

Urban Heat Island & Potential Link to Ground Level Ozone: A D.C. Perspective

Ivan Cheung
Assistant Professor of Geography
The George Washington University

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Crucial Definitions

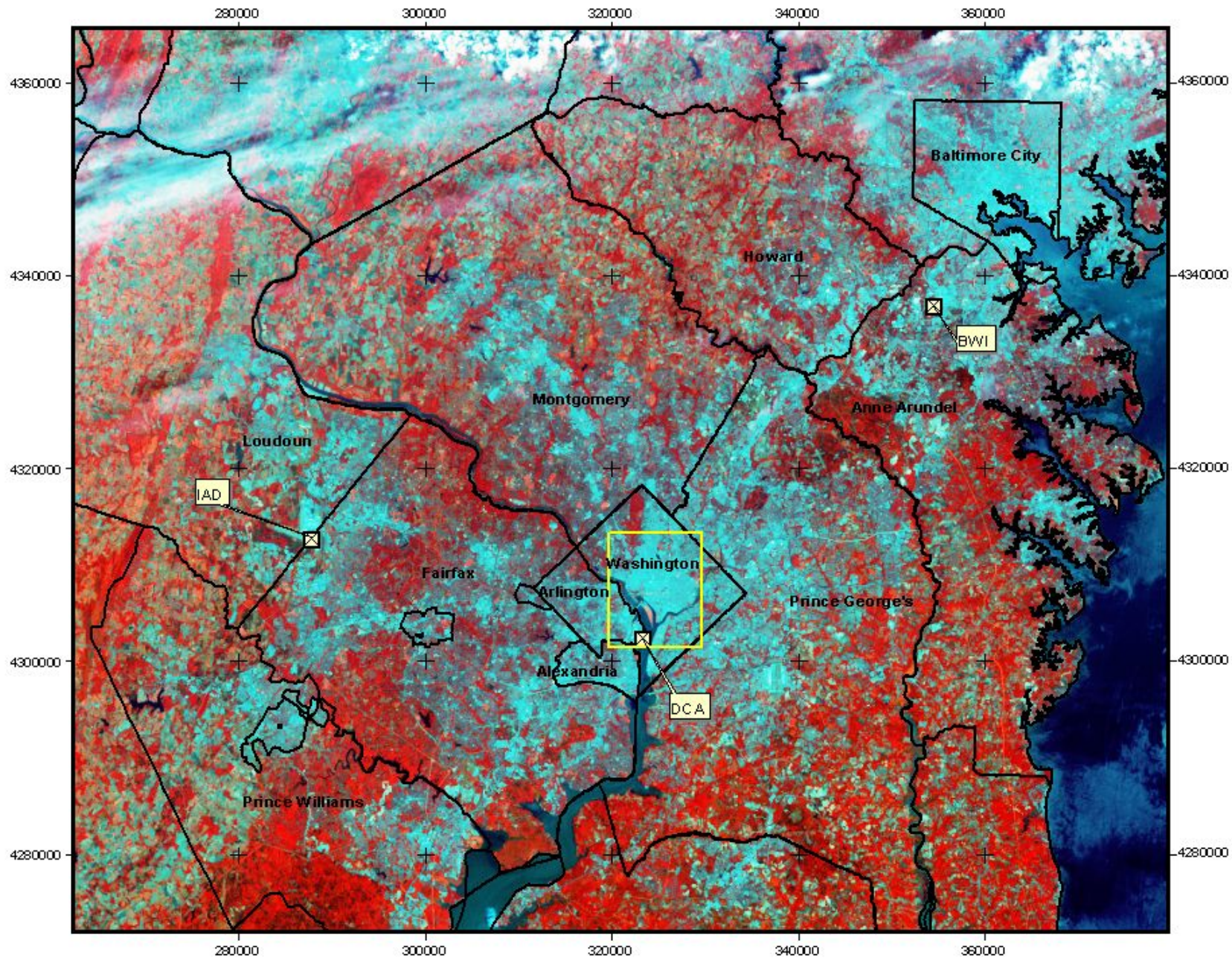
- Atmospheric Urban Heat Island:
 - Include Urban Canyon Layer UHI
 - Include Urban Boundary Layer UHI
- Surface Urban Heat Island (SUHI) :
 - As “seen” by thermal remote sensors;
 - As depicted by the uneven distribution of upwelling thermal radiance;

