Qualifying Dark Sky Parks

Kolláth Zoltán

Update – Hungarian parks

Dark Sky Parks in Hungary

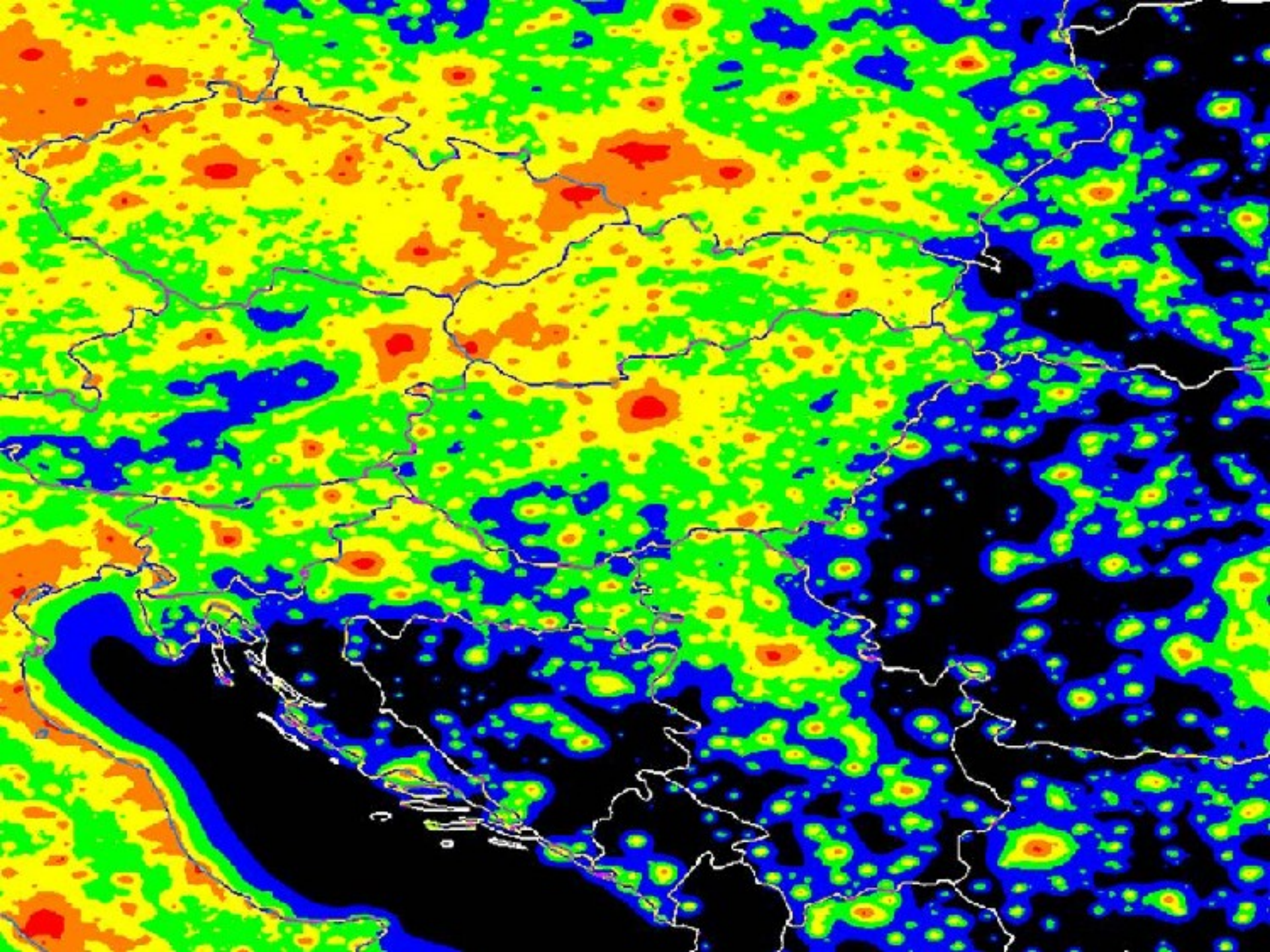
IDSPs recognized by IDA:

2009: (Nominated in Armagh, 2009)
Zselic Starry sky Park
Zselic Landscape Protection Area
supervised by Duna-Dráva National Park

2011: (Nominated in Kaposvár, 2010)
Hortobágy Starry Sky Park
In: Hortobágy National Park

ZSELICI CSILLAGOSÉGBOLT-PARK
ZSELIC STARRY SKY PARK

HORTOBÁGYI CSILLAGOSÉGBOLT-PARK
HORTOBÁGY STARRY SKY PARK



Dark Sky Parks in Hungary

New Candidates:

Kőrös-Maros National Park
- Pusta of Dévaványa-Ecseg

Bükk National Park

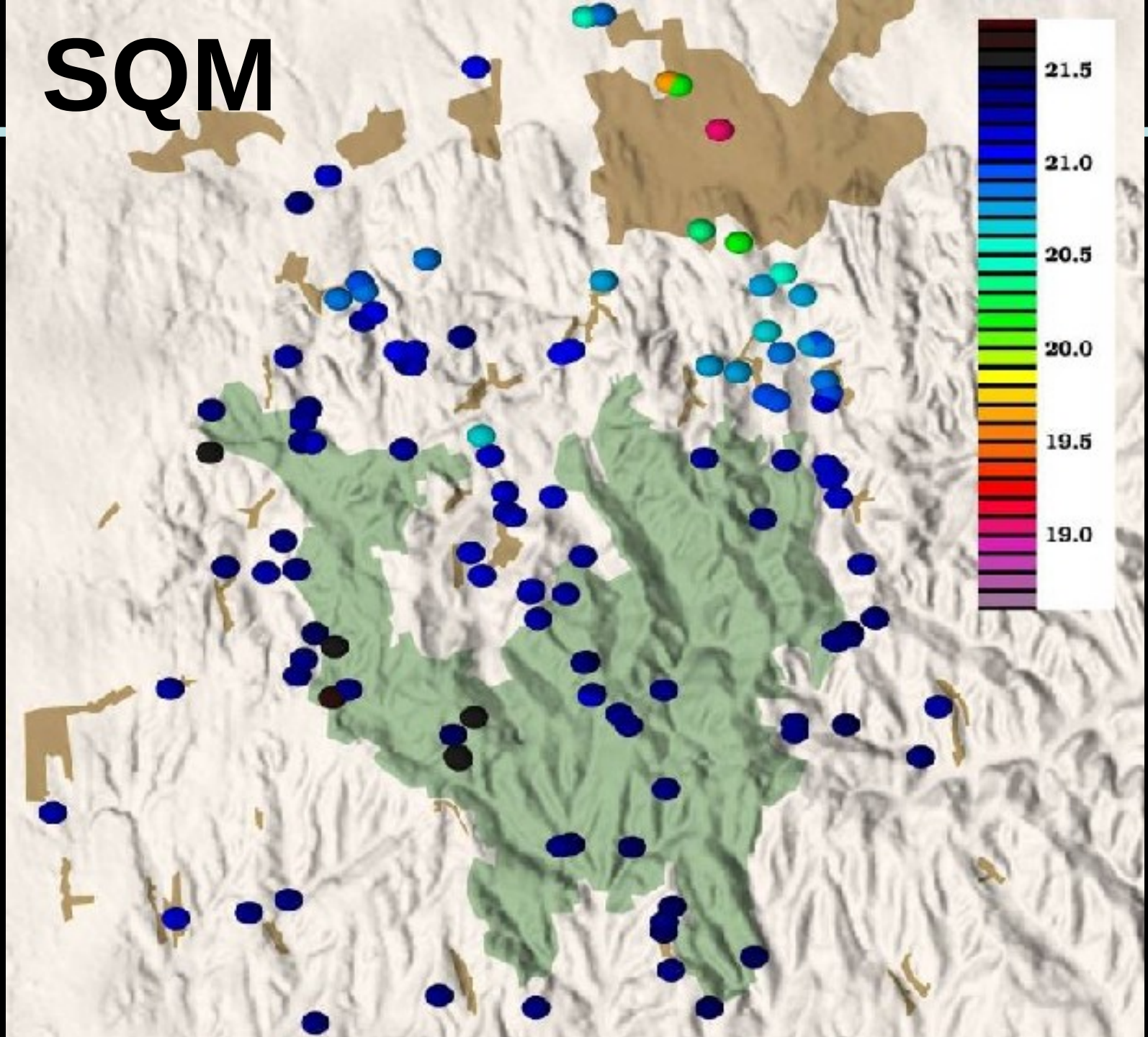
Aggtelek National Park
- National Park + Zemplén LPA

Balaton Uplands National Park
- High Bakony LPA

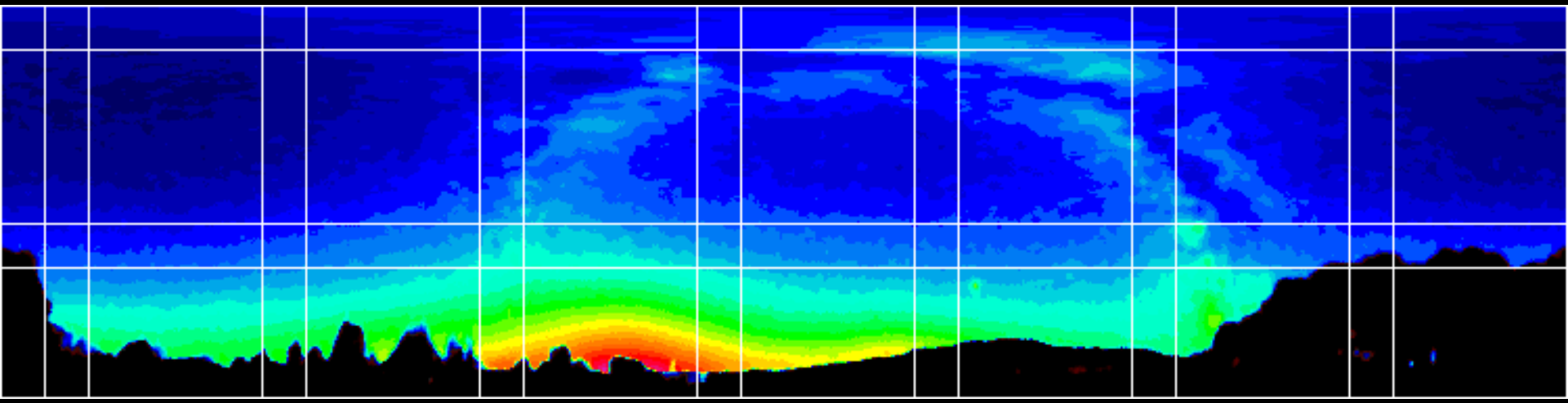
National Parks in Hungary

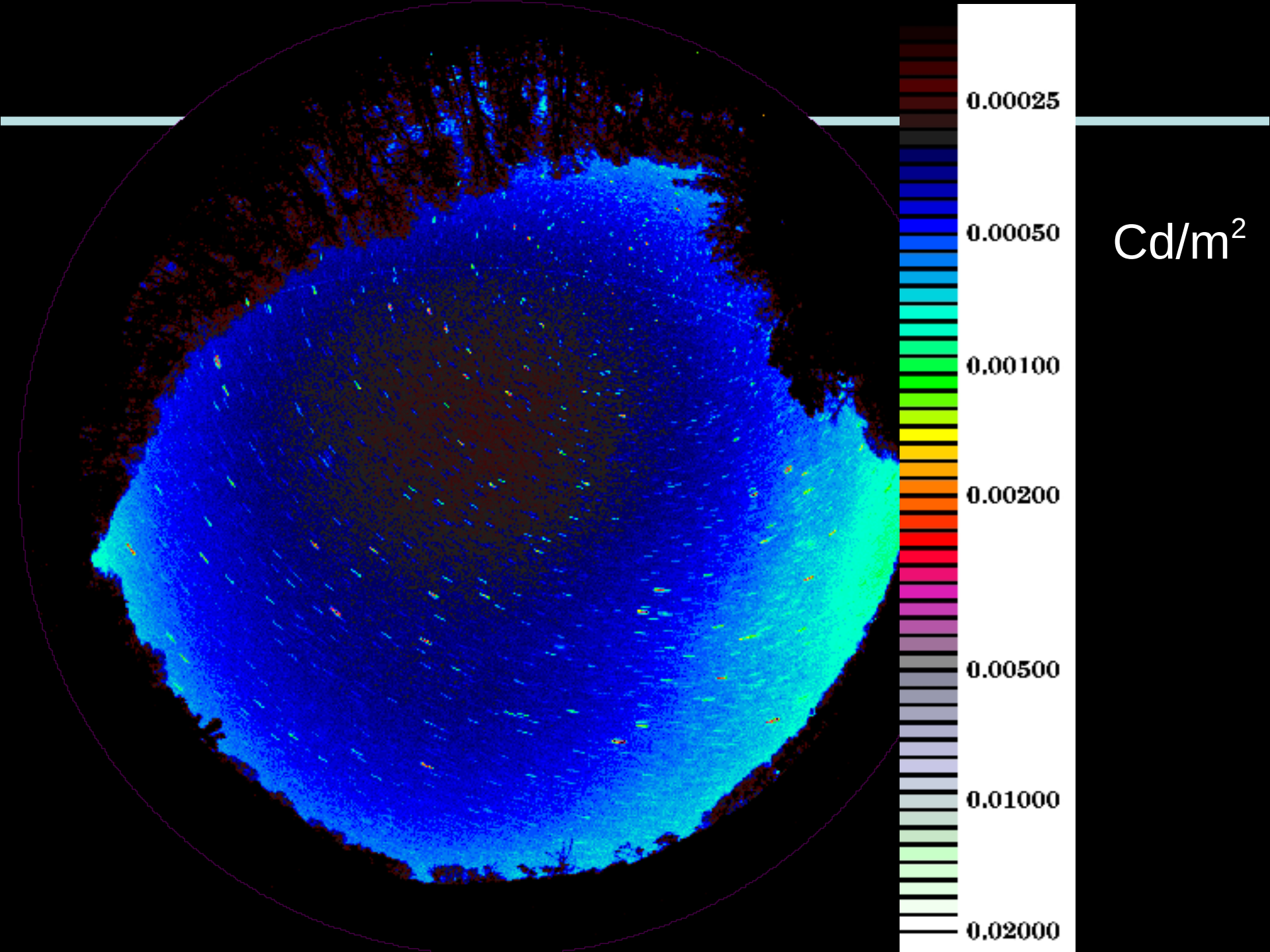
Measuring methods we applied:

