

Keep it Deep!

Günther Wuchterl

Kuffner-Sternwarte, Wien

Thüringer Landessternwarte, Tautenburg

IDA Austria

CEDIC, Linz, AEC, 20. März 2011, 9:00-9:40

GEO



Wo die Erdmännchen wohnen
Die Aufrechten aus der Kalahari

Die Welt mit anderen Augen sehen

Die Welt mit anderen Augen sehen



Rettet die Nacht!

Die Welt wird immer heller
Aber Körper und Seele brauchen die Dunkelheit



Kanarienvogel



Feuerzauber



Kalmücken



Energiequelle

... today at the
news-stand

*Save the night!
The world always
becomes brighter
but body and soul
need darkness.*

The “spots”(*) are the tools!

- Dark sky parks
- Starlight Reserves / Oasis
- European network of dark sky parks (officially established)
- ...

(*) Surfjargon: a “spot” is a place where the sea may produce waves but as well leaves the Surfer frustrated by dead-flat water. Sometimes exceptional conditions produce legends that are so unique that they are referred to by weekdays, e.g. “big wednesday”, that occupies the rank of the battle of Waterloo in surf-history.

Grossmugl Starlight Oasis – July 31st



Alexander Pikhard



Bild: Daniel Korbel, Kuffner-Sternwarte



Bild: Daniel Körbel, Kuffner-Steinwarte



Bild: Daniel Körbel, Kuffner-Steinwarte

It helps to talk

Jena, Saturday, April 4th, 2009, 21h – 24h

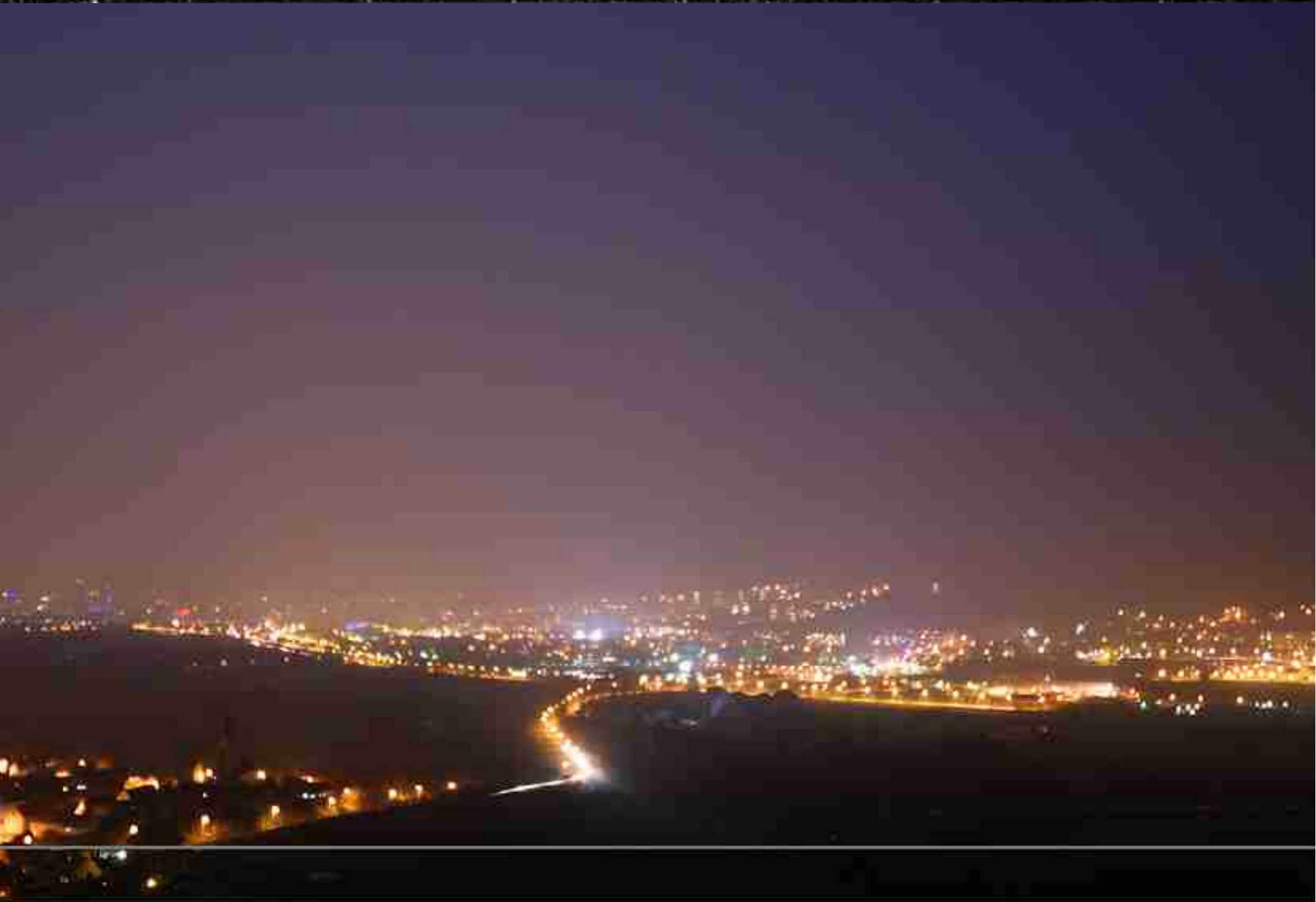
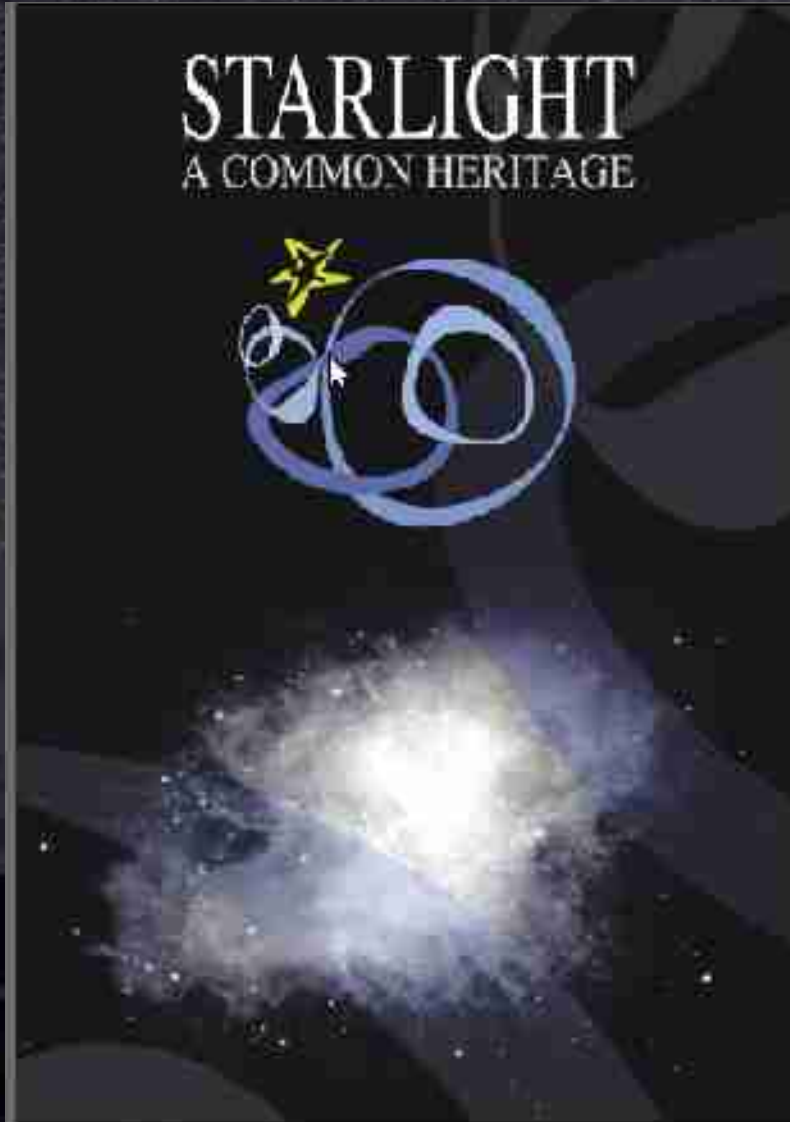


Bild: Christian Högner, Thüringer Landessternwarte Tautenburg



Bild: Christian Högner, Thüringer Landessternwarte Tautenburg

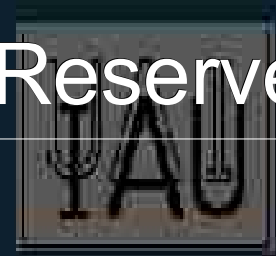
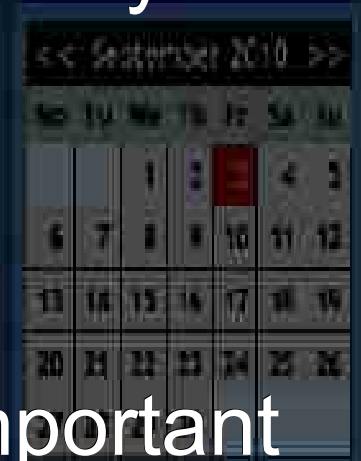
Starlight Initiative



- UNESCO, WTO, IAU, IUCN, ...
- Deklaration of La Palma, 2007
- Right for starlight
- Starlight Reserve 2009 (Oasis/Reserve)
- 2010: UNESCO World Heritage committee opens programme for the night-sky

Nightsky and World Heritage

- Brasilia session adopted "Thematic Study – Astronomy and World Heritage" UNESCO/IAU/ICOMOS
- <http://www.astronomicalheritage.org/>
- Astronomical contribution to the all important *Universal Outstanding Value* for the World Heritage Programme evaluated
- Nominations: national UNESCO comm.
- Starlight Reserves, Oasis, Skies of WHC-sites





Motto

Starlight for the millions

A night sky filled with stars, with a city skyline visible in the lower portion of the frame. The text "Which sky as a park?" is overlaid in the center.

Which sky as a park?

Often conflicting goals

- Perfect skies
- Perfect access for many people
- Perfect tourist infrastructure

- Starlight reserves where the people are
- Mountains helpful:
 - Height
 - Natural shielding

A night sky filled with stars, with a city skyline visible in the foreground. The text "Deep Skies near you" is centered in the sky.