Urban Heat Island Intensity in Washington DC

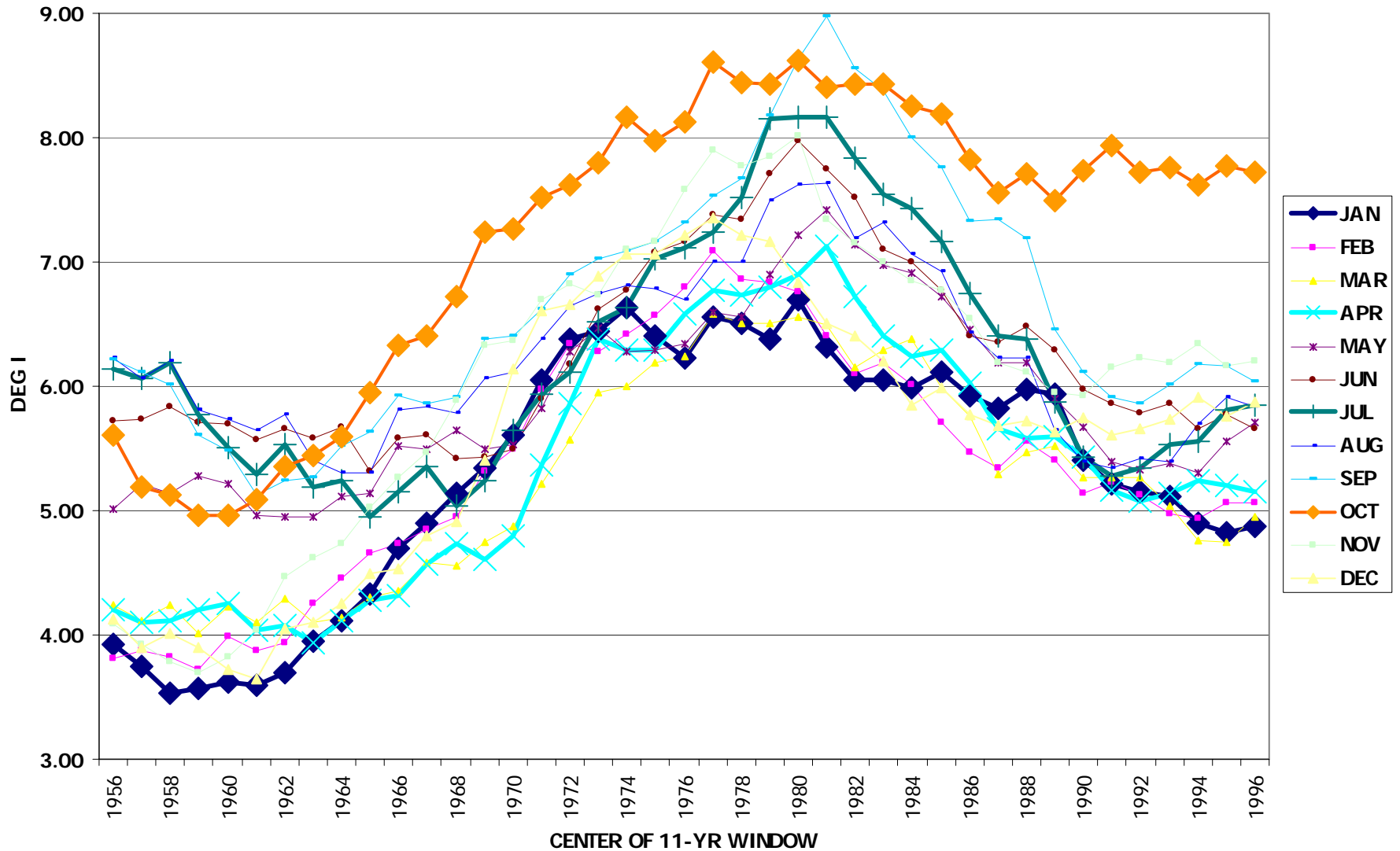
$$UHII = \Delta T_{U-R}$$

$$\Delta T_{U-R} = T_{min_{DCA}} - T_{min_{IAD}}^*$$

* *Predicted $T_{min_{IAD}} = 0.113 + 0.979 (T_{min_{Lincoln}})$
prior to November of 1962*



