Variations in sky luminance measurements

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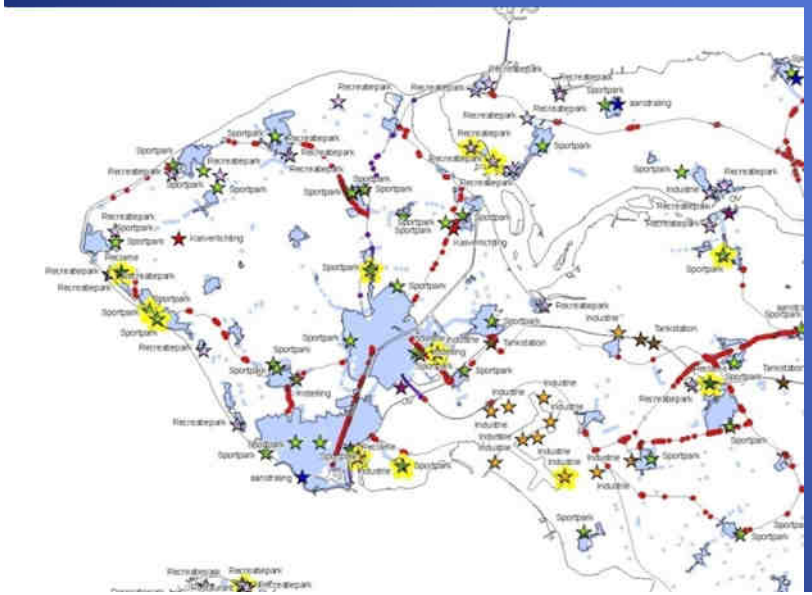
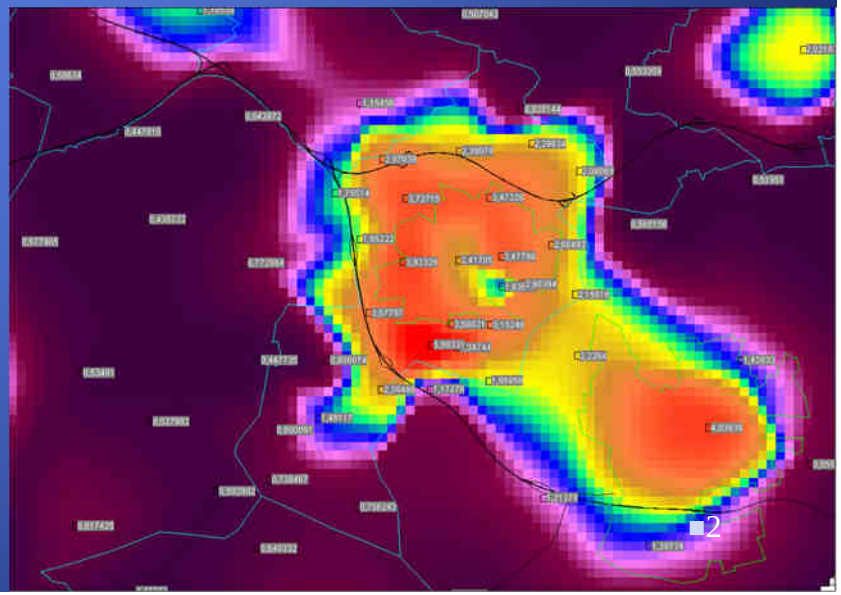
Introducing myself

- Ten years chairman of the Dutch Light Pollution Group
- Occupation: light pollution adviser: delivering data to governments: pictures, numbers and maps.





Content

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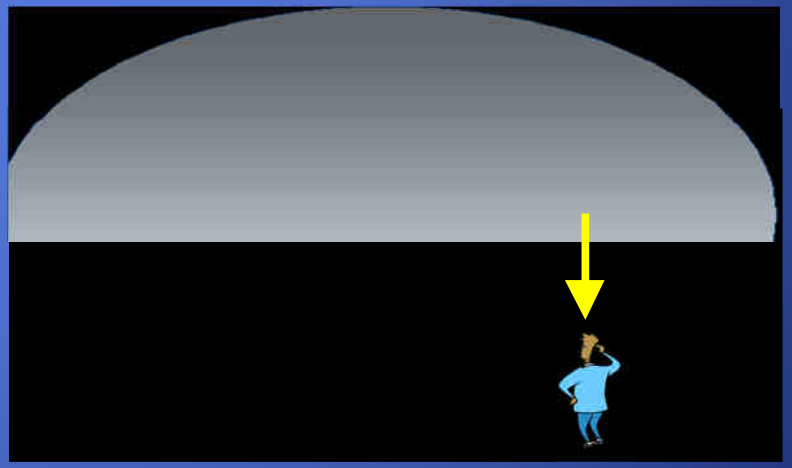