Deep Skies near you

2009 DMPS + A. Trawöger

<http://light.datenscheibe.org/>

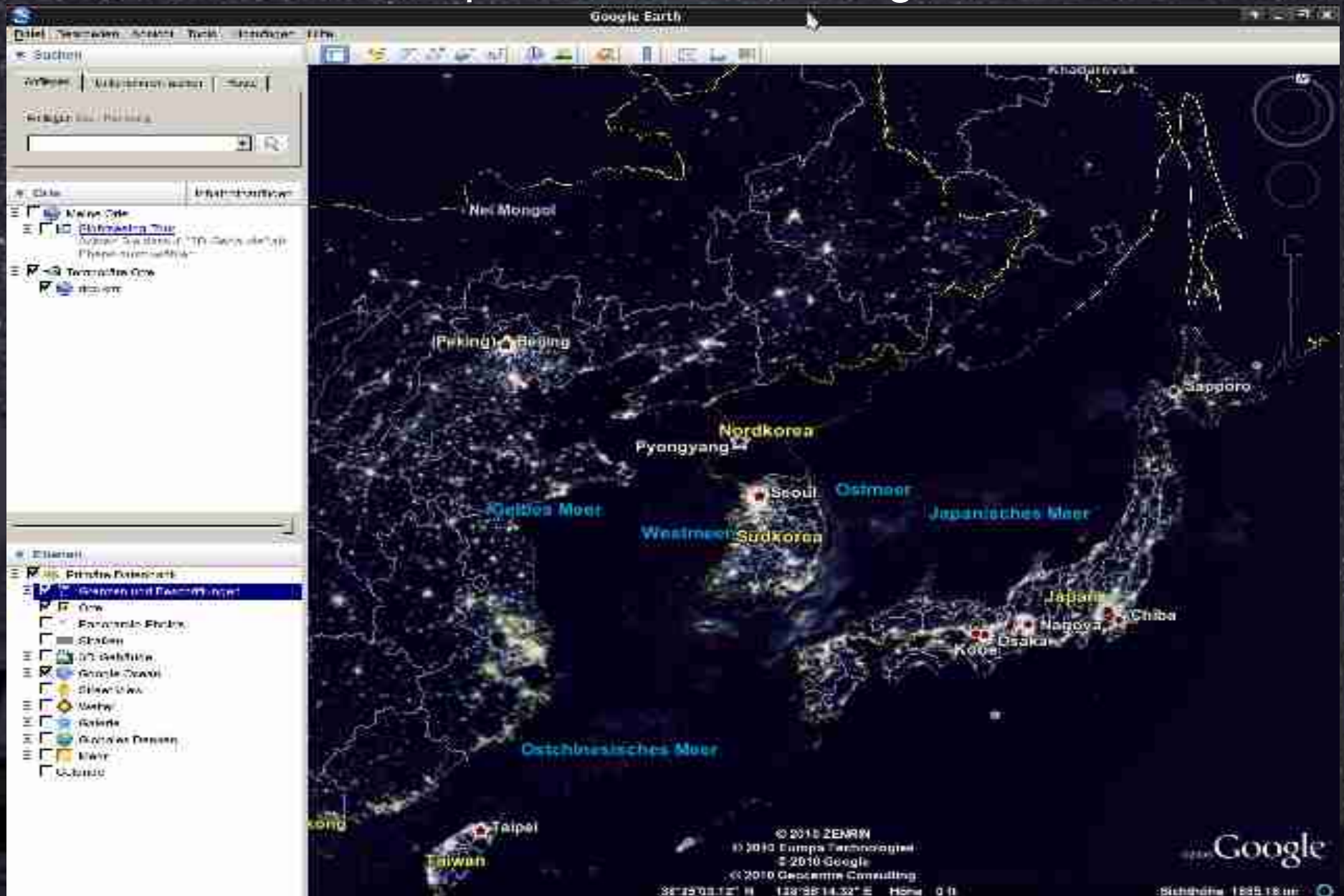


<http://light.datenscheibe.org/>



Google-Earth Overlays

<http://datenscheibe.org>

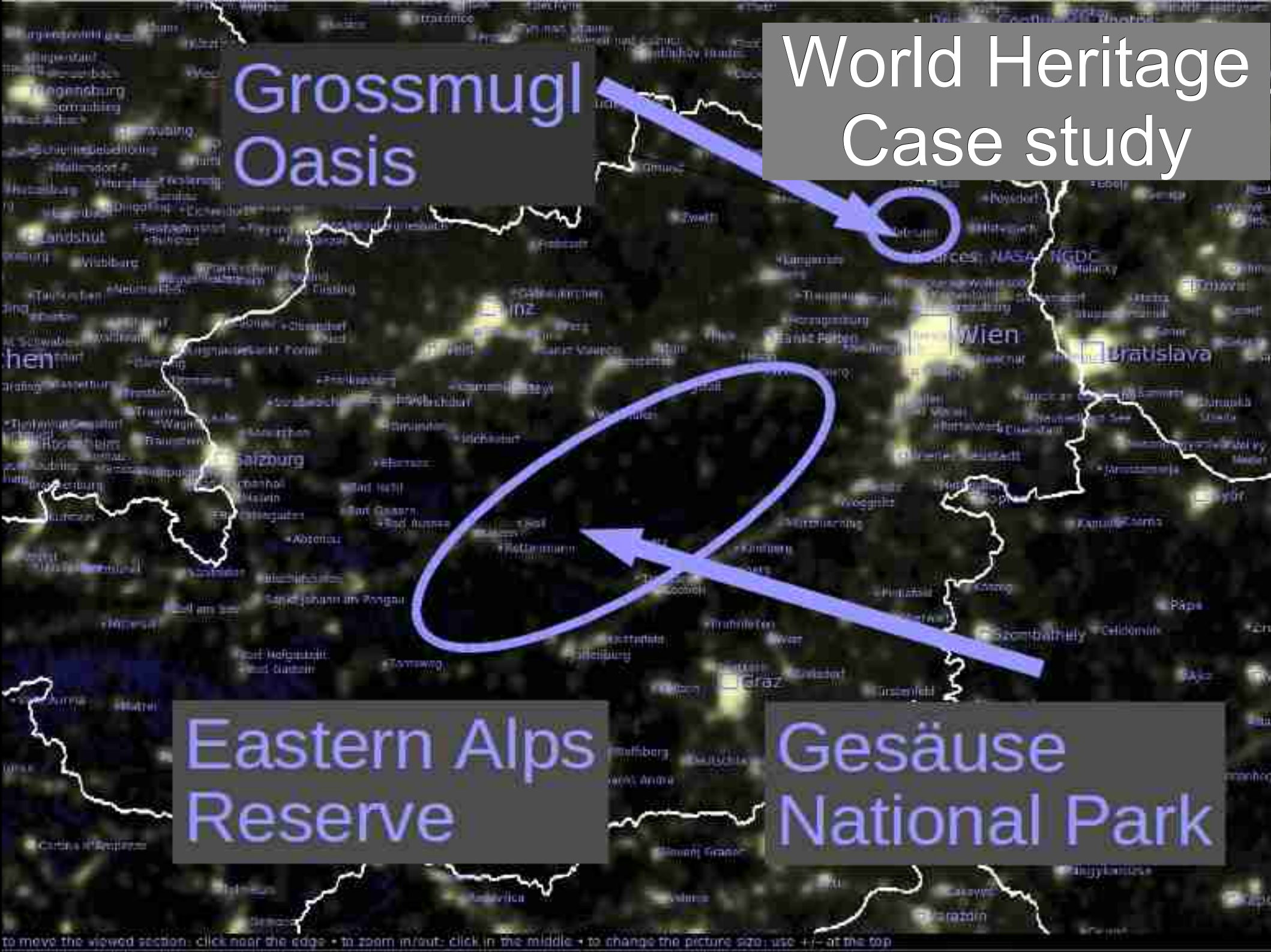


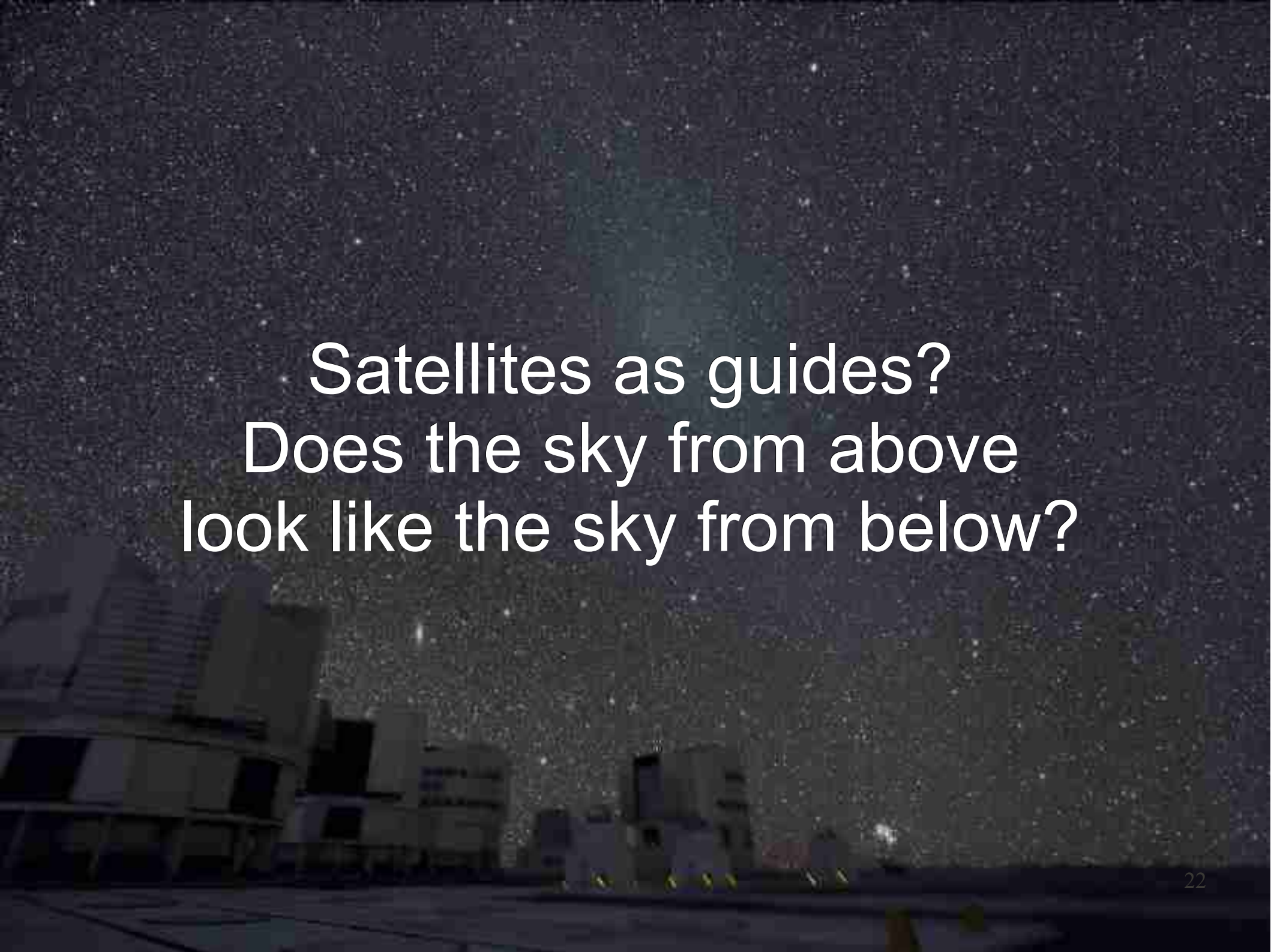
World Heritage Case study

Grossmugl
Oasis

Eastern Alps
Reserve

Gesäuse
National Park



A night sky filled with stars, with a city skyline visible in the foreground. The text is centered in the upper half of the image.

Satellites as guides?
Does the sky from above
look like the sky from below?

Which sky as a park?

Quantification and Comparison

Quantification? - Watt Quantity?

- Logarithmic light ratios to known stars: magnitudes per area – magnitudes - which magnitudes?
- Illumination for humans - Lux
- Energy stream of light – Watt/m^2

Watt Purpose?

- Magnitudes → astronomy
- Illumination → lighting for humans
- Energy flux → energy / CO2 / environment

Light is already monitored by atmospheric physics, solar-energy harvesting and meteorology:
total radiation (global radiation) –
“all light hitting the ground”

→ Do it at night and keep the Watt/m^2 – but how?

Run a solar cell at night

- Concept: solar cell collects energy
- The more light the more energy
- Light to the sky is unwanted “uplight”
- What is reflected down makes the sky and the environment brighter
- Anything above natural is pollution

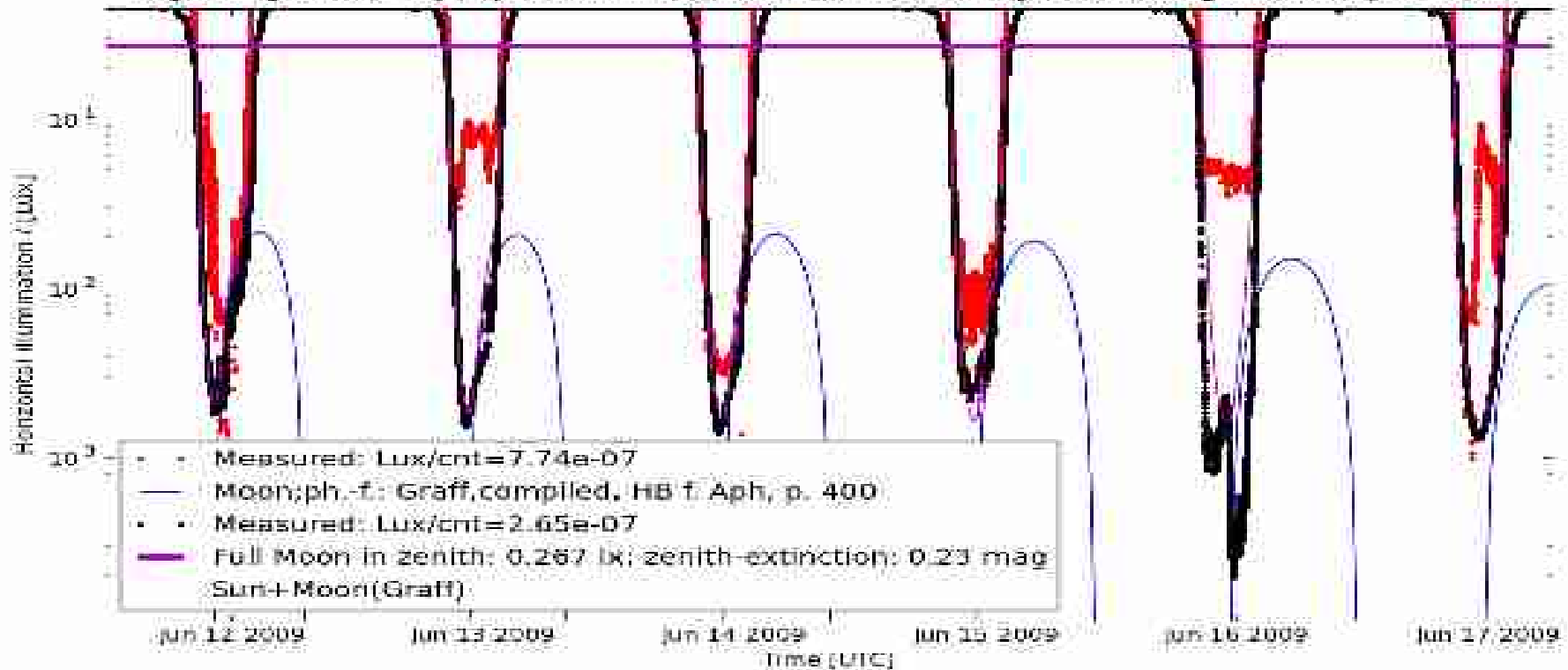
Can we measure it?

IYA-Lightmeter: simple, continuous sky- monitoring



How many stars can we still see? Year of Astronomy Lightmeter Network

Night brightness: city sky (Berlin in red) and near natural sky (Tautenburg in black), June 2009



Why a Lightmeter?

- Measure a known thing, but at night!
- Snapshot vs. Monitor --- light-weather vs. light climate
- Quantify night brightness as environmental factor
- Building an network fast ---> low cost (100 €) + existing technology (PC + Windows/Linux/Mac system)
- Easy to use long-term continuous monitor
- Long term comparability
- All weather (night pollution is much worse with clouds rain/snow)
- Short term variations give high-end sky quality
- Cloud detection and classification

Lightmeter 2011

- Mark 2.3l: August 2010
 - amorphous Si solar cell
 - USB-connection (up to 100m with Ethernet ext)
 - daylight part non-linear (from full moon)
 - 1 Hz
 - Linearity $< 0.1 \mu\text{W}/\text{m}^2 - 0.01 \text{ W}/\text{m}^2$ (1 Lux)
 - PC as data logger
 - detection limit a few $10 \text{ nW}/\text{m}^2$ (single stars)

Lightmeter Mark 2.4 pro: less latency, linear to 10 Lux, lower noise amplifier, windows supp