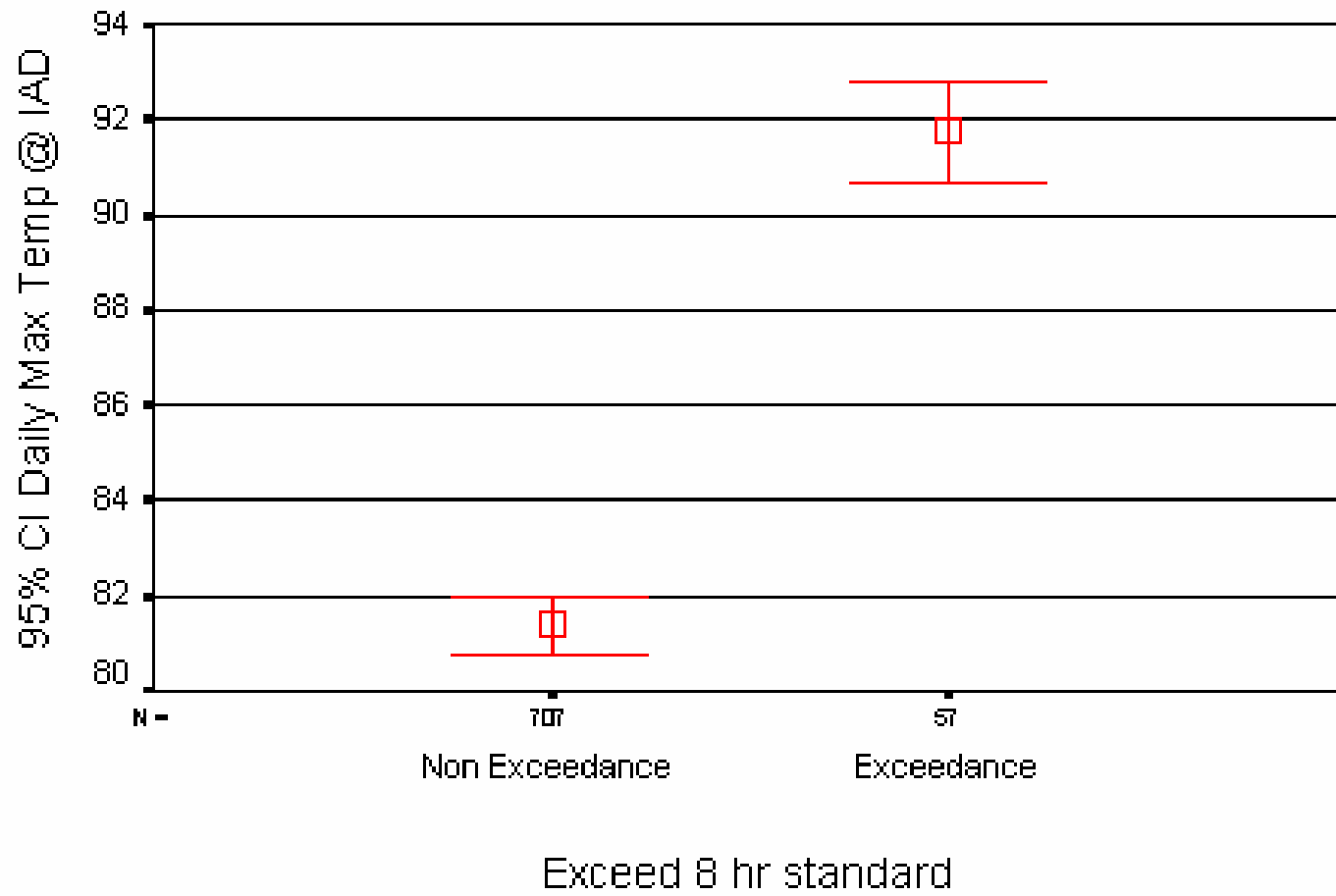
UHI INDEX (LOW PASS FILTER) 1951 - 2001



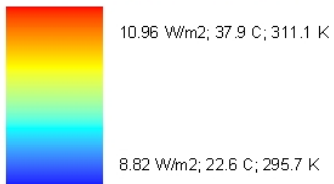
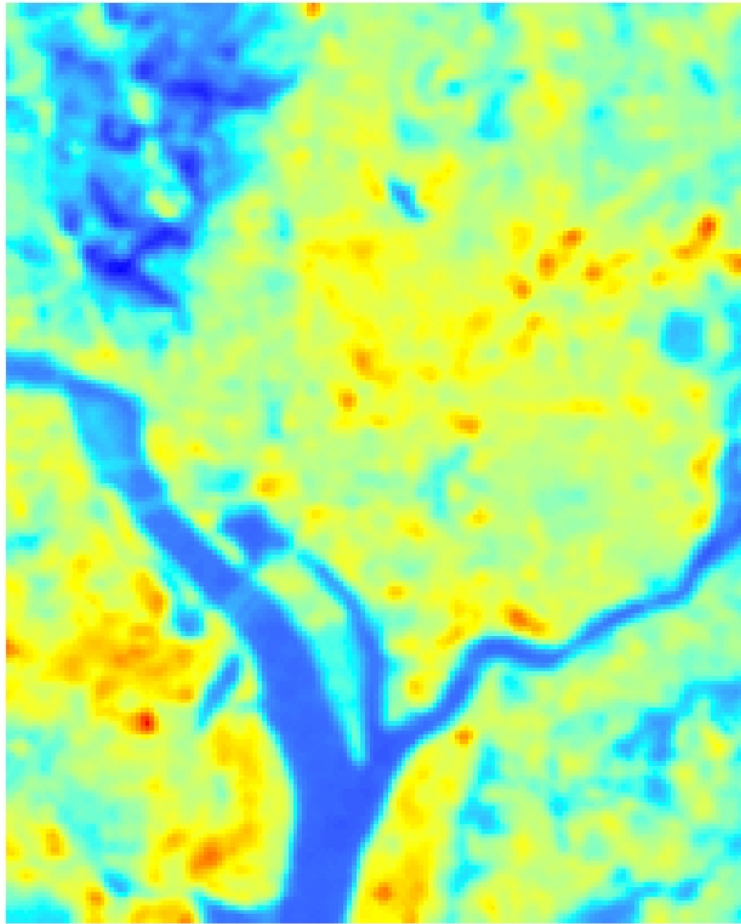
Crucial Definitions – Surface Temperature

- Directional Brightness Temperature (*At-Satellite Effective Temperature*);
- Directional Radiometric Temperature;
- Surface Temperature;

Difference in Daily Maximum Temperatures Non Exceedance versus Exceedance

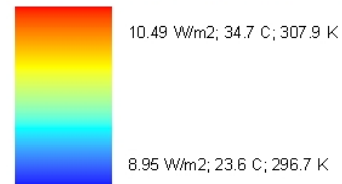
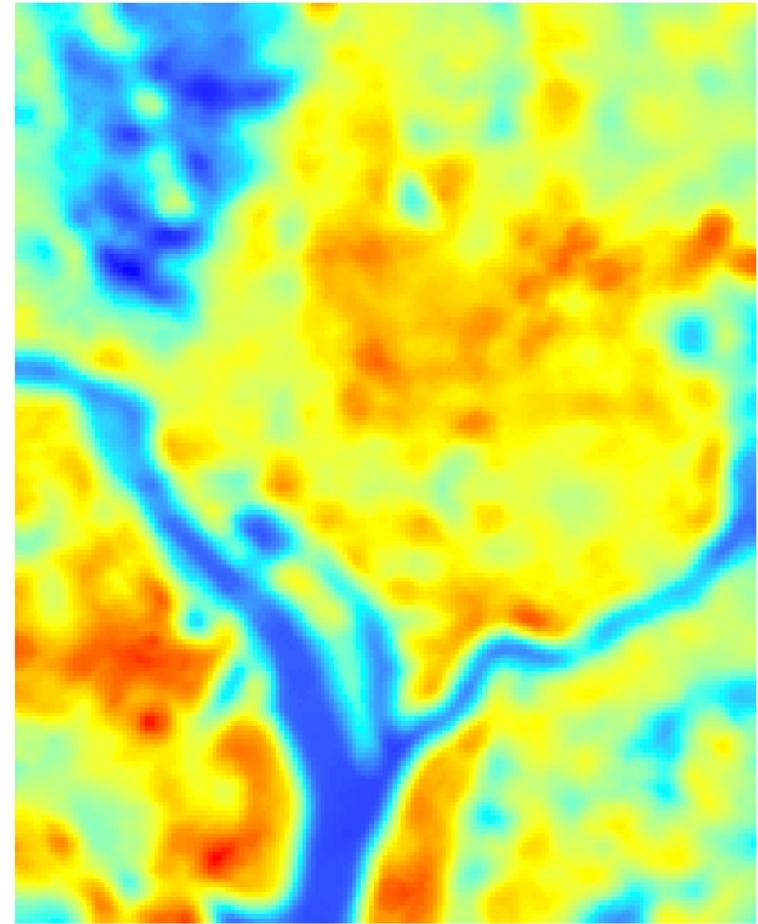


