

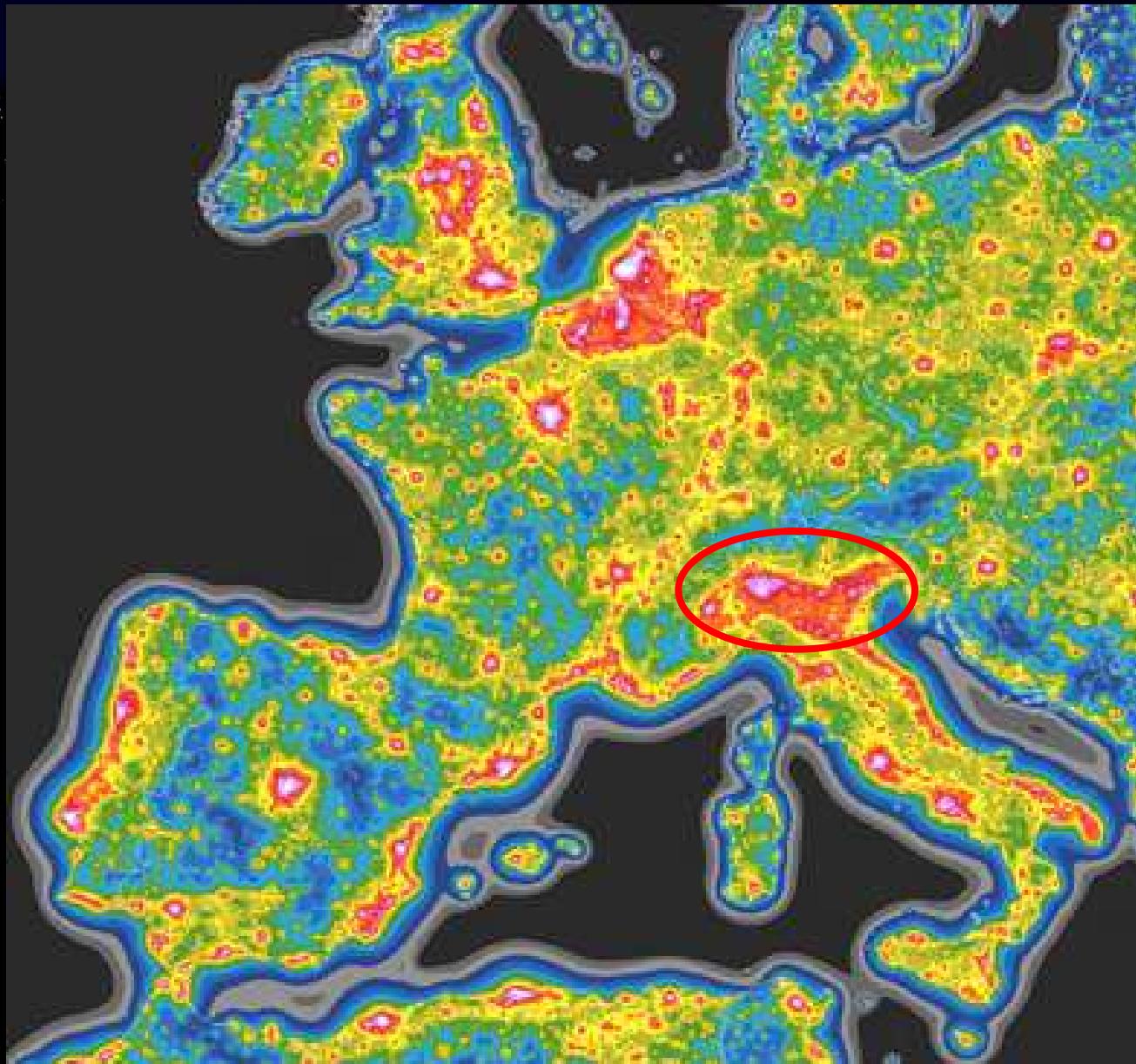
Measurements of Night Sky Brightness in Veneto region: sqm network implementations and results

A. Bertolo & R. Binotto - ARPAV Padova

Sergio Ortolani - University of Padova

Luca Zaggia - Venetostellato

Night Sky - Capraia - september 2018



One of
the most
light
polluted
country
in the
world !



A continuous light carpet....

VENETOSTELLATO, 2014

ARPAV activities

- **Controlling** the territory of existing public and private installations, in particular for upward direct emission
- **Investigation** of design, from large installations (highways, hospitals, shopping malls) to residential ones
- **Regional committee on light pollution**, checking law effectiveness, reporting to the regional administration, and promoting studies and initiatives on the issue, in collaboration with research institutions
- **Training and education**

Monitoring light pollution in Veneto

- An effective and reliable network to monitor light pollution
- Measurements by professional institutions supplemented by amateur astronomers
- ARPAV is collecting all the data and ensures the quality of the data with appropriate calibration (carried out by means of a shared reference SQM)