Skies – from deep to shallow

Results from the
International Year of Astronomy
Lightmeter Network

<http://lightmeter.astronomy2009.at>

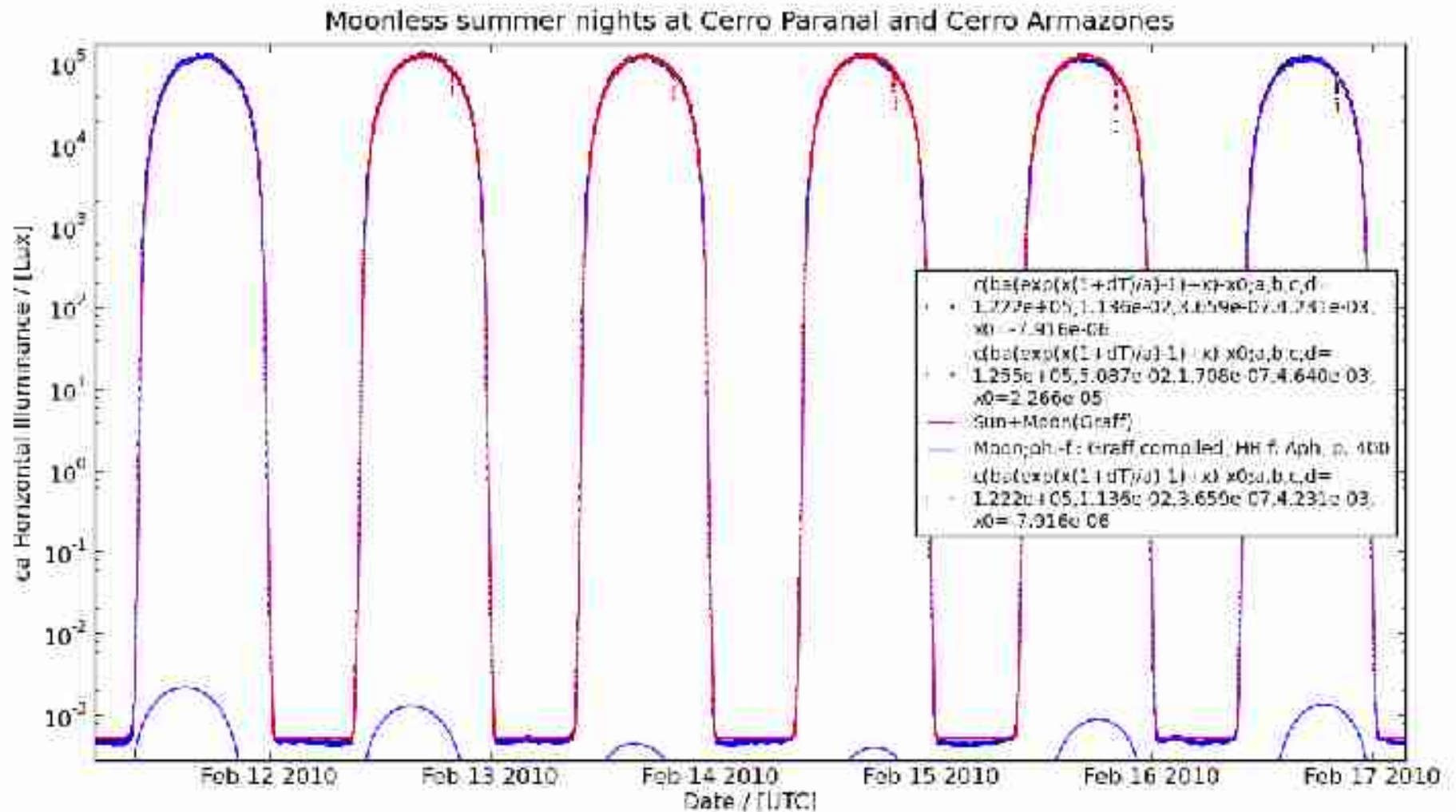
One of ~150: Teide Observatory



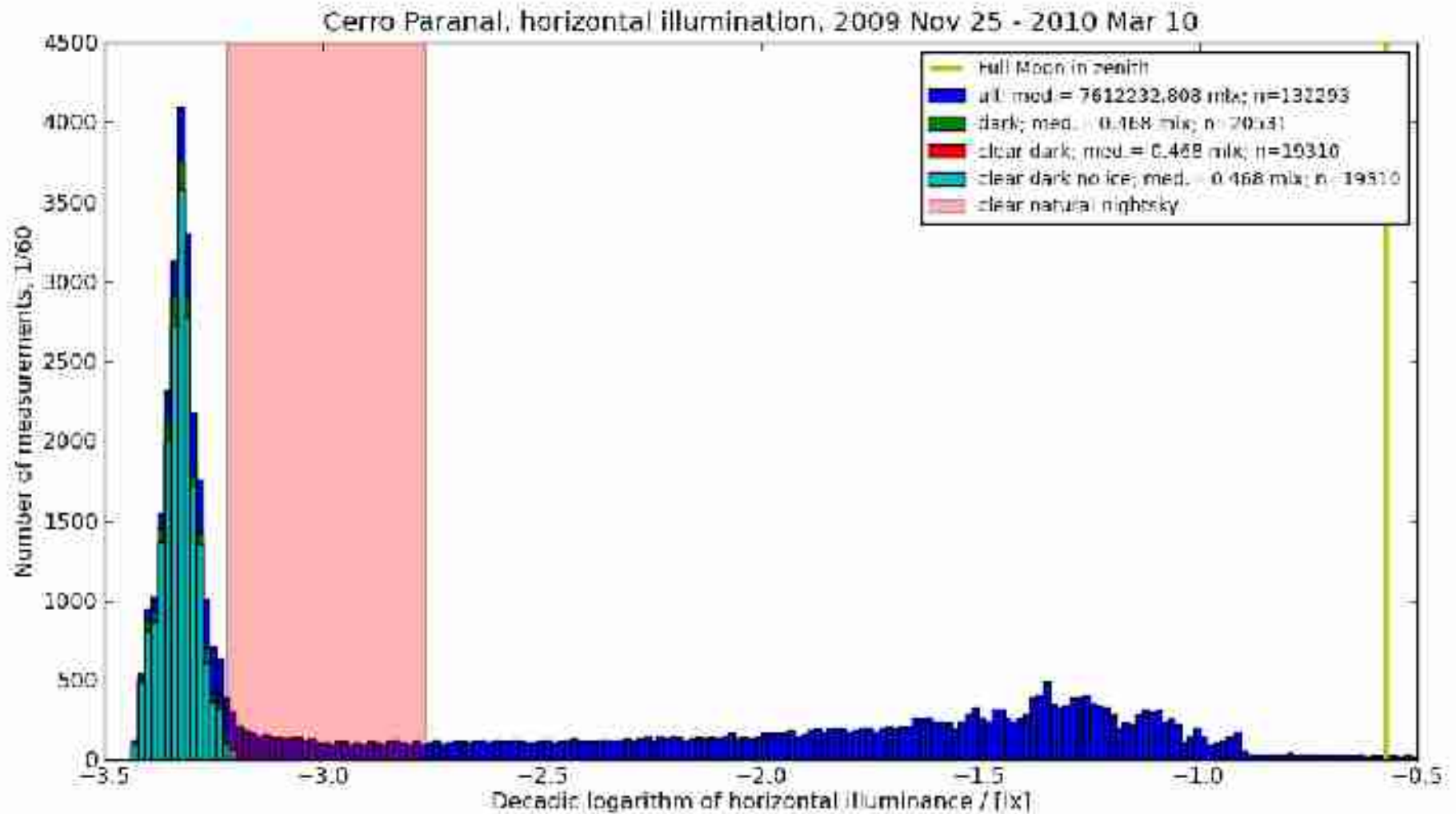
Near ESO-VLT at Paranal



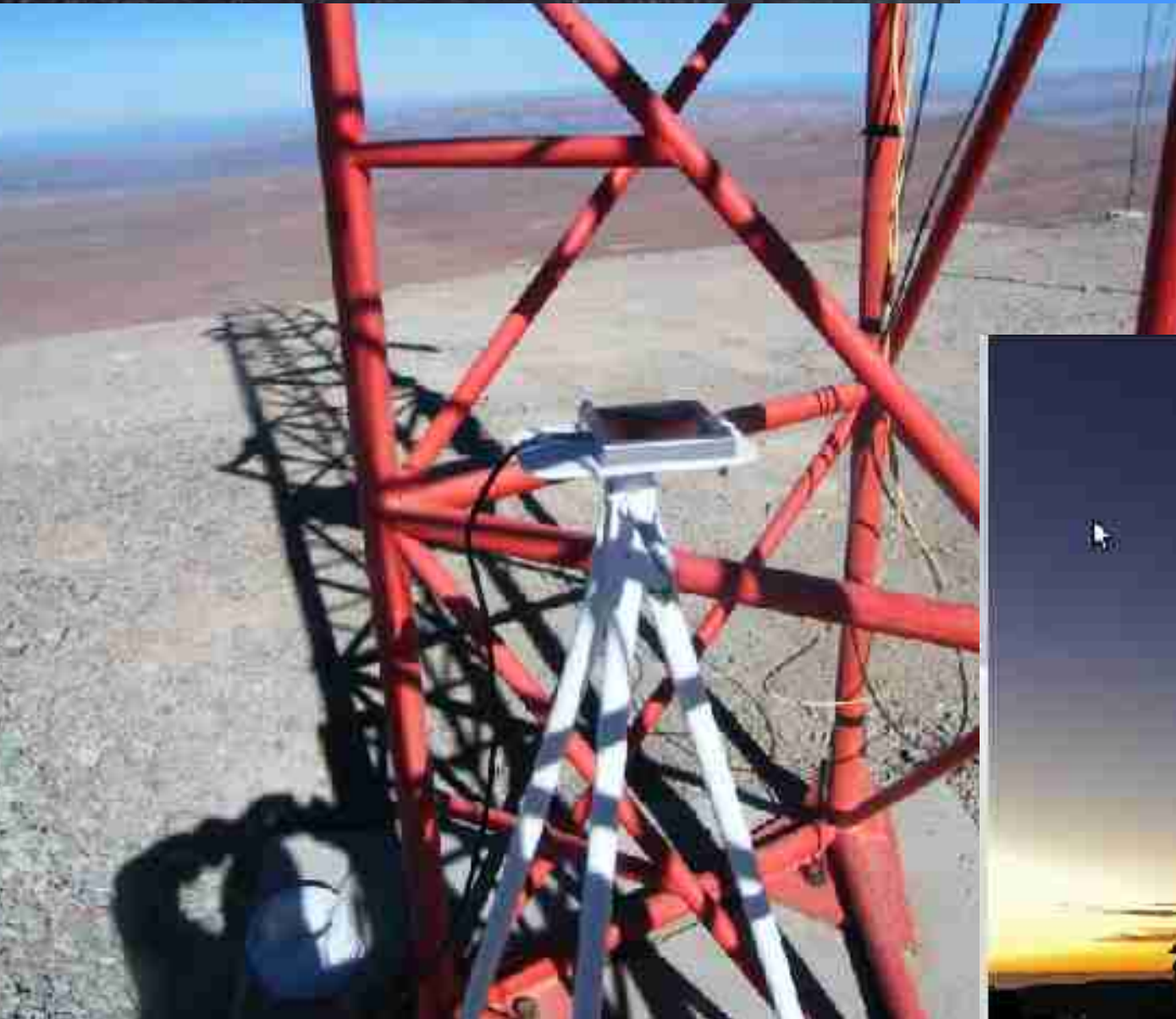
Atacama summer nights Feb 2009



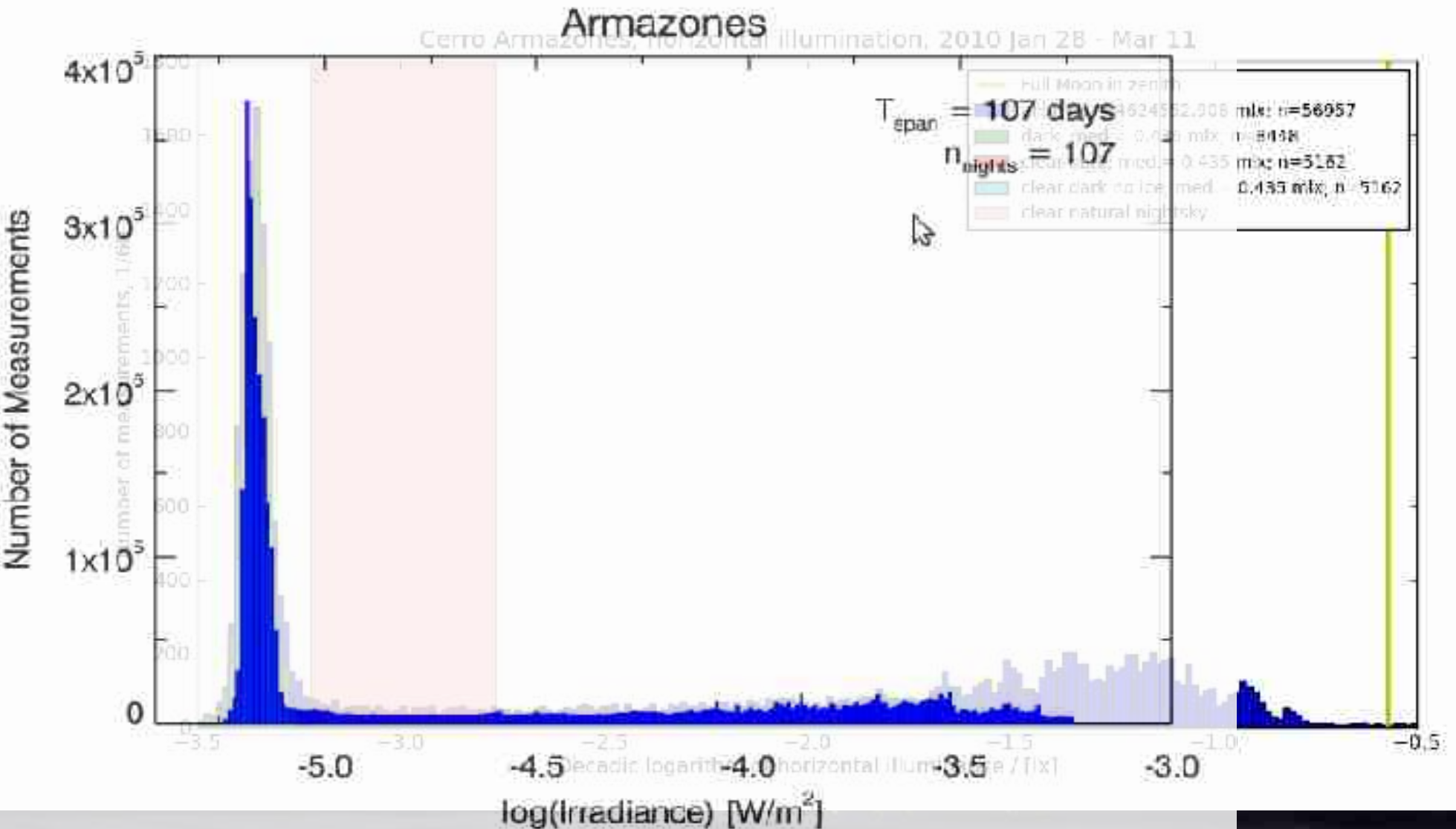
Paranal 2009 / 2010



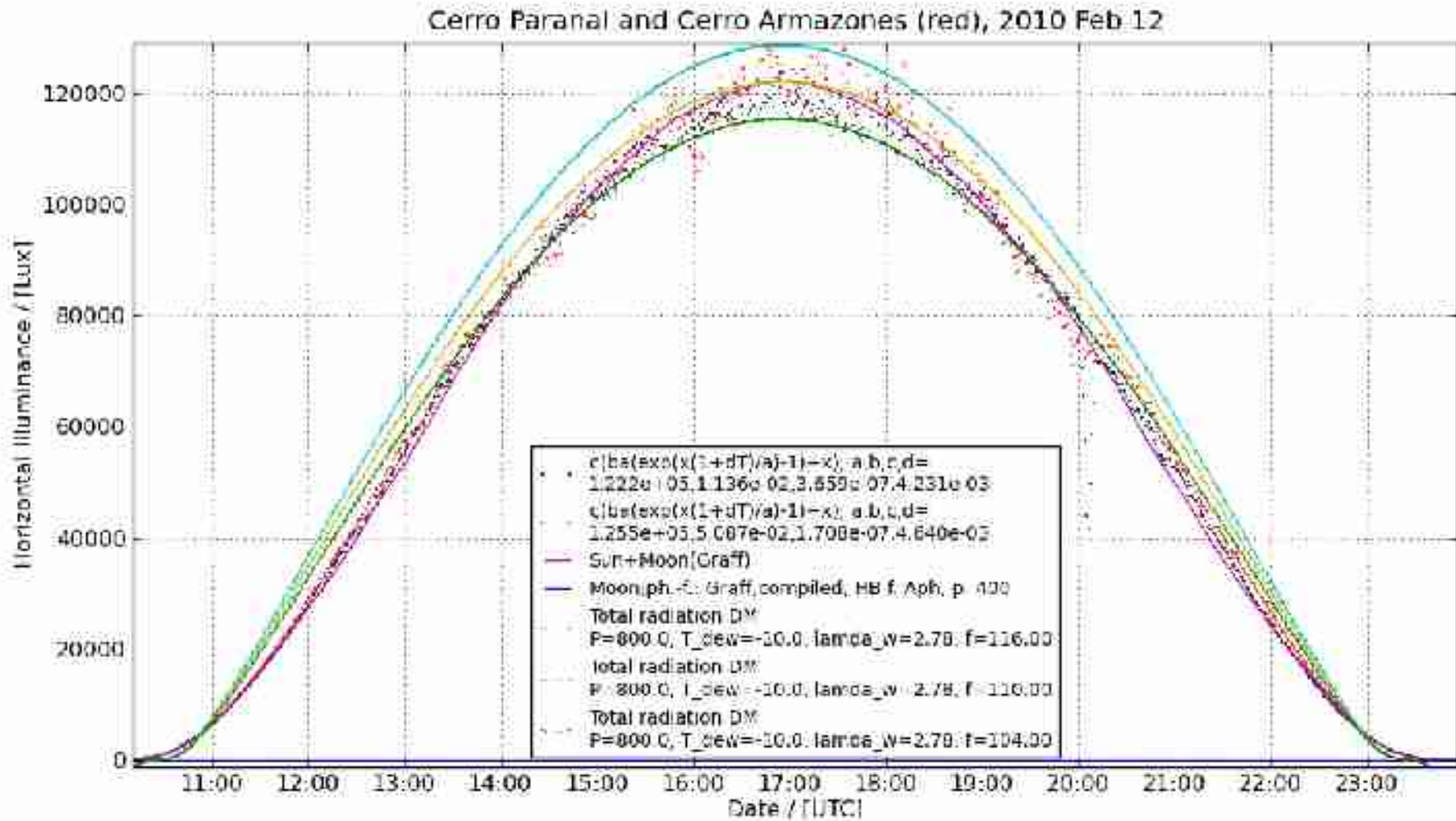
42m ELT-site Cerro Armazones