AT-SATELLITE EFFECTIVE TEMPERATURE
(Composite - 6/18; 8/5; 9/6/2004)



Smoothing Window of 120m Radius

AT-SATELLITE EFFECTIVE TEMPERATURE
(Composite - 6/18; 8/5; 9/6/2004)



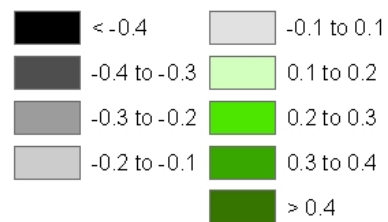
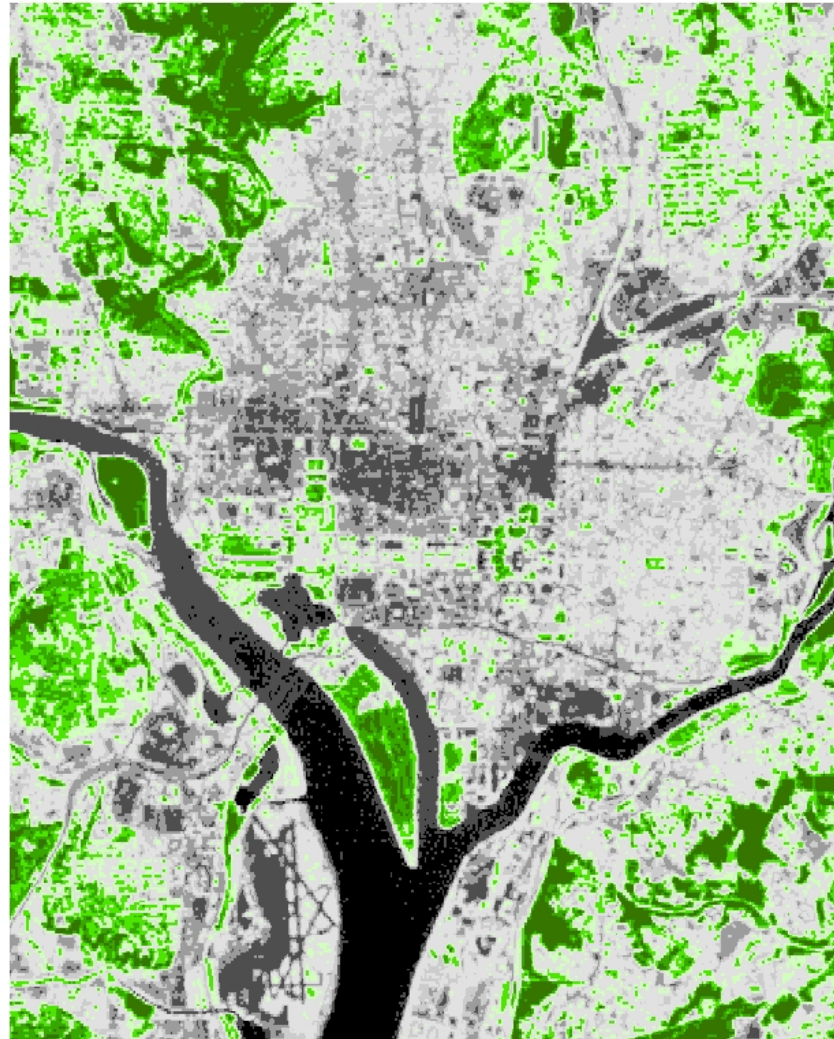
Smoothing Window of 240m Radius

