



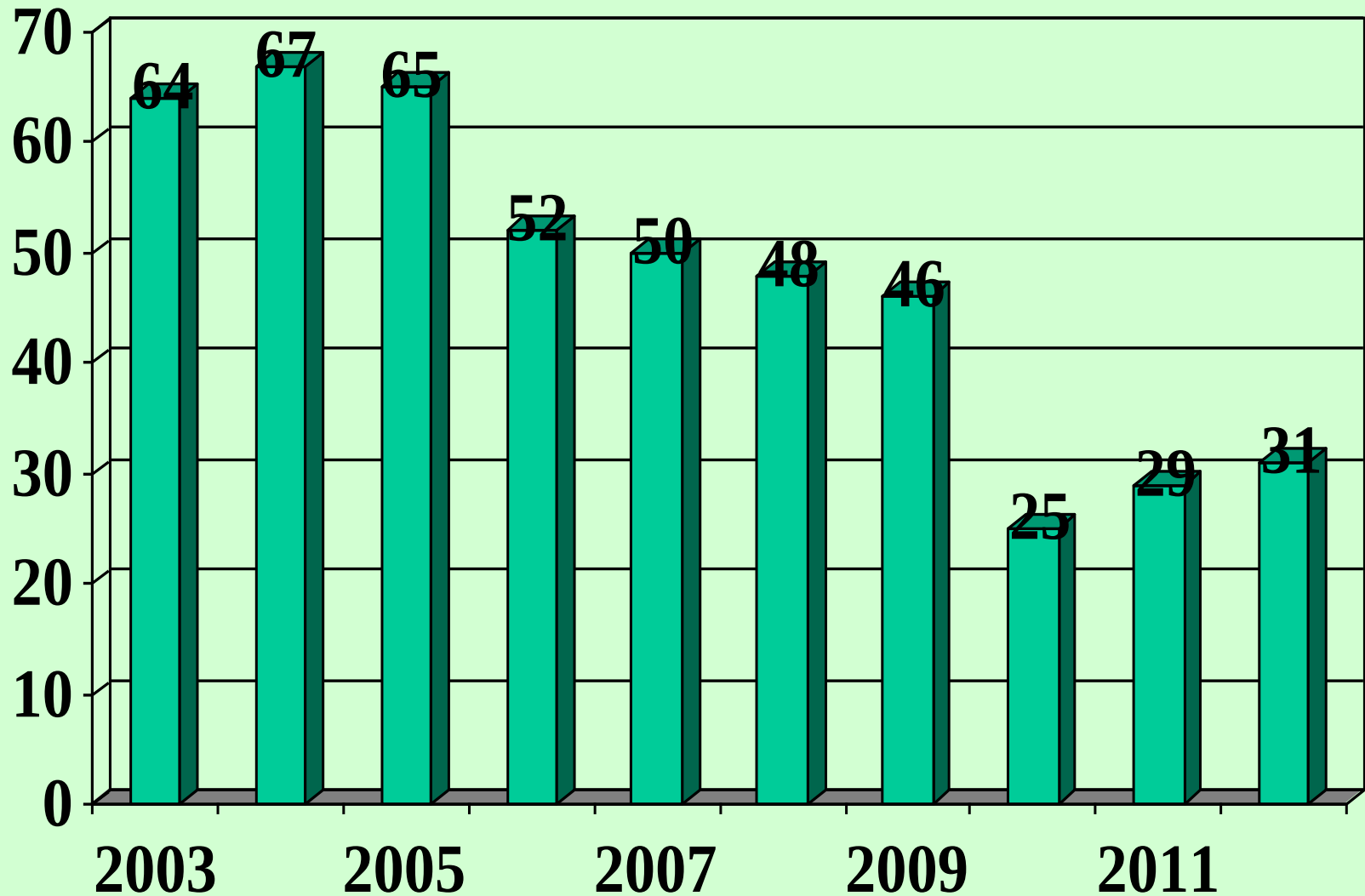
Optical and Scene Networks

Lake Tahoe

October 23, 2012

John V. Molenar
Air Resource Specialists, Inc.