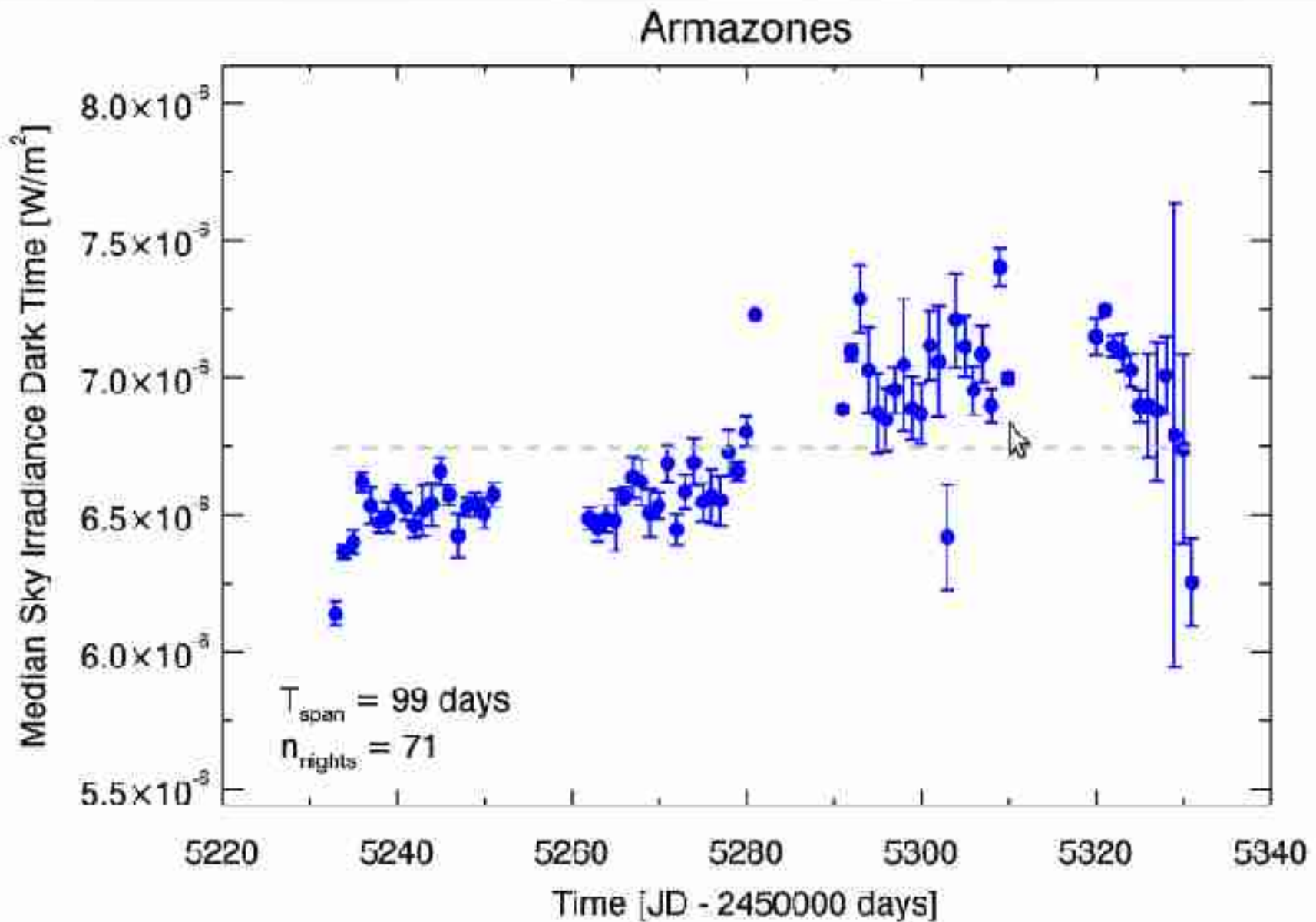
Cerro Armazones Feb 2010



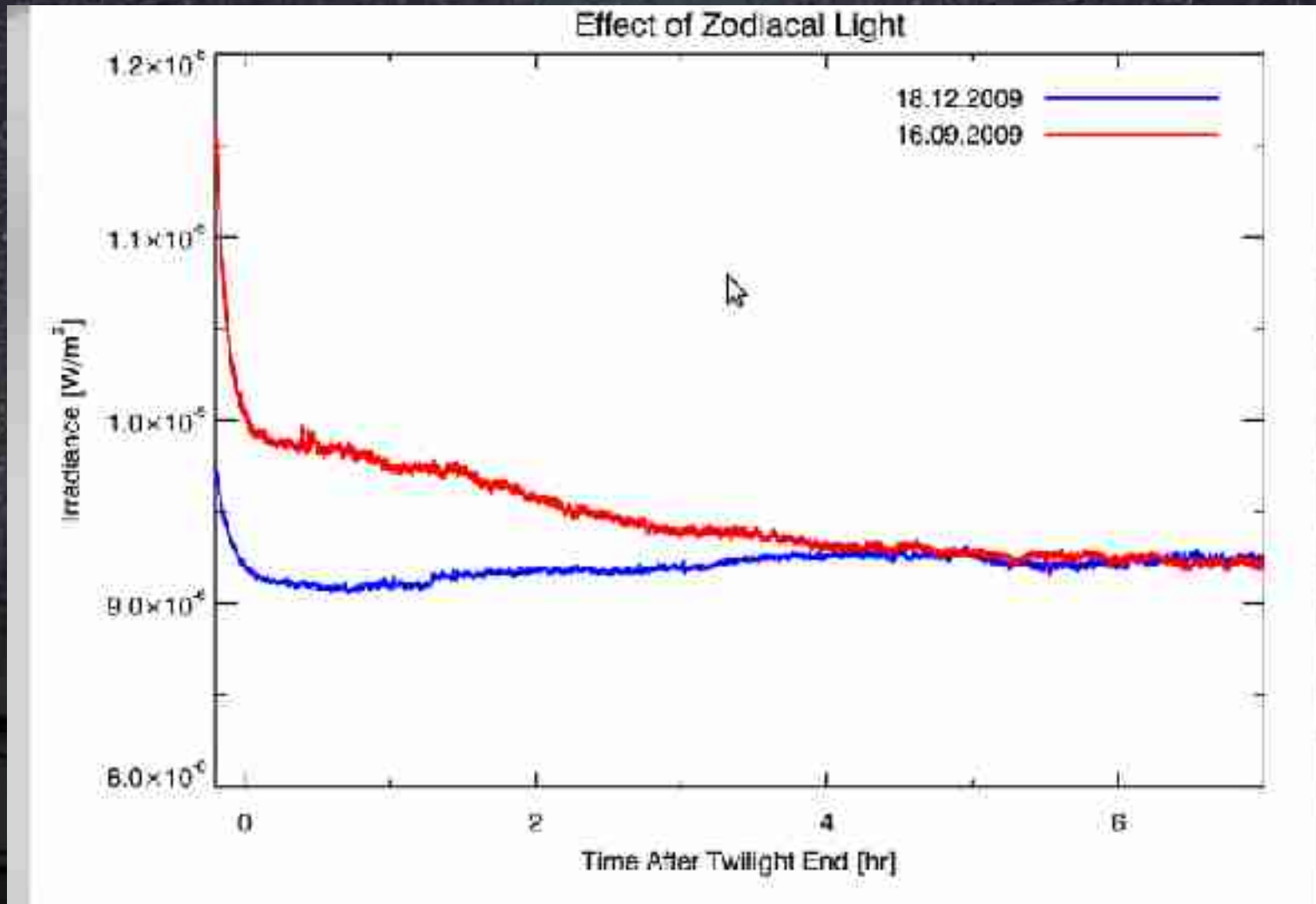
Atacama - total radiation - W/m²



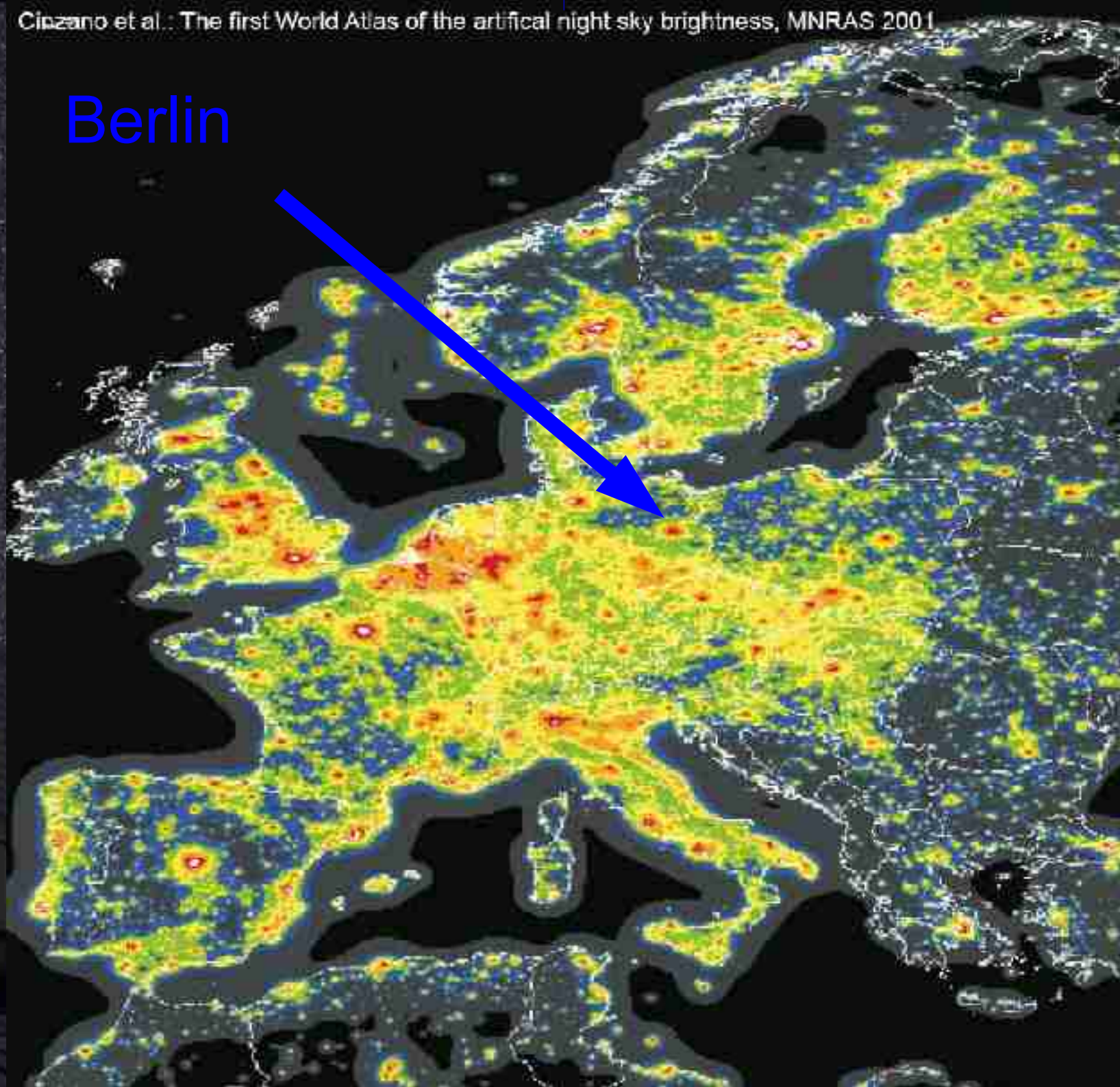
Seasonal variations – Milky Way



Zodiacal Light



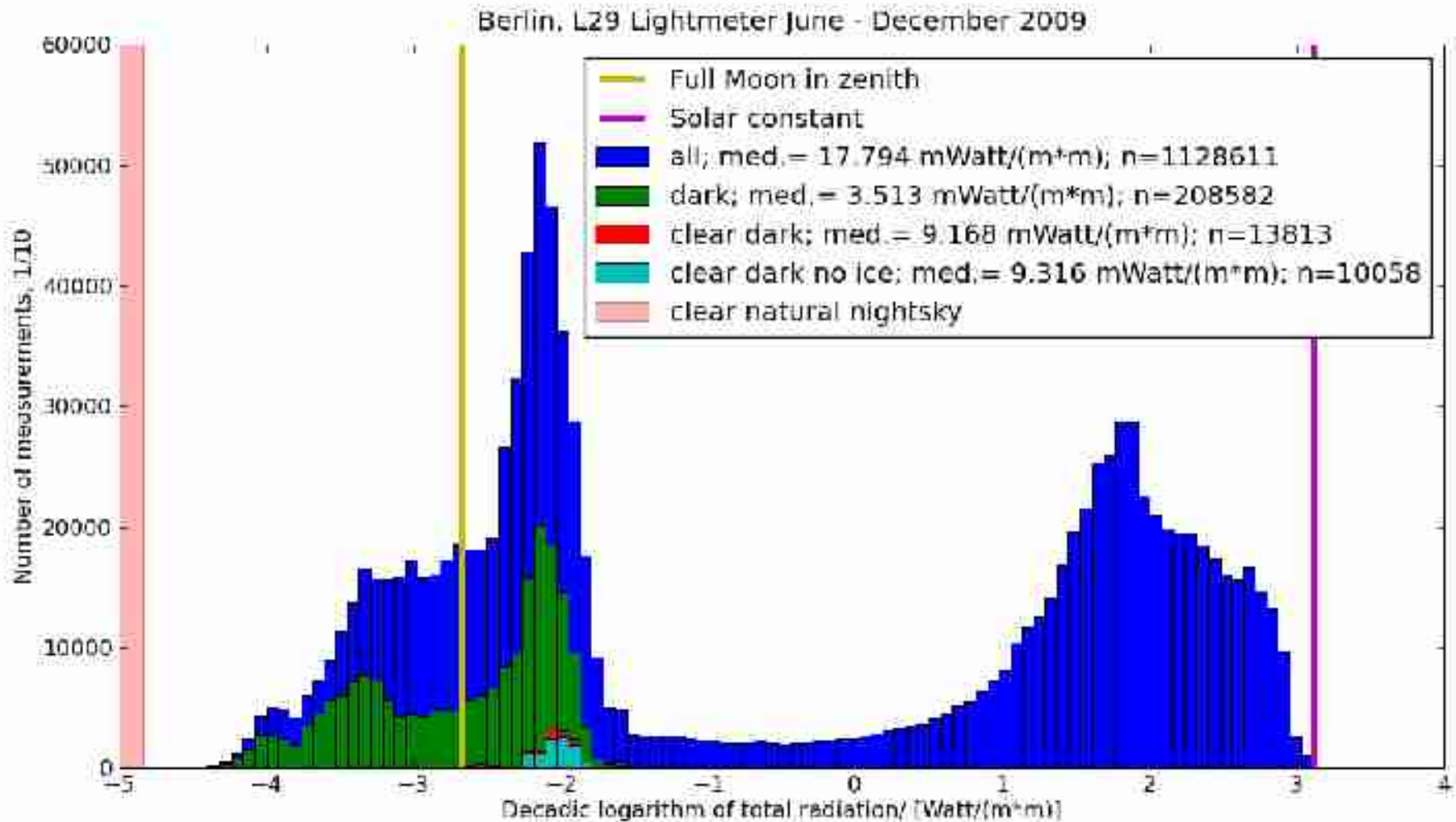
Berlin



Berlin - centre



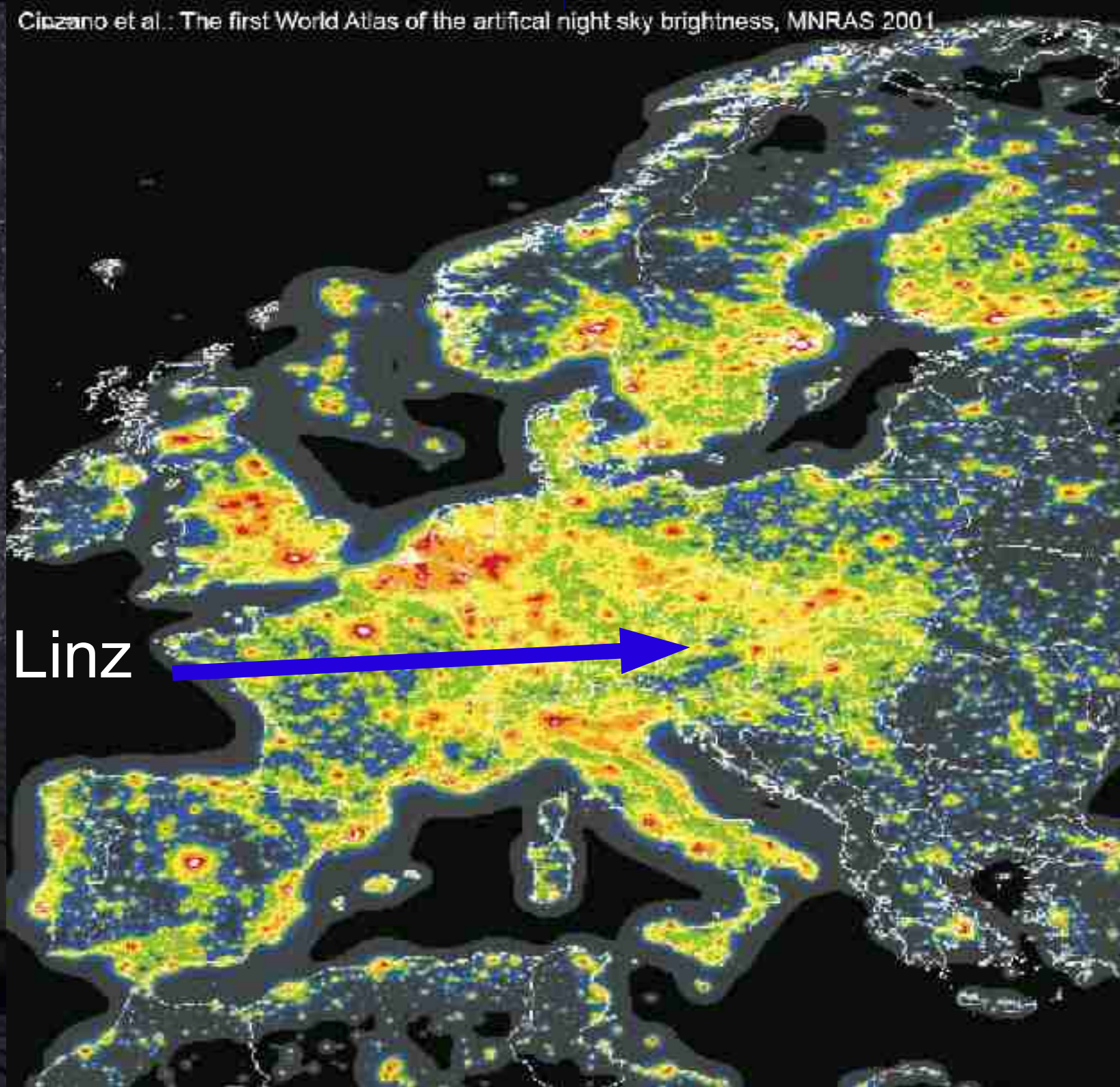
Berlin 2009



Linz

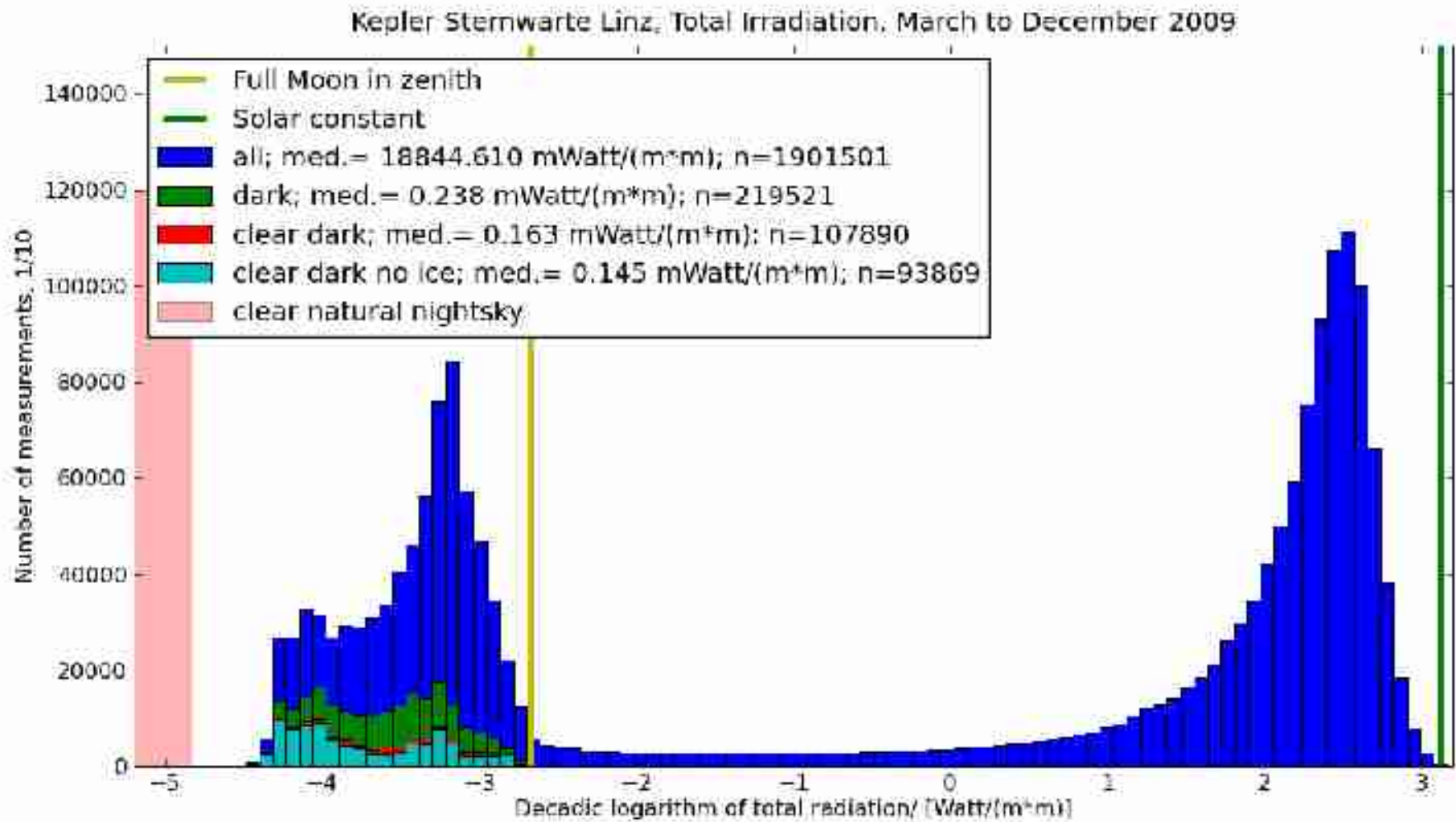
Johannes Kepler Observatory

20.624 luminaries,
23.206 lights,