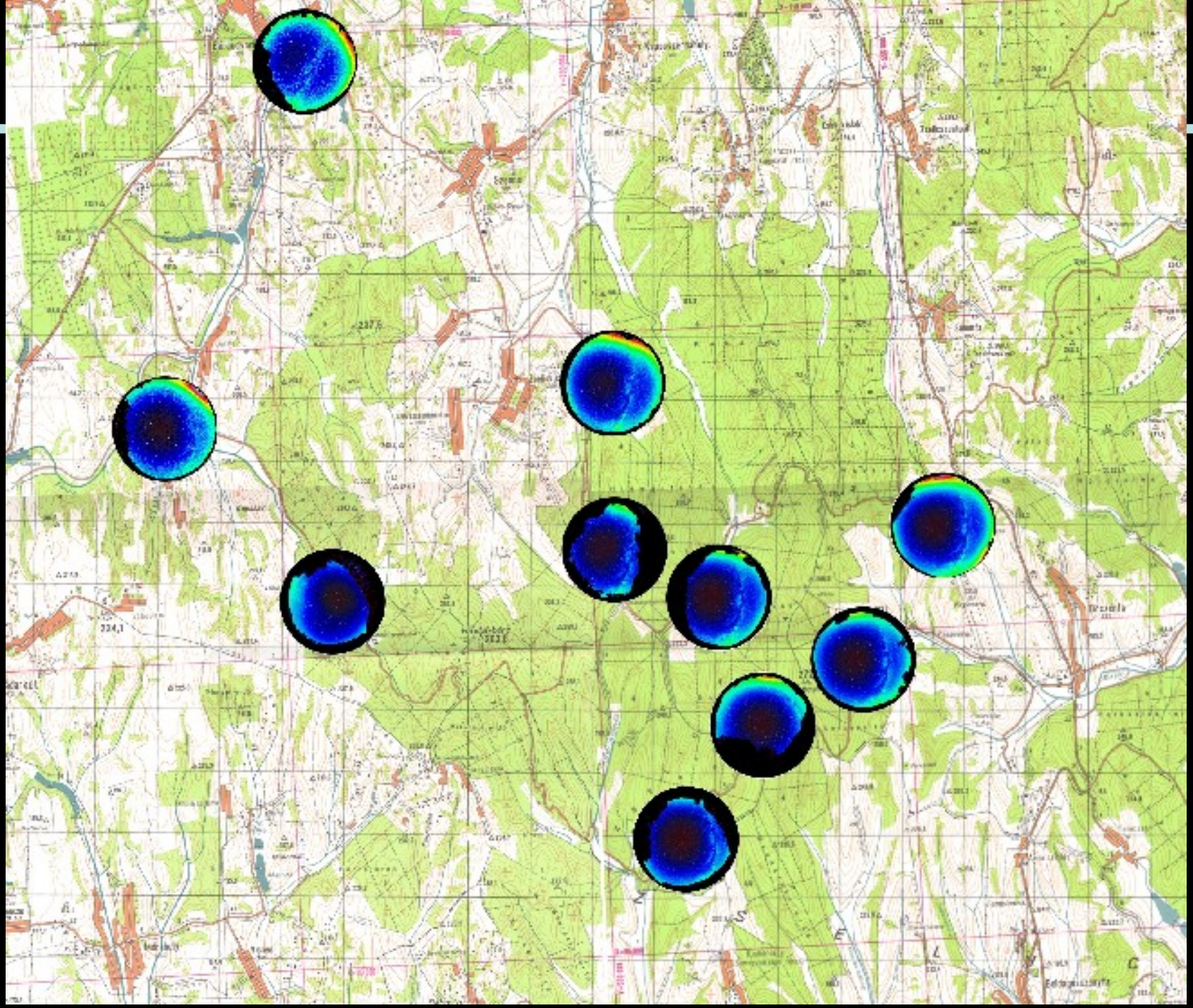
SQM



Calibrated DSLR + fisheye lens




0.00025
0.00050
0.00100
0.00200
0.00500
0.01000
0.02000
Cd/m2



Objective quality criteria (measurements)

Cinzano et. al .2001 Sky Brightness Model	< 0.11 artificial light contribution at zenith (as a fraction of natural background)	0.11-3.0 artificial light contribution at zenith (as a fraction of natural background)	3.0-9.0 artificial light contribution at zenith (as a fraction of natural background)
NPS Method Total Sky Brightness Above 20° Alt.	*Pending- propose –6.75*	*Pending- propose –8.00*	*Pending- propose –10.00*
Unihedron Sky Quality Meter	*Pending- propose 21.75*	*Pending- propose 21.00*	*Pending- propose 20.00*

Dark-Sky Park Program
(Version 1.31 - 2006)

Majority of proposals: SQM

But: SQM (old) vs. SQM L(E/U)

Objective quality criteria (measurements)

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Unihedron Sky Quality Meter	*Pending- propose 21.75*	*Pending- propose 21.00*	*Pending- propose 20.00*

Cinzano 2001: Natural Sky Luminance (NSL)