Number of Optical Monitors



Optical & Webcam Networks: 10/23/2012

Network	Transmissometers		Nephelometers		Webcams and Exhibits
	Remote	Urban	Remote	Urban	
Arizona (4)	-	1	0	3	5
NPS (13)	-	-	12	1	22
Wyoming (4)	-	-	4	-	17
Colorado (4)	-	2	-	2	2
USFS (1)	1	-	-	-	20
Nevada (2) (Clark County)	-	2	-	-	2
SCDEQ (1)	-	-	1	-	-
Midwest Hazecam (0)	-	-	-	-	8
CAMNET (0)	-	-	-	-	10
Solar Energy Industry (2)	2	-	-	-	-
Totals (31)	3	5	17	6	86

SOPs/TIs

All Nephelometer, Transmissometer, and Scene SOPs and TIs are current. Updates are being made for the LED nephelometers and transmissometers.

All documents receive a yearly review (and update if necessary) during their anniversary month.

Optical Data

Nephelometer data through 06/30/2012 delivered to NPS/CIRA on 9/26/2012

Transmissometer data (2 USFS sites - Bridger & San Geronio) through 12/31/2011 delivered to NPS/CIRA on 7/18/2012

Aerosol decadal trends – Part 1: In-situ optical measurements at GAW and IMPROVE stations

M. Collaud Coen¹, E. Andrews^{2,3}, A. Asmi⁴, U. Baltensperger⁵, N. Bukowiecki⁵, D. Day⁶, M. Fiebig⁷, A. M. Fjaeraa⁷, H. Flentje⁸, A. Hyvärinen¹¹, A. Jefferson², S. G. Jennings⁹, G. Kouvarakis¹⁰, H. Lihavainen¹¹, C. Lund Myhre⁷, W. C. Malm⁶, N. Mihalopoulos¹⁰, J. V. Molenar¹², C. O'Dowd⁹, J. A. Ogren³, B. A. Schichtel¹³, P. Sheridan³, A. Virkkula⁴, E. Weingartner⁵, R. Weller¹⁴, and P. Laj¹⁵

¹Federal Office of Meteorology and Climatology, MeteoSwiss, 1530 Payerne, Switzerland

²University of Colorado, CIRES, Boulder, Colorado, 80305, USA

³National Oceanic and Atmospheric Administration, Earth System Research Laboratory, Boulder, Colorado, 80305, USA

⁴Department of Physics, University of Helsinki, P.O. Box 64, Helsinki, Finland

⁵Paul Scherrer Institute, Laboratory of Atmospheric Chemistry, 5232 Villigen PSI, Switzerland

⁶Colorado State University, Cooperative Institute for Research in the Atmosphere, Fort Collins, CO 80523, USA

⁷NILU – Norwegian Institute for Air Research, Instituttveien 18, 2027 Kjeller, Norway

⁸German Weather Service, Meteorological Observatory Hohenpeißenberg, Albin-Schwaiger-Weg 10, 82383 Hohenpeißenberg, Germany

⁹School of Physics, National University of Ireland Galway, Galway, Co. Galway, Ireland

¹⁰Environmental Chemistry Processes Laboratory, Dept. of Chemistry, University of Crete, 71003 Heraklion Crete, Greece