86,59 Watt / light average
2 MW total

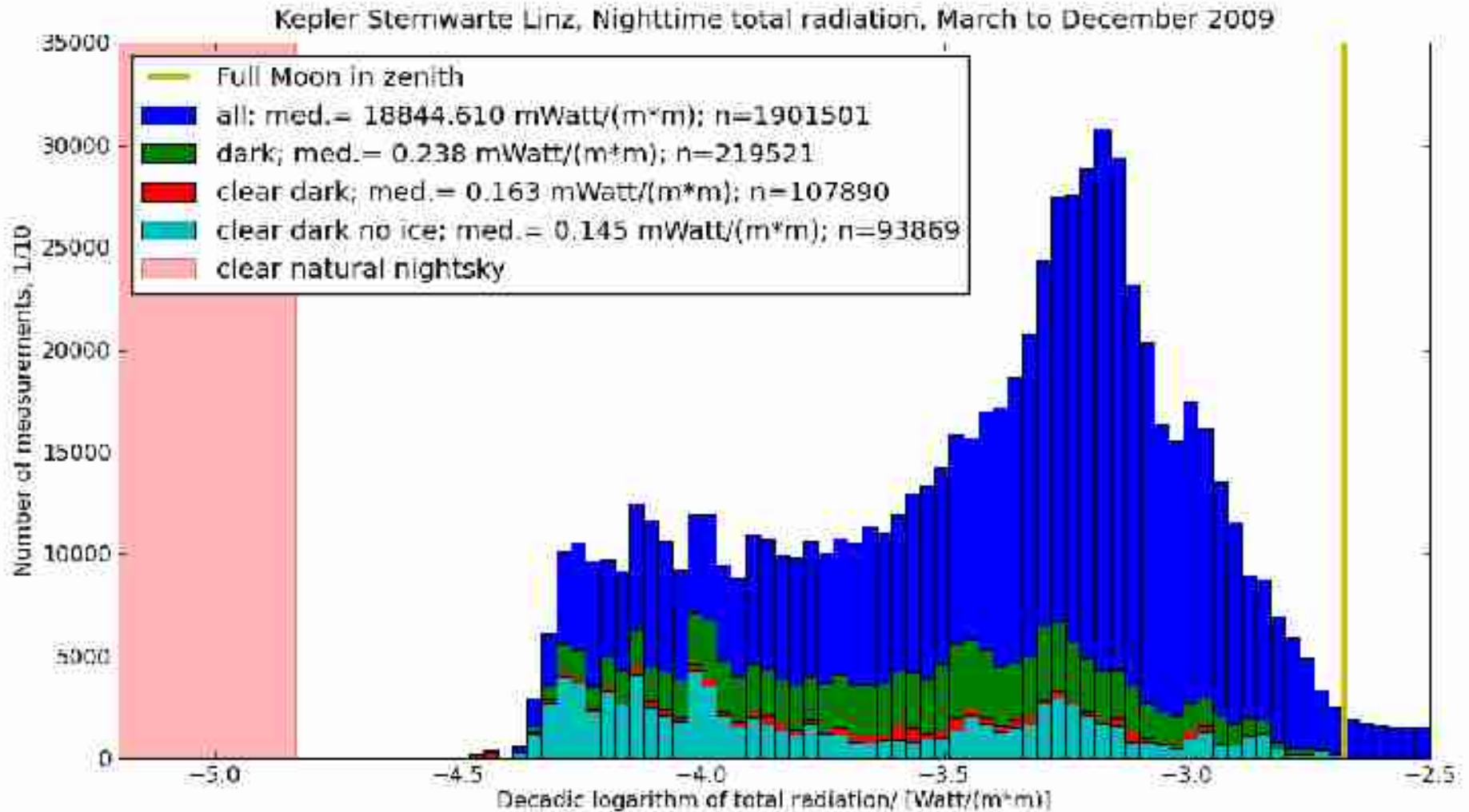


Linz

Kepler Observatory Linz

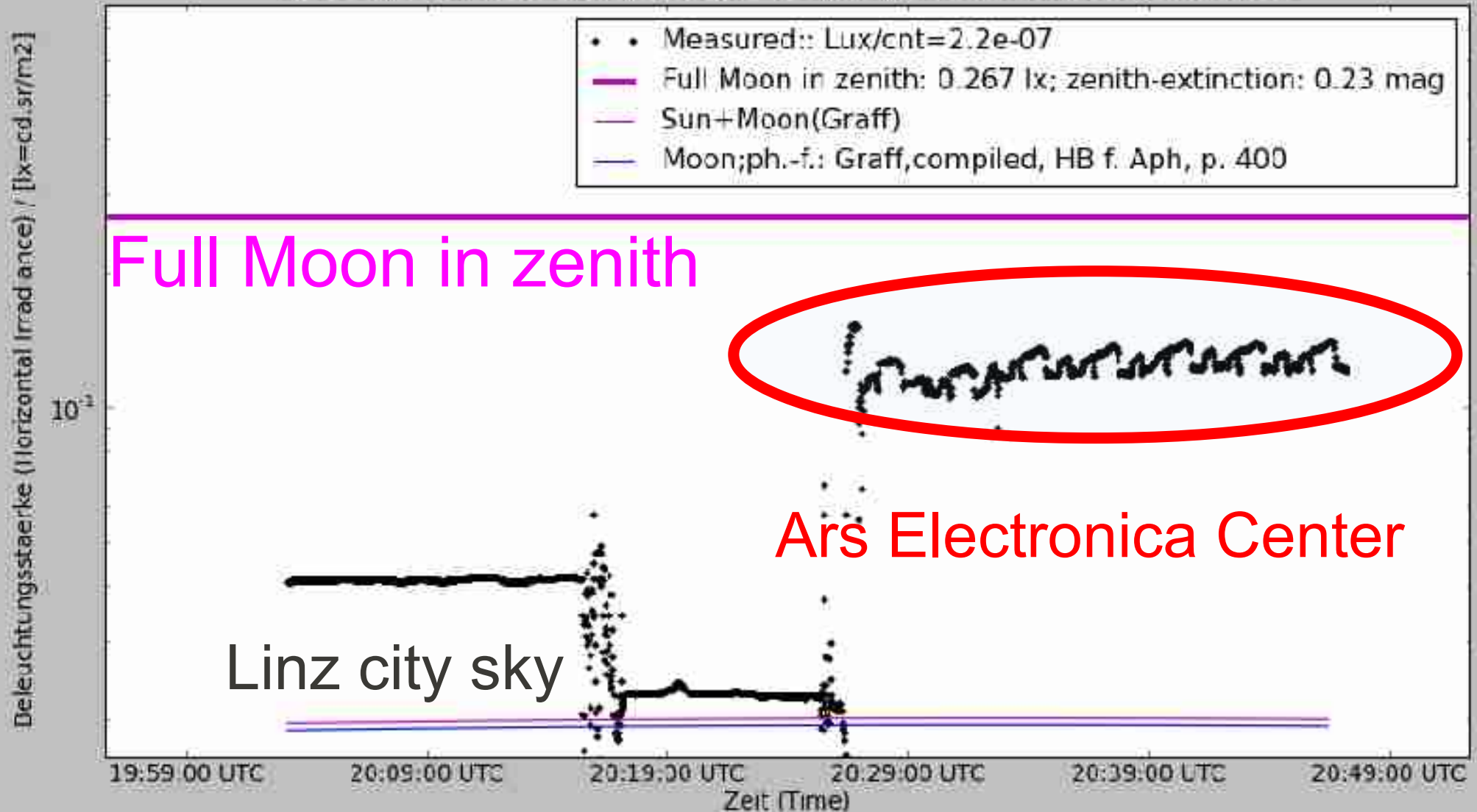


Kepler Observatory Linz

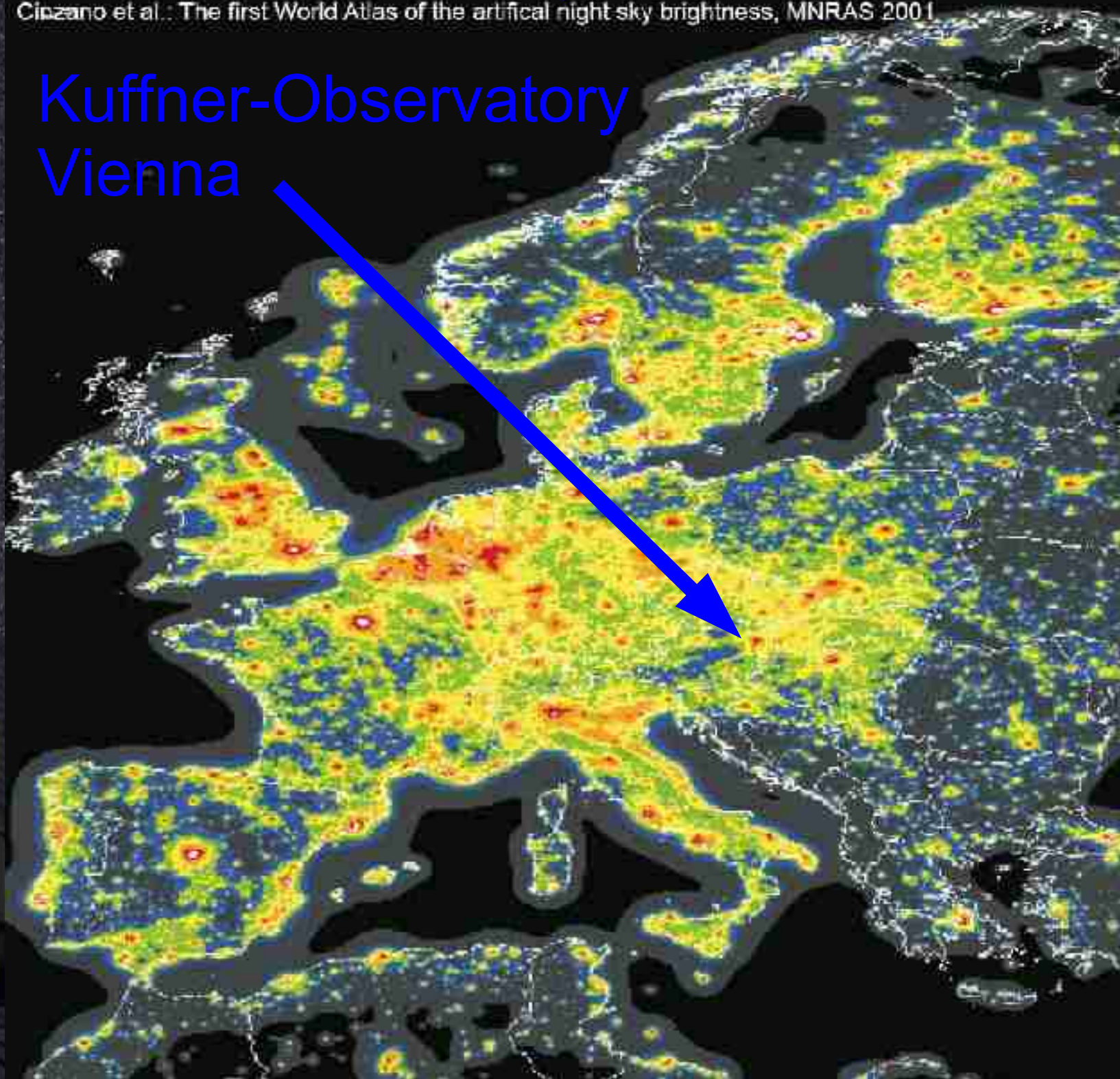
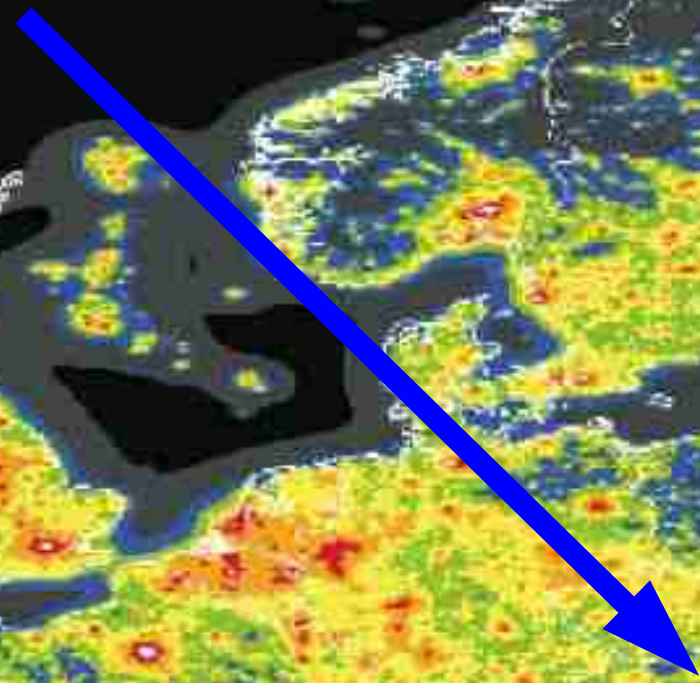


AEC from Schlossberg, 31. Aug.

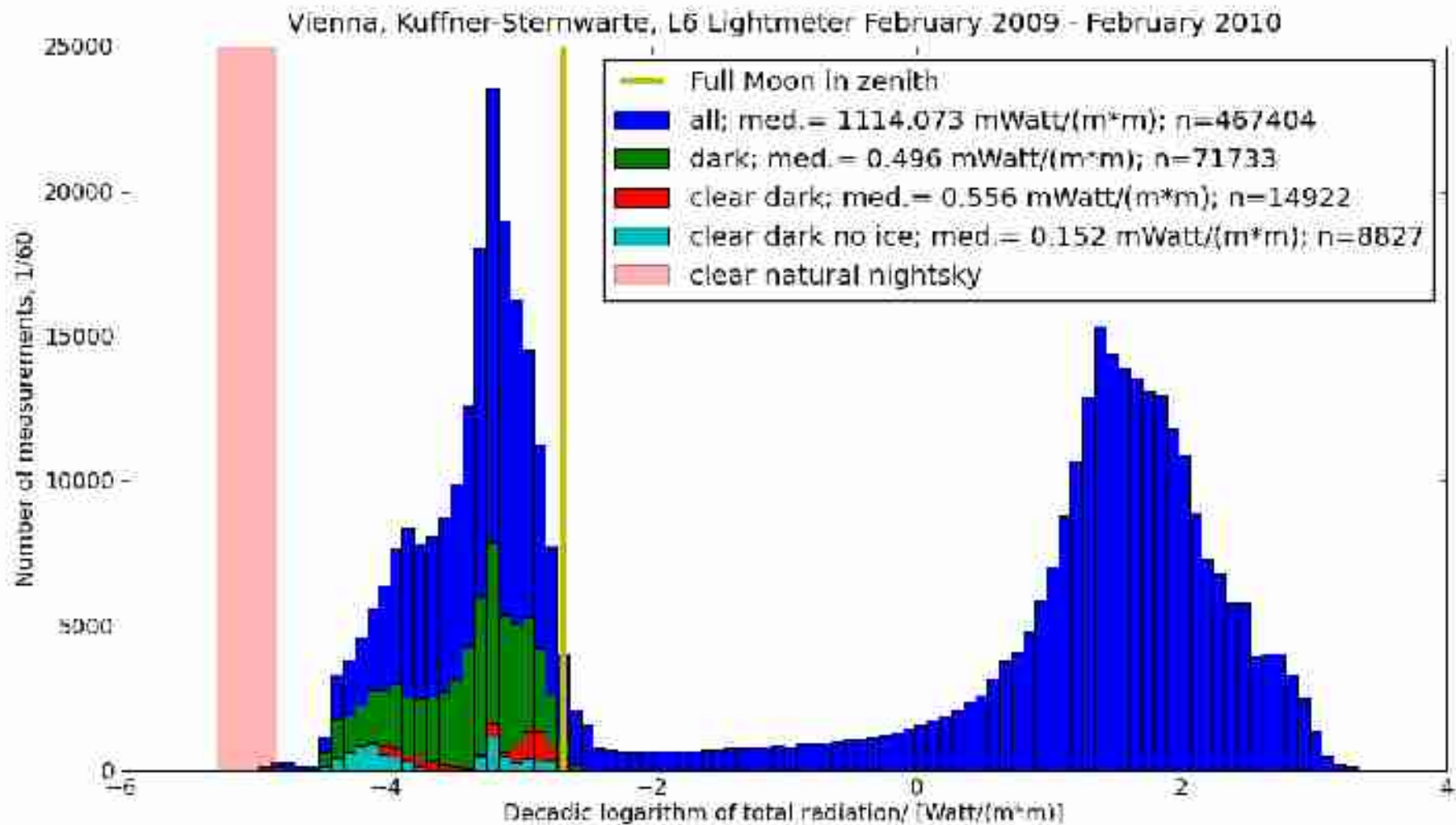
Mondlicht (12 min), Mondschatten (10 min), Ars Electronica Center (vertikal, 10m)
L003 Linz, Schlossberg nahe Kepler-Denkmal, 31. Aug 22h03-22h47 MESZ



