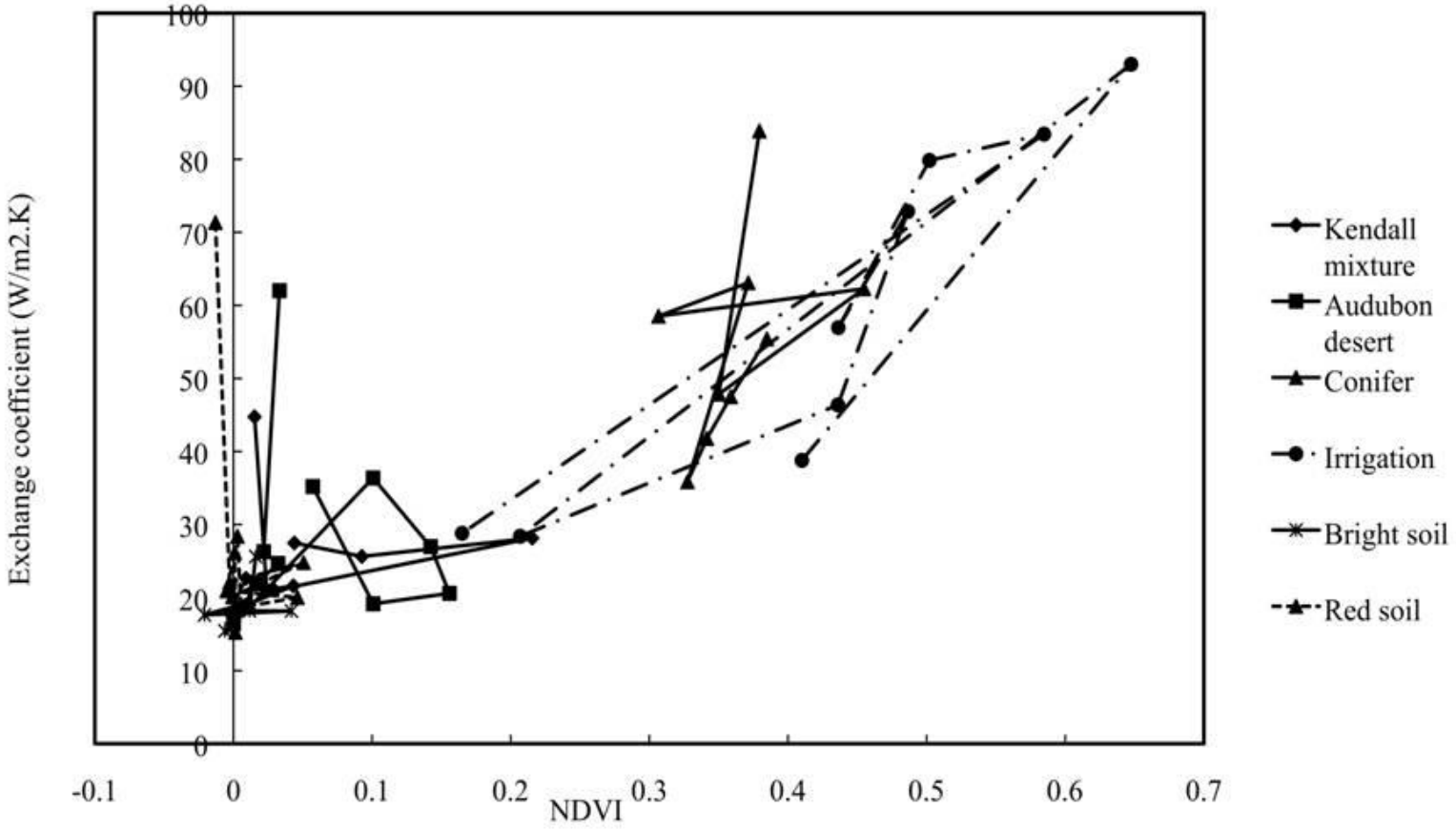

AZ: 7-4-1RGB (20080606)
110°5'W
110°W
32°25'N
32°20'N
0 2 4 6
Km


AZ: Exchange Coefficient (20080606)
110°5'W
110°W
32°25'N
32°20'N
0 2 4 6
Km
0 100 200
(W/m².K)


AZ: 7-4-1 RGB (20090727)
110°5'W
110°W
32°25'N
32°20'N
0 2 4 6
Km


AZ: Exchange Coefficient (20090727)
110°5'W
110°W
32°25'N
32°20'N
0 2 4 6
Km
0 100 200
(W/m².K)

AZ: K vs NDVI


Exchange coefficient (W/m2.K)
100
90
80
70
60
50
40
30
20
10
0
-0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
NDVI
Kendall mixture
Audubon desert
Conifer
Irrigation
Bright soil
Red soil

AZ: K vs NDVI (more irrigation circles)