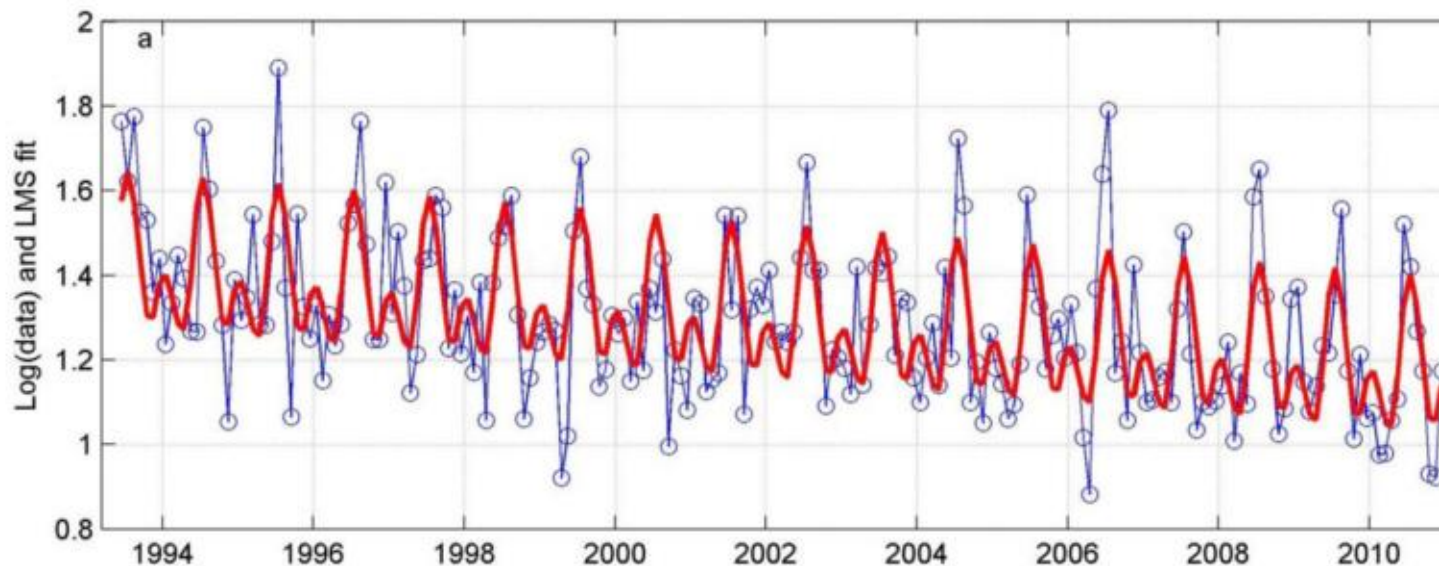
¹¹Finnish Meteorological Institute, Erik Palmenin aukio 1, 00560 Helsinki, Finland

¹²Air Resource Specialists, Inc., 1901 Sharp Point Drive, Suite E, Ft. Collins, CO 80525, USA

¹³National Park Service, Fort Collins, CO 80523, USA

¹⁴Alfred-Wegener-Institute for Polar and Marine Research, Am Handelshafen 12, 27570 Bremerhaven, Germany

¹⁵UJF-Grenoble 1/CNRS, LGGE UMR5183, 38041 Grenoble, France



LMS trend analysis of the Acadia National Park aerosol scattering coefficient: logarithm of the data monthly medians in blue and LMS fit in red.

	% Change 2001-2010	LMS Trend 95% Significance
Acadia, NP	-12.4	Negative
Big Bend, NP	-6.5	Negative
Great Smoky Mts., NP	-8.4	Negative
Grand Canyon, NP	-1.4	No trend
Mammoth Cave, NP	-2.0	No trend
Mt. Rainier, NP	-4.1	No trend
Shenandoah, NP	-4.0	No trend
Phoenix, AZ	-9.9	Negative
Ike's Backbone W, AZ	11.5	Positive
Sycamore Canyon W, AZ	1.6	No trend
Sierra Ancha W, AZ	-20.4	Negative
Mt Zirkel W, CO	21.7	Positive

NPS Webcam Network and Web Site Upgrades

November 2008: Start of partnership between NPS and Olympus to upgrade and support 16 site webcam network

Oct 2010 – Oct 2011: Shenandoah, Hawaii Volcanoes and Grand Tetons added to network.

Network Operations (NPS-Olympus Partnership funded to October 2011)

- Technical support, backup equipment, communications, archive
- Annual agreements. Third and final agreement ended October 1, 2011

Network Upgrades

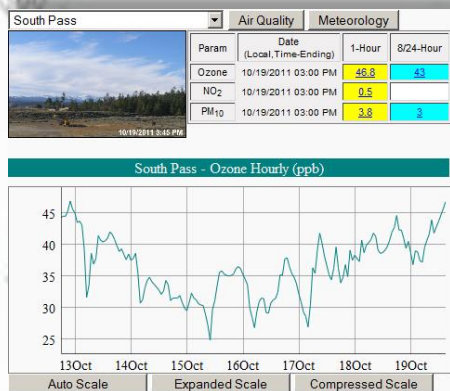
- Backup digital SLRs (E420) supplied by Olympus available to network
- Dial-up connections being replaced with cellular, DSL or DOI network where possible (Sequoia, Olympic, Point Reyes complete, Mount Rainier, Theodore Roosevelt planned)
- Camera control software updated to support new camera settings and additional camera models (ie. Canon Rebel series)

Web Site Upgrades (NPS-ARD funded)

- NPS-ARD redesigned web site went live early Summer 2010
- Continuing improvements to image and web site content creation software
- NPS-ARD developing online archive of all digital images captured since network inception

Mobile Applications

ARS has developed mobile applications for...