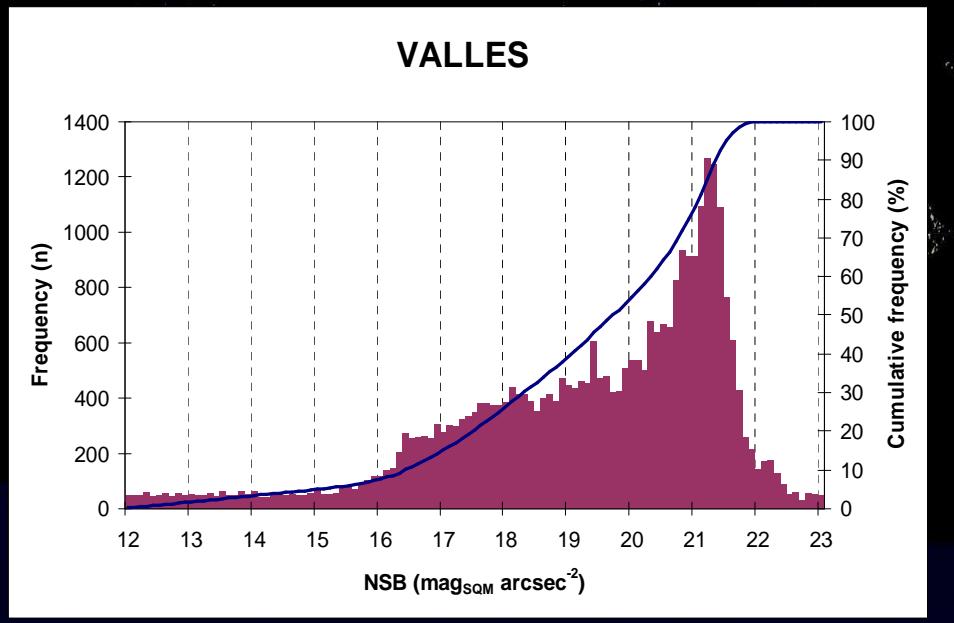
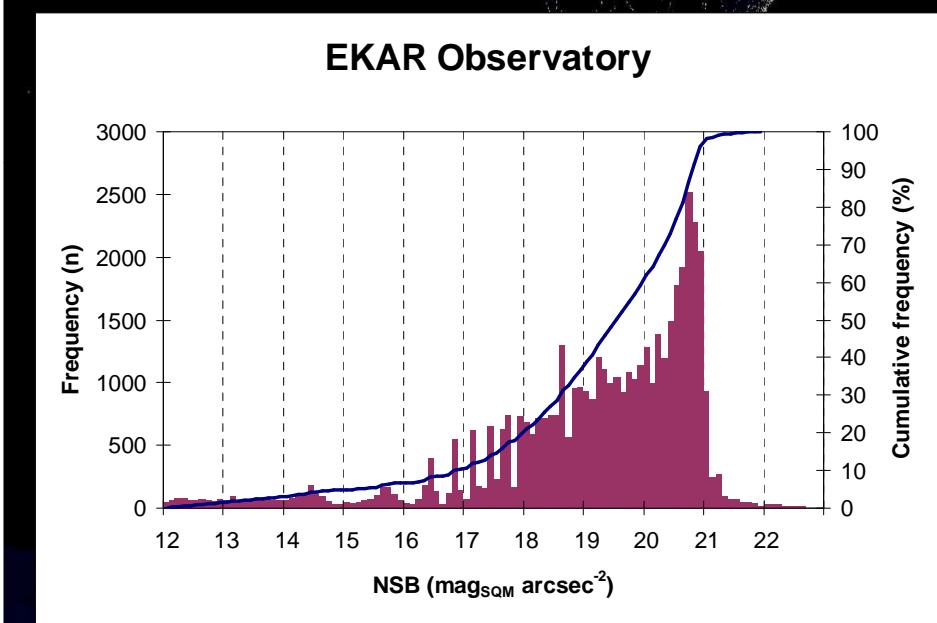
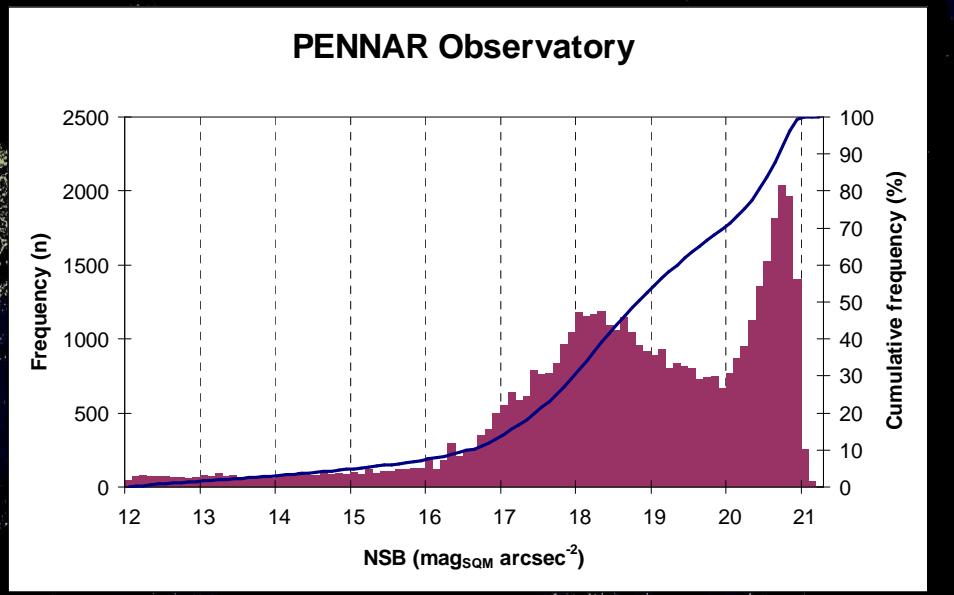
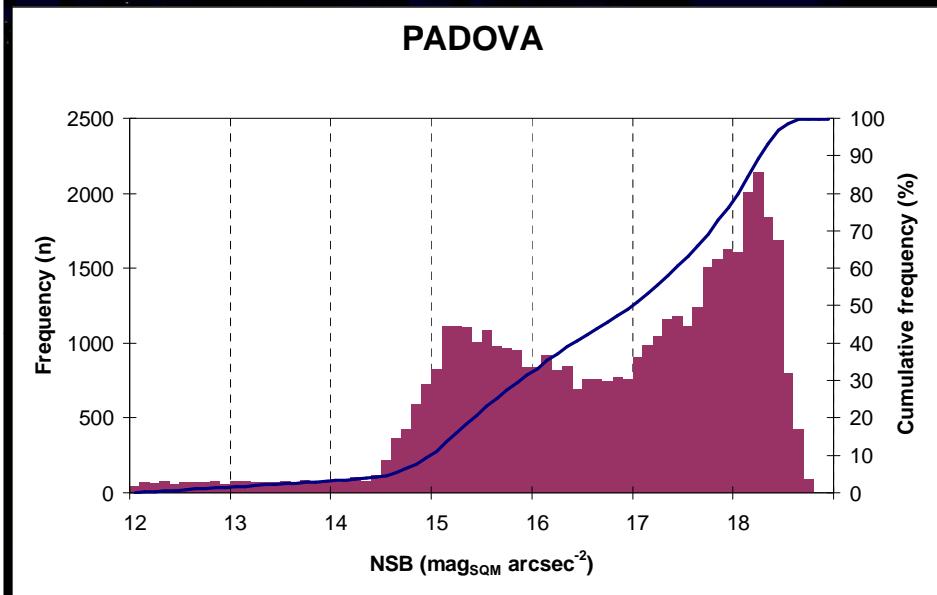