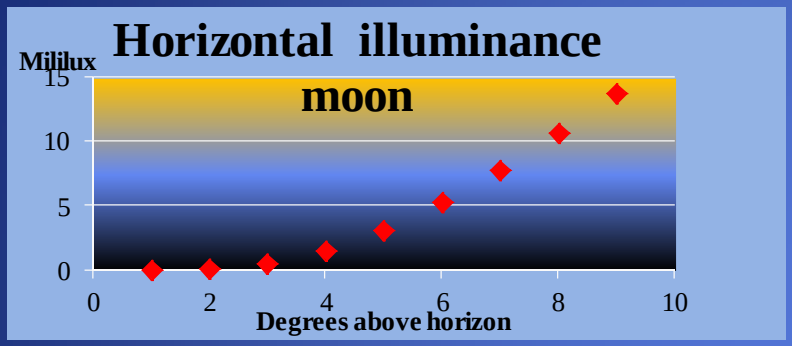
What are we measuring?

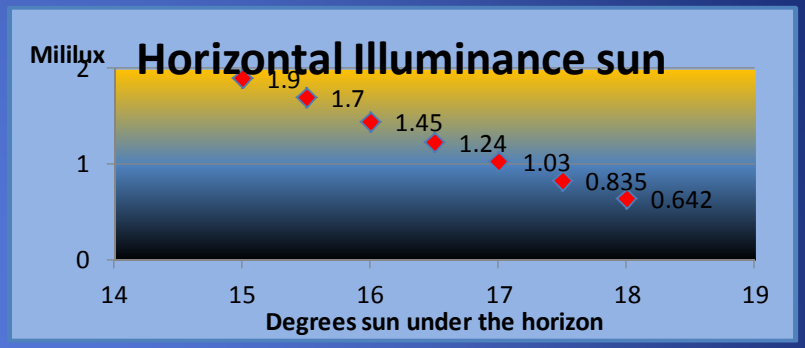
Our interest: artificial light

- Sun and moon and clouds
- Stars
- Milky way
- Natural darkness

- Artificial light

What are we measuring: sun and moon, clouds





Astronight:

- Altitude sun: < -18 degrees
- Altitude moon < 0 degrees

Clear sky: clouds give till 5 magnitudes more light

What are we measuring: stars

- A magnitude 22 sky gives light of 847 magnitude 0 stars.
- All 6000 visible stars give light of 80 magnitude 0 stars.
- Stars contribute less than 10% of the sky luminance
  - In direction of Milky way higher
  - In direction of horizon much lower
- Natural sky: varies a little; difficult to determine

What are we measuring: artificial light

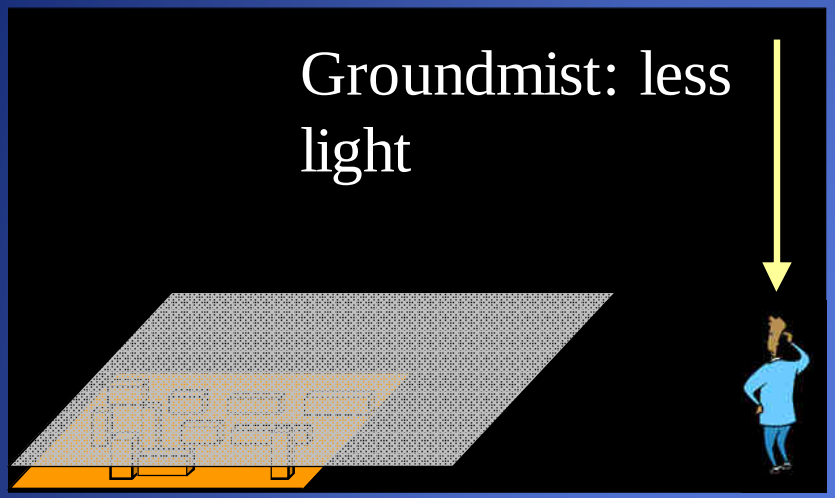
- At 5 locations 30 measurements in different nights: till 30 % variation; most around 10%.