Displaying images and monitoring data

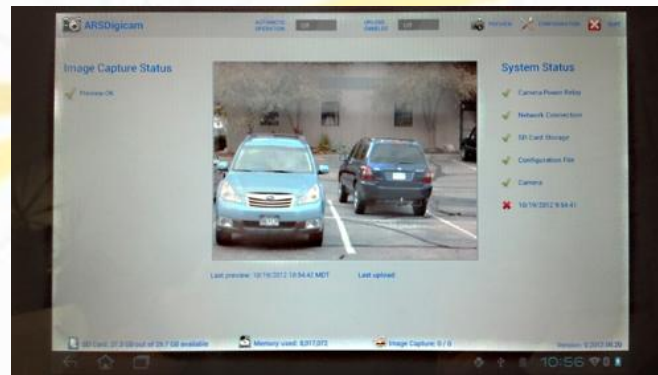


Image capture from digital SLR camera

AQDB Data Collection Status 10/19/2011 16:06

PollAbbr	MinAgo	PollGroup	LastTime
AFTC	0	A	10/19/2011 16:06
BASI	57	A	10/19/2011 15:09
BLIS	711	A	10/19/2011 04:15
BOULDER	56	B	10/19/2011 15:10
BRSo-TR	649	A	10/19/2011 05:17
BRSoanlg	653	A	10/19/2011 05:13
BRSoDig	651	A	10/19/2011 05:15
BU	51	A	10/19/2011 15:15
CAMP	54	D	10/19/2011 15:11
CAMT	57	B	10/19/2011 15:09
CASP-SR	102930	A	08/09/2011 04:36
CAVE2	44	B	10/19/2011 15:22
CHEY-SC	471	D	10/19/2011 08:15
CHEY-SC1H	3	D	10/19/2011 16:03
CHEY1min	660	D	10/19/2011 05:06
CHEYBAM	48	A	10/19/2011 15:18
CHEY_5min	602	D	10/19/2011 06:03
CLHA	743	A	10/19/2011 03:43
CPWA	1062	A	10/19/2011 07:02

Summarizing data collection status



Presenting time lapse video



NPS WebCam Stats 2011 – Pages

Rank	Park (through September)	Visits	Daily Average
1	Great Smoky Mountains NP- Purchase Knob	837,301	2,294
2	Great Smoky Mountains NP – Look Rock	786,850	2,156
3	Grand Canyon NP	688,667	1,887
4	Point Reyes NS	357,175	978
5	Denali NP	306,075	839
6	Mount Rainier NP	265,330	726
7	Washington DC Mall	255,104	699
8	Yosemite NP	244,747	671
9	Olympic NP	241,273	661
10	Sequoia-Kings Canyon NP	236,464	648
11	Theodore Roosevelt NP	205,140	562
12	Mammoth Cave NP	185,401	508
13	North Cascades NP	180,947	496
14	Acadia NP	155,517	426
15	Joshua Tree NP	139,123	381
16	Shenandoah NP (partial year)	130,269	357
17	Big Bend NP	121,441	333
18	Hawai'i Volcanoes NP (partial year)	113,286	310
19	Grand Teton NP (partial year)	66,428	182
Total		5,516,618	