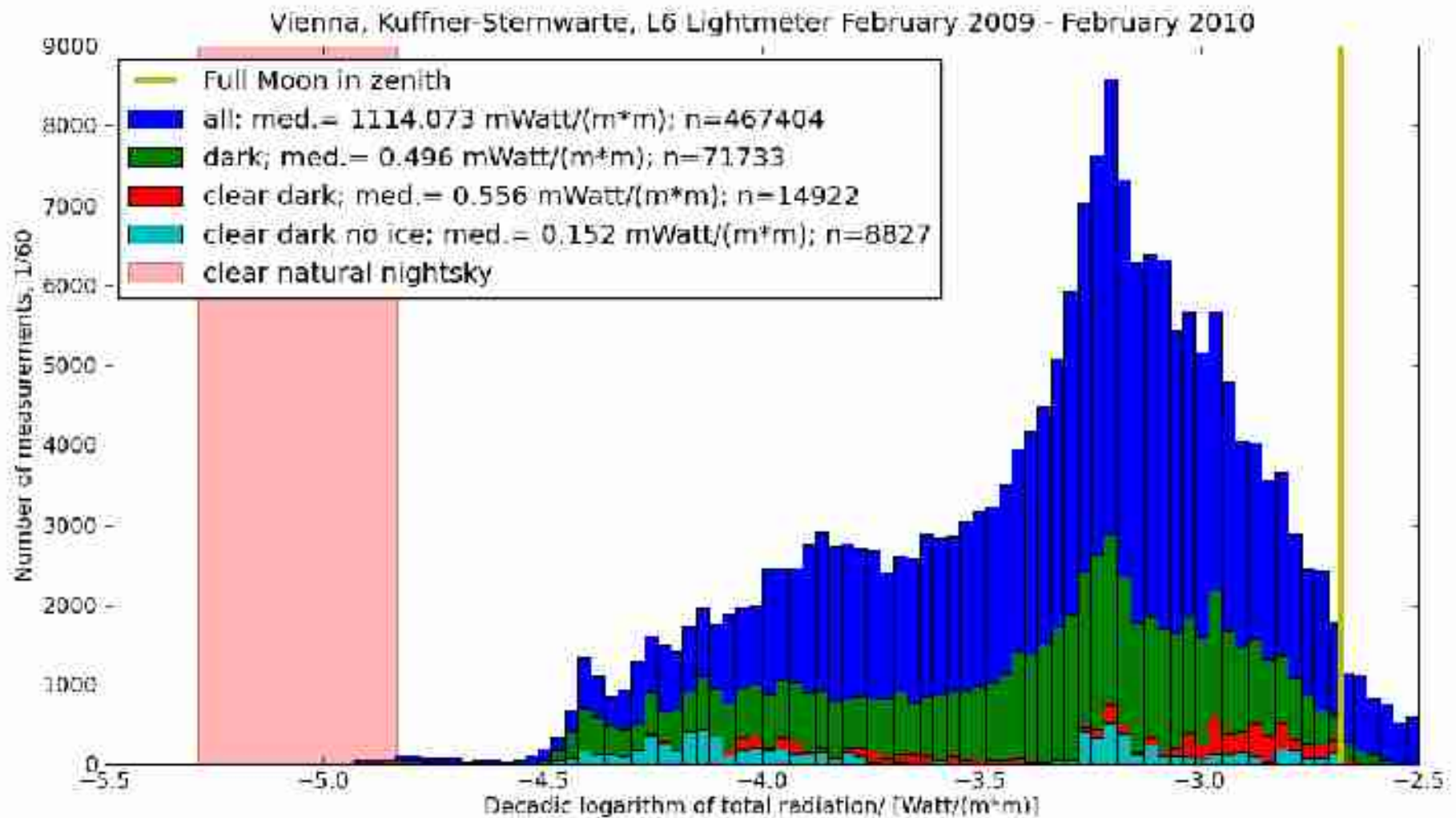
Kuffner-Observatory
Vienna



Kuffner-Observatory / Vienna 2009



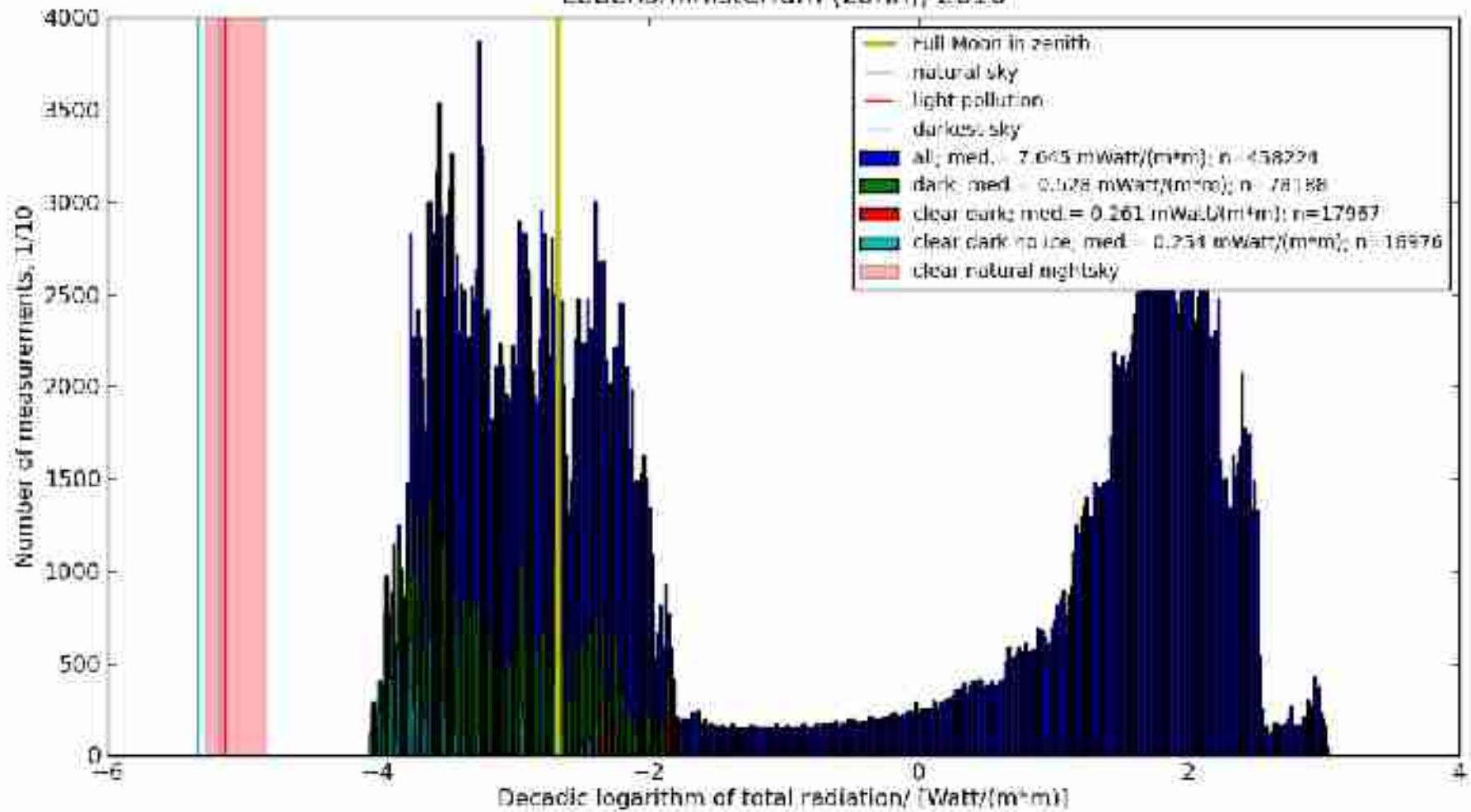
Kuffner-Observatory / Vienna 2009



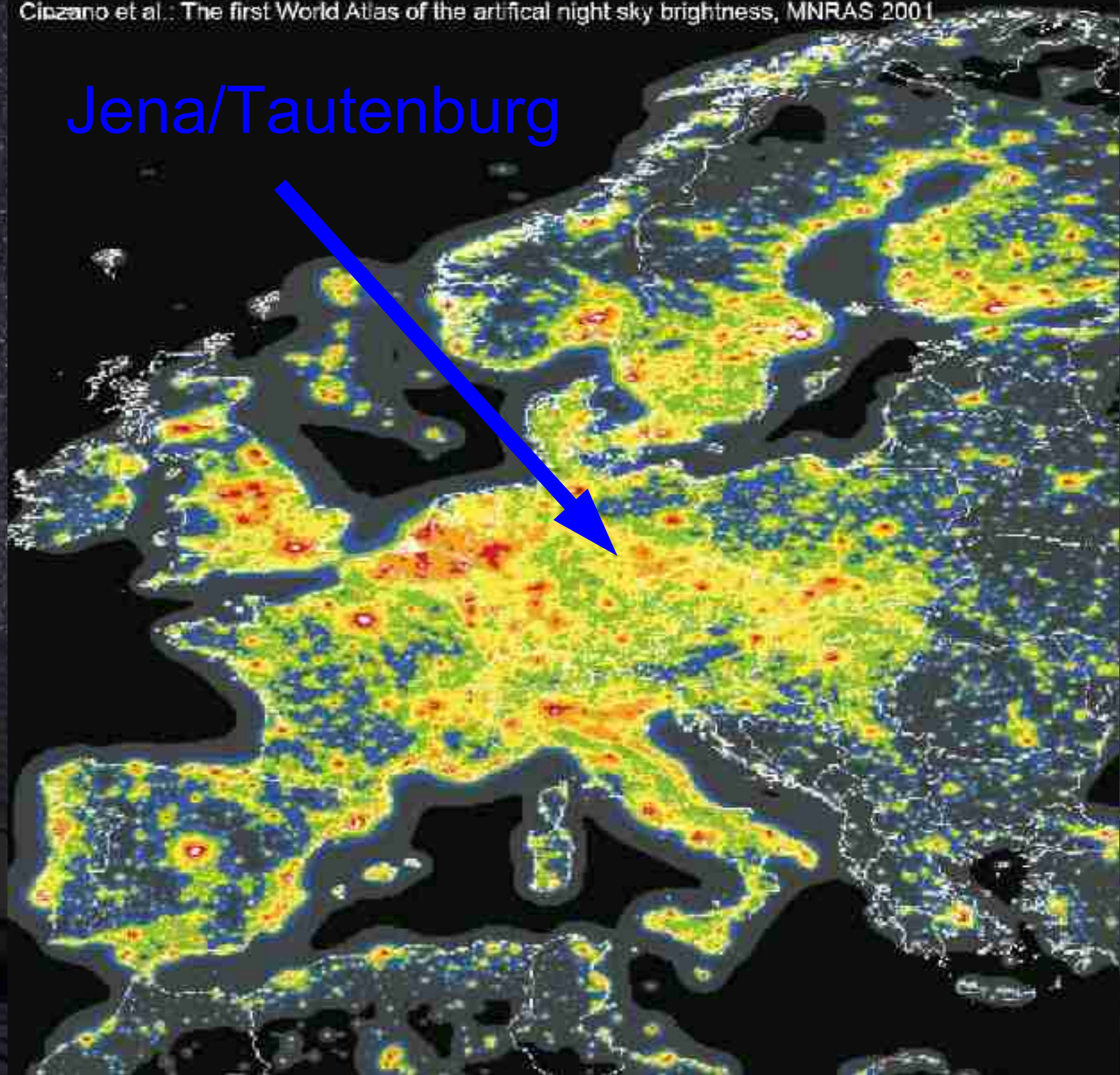
Vienna Centre

Wed Jun 9 14:10:56 2010 to Thu Dec 2 18:00:00 2010

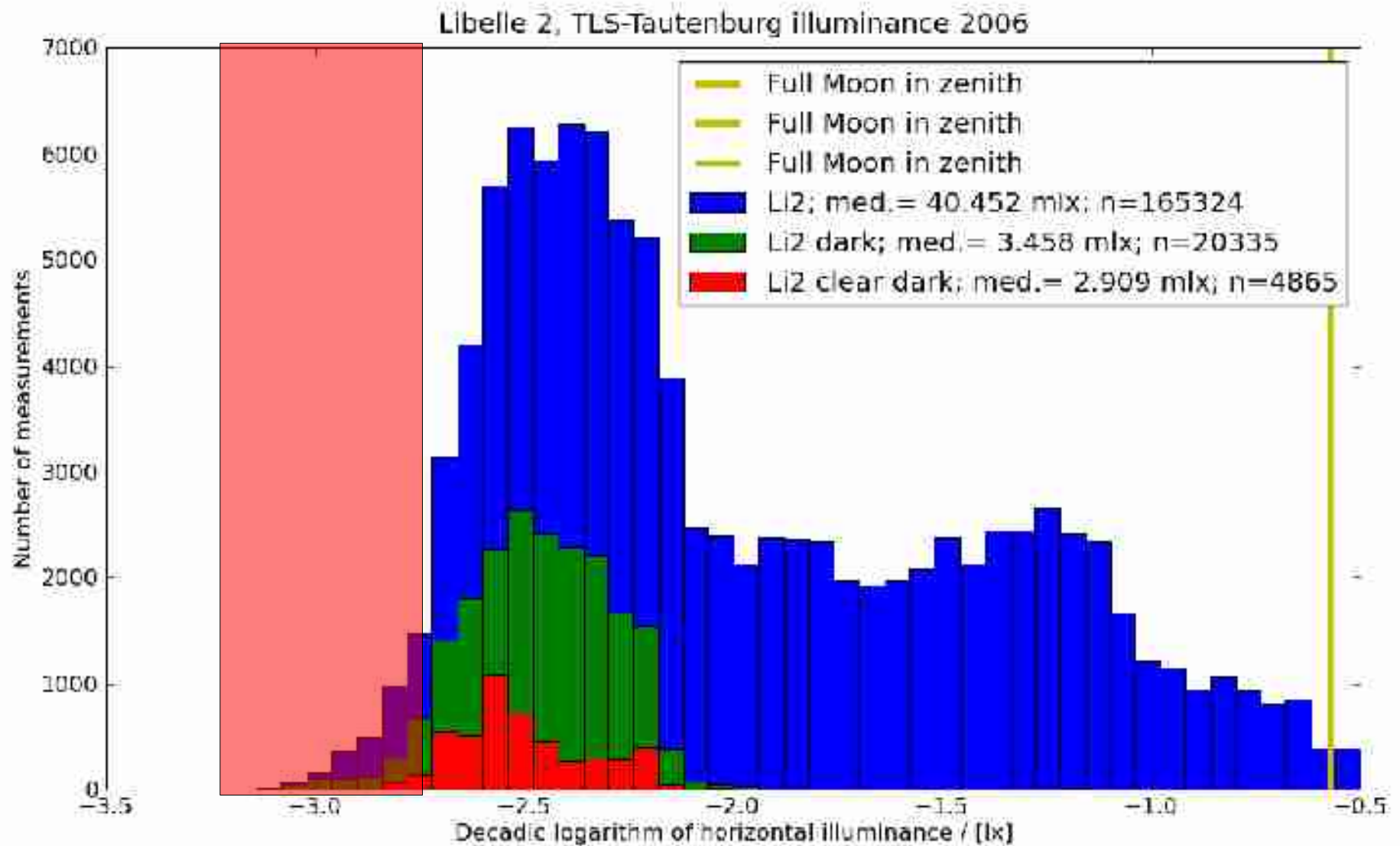
Lebensministerium (LÖnn), 2010



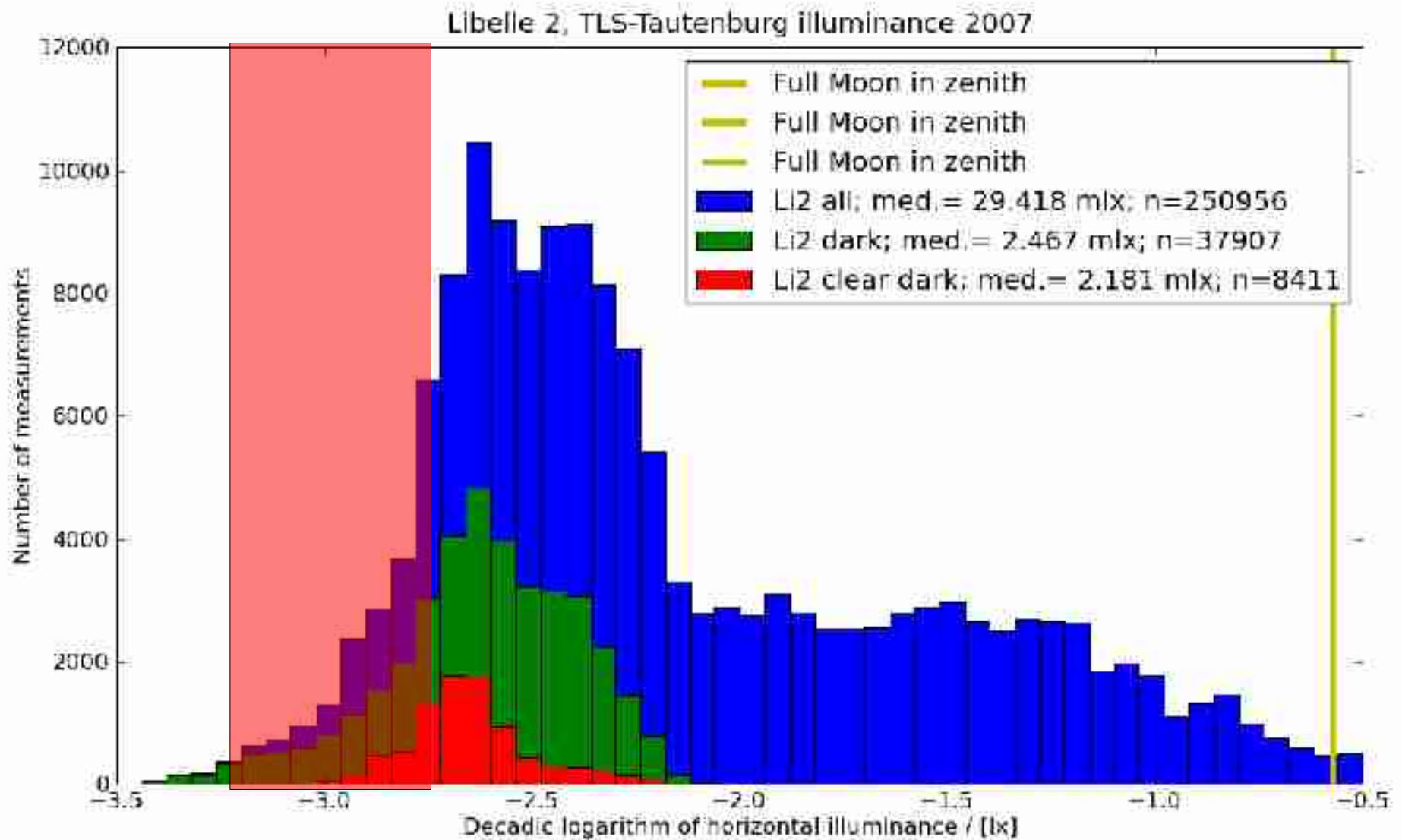
Jena/Tautenburg



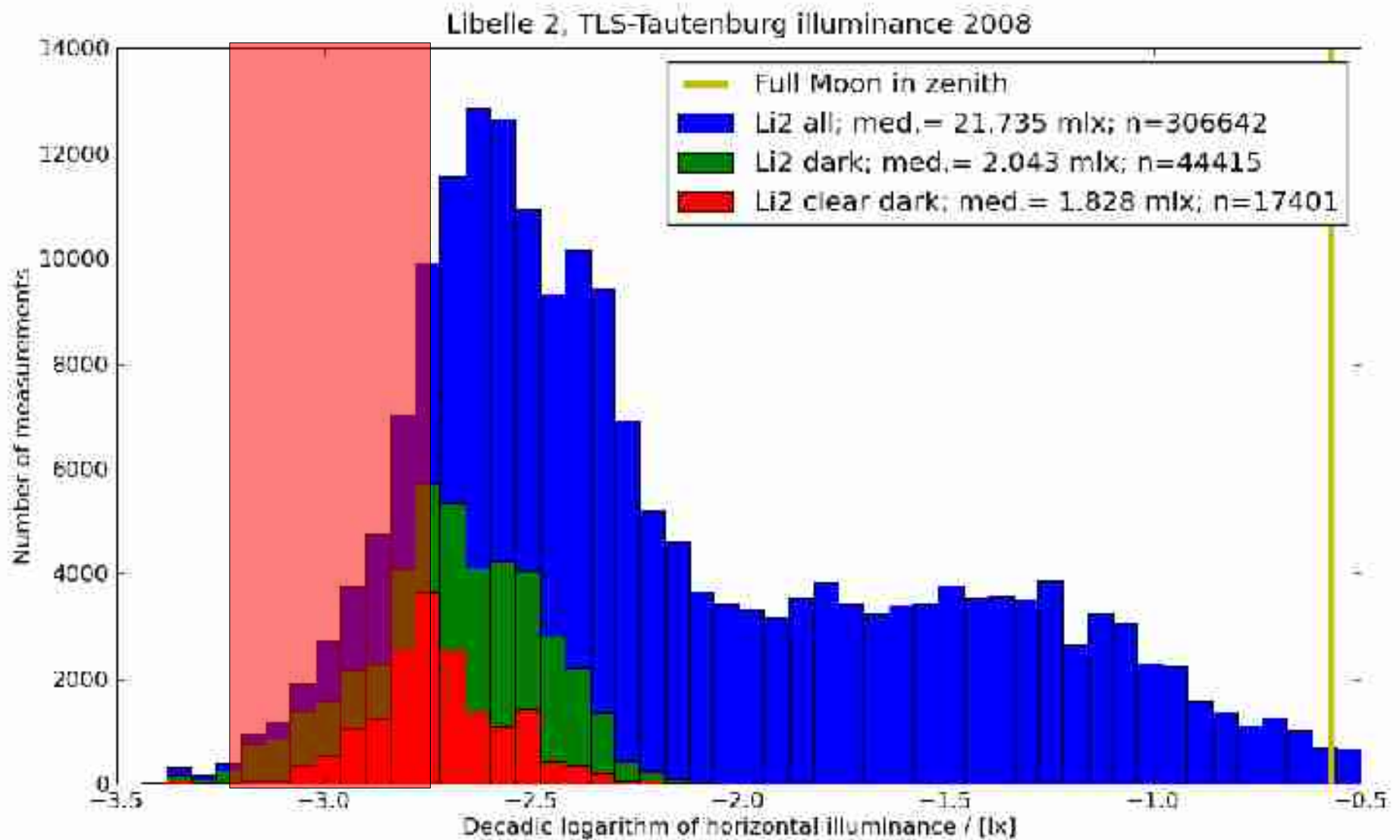
Tautenburg 2006



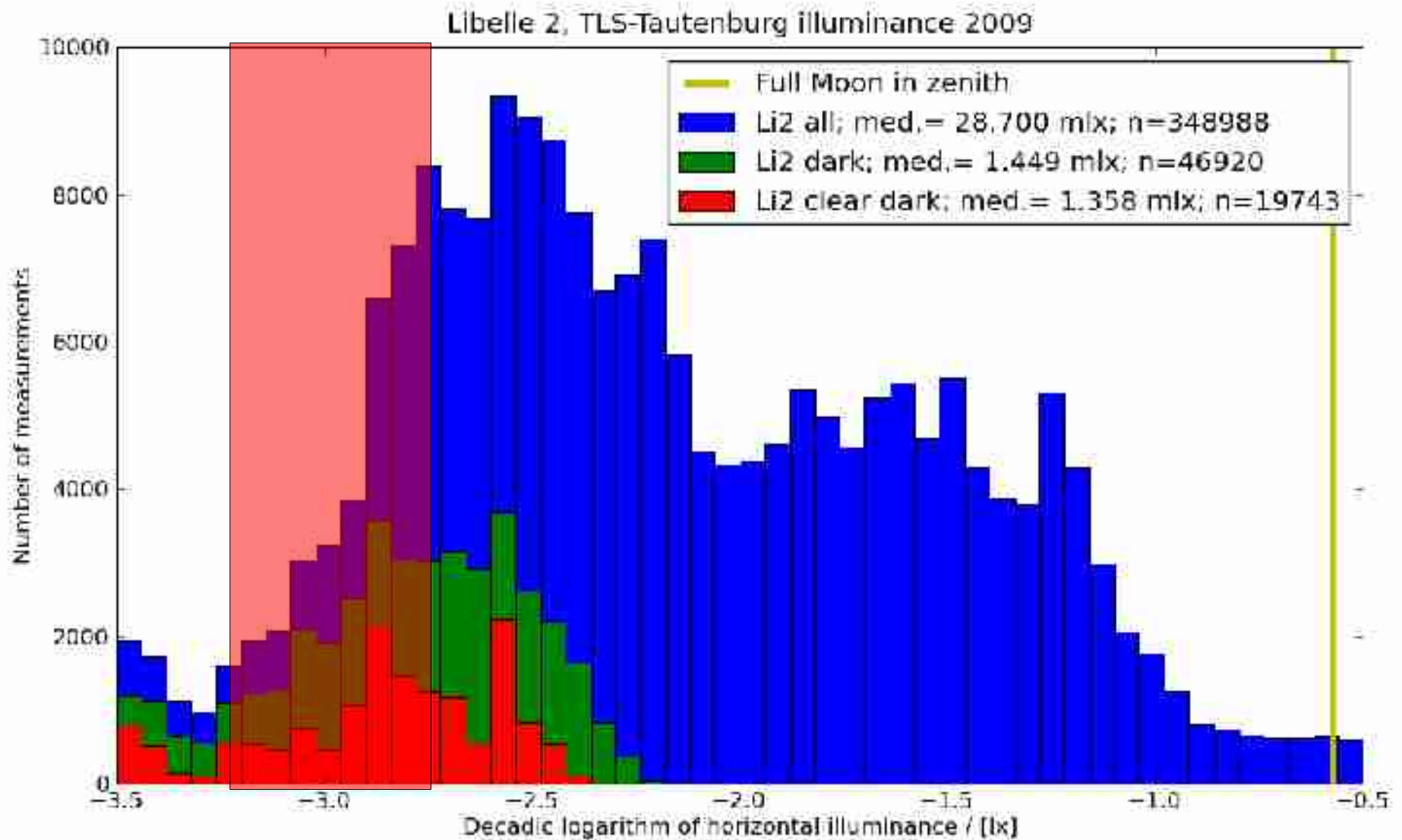
Tautenburg 2007



Tautenburg 2008

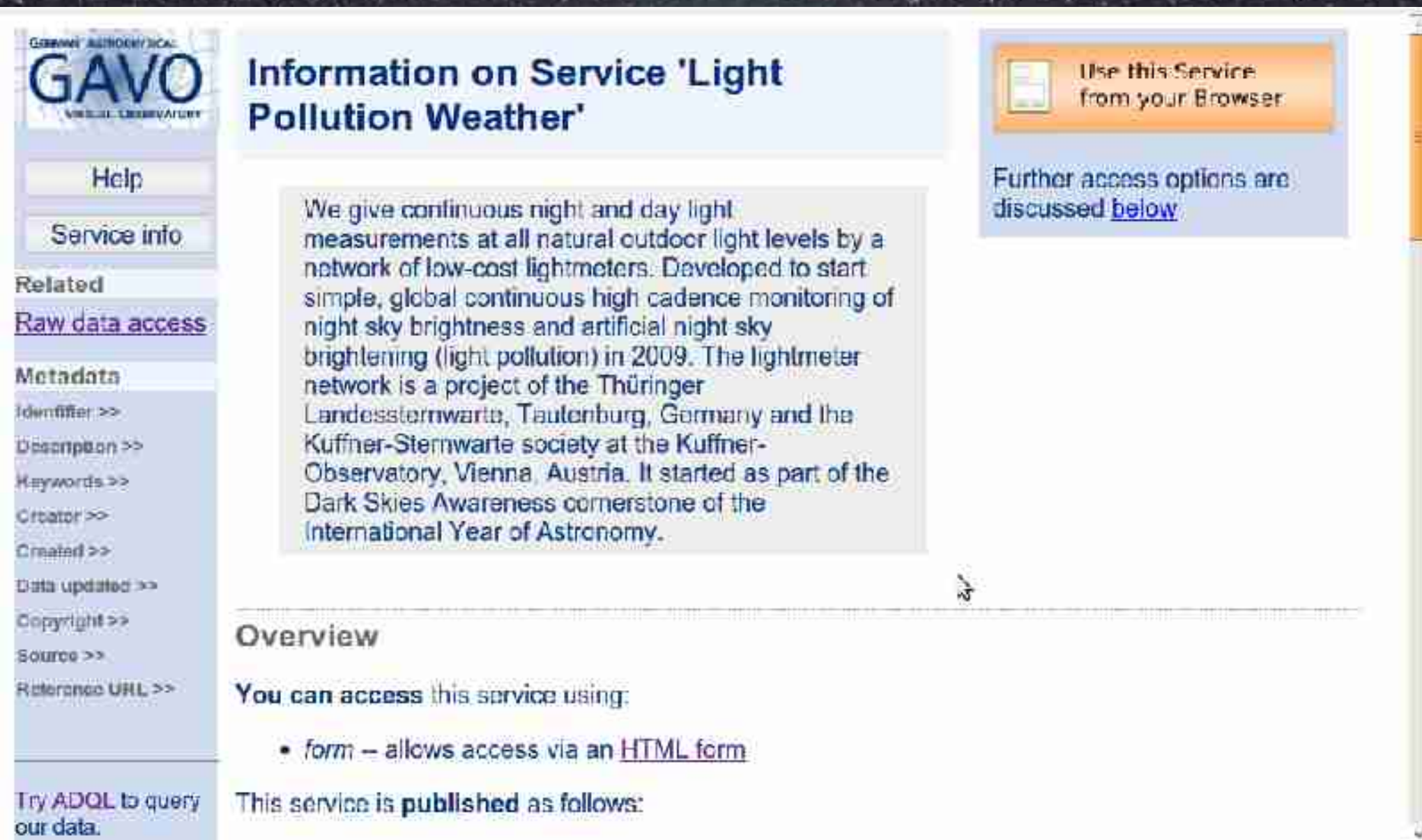


Tautenburg 2009



Lightmeter Datacenter at GAVO

<http://vo.uni-hd.de/lightweather>



GAVO
VIRTUAL OBSERVATORY

Help

Service info

Related

[Raw data access](#)

Metadata

Identifier >>

Description >>

Keywords >>

Creator >>

Created >>

Data updated >>

Copyright >>

Source >>

Reference URL >>

Try ADQL to query our data.

Information on Service 'Light Pollution Weather'

We give continuous night and day light measurements at all natural outdoor light levels by a network of low-cost lightmeters. Developed to start simple, global continuous high cadence monitoring of night sky brightness and artificial night sky brightening (light pollution) in 2009. The lightmeter network is a project of the