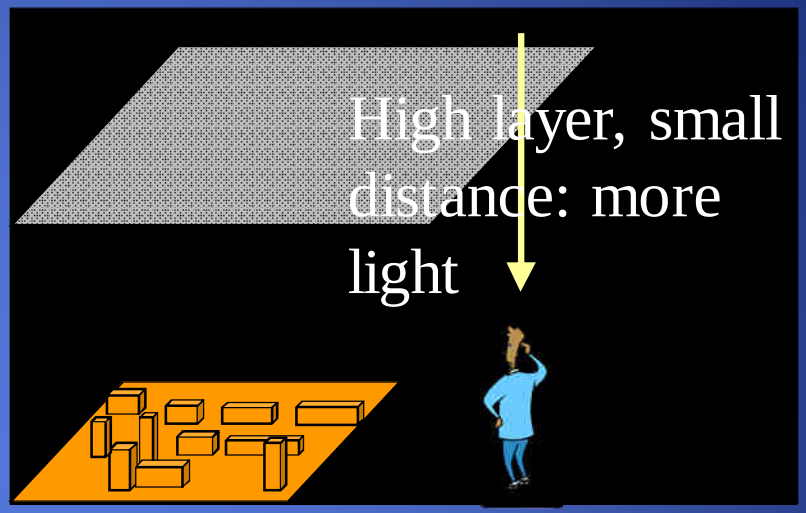
- Extinction correction
- Geography and weather
- Time of the night?

What are we measuring: artificial light

- Sky luminance dependent of extinction: higher extinction, higher sky luminance
- A standard atmosphere (12 km horizontal sight and 0,3 magn extinction)
- But still 6 till 20% differences.