NPS WebCam Stats 2012 – Pages

Through September 30

Rank	Park (through September)	Visits	Daily Average (based on 274 days)
1	Grand Canyon NP	613,562	2,239
2	Great Smoky Mountains NP – Purchase Knob	507,348	1,852
3	Great Smoky Mountains NP – Look Rock	460,570	1,680
4	Point Reyes NS	215,473	786
5	Washington DC Mall	189,038	691
6	Sequoia-Kings Canyon NP	183,293	669
7	Grand Teton NP	180,637	659
8	Mount Rainier NP	166,087	606
9	Olympic NP	158,334	578
10	Denali NP	154,282	563
11	Yosemite NP	139,429	509
12	Theodore Roosevelt NP	133,146	486
13	Mammoth Cave NP	124,593	455
14	North Cascades NP	118,435	432
15	Shenandoah NP	112,641	411
16	Hawai'i Volcanoes	105,975	387
17	Acadia NP	98,354	359
18	Joshua Tree NP	92,181	336
19	Big Bend NP (partial year)	79,236	289
Total		3,832,612	

NPS WebCam Stats 2011 – Images

Rank	Park	Image Visits
1	Denali NP	3,824,033
2	Grand Canyon NP	3,260,319
3	Great Smoky Mts NP - Look Rock	1,748,899
4	Great Smoky Mtns NP – Purchase Knob	1,398,401
5	Big Bend NP	373,038
6	Point Reyes NP	357,175
7	Acadia NP	285,831
8	Mount Rainier NP	265,330
9	Washington DC Mall NP	255,104
10	Yosemite NP	244,747
11	Olympic NP	241,273
12	Sequoia – Kings Canyon NP	236,464
13	Theodore Roosevelt NP	205,140
14	Mammoth Cave NP	185,481
15	North Cascades NP	180,947
16	Joshua Tree NP	139,123
17	Shenandoah NP (partial year)	130,269
18	Hawai'i Volcanoes NP (partial year)	113,286
19	Grand Teton NP (partial year)	66,428
Total		

NPS WebCam Stats 2012 – Images

Through September 30

Rank	Park	Image Visits
1	Denali NP	2,400,933
2	Grand Canyon NP	1,689,366
3	Great Smoky Mts NP - Look Rock	920,432
4	Great Smoky Mtns NP – Purchase Knob	807,187
5	Big Bend NP	236,866
6	Point Reyes NP	215,473
7	Washington DC Mall NP	189,036
8	Acadia NP	184,452
9	Sequoia – Kings Canyon NP	183,293
10	Grand Teton NP NP	180,637
11	Mount Rainier NP	166,087
12	Olympic NP	158,334
13	Yosemite NP	139,429
14	Theodore Roosevelt NP	133,146
15	Mammoth Cave NP	124,593
16	North Cascades NP	118,435
17	Shenandoah NP (partial year)	112,641
18	Hawai'i Volcanoes NP	105,975
19	Joshua Tree NP	92,181
Total		

NPS WebCam Stats

2010-2012 Monthly Summary

- Cumulative as year progresses.
- *New web site fully operational in 2011. Page and image structure changed.
- **Site move to new web server in 2012. Several weeks of down time.

Month	Website Visits			Photo Image Visits		
	2010	2011*	2012**	2010	2011*	2012**
January	451,042	513,989	459,978	2,049,129	1,098,377	1,060,079
February	847,662	896,263	1,311,657	3,855,339	1,982,918	2,889,893
March*	1,205,117	1,385,259	2,118,231	5,595,047	3,141,685	4,760,095
April	1,508,443	1,797,284	2,768,208	7,052,696	4,195,456	6,429,538
May	1,788,968	2,190,938	3,021,260	8,561,899	5,269,692	6,973,849
June	2,134,070	2,617,237	3,210,446	10,116,835	6,375,221	7,243,967
July	2,483,389	3,064,423	3,444,089	11,649,638	7,535,156	7,597,458
August	2,821,834	3,505,861	3,632,338	13,042,821	8,673,499	7,870,311
September	3,190,536	3,970,698	3,832,612	14,521,384	9,883,145	8,158,496
October	3,802,349	4,537,517		16,654,932	11,182,611	
November	4,242,234	5,001,288		18,255,632	12,307,925	
December	4,808,119	5,516,618		20,274,168	13,511,279	