NSL 250 µcd/m2≃21.75 SQM

+ 0.11 * NSL ≃ 21.64 SQM

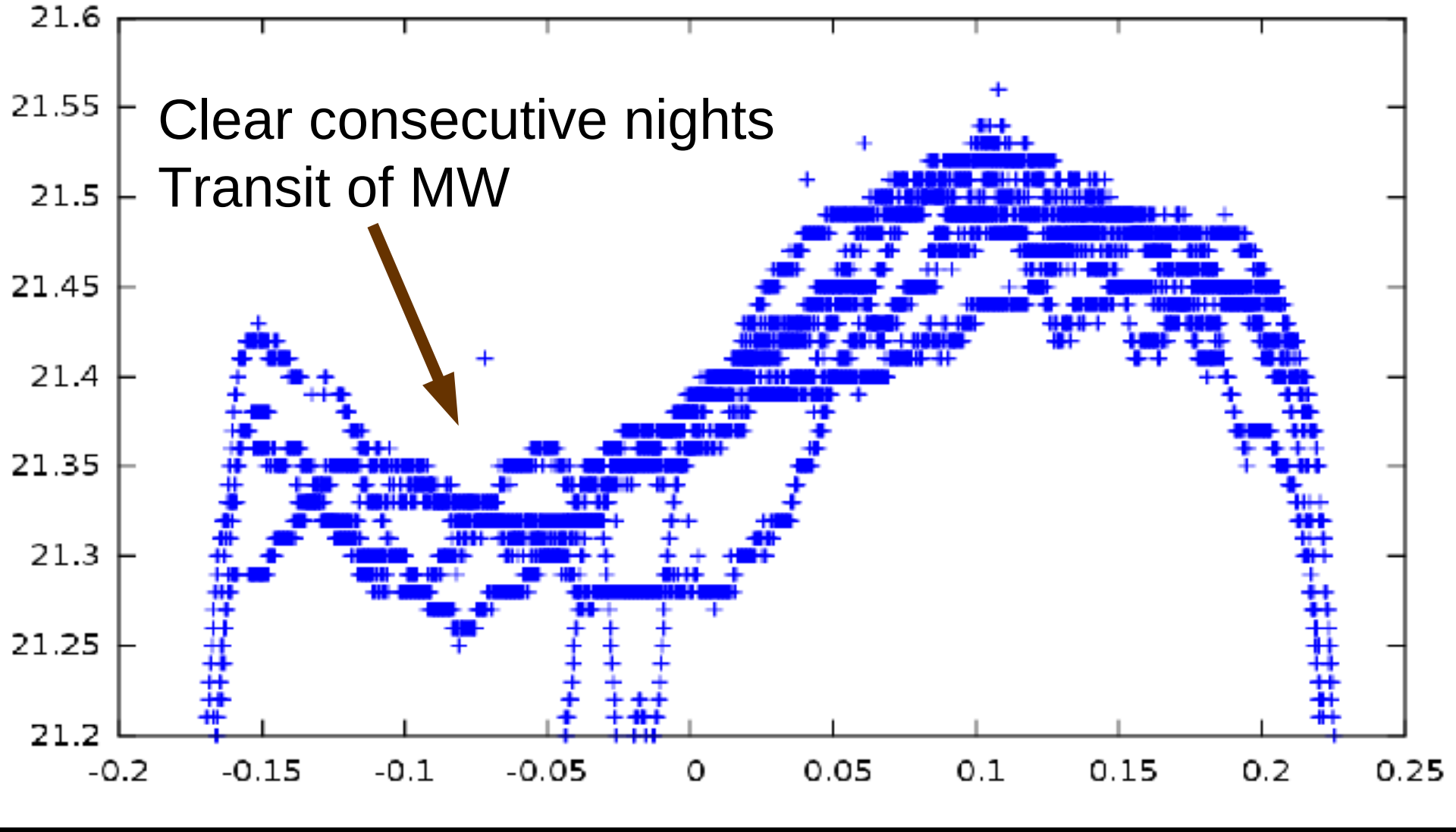
+ 0.50 * NSL ≃ 21.31 SQM

+ 2.00 * NSL ≃ 20.56 SQM

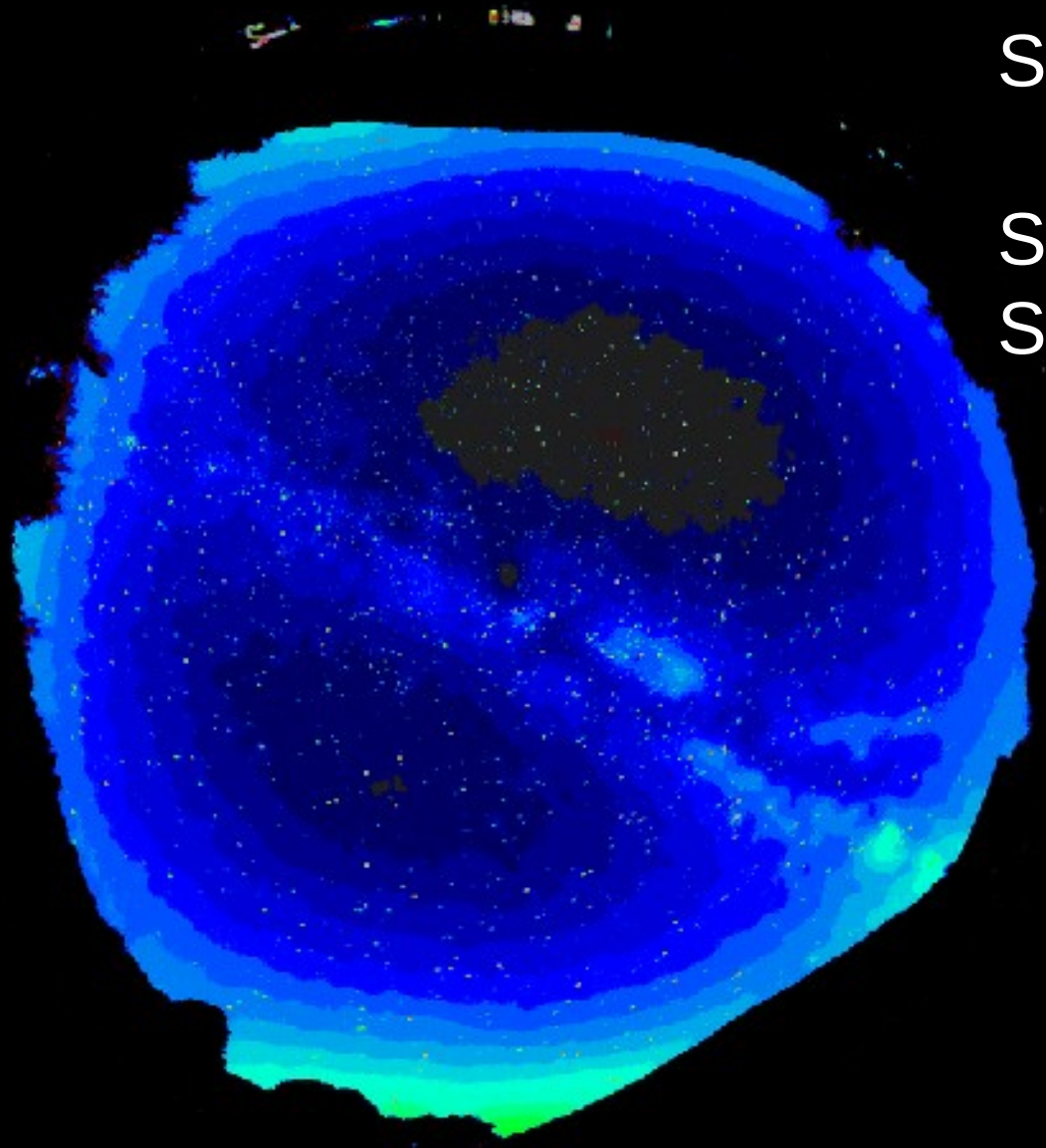
+ 3.00 * NSL ≃ 20.25 SQM

+ 9.00 * NSL ≃ 19.26 SQM

Effect of Milky Way on SQM-LE values



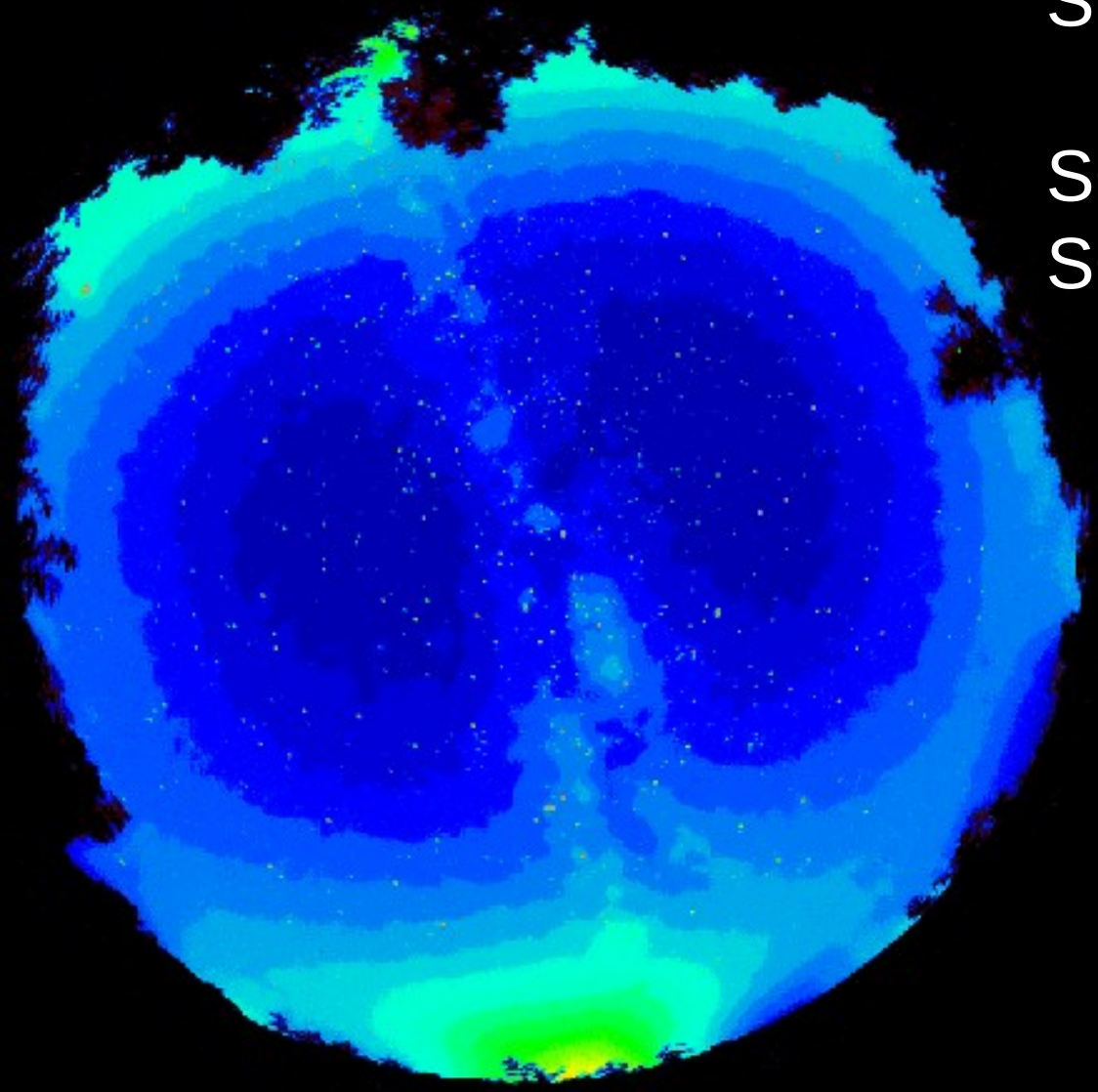
Wide angle SQM vs SQM-LE



Simulated values:

SQM: 21.26
SQM-LE 21.22

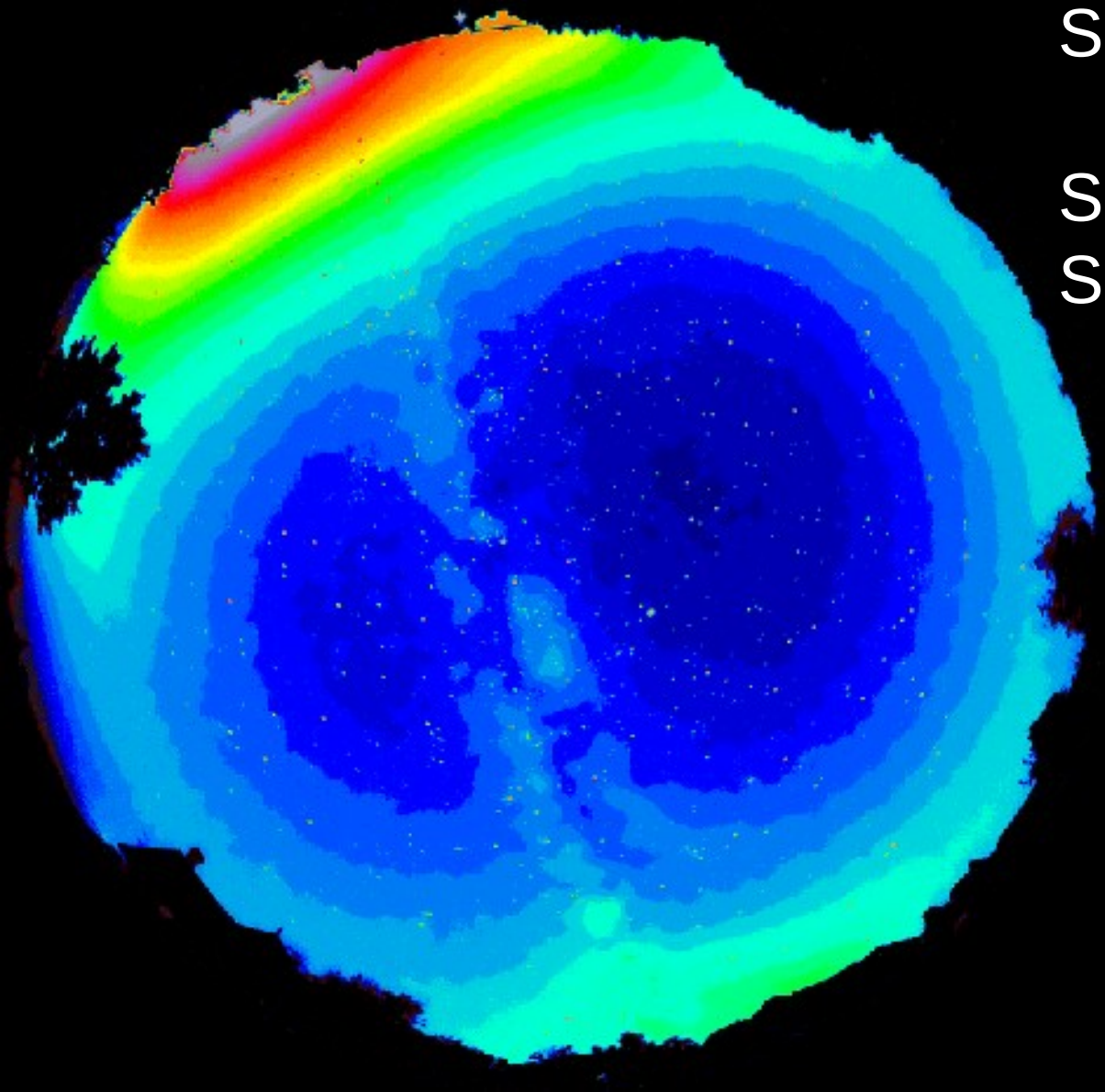
Wide angle SQM vs SQM-LE



Simulated values:

SQM: 21.06
SQM-LE 21.08

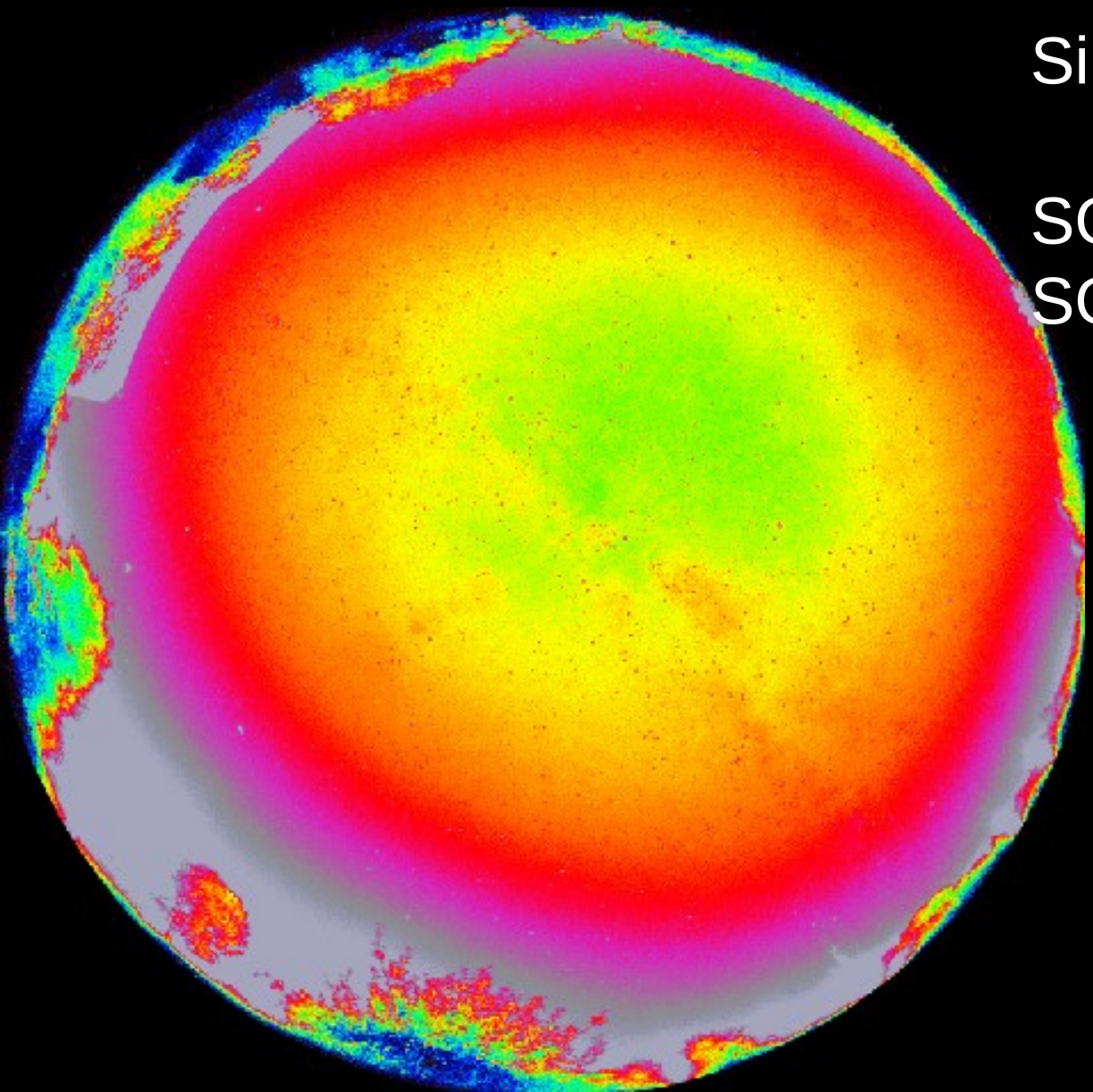
Wide angle SQM vs SQM-LE



Simulated values:

SQM: 20.98
SQM-LE 21.09

Wide angle SQM vs SQM-LE



Simulated values:

SQM:	19.65
SQM-LE	19.88

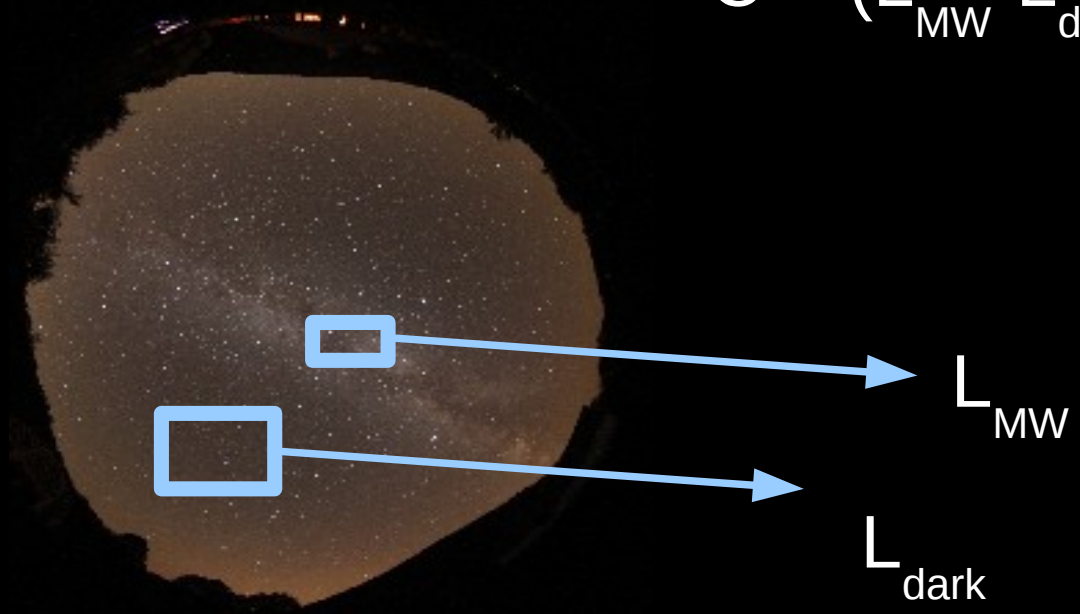
Other possibilities to measure sky quality

- Many proposals contain fish eye images of the whole sky.
- Problem: calibration (laboratory, luminance meter, etc.)
- But: Raw images contain useful information...