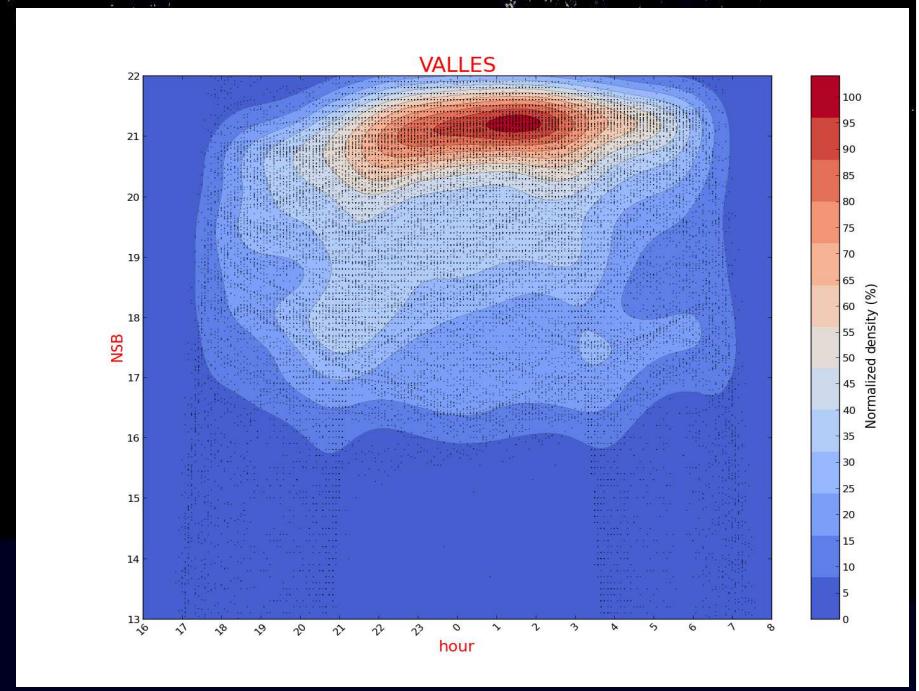
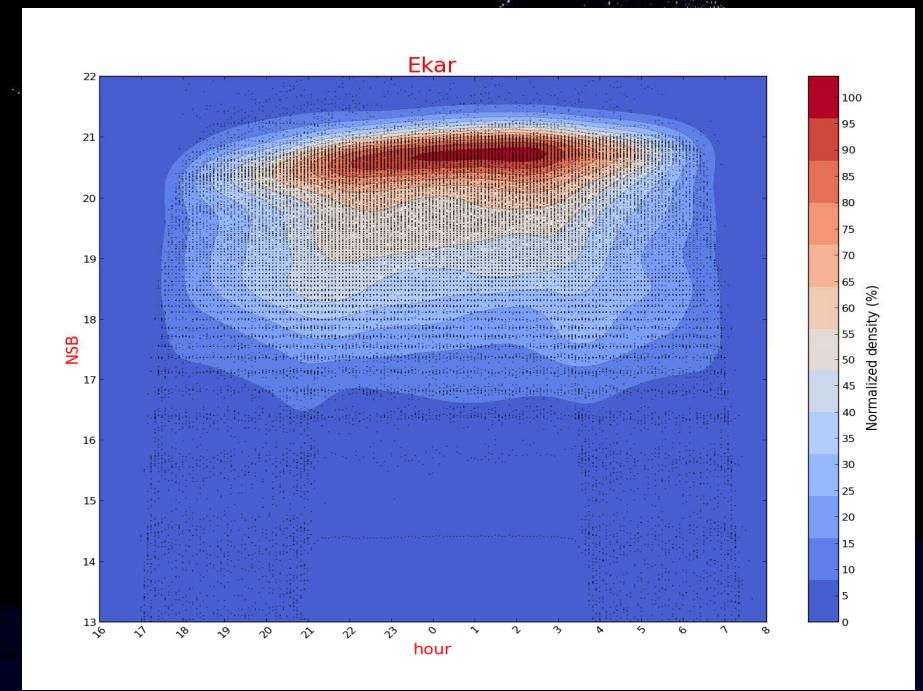
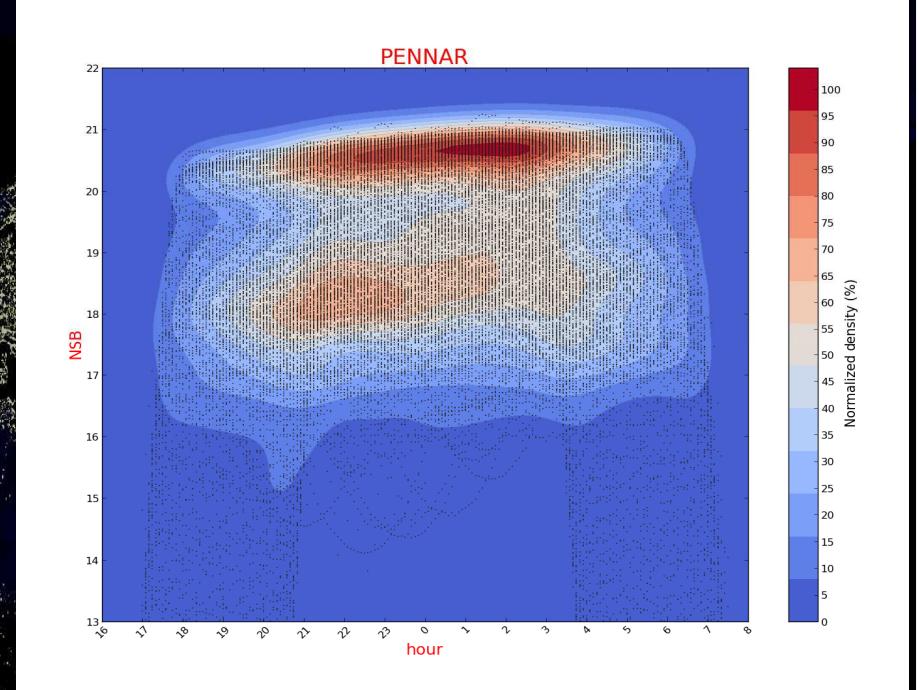
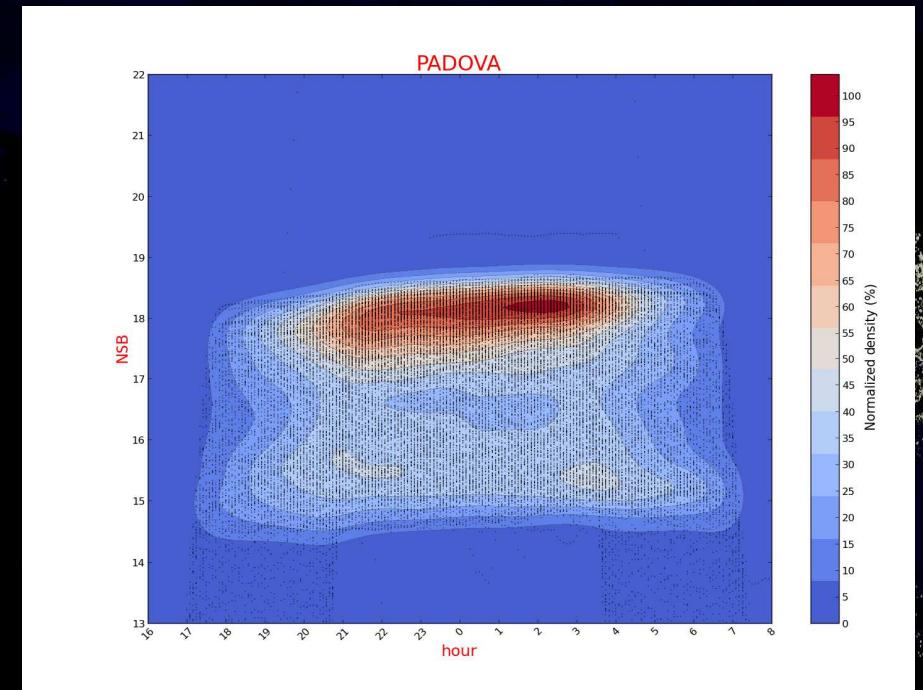
11/09/201