To Salt Lake City & Denver

UTAH



**BRYCE
CANYON
NATIONAL
PARK**



**ZION
NATIONAL
PARK**



**Alton Coal, LLC
Project Location**

To Las Vegas
& Los Angeles

To Grand Canyon National Park

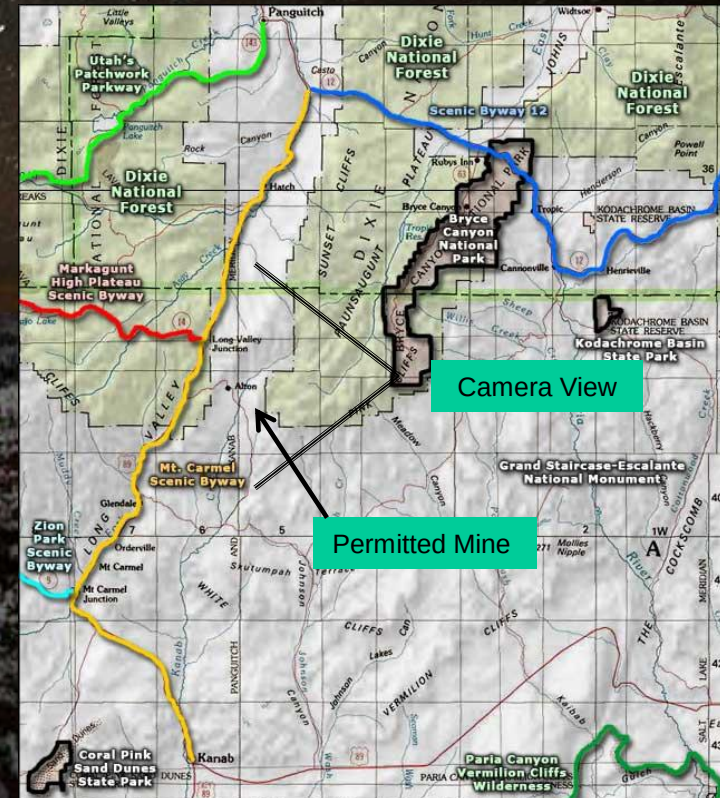
Nighttime Visual Intrusion Monitoring Bryce Canyon National Park

Qualitative Monitoring

- Capture night sky images prior to and during operation
- Capture images compatible with NPS webcam network (day and night)
- Remote low power operation using Canon DSLR and Android tablet controller with custom app

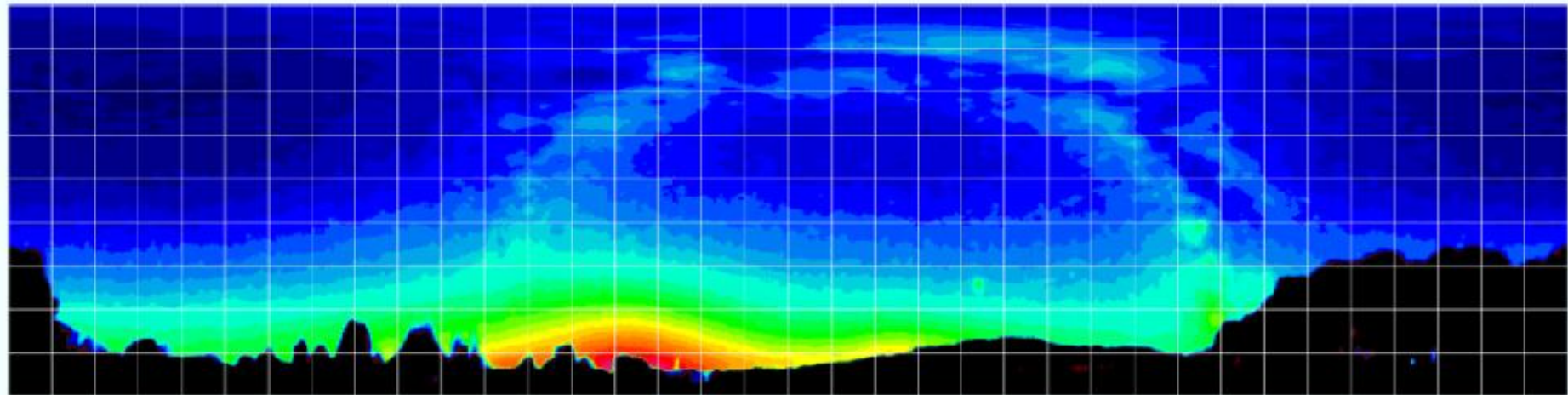
Quantitative Monitoring

- Derive spectral radiance field from raw images
 - Determine flat field response of lens/ camera system
 - Calibrate camera to known radiance field
 - Handle cloudless and cloudy conditions
 - Hourly or sub-hourly image capture
- Compare data to measurements with sky quality meter