Thüringer Landessternwarte, Tautenburg, Germany and the Kuffner-Sternwarte society at the Kuffner-Observatory, Vienna, Austria. It started as part of the Dark Skies Awareness cornerstone of the International Year of Astronomy.

Use this Service from your Browser

Further access options are discussed [below](#).

Overview

You can access this service using:

- *form* – allows access via an [HTML form](#)

This service is **published** as follows:

Lightmeter Datacenter at GAVO

<http://vo.uni-hd.de/lightweather>

GAVO
VIRTUAL OBSERVATORY

Help

Service info

Related

[Raw data access](#)

Metadata

Identifier >>

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Try ADQL to query our data.

Light Pollution Weather

Date / / (day/month/year)

Time (UTC)

plus/minus [minutes]

Give measurements within this many minutes of your chosen date and time. The sampling rate is 20 minutes.

Station ID

No selection matches at multiple values legal

Identifier of the measuring station, starting with an ISO CC

Table Sort by Limit to items.

Output format

[\[Result link\]](#) ★

Feed the database!

Instructions for set-up

<http://lightmeter.astronomy2009.at>

Lightmeter requests and wiki-UID

lightmeter@astronomy2009.at

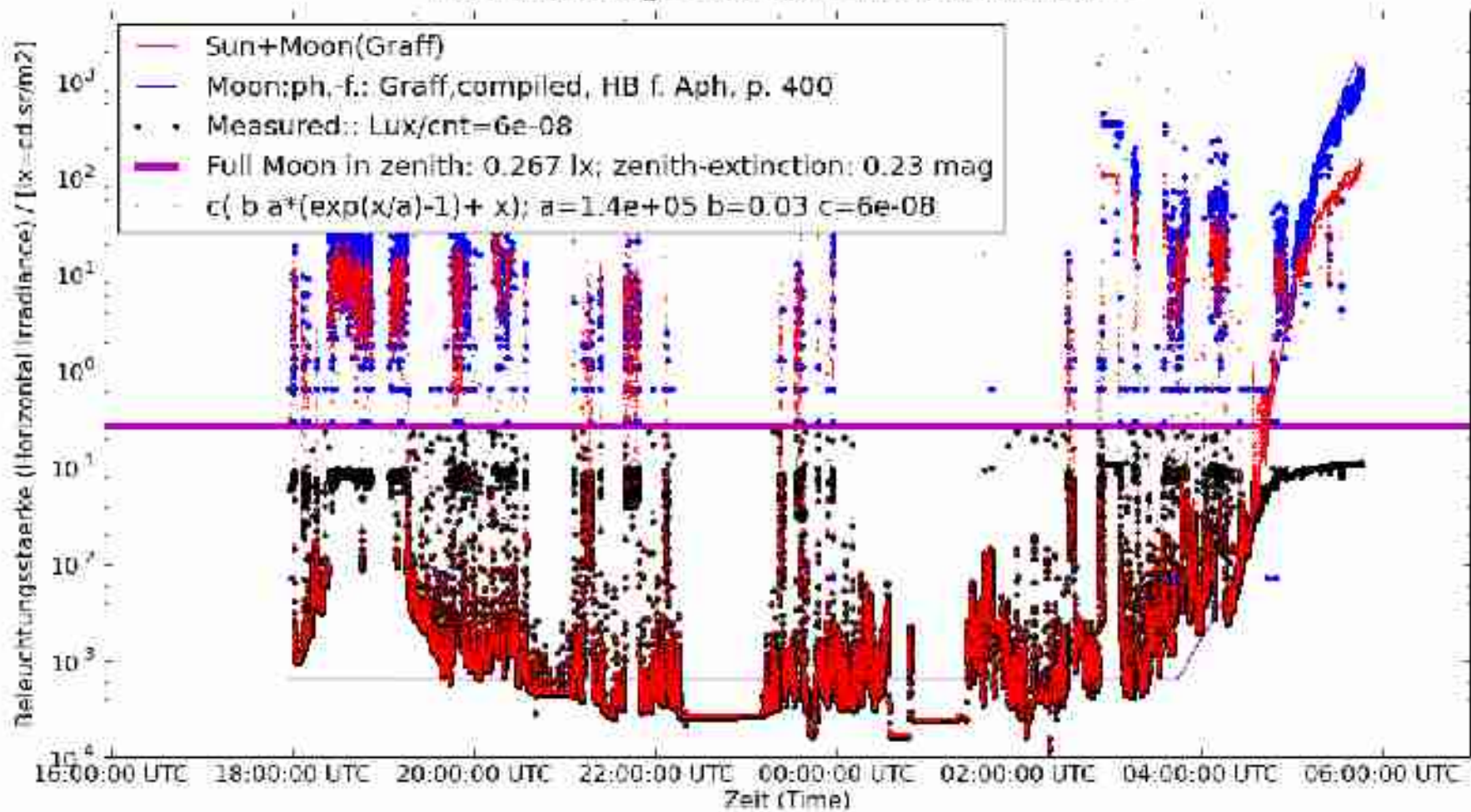
One of many uses: calibrate the satellites...