elaborated by Falchi et al.: The new world atlas(2016)

SQM Station	Altitude (m)	Global Mode (mag _{SQM} arsec ⁻²)
<i>urban center</i>		
Padova (<u>imm</u>)	12	18.2
<i>suburban</i>		
Nove (VI)	77	19.6
Montebello (VI)	212	19.7
<i>Rural</i>		
Cattignano (VI)	505	20.0
Pennar (VI)	1050	20.7
<i>Montane</i>		
Monte Baldo (VR)	1208	20.5
Cima Ekar (VI) (<u>imm</u>)	1366	20.7
Passo Valles (BL) (<u>imm</u>)	2032	21.2

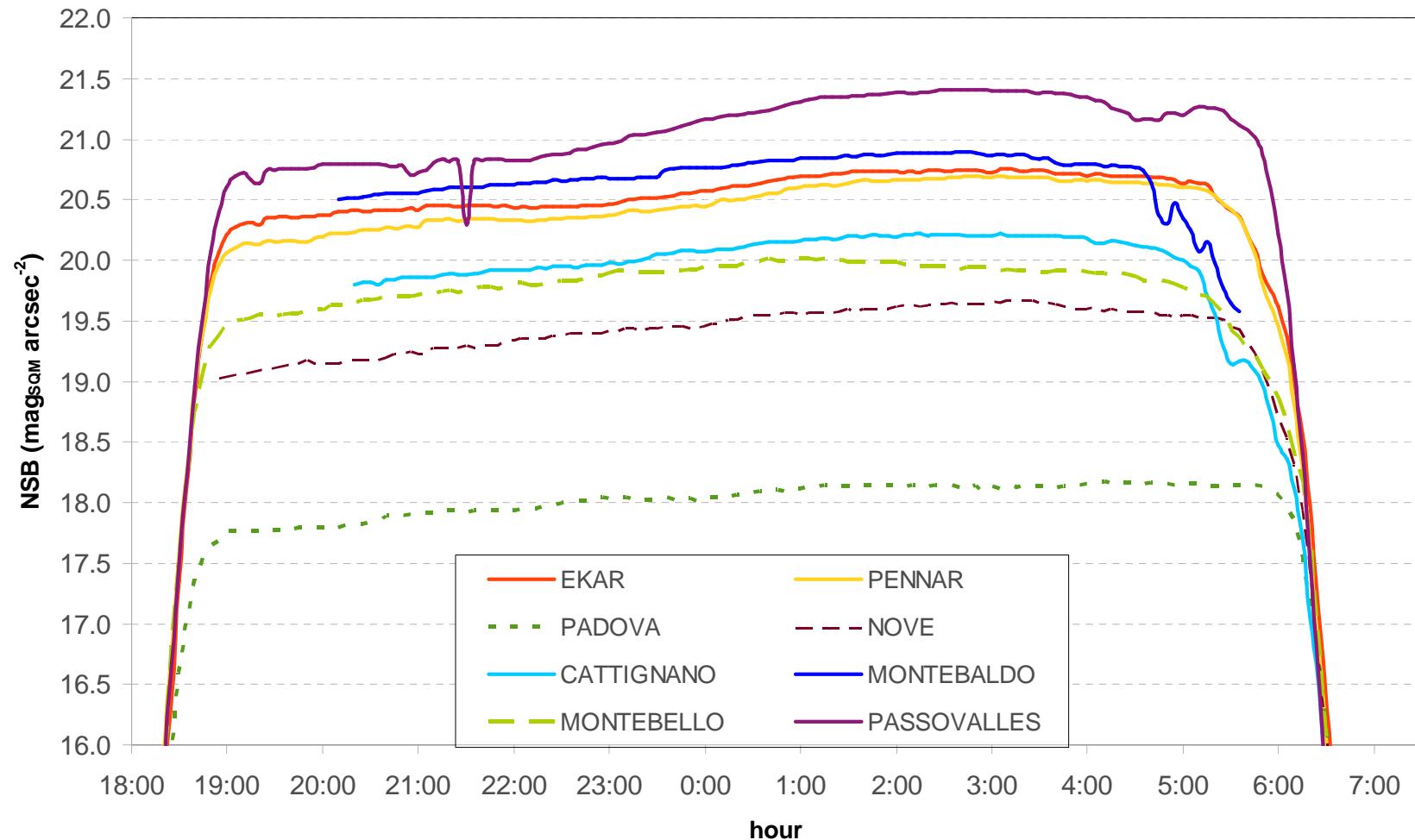
NSB distributions





NSB nocturnal development

VENETO SQM NETWORK - 14/2/2018

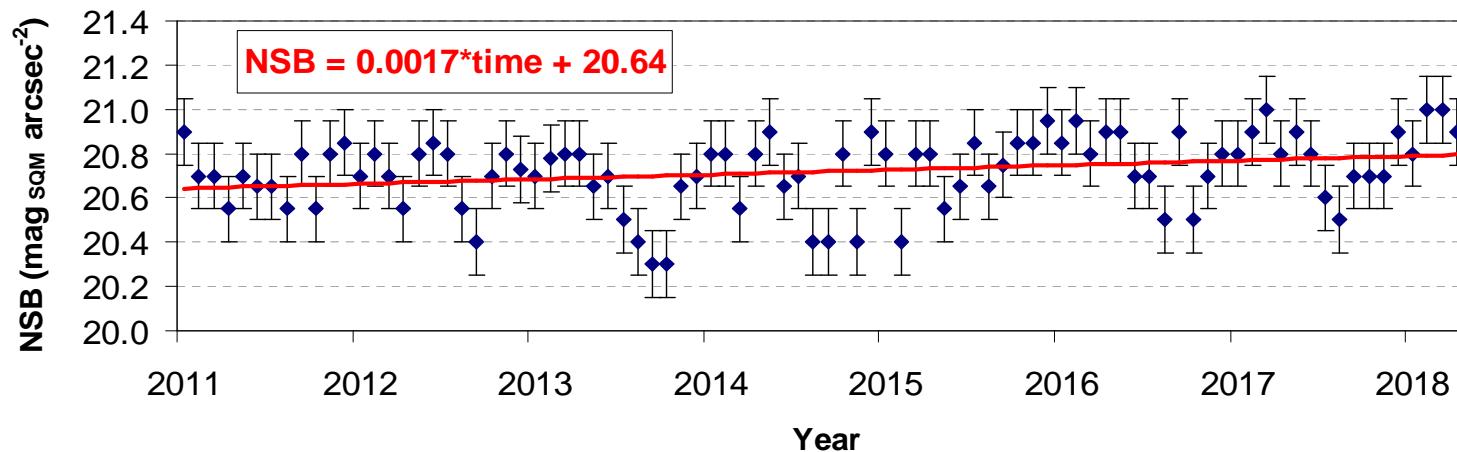


Discussion

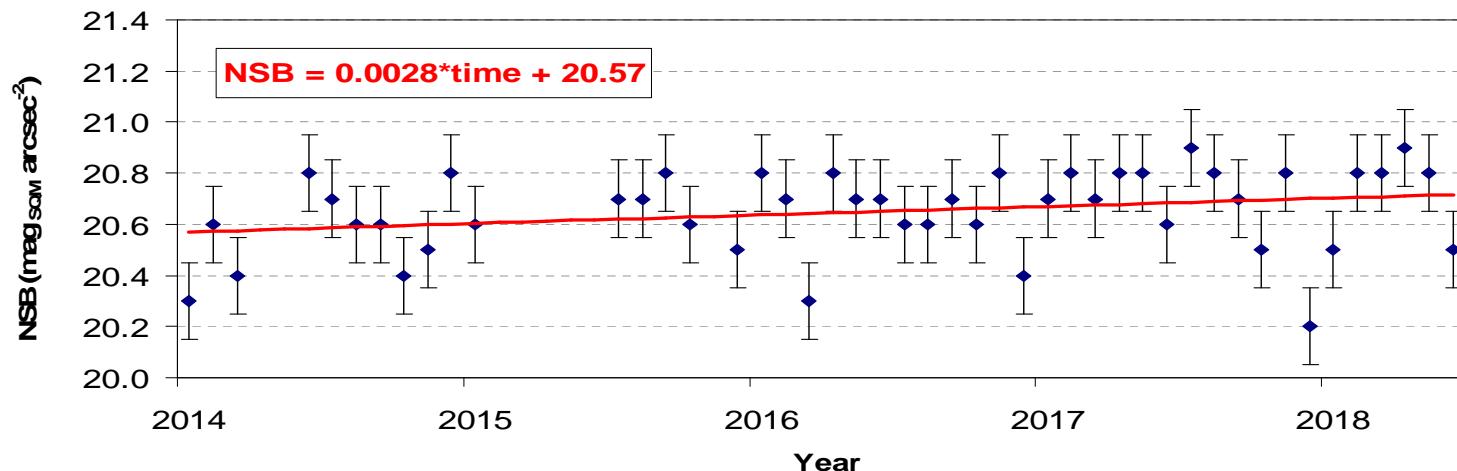
- Great NSB differences between urban, rural and mountain stations
- The NSB decreases during the night in all the sites, but with a different slope
- In very dark sites the presence of the Milky Way in the sky increases the NSB