Other possibilities to measure sky quality

A proposed measure: Contrast of the
Milky Way compared to the darkest part of the sky

$$C = (L_{MW} - L_{dark}) / L_{dark}$$



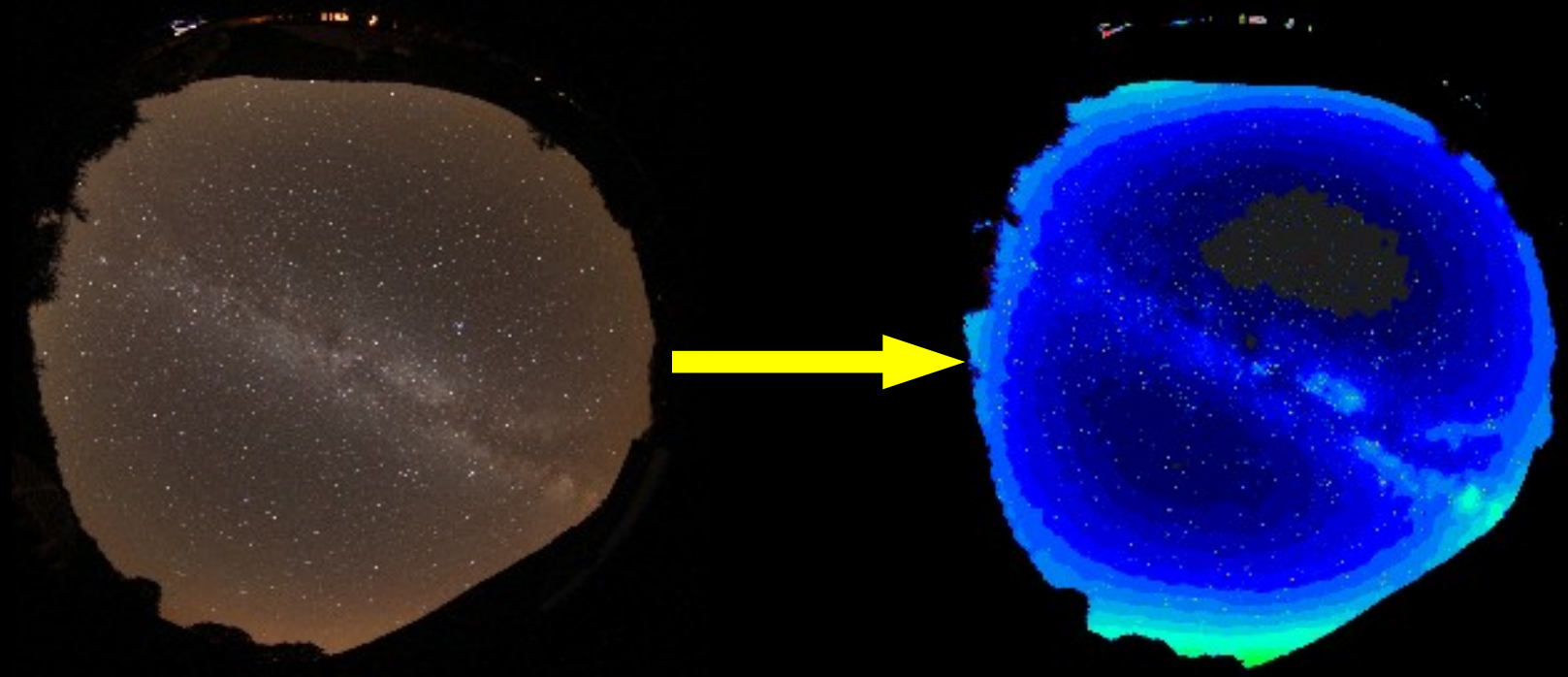
Other possibilities to measure sky quality

Visibility of Milky Way depends on its contrast relative to the sky background!

$$C = (L_{MW} - L_{dark}) / L_{dark}$$

- RAW images provides the necessary information
- No absolute calibration needed (but for vignetting)
- Which part of the Milky Way?
  - Solution: construct a contrast map...

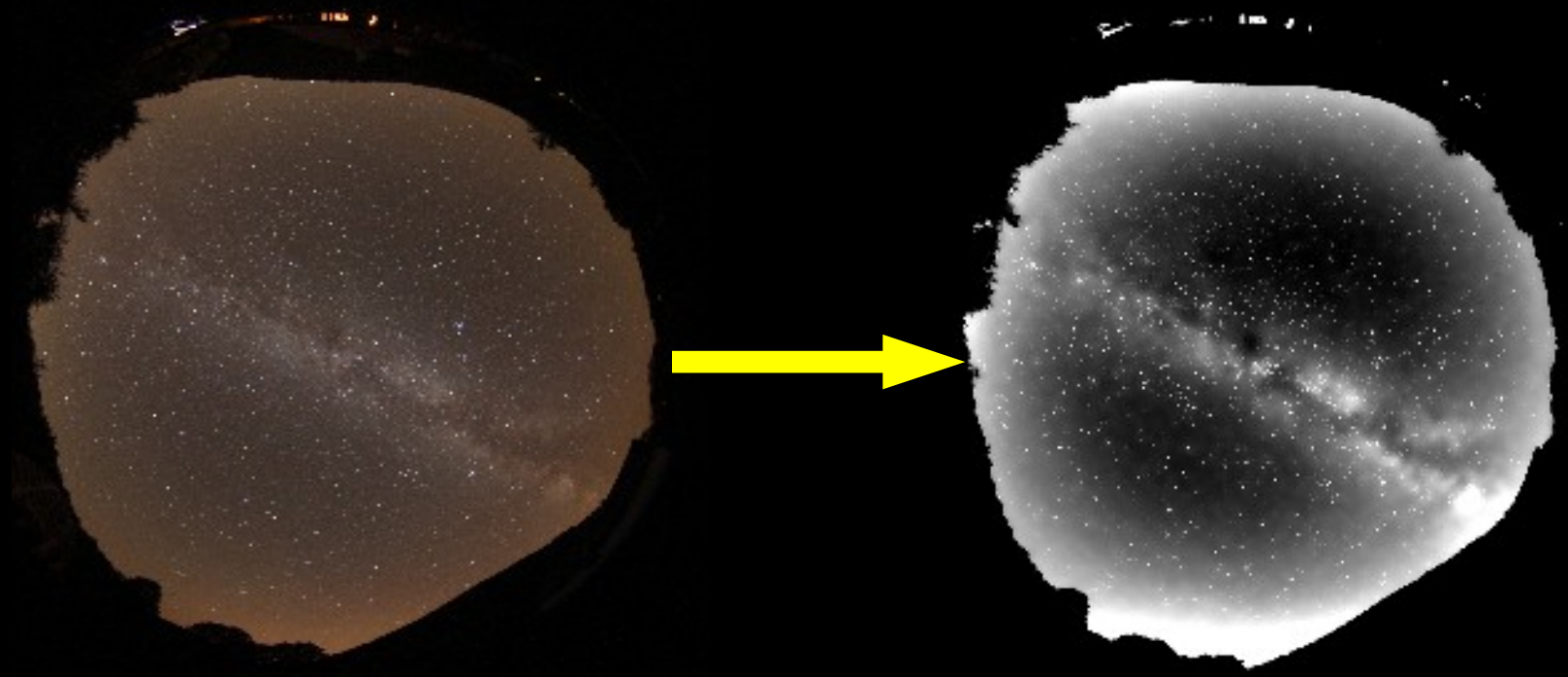
Other possibilities to measure sky quality



Calibration is necessary!