A night sky filled with stars, with a city skyline visible in the foreground. The sky is dark and filled with numerous bright stars of varying sizes and colors. The city skyline is visible in the lower portion of the image, with several buildings of different heights and shapes. The overall scene is a clear night sky over a city.

In search of Alpine starlight

In search for Alpine Starlight

L051 Grossmugl - Gesäuse - Wien, Oktober 2009



Starshine mapping: Gesäuse





Admonter Kalbling, 2196m at Moonset – Gesäuse National Park
Thomas Posch





Orion drowning in stars – Gesäuse National Park
Markus Reithofer



Mountains in starlight – Gesäuse National Park, Austria – Andreas Trawöger

Conclusion: How to keep it deep

- Monitor your home-sky with a lightmeter
- Find and protect a starlight reserve near you
- Create a starlight oasis near the people
- Reconnect people to the firmament and nightscape
- Find the artistic means for it

How many stars can we still see?

<http://starlit.astronomy2009.at>

- always and everywhere
- worldwide applicability
- by Orion and UMi
- many languages -
- create your own access
- same method for 10 years, 2001 -2010 ...
- real-time result maps
- SQM and lightmeter integration
- time and weather anchor by lightmeter network

Change Area: Sky conditions: Since: (Note: 2006 takes time) Until:

Visual: SQM: SQM-L:

Sky condition colours: 1, no stars 2, very bad 3, bad 4, moderate 5, good 6, very good 7, natural sky

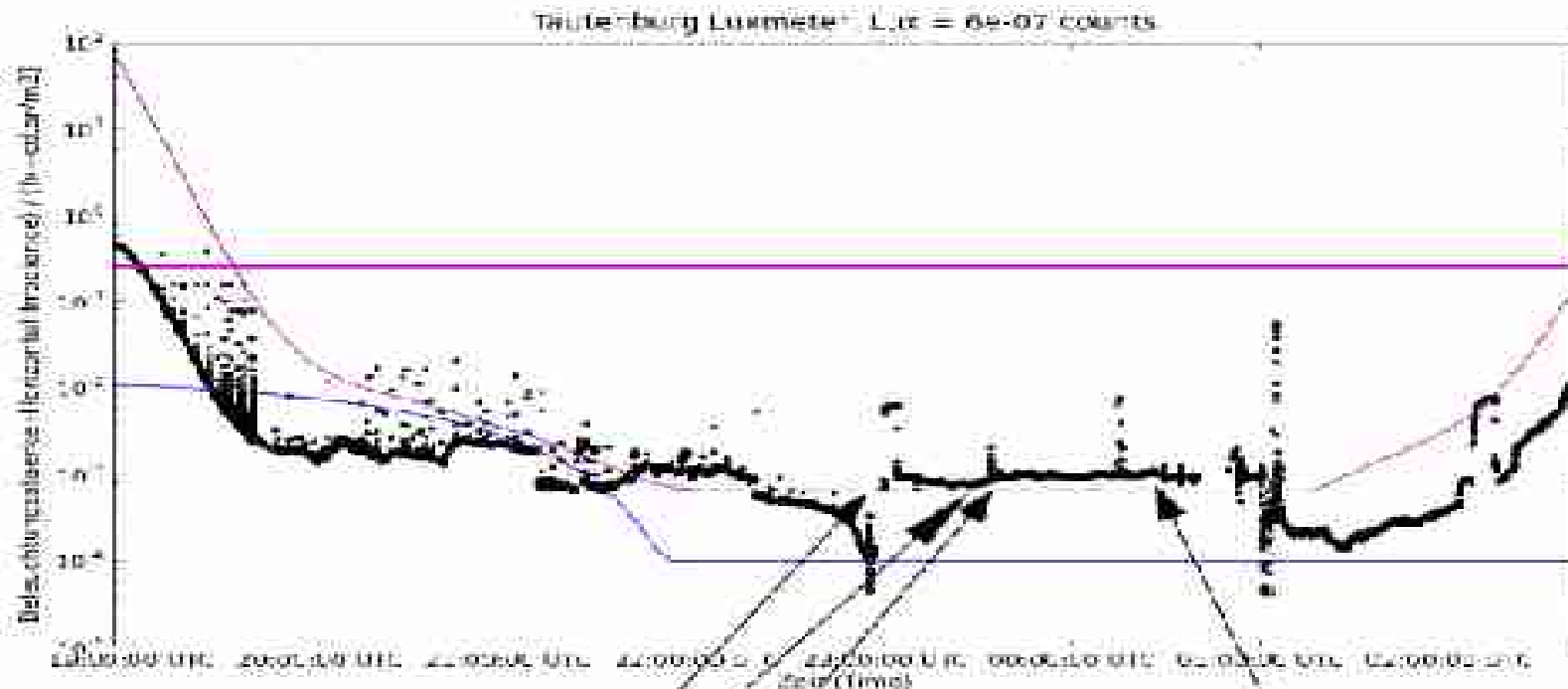
Calibration always and everywhere

- ~~Simultaneous measurements with other instruments (Luxmeter, SQM)~~
- ~~Daylight Sensor (Mark 2.3 IYA Lightmeter)~~
- Sun
- Twilight
- Moon (less available; use for checks)



Milky way during the nautical twilight with the Moon rising, A. Trawöger

When brighter is better Life is not always sunshine ...



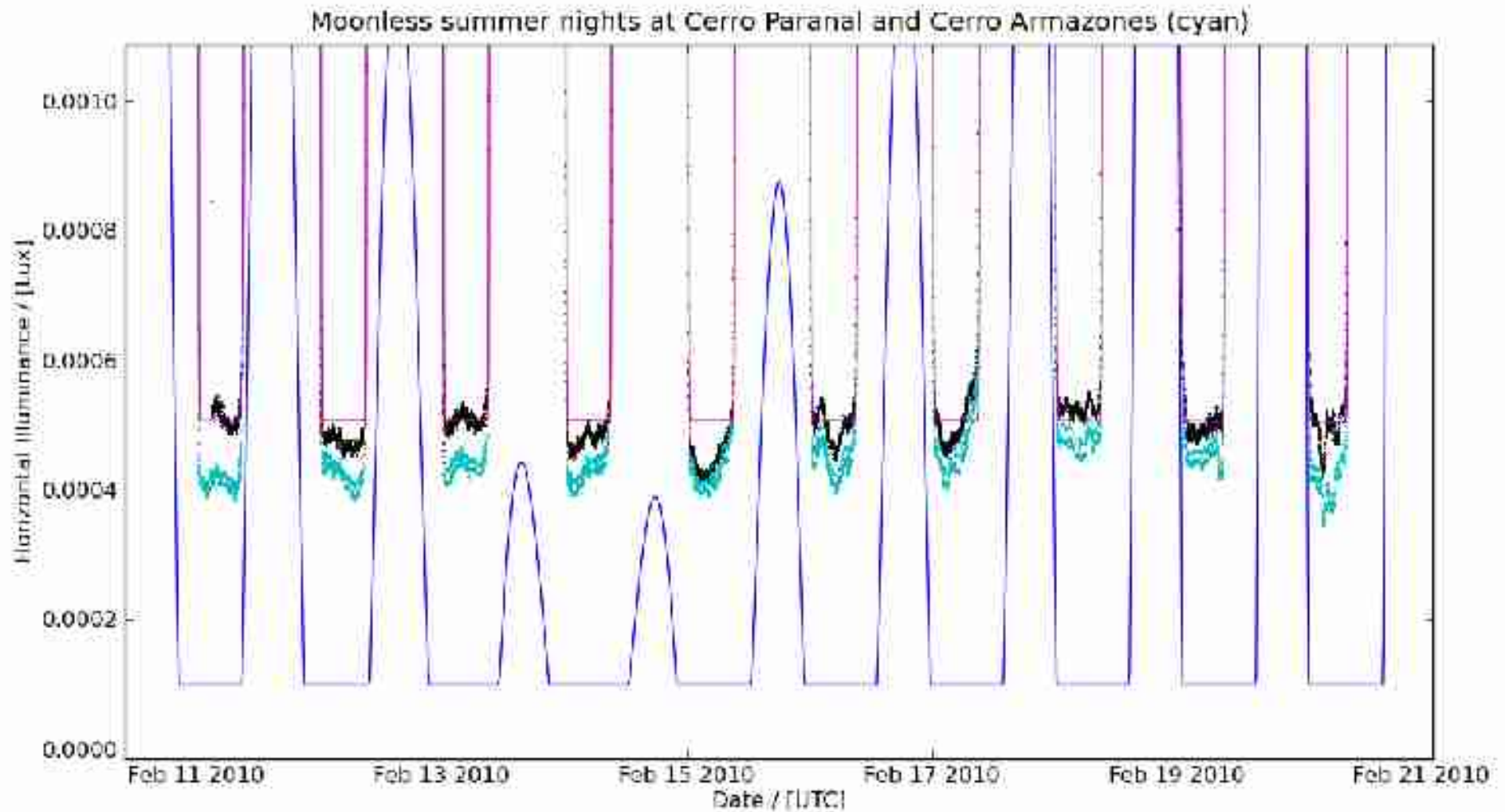
23:00 (01:00 MESZ): Wechselt zur Tisch

23:25 UTC (01:25 MESZ) Jupiter mit Hof

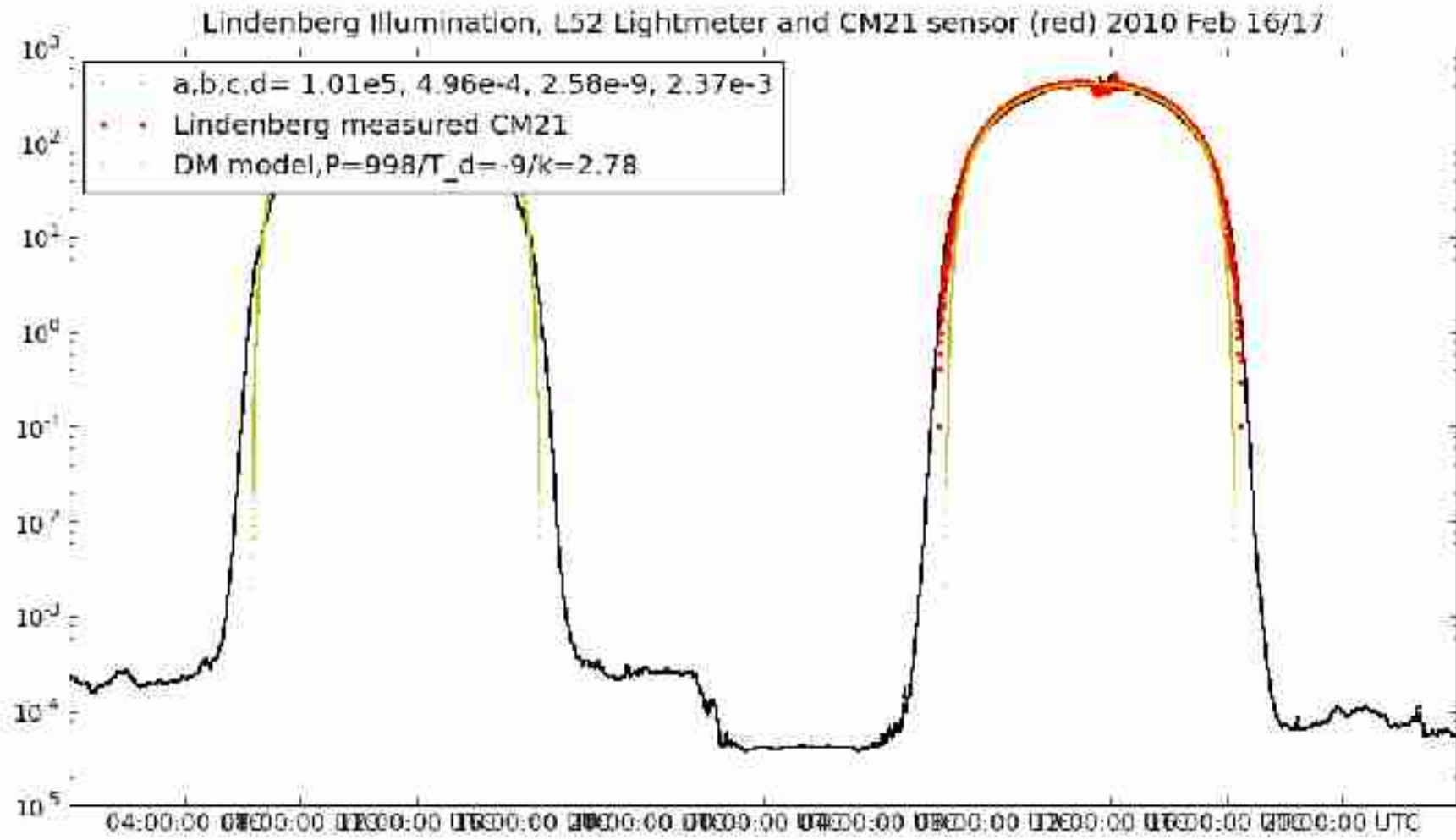
23:30 (01:30) Auftreten der Wolken
Milchstraße im Cygnus schimmer durch Stratus-Wolken!

00:27 (02:27) Zenit bedeckt
Keine Sterne

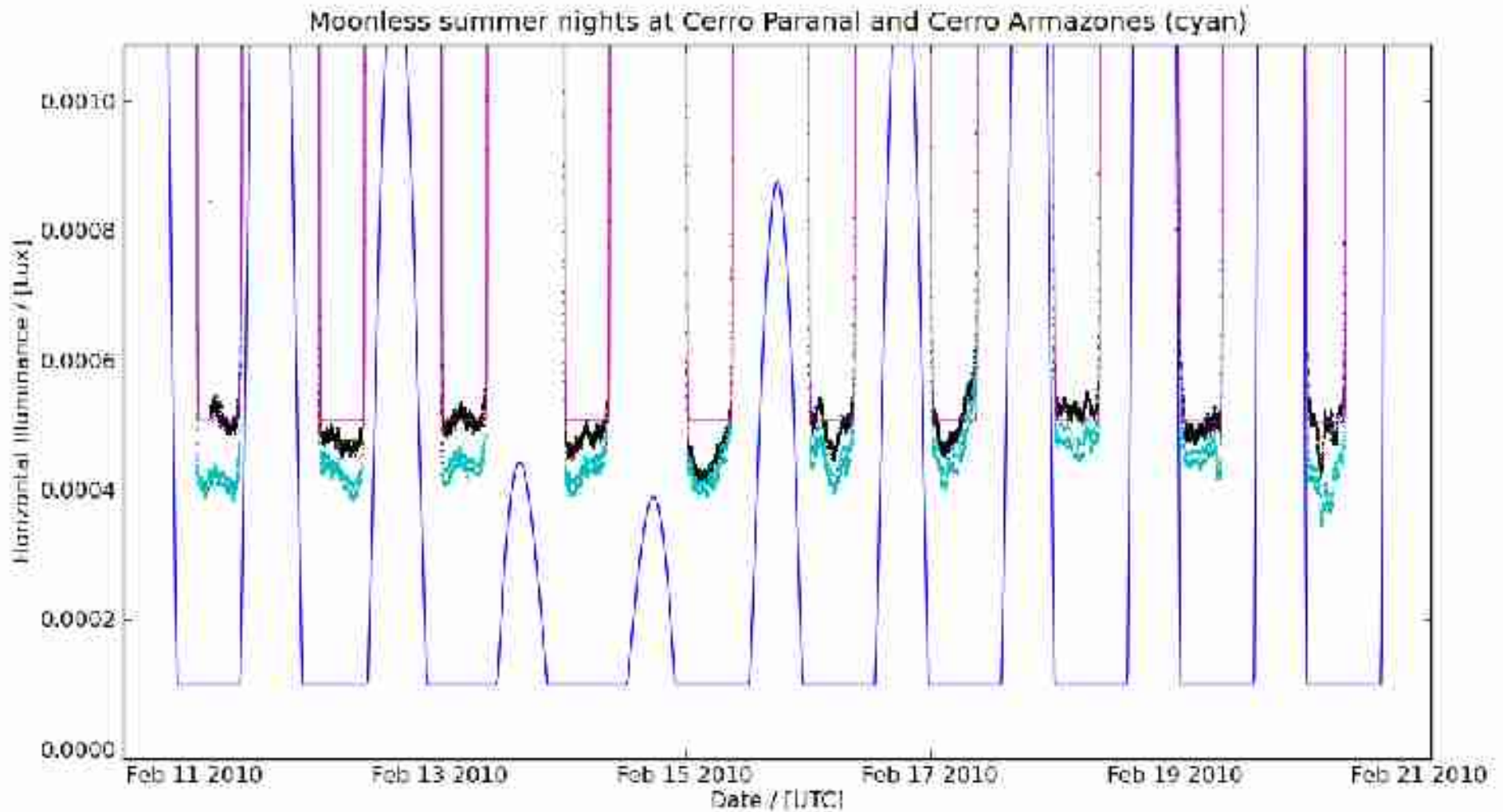
Micro-Lux at Atacama



Check with total-rad. measurements



Micro-Lux at Atacama



Check with total-rad. measurements At your local weather station!