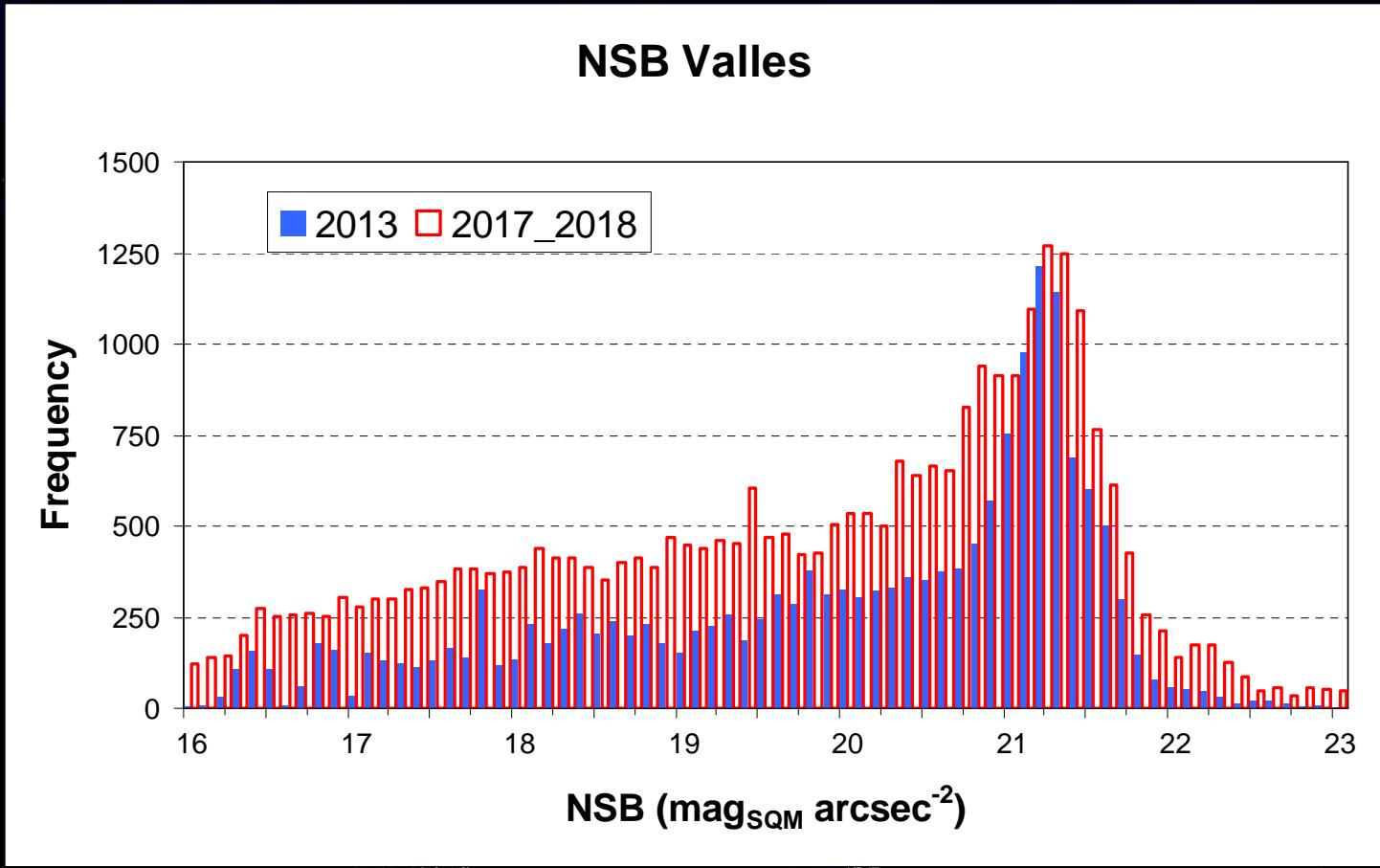
Long term trends of NSB

NSB_{month} - EKAR Observatory



NSB_{month} - PENNAR Observatory





The sky brightness in the studied sites in the last 7 years, within uncertainties, does not seem to increase, eventually it shows a slight decrease

WHY ????

“Source” factors

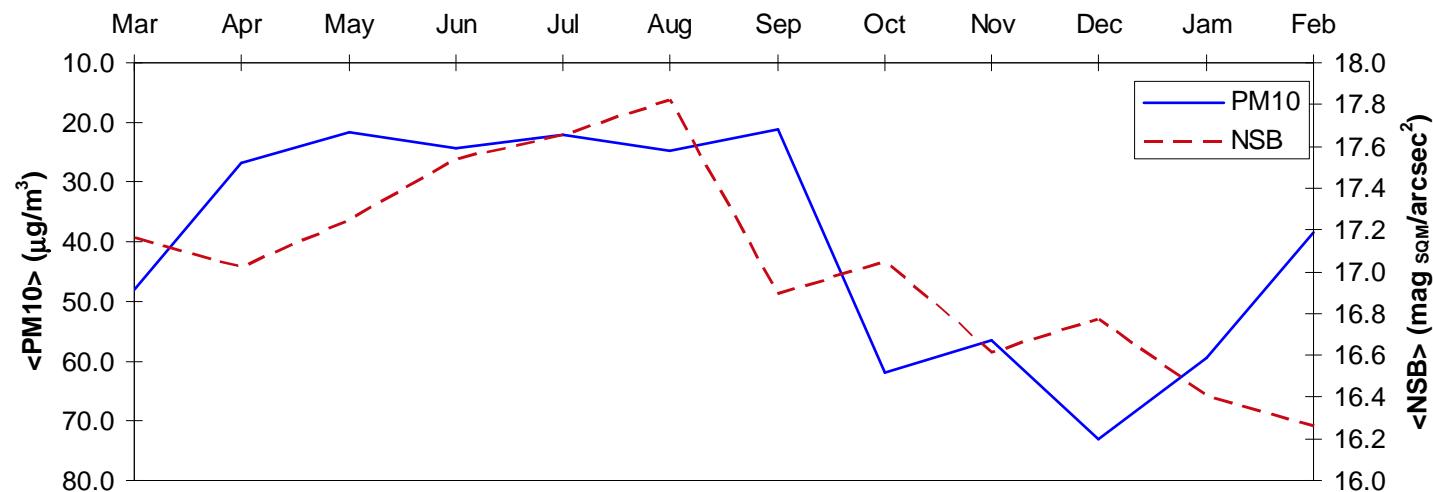
	2010	2016	Difference	Difference %
Consumption for inhabitant (kWh)	93	84	- 4	- 10 %
Electric Power for luminarie (W)	121	98	- 23	- 19 %
Public luminaries	893900	1009640	+ 115740	+ 13 %
LED	--	162000		