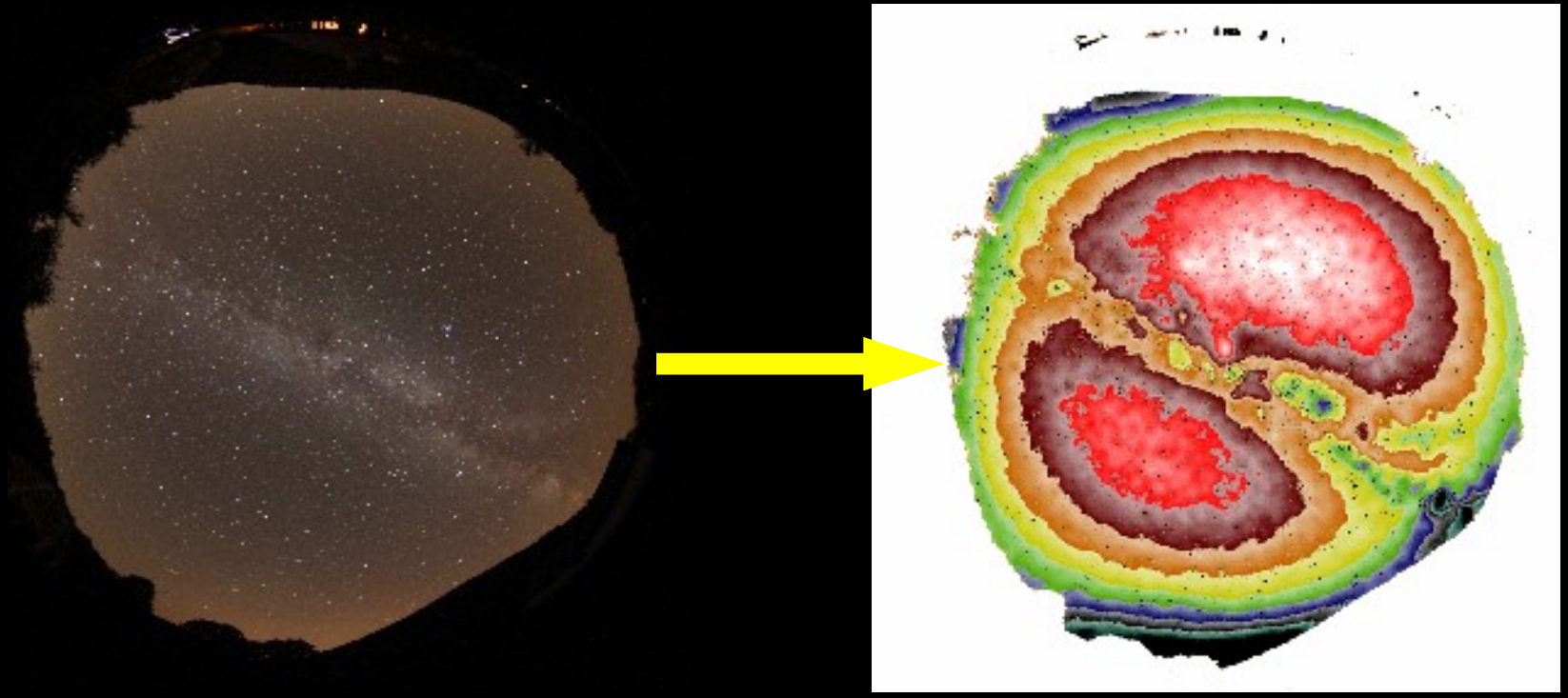
Luminance map

Other possibilities to measure sky quality



Gray-scale contrast map

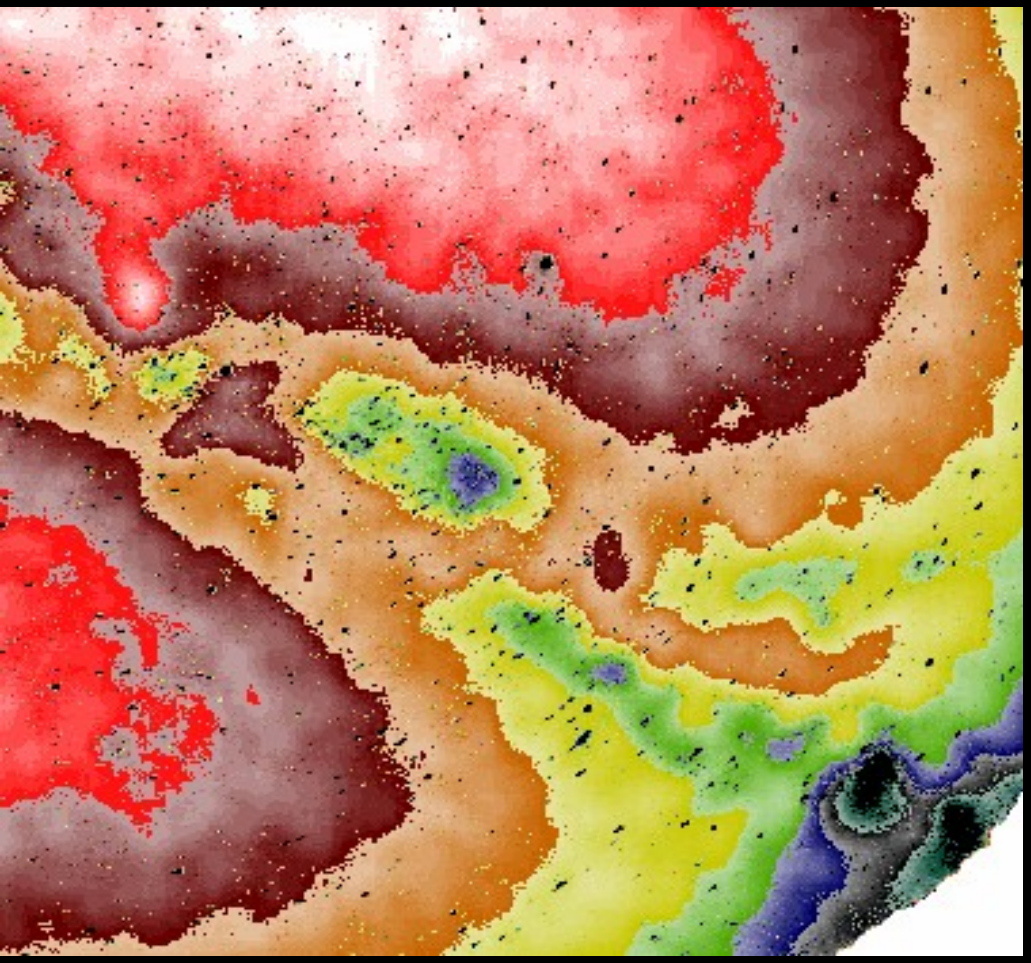
Other possibilities to measure sky quality

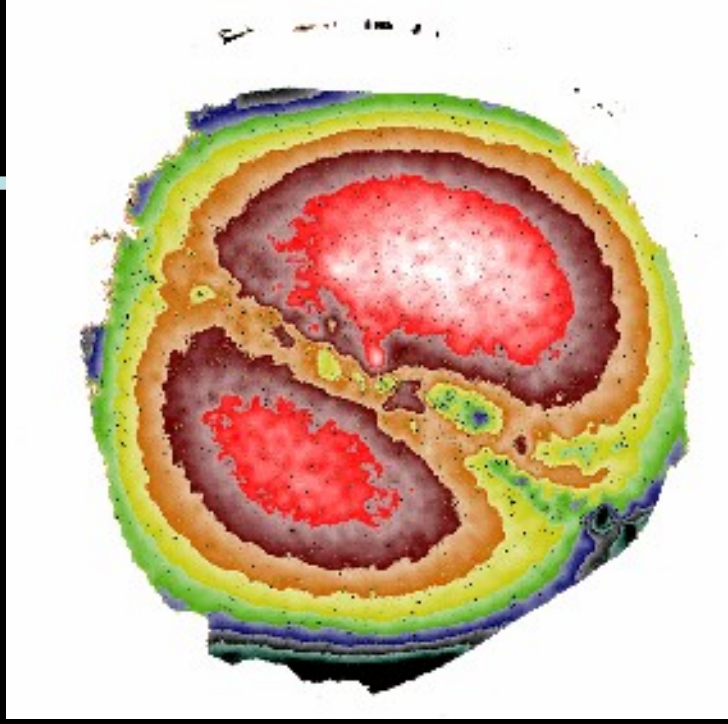


False colour contrast map

Colouring scheme

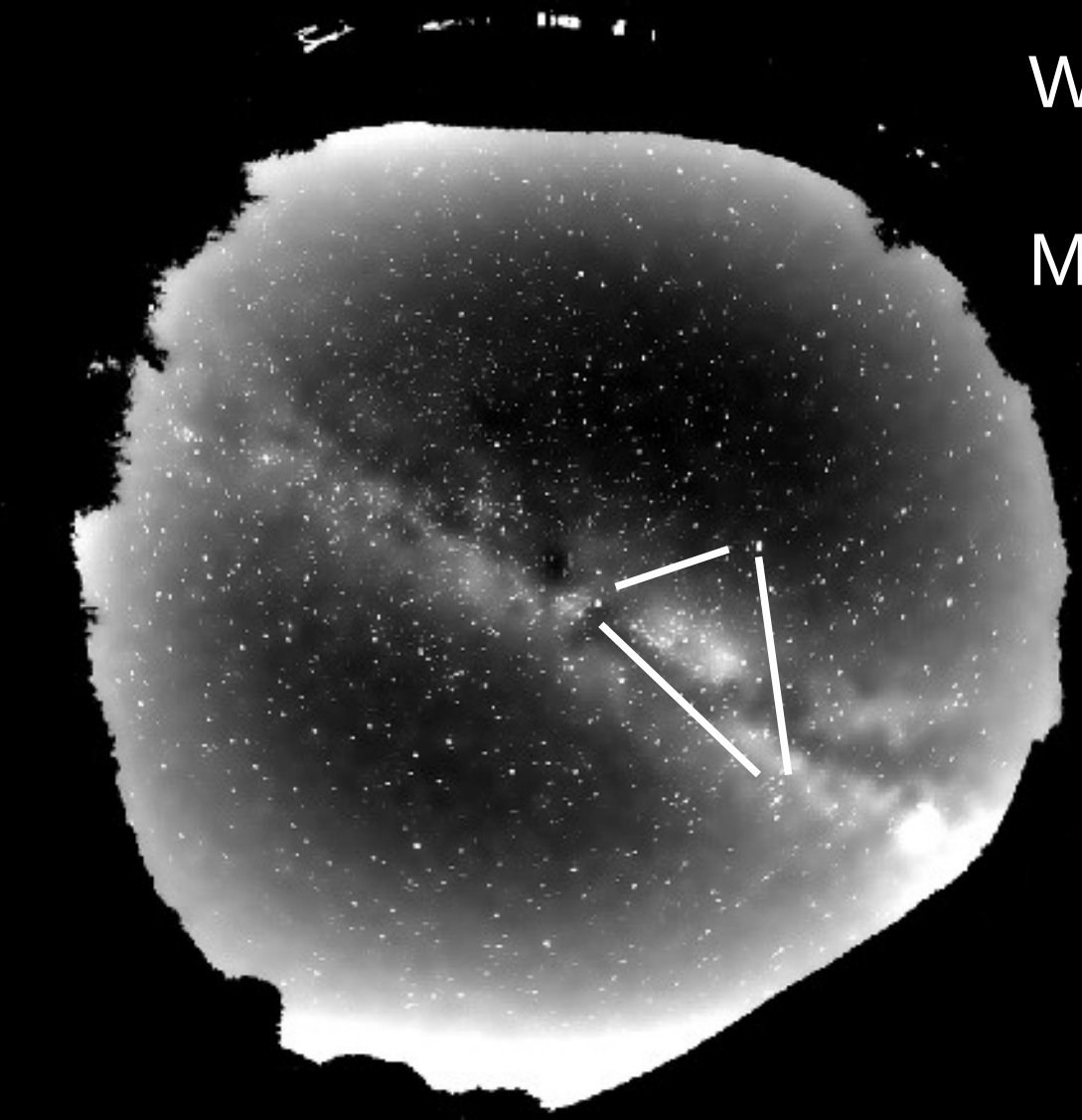
C=0.0 0.2 0.4 0.6





0.8 (yellow)
1.0 (green)
1.2 (blue)
1.4 (black)
1.6 (turquoise)

Other possibilities to measure sky quality



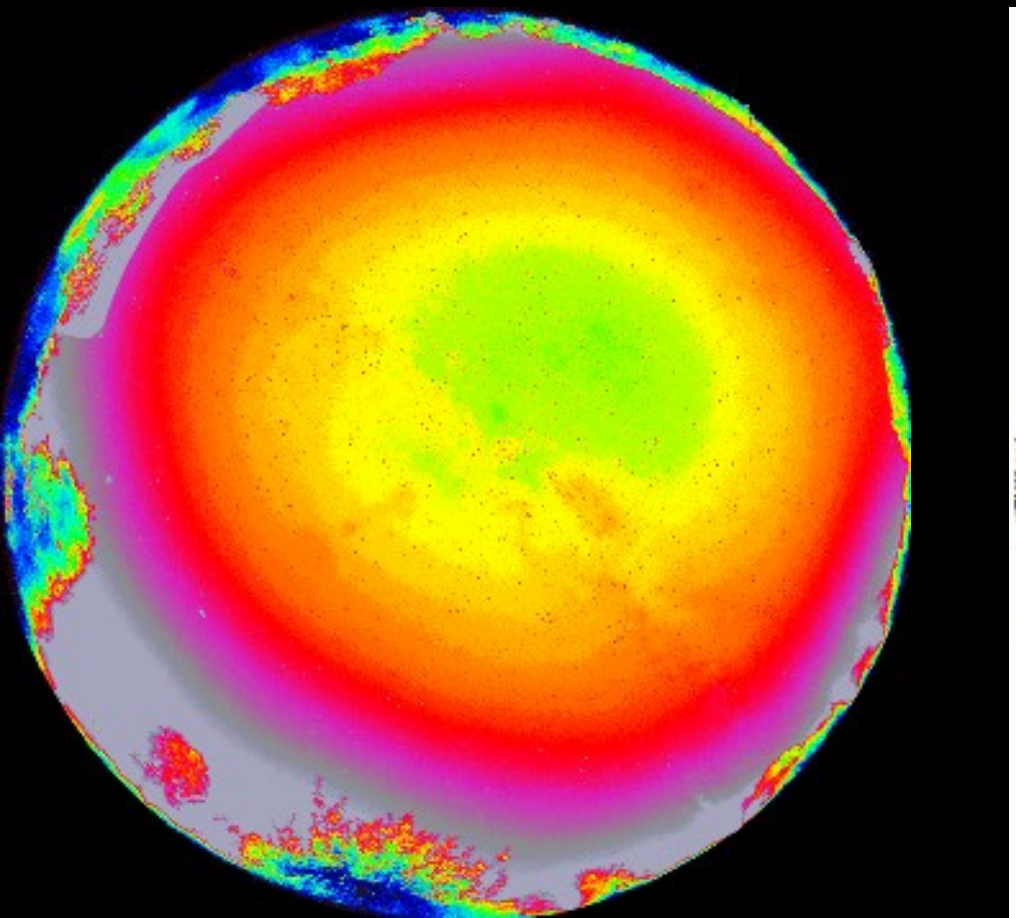
Which part of the MW?

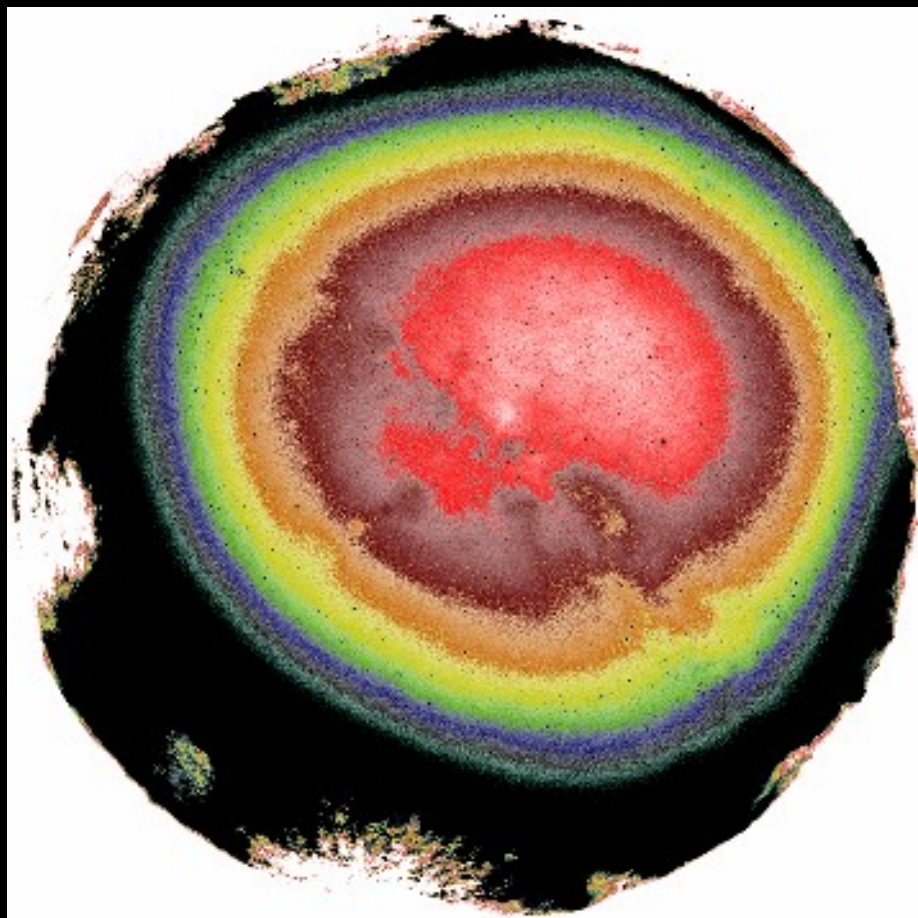
Mid latitudes:

Brightest blob in Summer Triangle

Examples

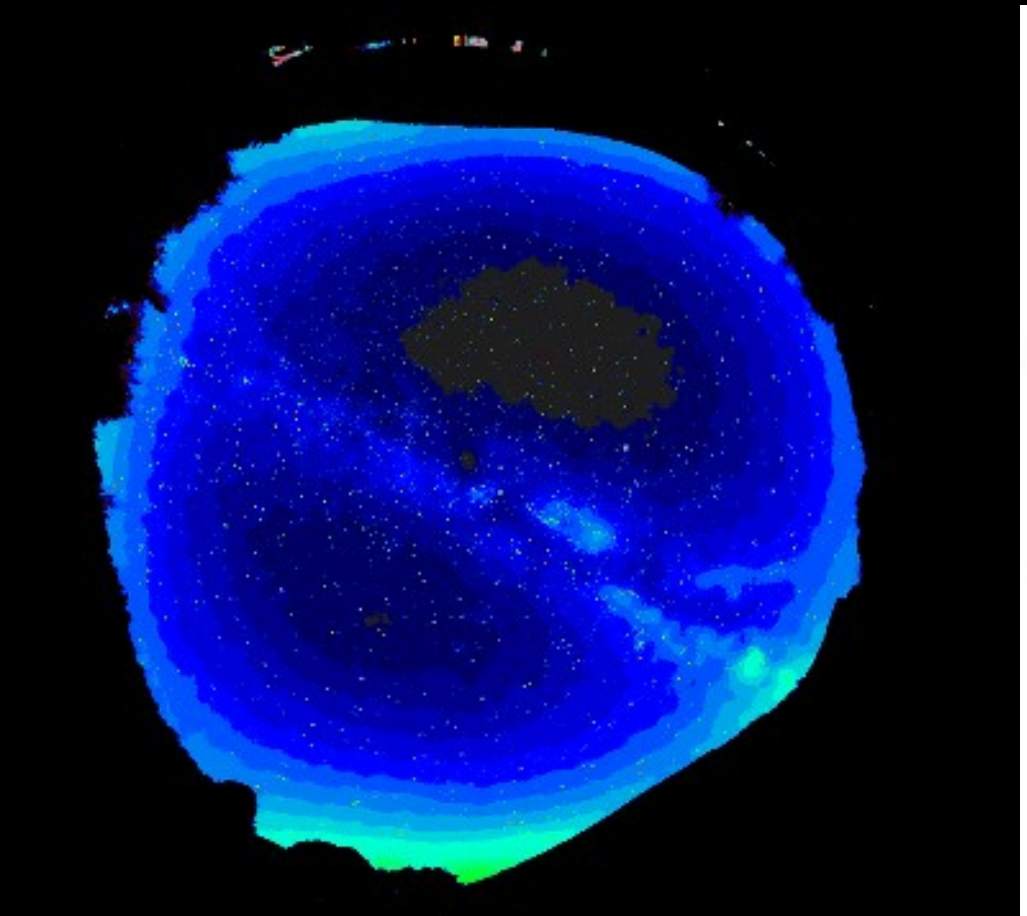
SQM: 19.6/19.8 C_{max} =0.6

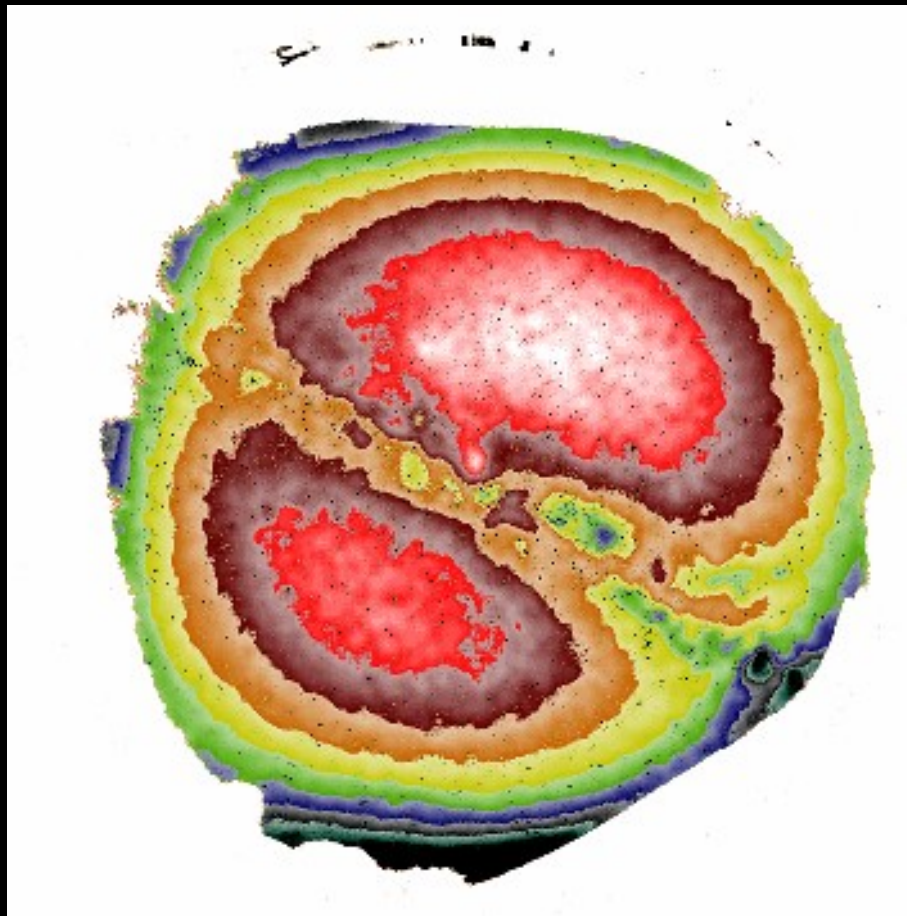




Examples

SQM: 21.3/21.2 C_{max} =1.2





Pro and contra...

- No calibration is necessary, just RAW image files and dark images
- Correlates with the real visibility of faint objects

BUT

- Depends on weather conditions (but it is true for all the other qualifiers)
- Depends on geographical location (position of the MW & it visible parts) – can be handled.

Work in progress...

Cross calibration contrast (C) vs SQM

You can help with RAW DSLR images (with dark frame) and SQM values

(zkollath@gmail.com)

Recommendation for IDSP tiers

Photopic vs. scotopic contrast

Colour of lighting (LED e.t.c)