Calibrated DSLR images

Zselic Landscape Protection Area



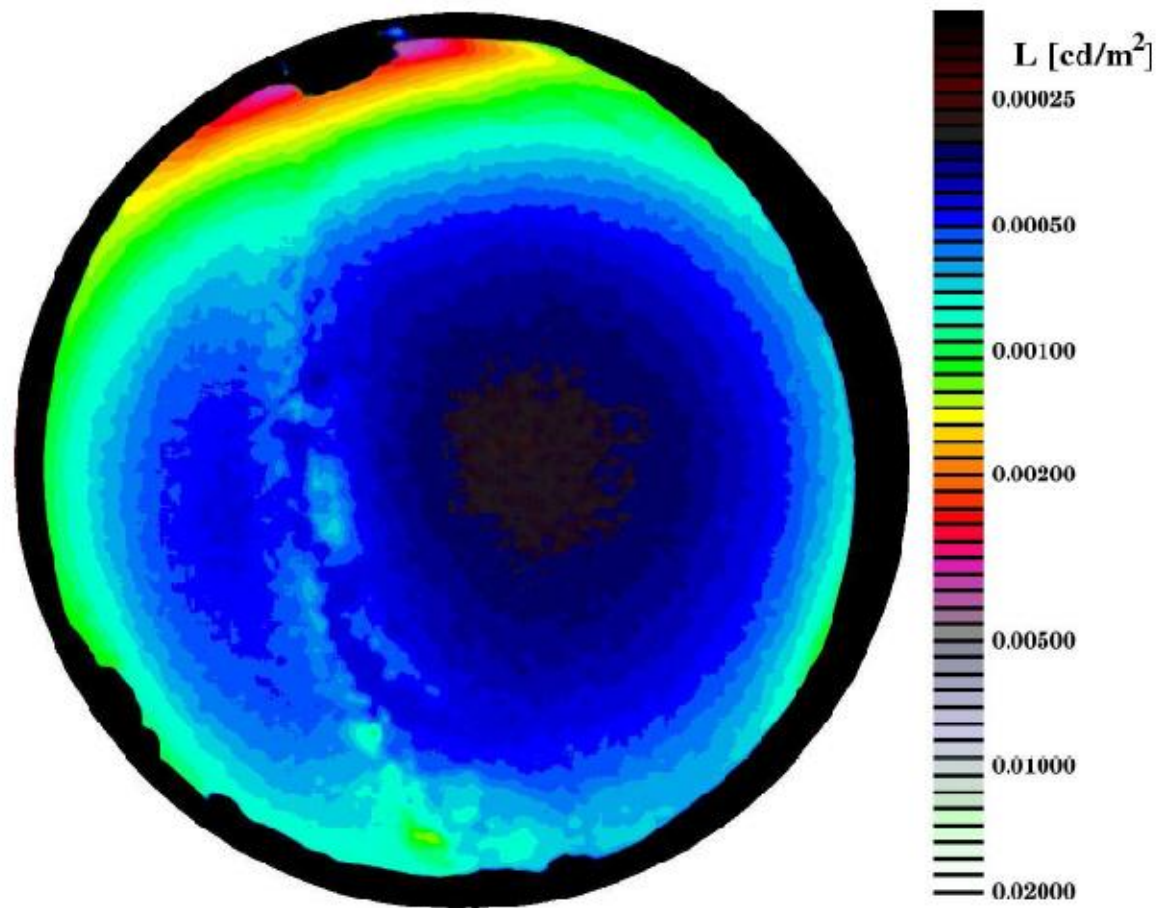


Figure 1. Luminance distribution of the clear night sky at a typical location inside the Zselic Landscape Protection Area. The brighter part at the top of the image indicates the direction of the city of Kaposvár.