Survey ARPAV in municipalities in Veneto 2010-2013-2016

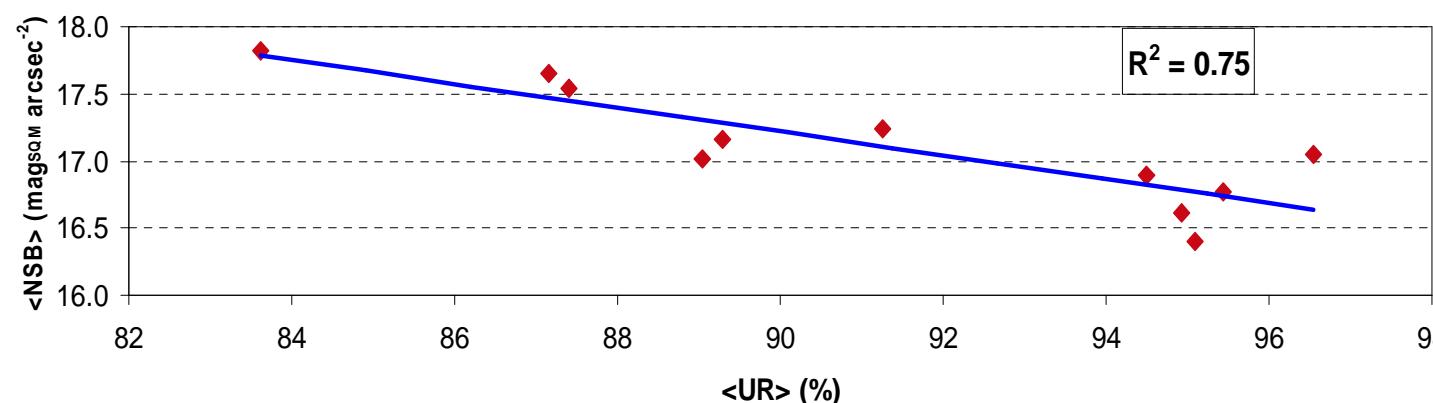
- All new light points have no direct emission upwards...
.... but the total flux does not decrease with the new LEDs installations, instead it should increase!

Environmental parameters

PADOVA: $\langle \text{PM10} \rangle_{\text{month}}$ and $\langle \text{NSB} \rangle_{\text{month}}$



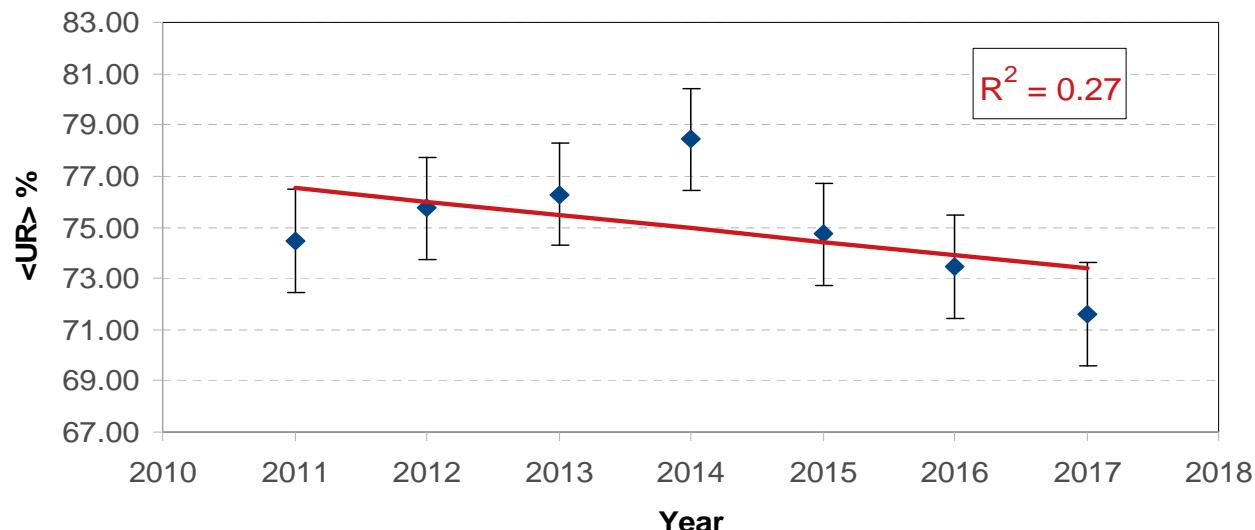
PADOVA: $\langle \text{UR} \rangle$ vs $\langle \text{NSB} \rangle_{\text{month}}$