It is not included in IDSP rules

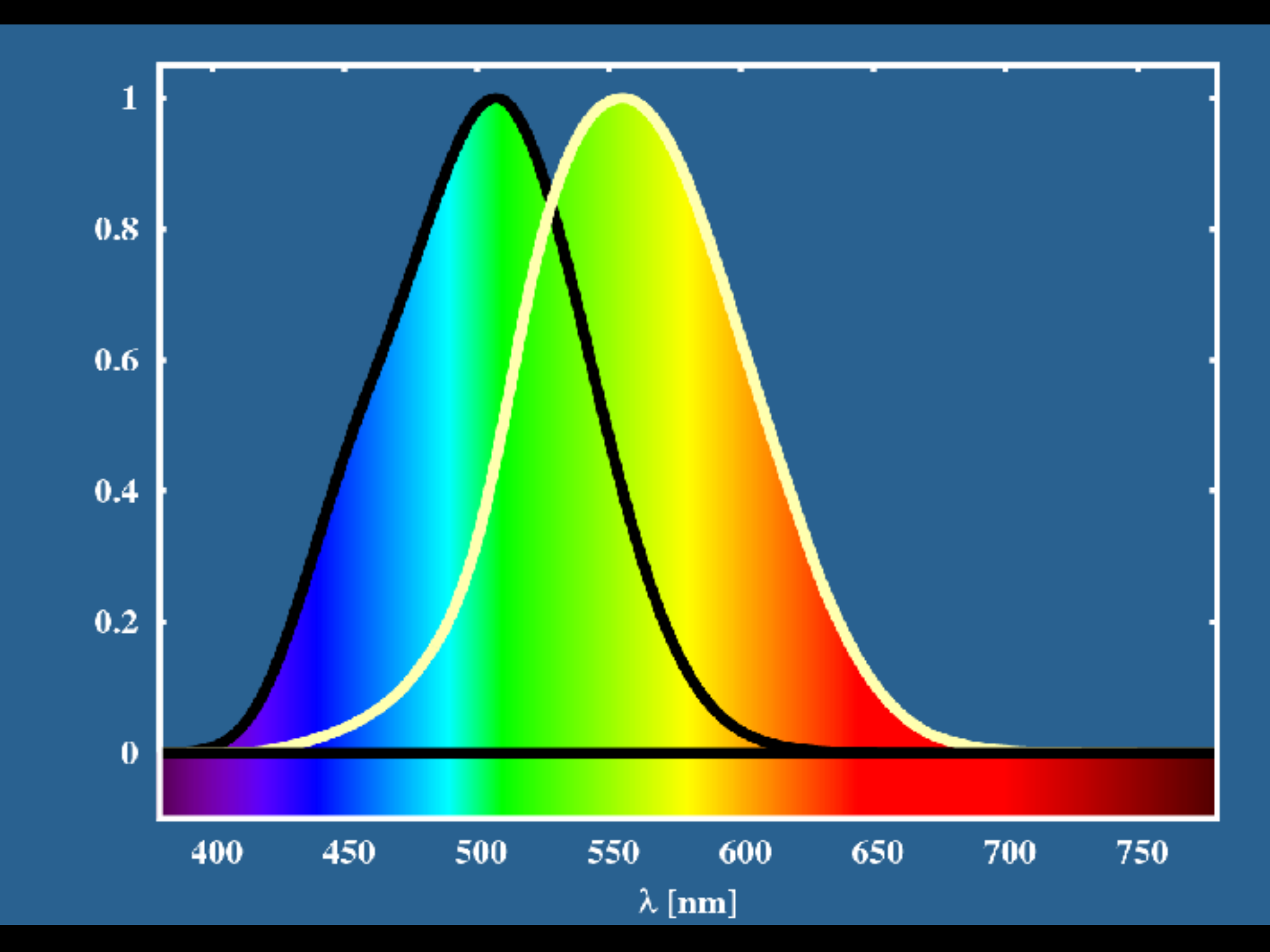
-

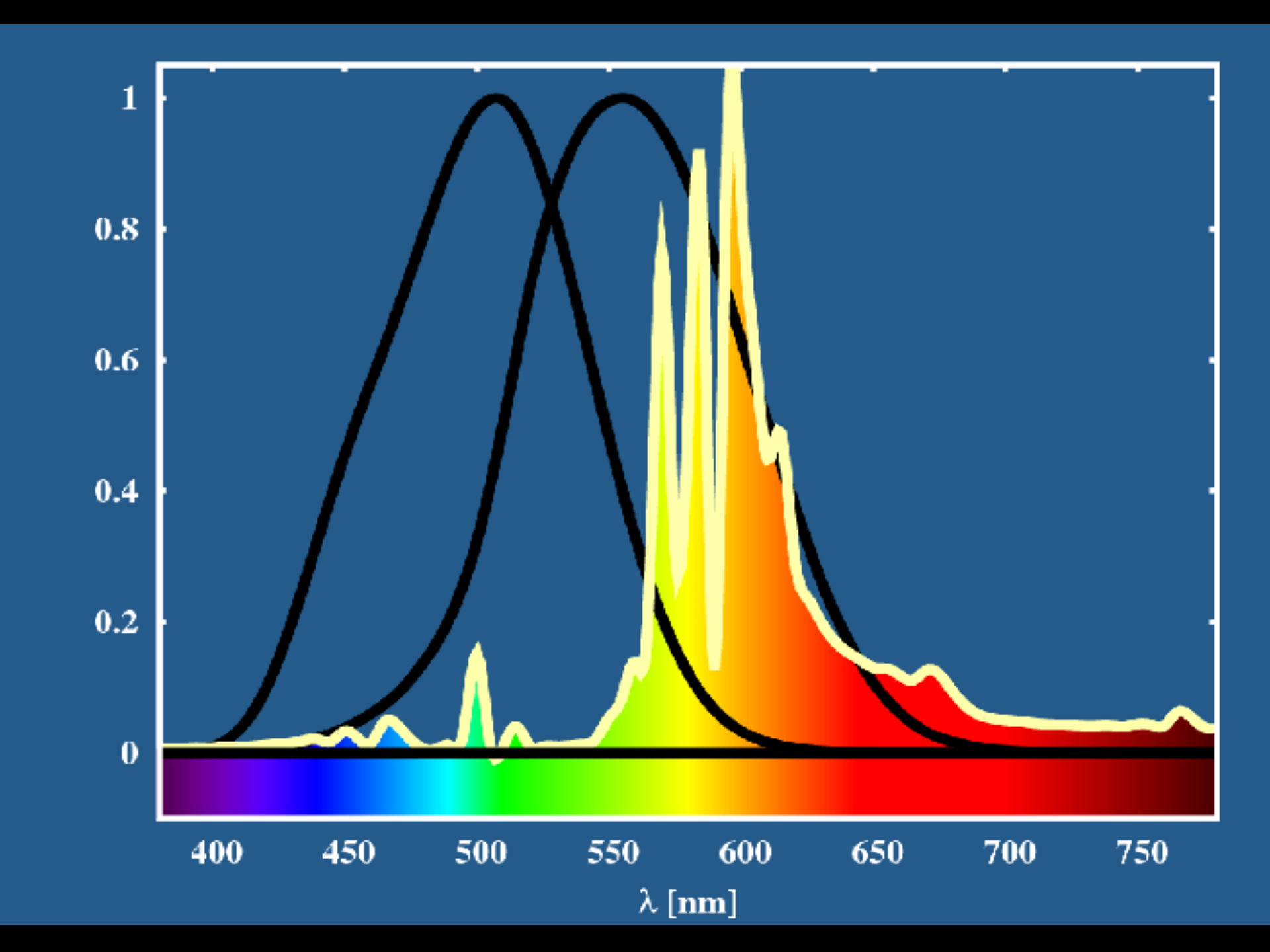
BUT extremely important

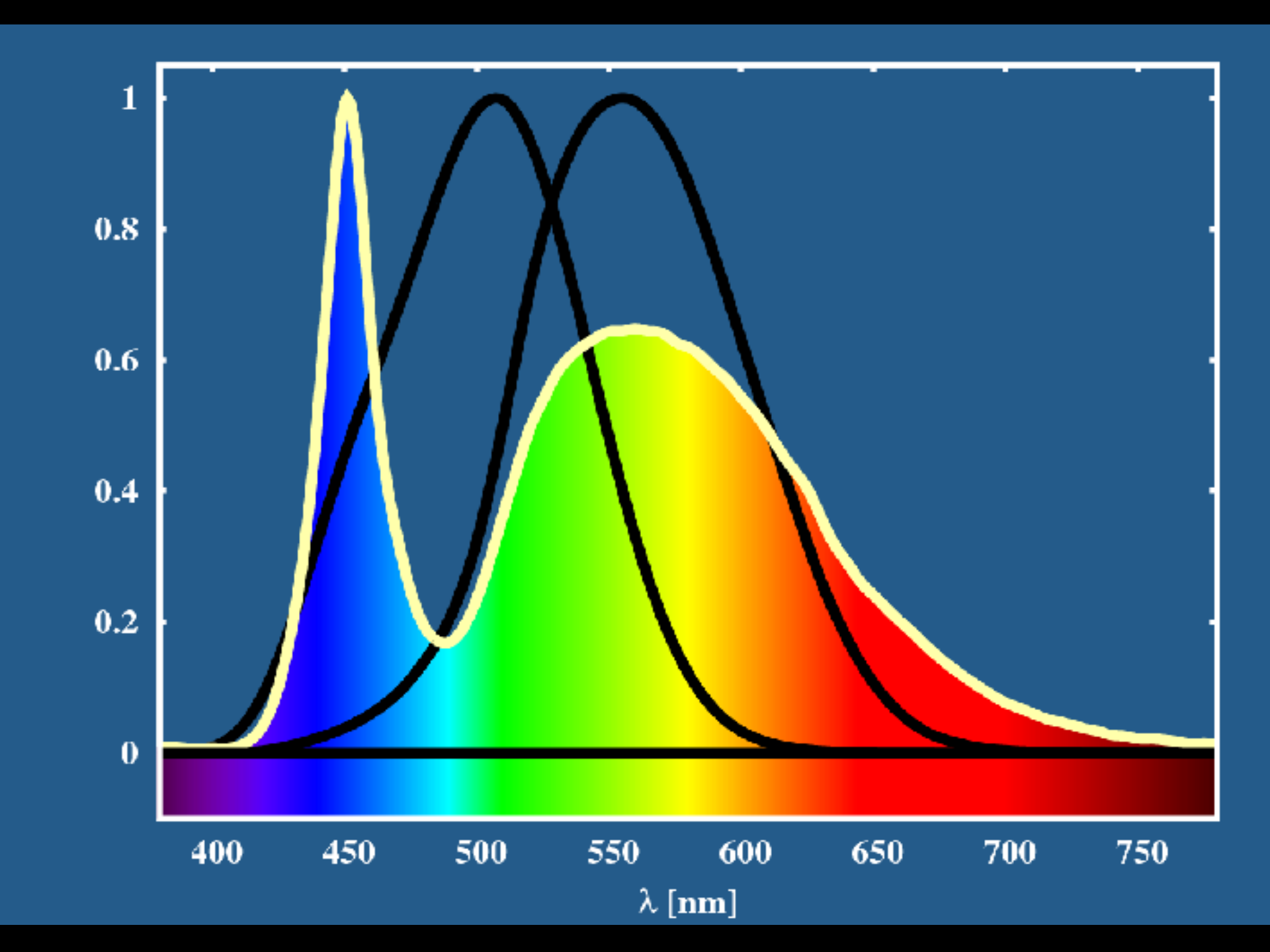
- Night vision, visible sky
- ecological impacts

- > colour of the sky

- Contrast for green and blue channels of the RAW images...


1
0.8
0.6
0.4
0.2
0
400
450
500
550
600
650
700
750
λ [nm]


1
0.8
0.6
0.4
0.2
0
400
450
500
550
600
650
700
750
λ [nm]


1
0.8
0.6
0.4
0.2
0
400
450
500
550
600
650
700
750
λ [nm]

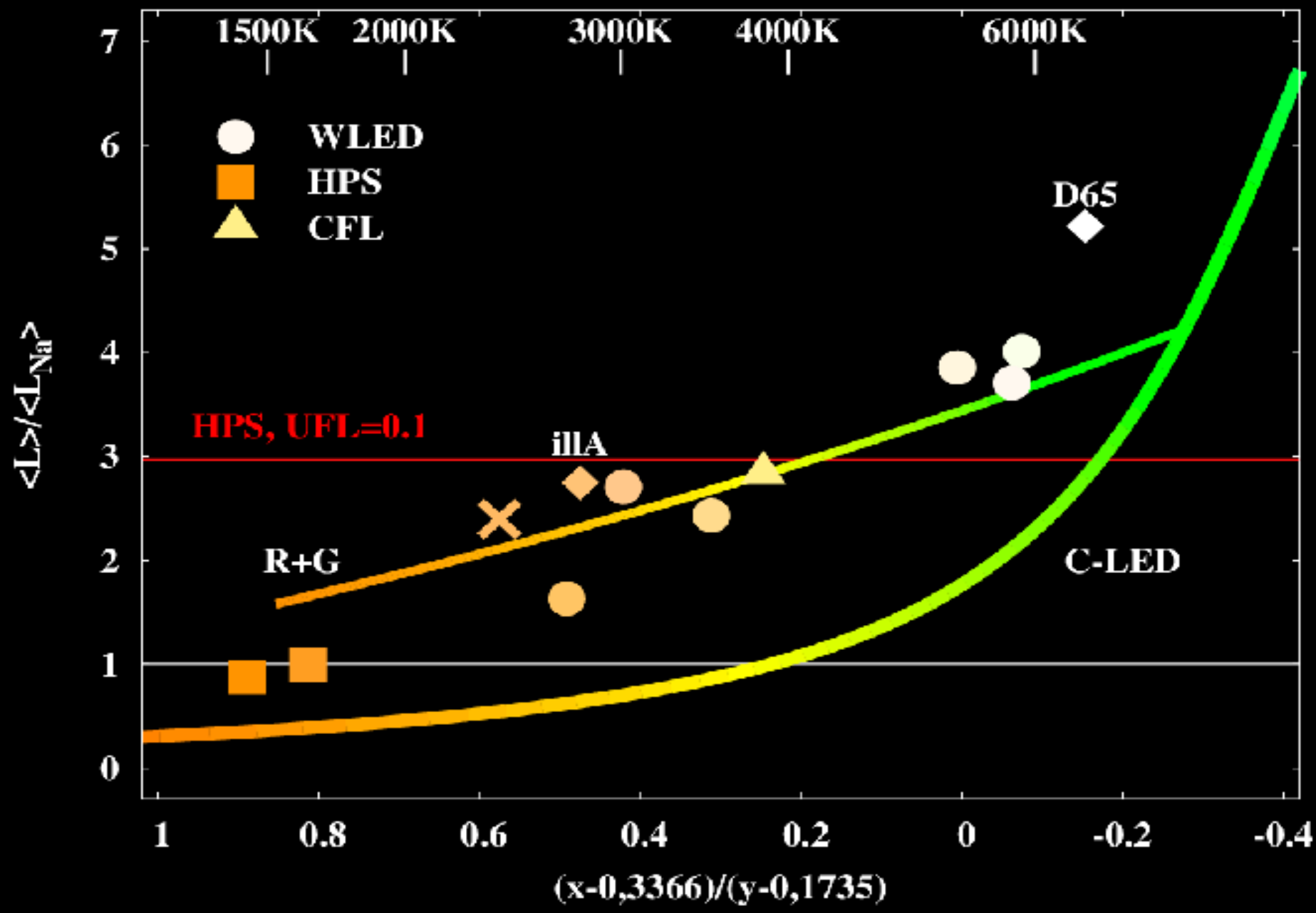
Effect of source colour to light pollution

- A measure:
- Provide the same photopic illumination/luminance on the road
- Measure/calculate the scotopic luminance of sky background 15km from the source
- Normalize with 0 UFR (Upper Flux Ratio) sodium lamp

- Following diagram: Ls/Ls(Na) vs a function of colour coordinates (x,y).

  WLED: white LED, C-LED: monochrome LED
- Thanks for Károly Molnár (University of Óbuda) for spectral measurements of light sources used for the creation of the figure.

Relative sky luminance with different light sources



- Lighting code should rule out high colour temperature sources
- Switching sodium light to cold white LED is not an improvement!
- Even warm white sources provide a risk -> optimize for illuminance, dim after 10-11PM, etc...

One more issue...

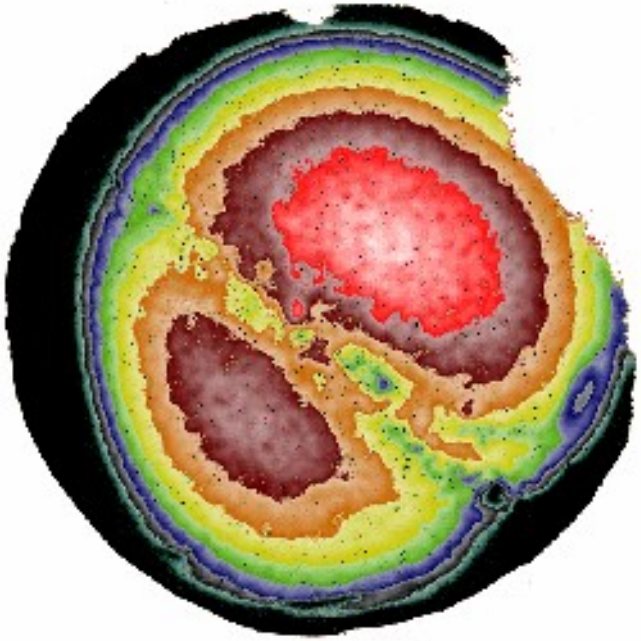
Topology (geometry) of the Park

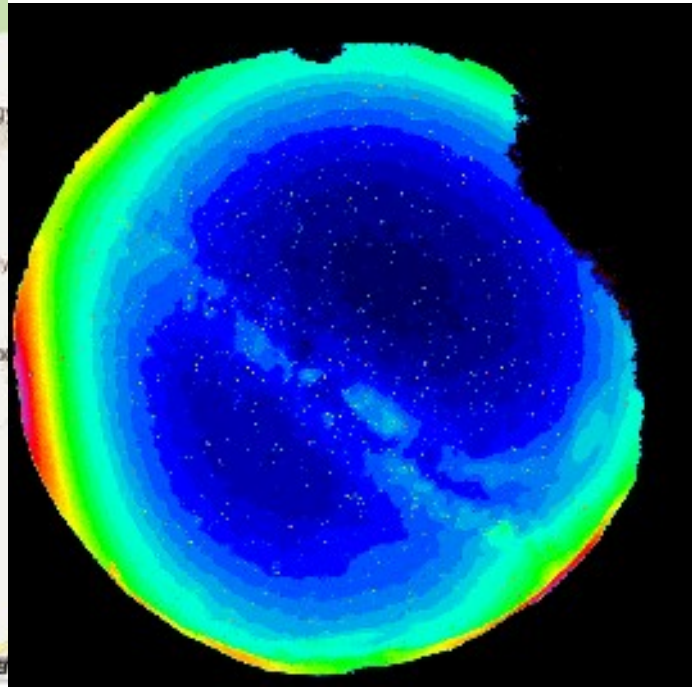
- no lower size limit (>50000ha – can be divided)

Different geometries:
- continuous with settlements inside
- continuous with no settlements inside
- mosaic like (usually with no cities, villages inside)