Normalized Difference Vegetation Index

$$NDVI = \frac{NIR - RED}{NIR + RED}$$

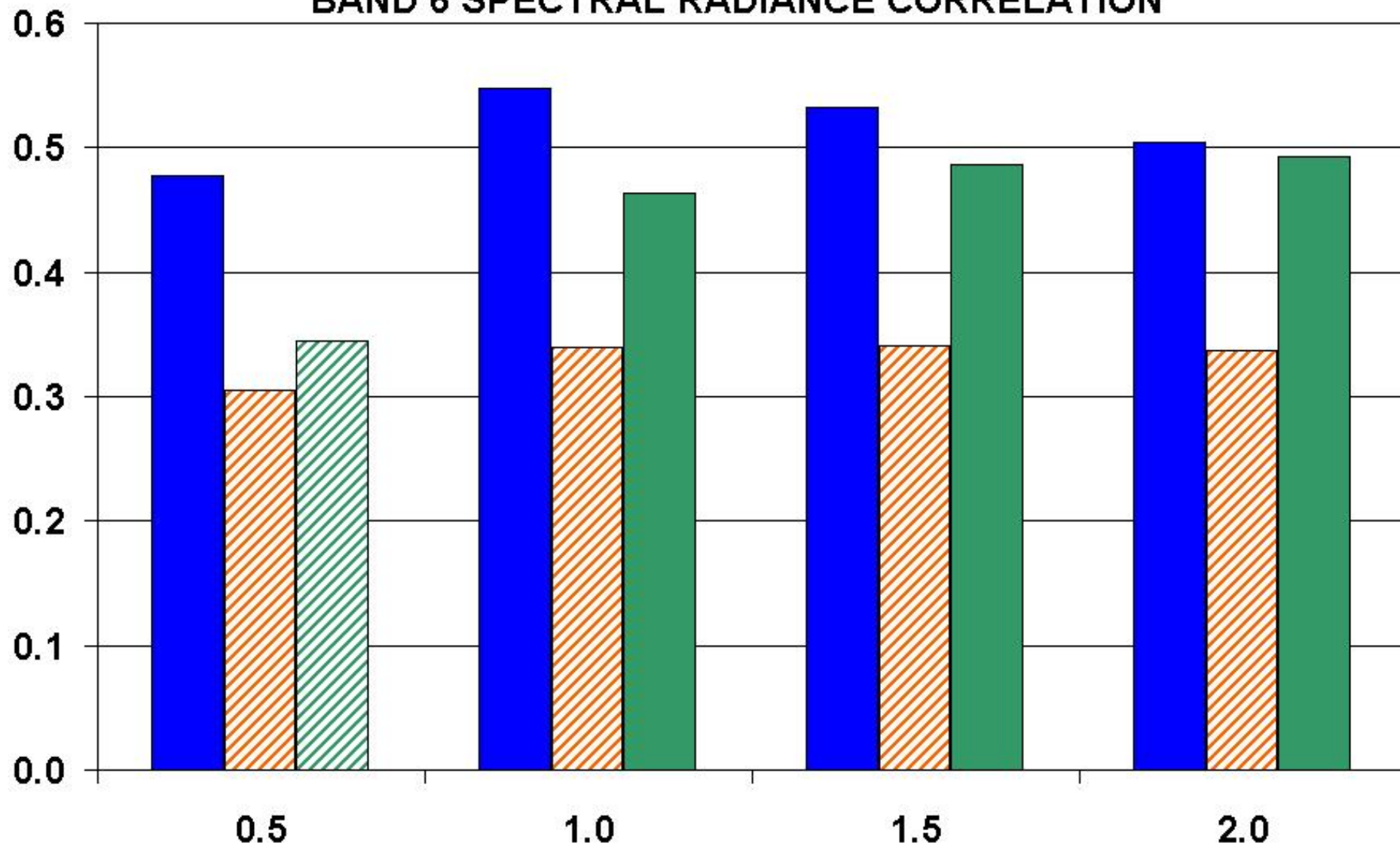
Very low values of NDVI (0.1 and below) correspond to barren areas of rock, sand, or snow. Moderate values represent shrub and grassland (0.2 to 0.3), while high values indicate temperate and tropical rainforests (0.6 to 0.8).

NORMALIZED DIFFERENCE VEGETATION INDEX (Composite - 6/18; 8/5; 9/6/2004)