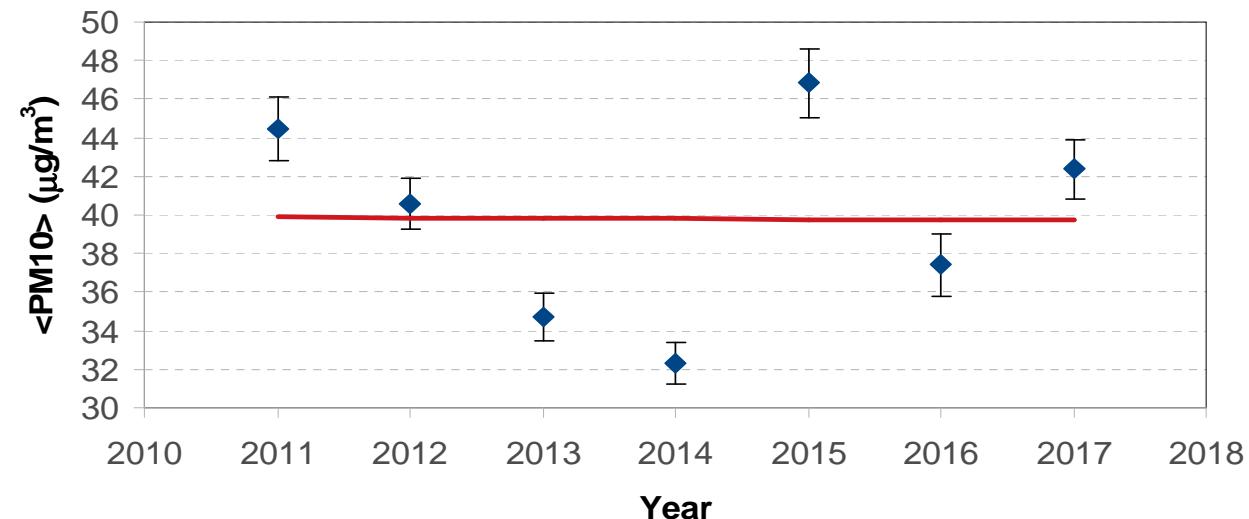
Discussion

- The sky brightness for the dark mountain stations depends mainly depends on the light coming from cities (at the sea level).
The local lights have a limited contribution.
- Considered an increase of about 15% of the public lights (and supposing the same for the private ones) the sky brightness should increase by about 0.15 mag. But we don't see it !
- Is there any influence of the environment?

UR trend

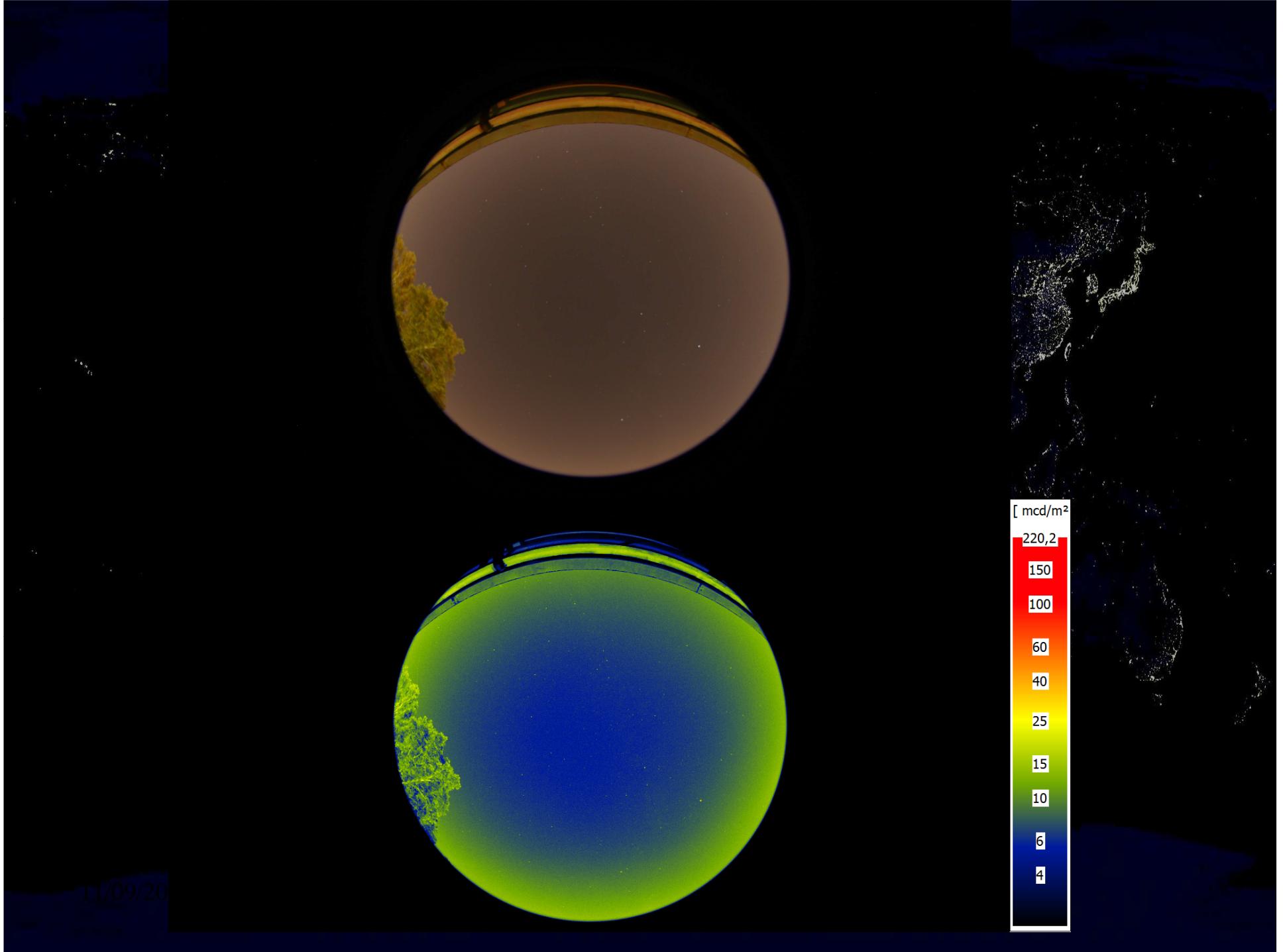


PM10 Trend



Conclusion and suggestions

- An SQM network allows to have a large amount of data available to correlate the sky brightness with environmental and meteorological parameters.
- Veneto Sky Brightness, within uncertainties, does not seem to increase, eventually it seems slightly decreasing.
- The regional law on light pollution is very effective particularly in limiting the upward emission.
- In order to better understand the light pollution mechanism, correlations with environmental parameters must be considered, including humidity and atmospheric particulate, and also others (...)
- Spectral role? (see tomorrow presentation by prof. Ortolani)
- Use of all sky photometry



THANK YOU FOR ATTENTION !



For further details and information

<http://www.arpa.veneto.it/temi-ambientali/luminosita-del-cielo>

Inquinamento.Luminoso@arpa.veneto.it