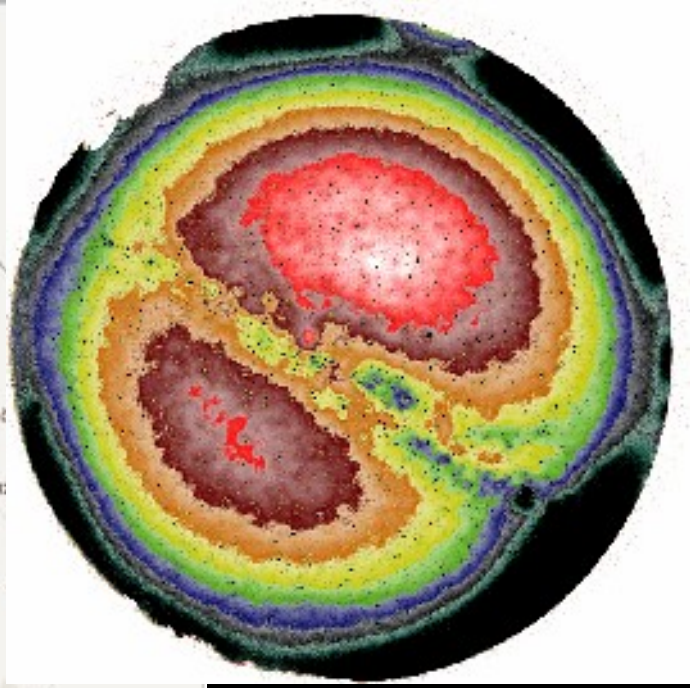
-> Not even chances to form IDSP

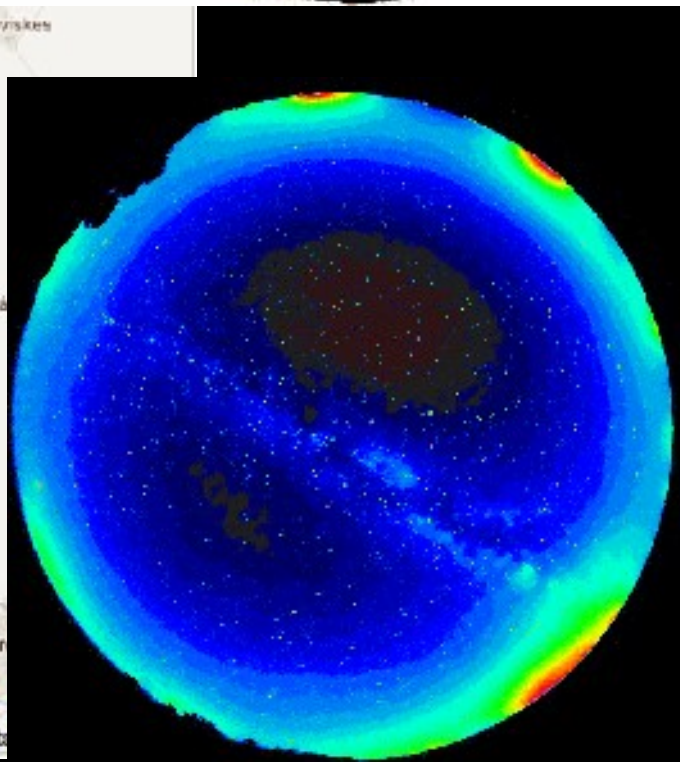
Bükk National Park





Kőrös-Maros National Park





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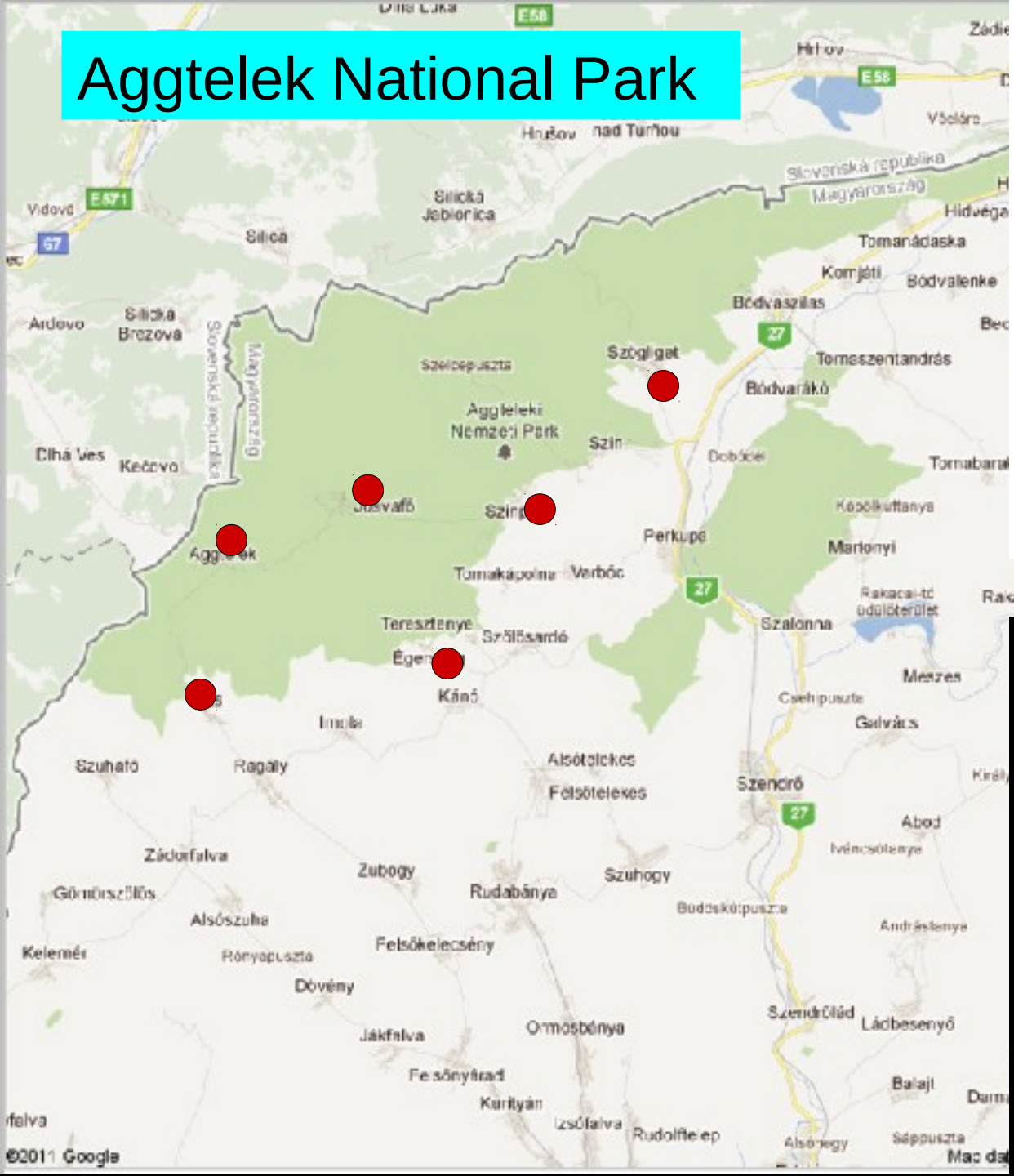
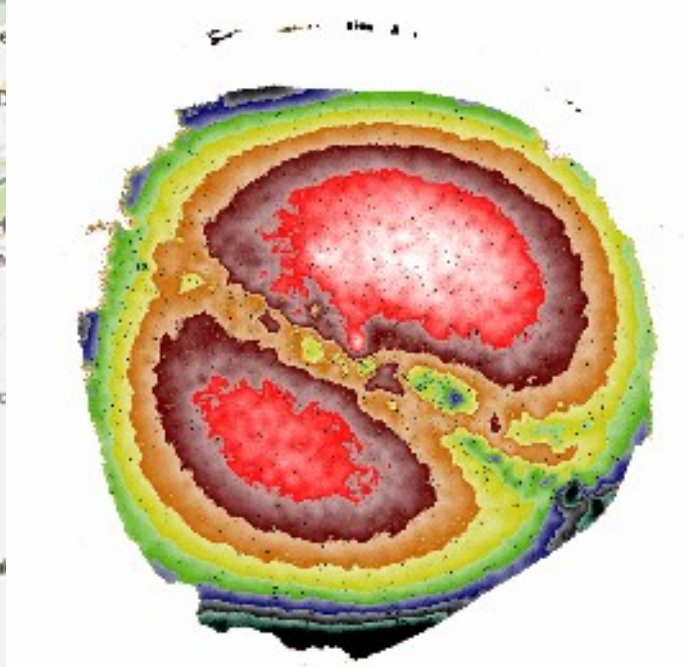
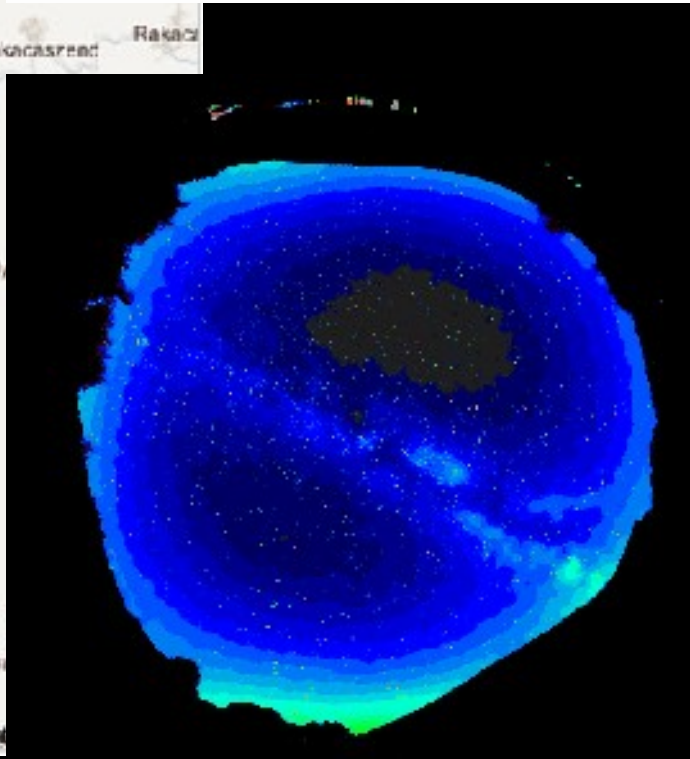
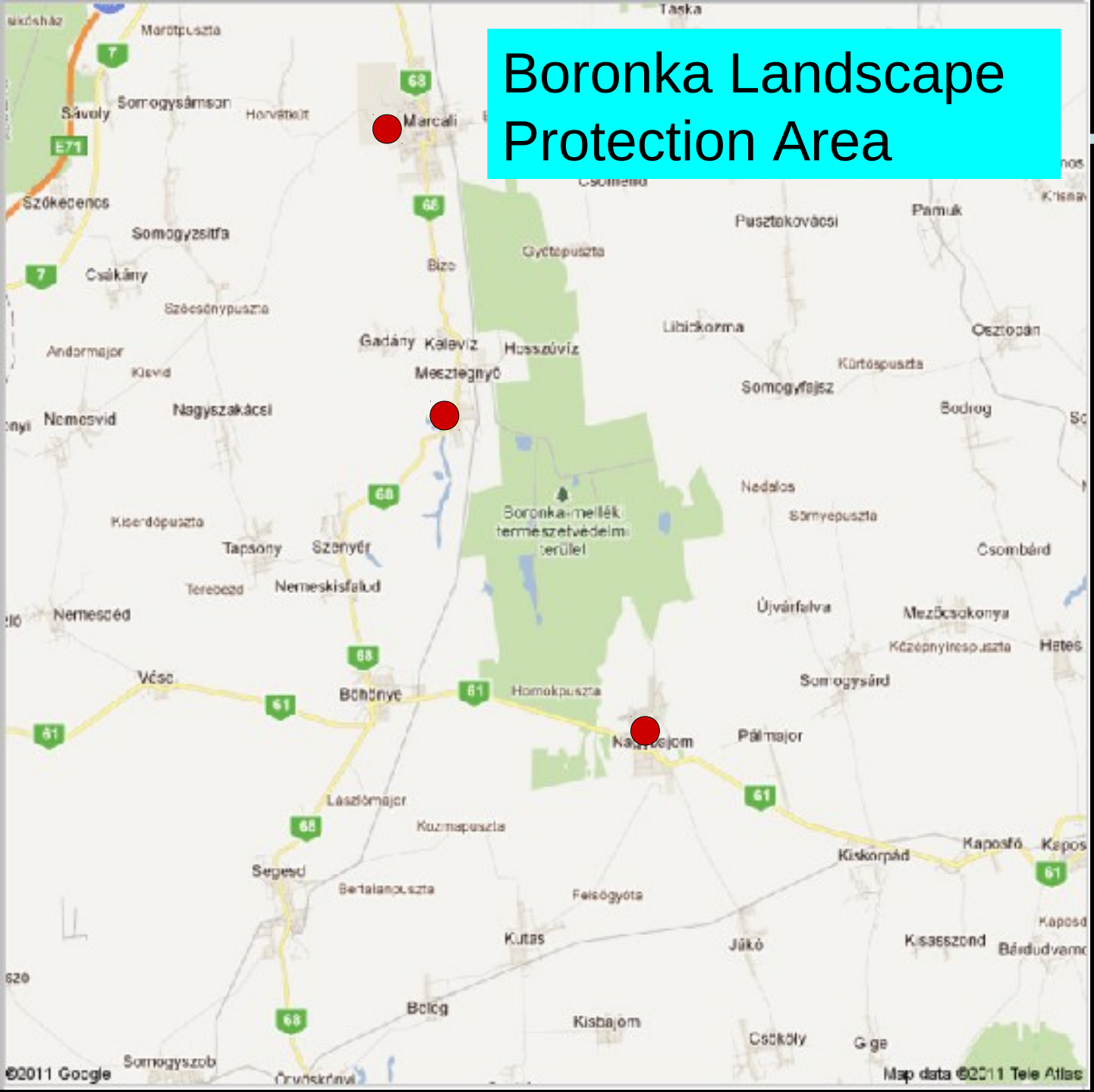
Aggtelek National Park







Boronka Landscape Protection Area



How to handle topology?

It should be included in IDSP rules...

- Any recommendations?

Thank you for your attention!

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