30m x 30m Original Grid

BAND 6 SPECTRAL RADIANCE CORRELATION



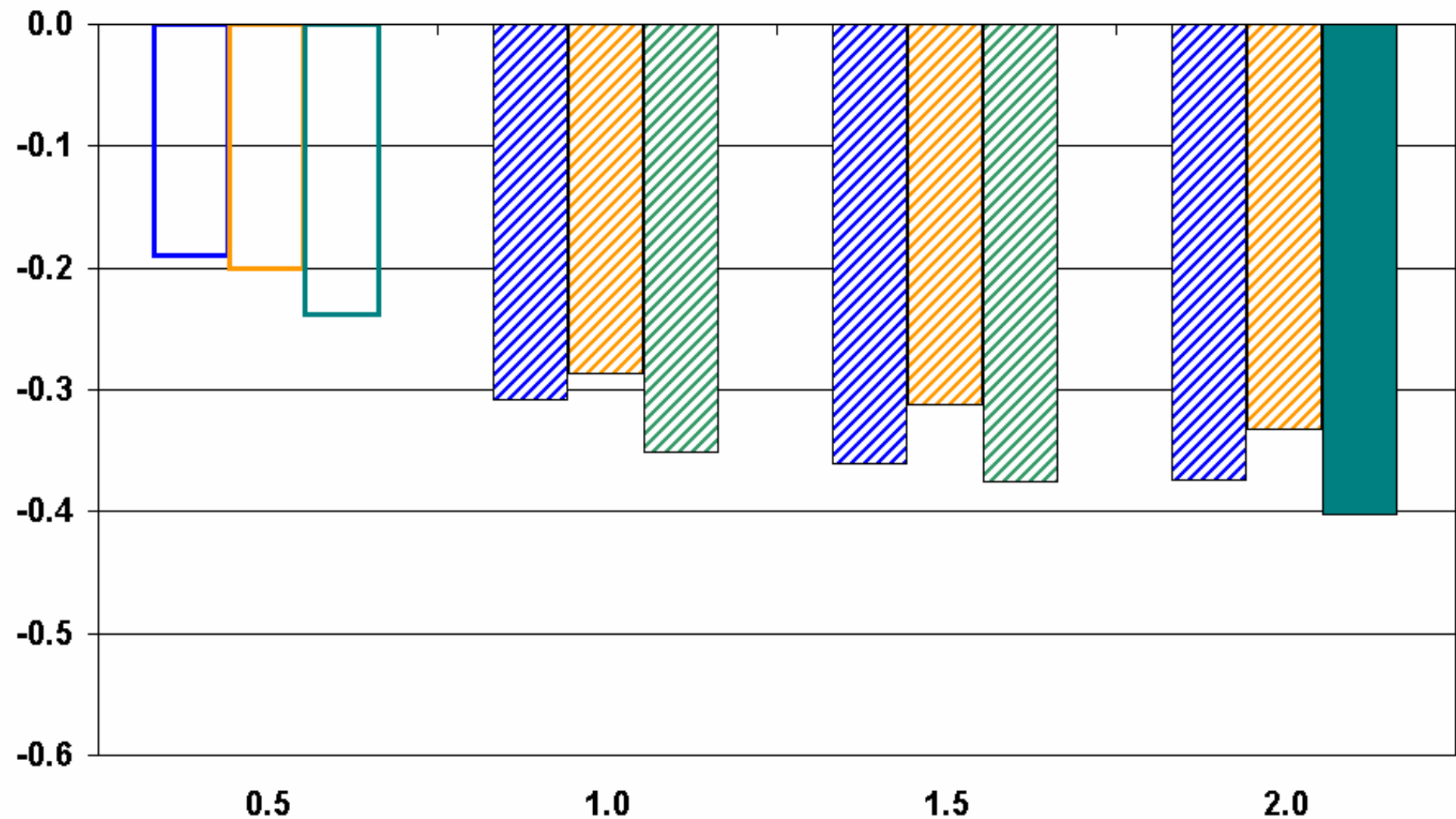
■ 18-Jun

▨ 5-Aug

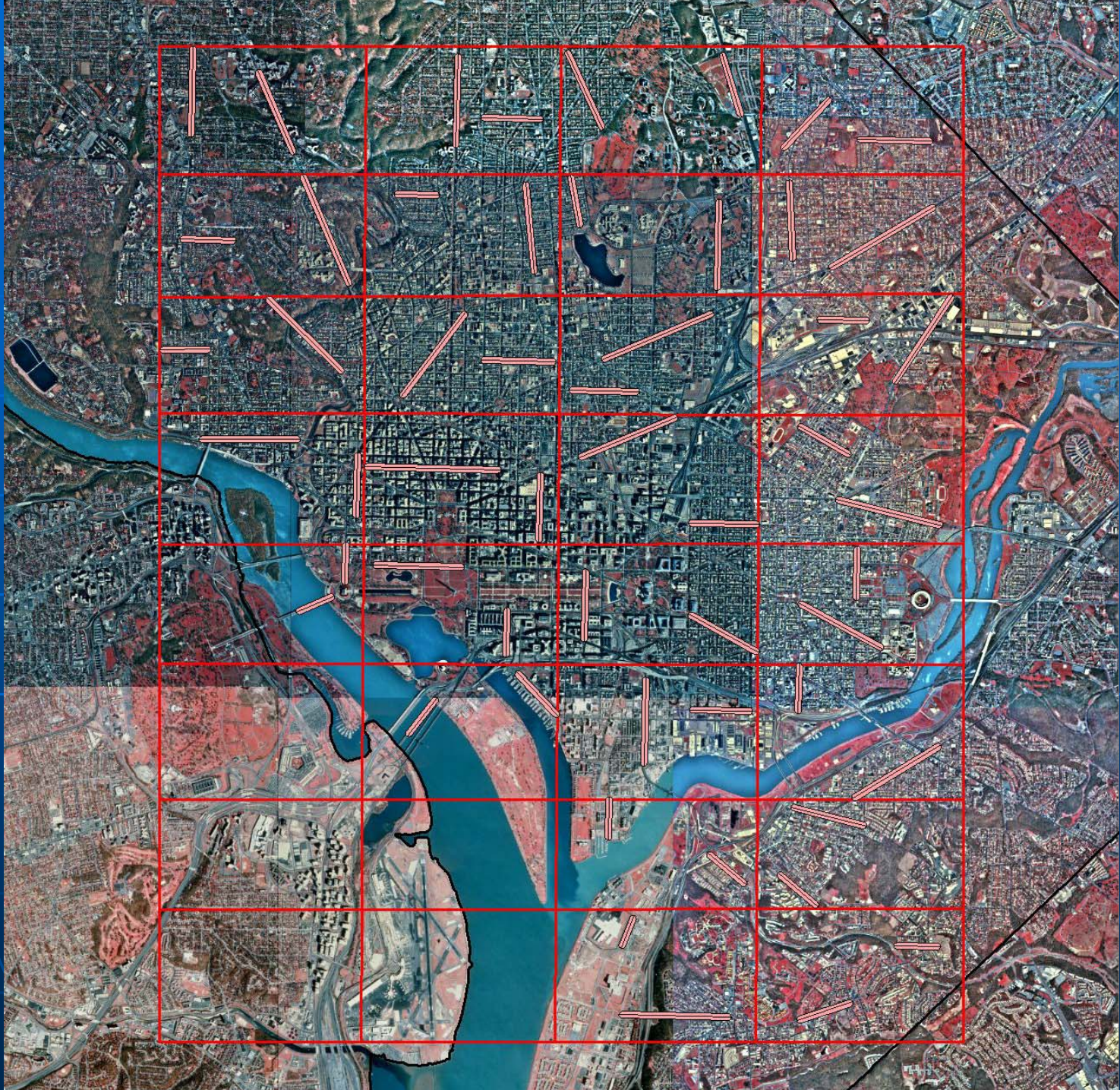
■ 6-Sep

Note: Solid = Signif @ 99% CL;
Stripe = Signif @ 95%; Hollow = Not Sign

NDVI CORRELATION ANALYSIS

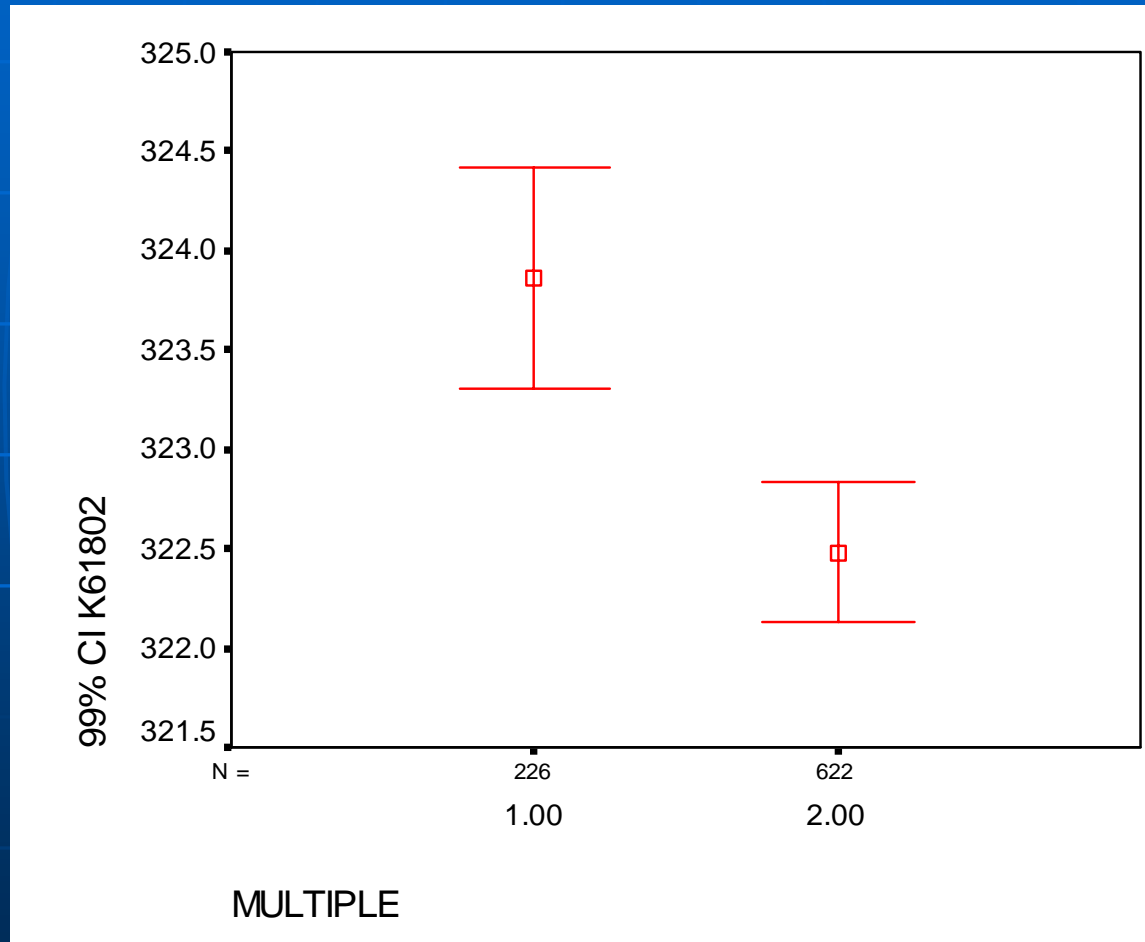


Note: Solid = Signif @ 99% CL;
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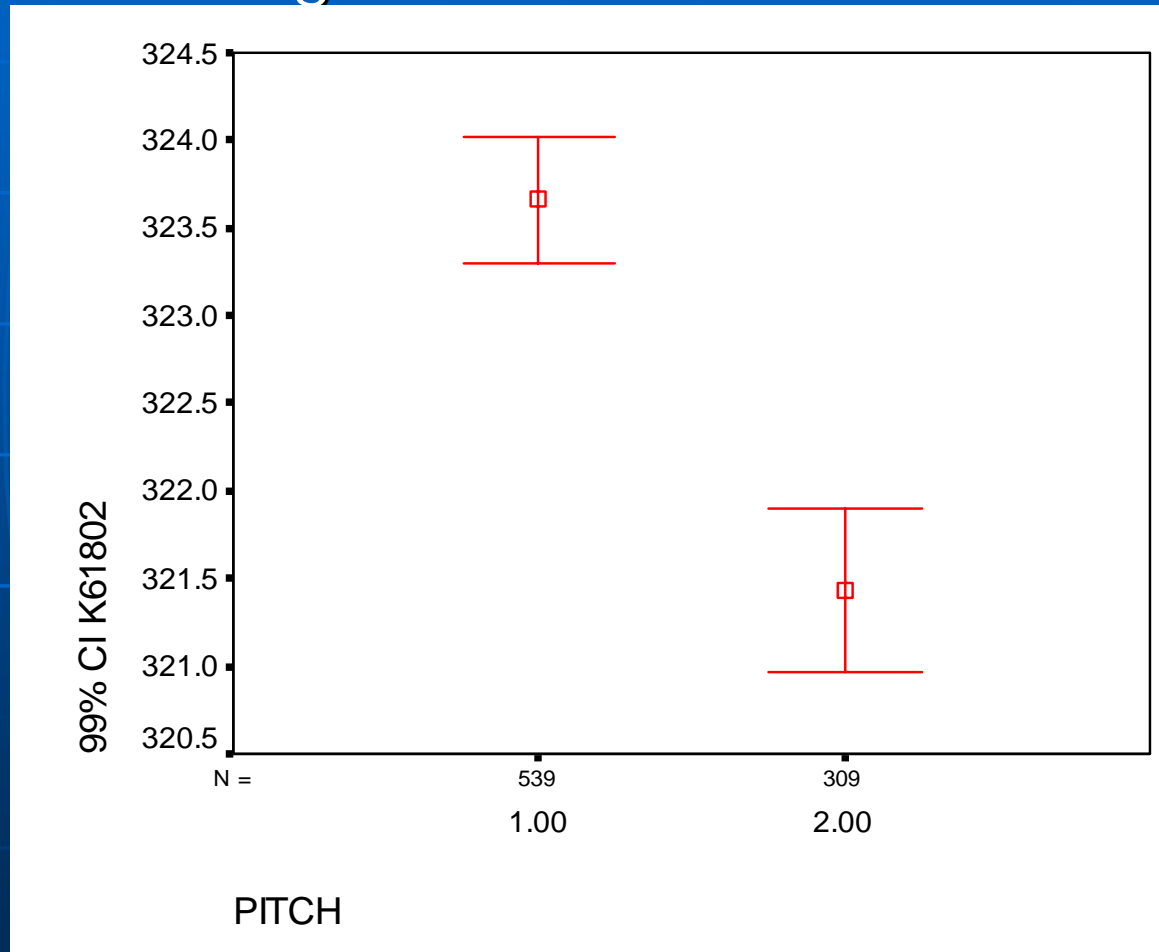


Estimated Surface Temperature

- Multiple level roof > Simple roof
 - Statistical significance: 6/18/2002 Not composite

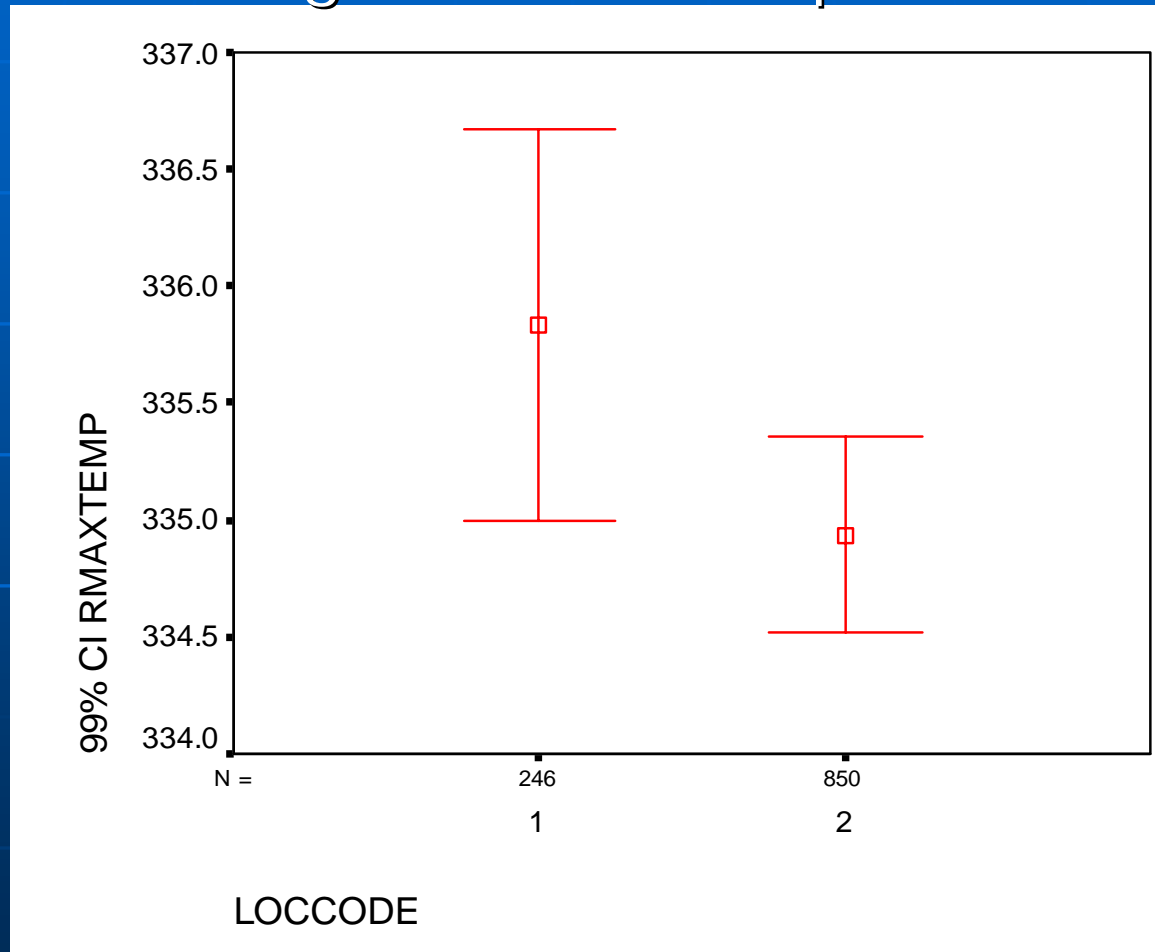


- Flat roof > Pitch roof
 - Statistical significance 6/18/2002 & composite



■ Canyon > Roof

- Statistical significance: composite Not 6/18/02



Correlation Coefficients (Temperature)

		C51100	C100200	C53001	C80201	C61802	C80502	C90602	CMAXTEMP
IMPERVIOUS	-0.215	0.007	0.250	0.247	0.261	0.220	0.190	0.220	
VEGETATION/SOIL	0.067	0.003	-0.354	-0.331	-0.313	-0.293	-0.232	-0.293	
WATER	-0.099	0.030	0.007	0.036	0.019	-0.026	0.051	-0.026	
HEIGHT	-0.402	-0.172	0.154	0.237	0.262	0.063	0.068	0.063	
ADJ WIDTH	0.167	-0.053	-0.138	-0.133	-0.128	-0.174	-0.136	-0.174	
H:W RATIO	-0.391	-0.028	0.187	0.259	0.262	0.147	0.138	0.147	
TREE COUNT	0.026	-0.204	-0.297	-0.285	-0.324	-0.312	-0.285	-0.312	
EST WALL AREA	-0.377	-0.158	0.127	0.207	0.230	0.037	0.093	0.037	
EST ROOF AREA	-0.172	0.011	0.160	0.147	0.173	0.179	0.175	0.179	

Correlation Coefficients (NDVI/Temp)

	COMPNDVI	C61802	CMAXTEMP
IMPERVIOUS	-0.464	0.261	0.220
VEGETATION/SOIL	0.634	-0.313	-0.293
WATER	0.013	0.019	-0.026
HEIGHT	-0.375	0.262	0.063
ADJ WIDTH	-0.018	-0.128	-0.174
H:W RATIO	-0.233	0.262	0.147
TREE COUNT	0.295	-0.324	-0.312
EST WALL AREA	-0.303	0.230	0.037
EST ROOF AREA	0.010	0.173	0.179