Geography and weather



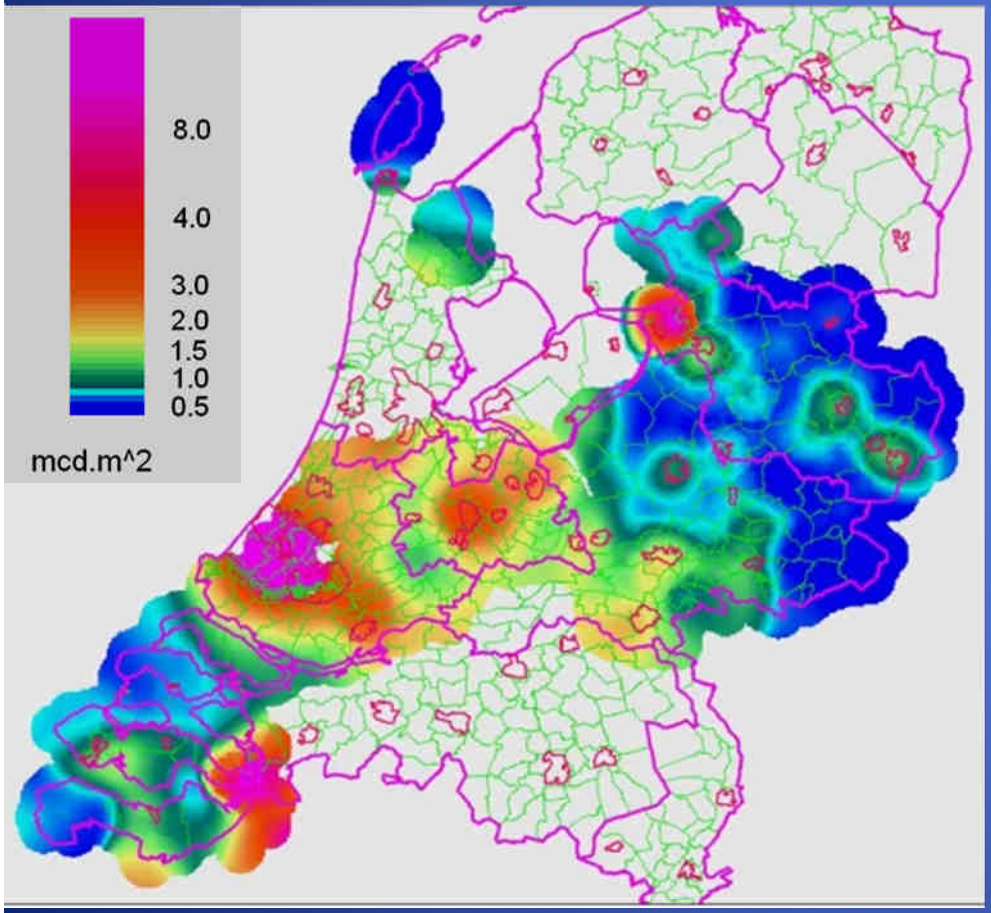


What are we measuring: Standard conditions

- We need a standard about influence of moon and sun
- We need a standard atmosphere

- Always be some variance in measurements: weather conditions and local geography: do more measurements to get the variance at a location

Variations in space

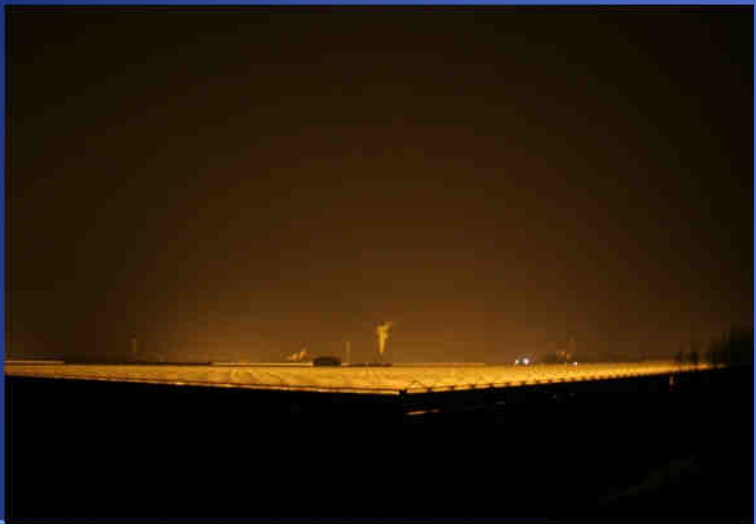


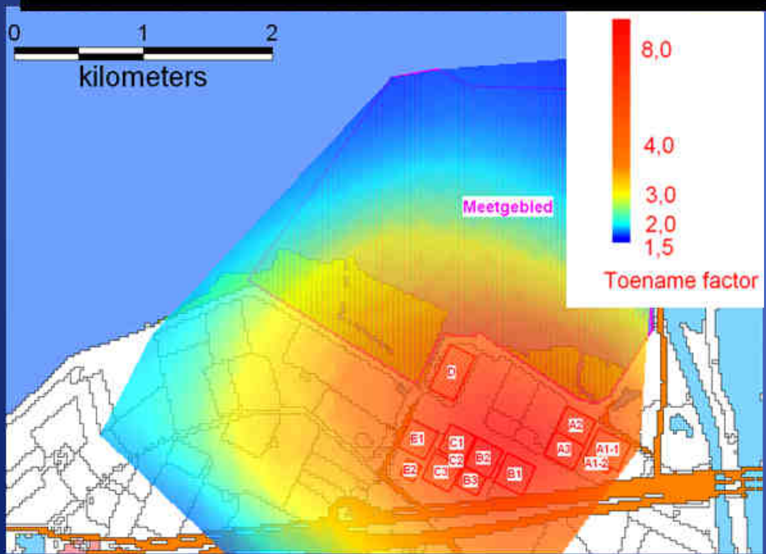
- 2000 measurements sky luminance of the zenith
- Minimum value: 0,27 mcd/m², around magn 21,8
- Maximum value 30 mcd/m², around magn 16.

Variations in space

- The Netherlands are not totally light polluted
- Big differences between west and north
- In the north: pristine conditions, comparable to the best places in Europe
- Large difference between towns and countryside.

Variations in space



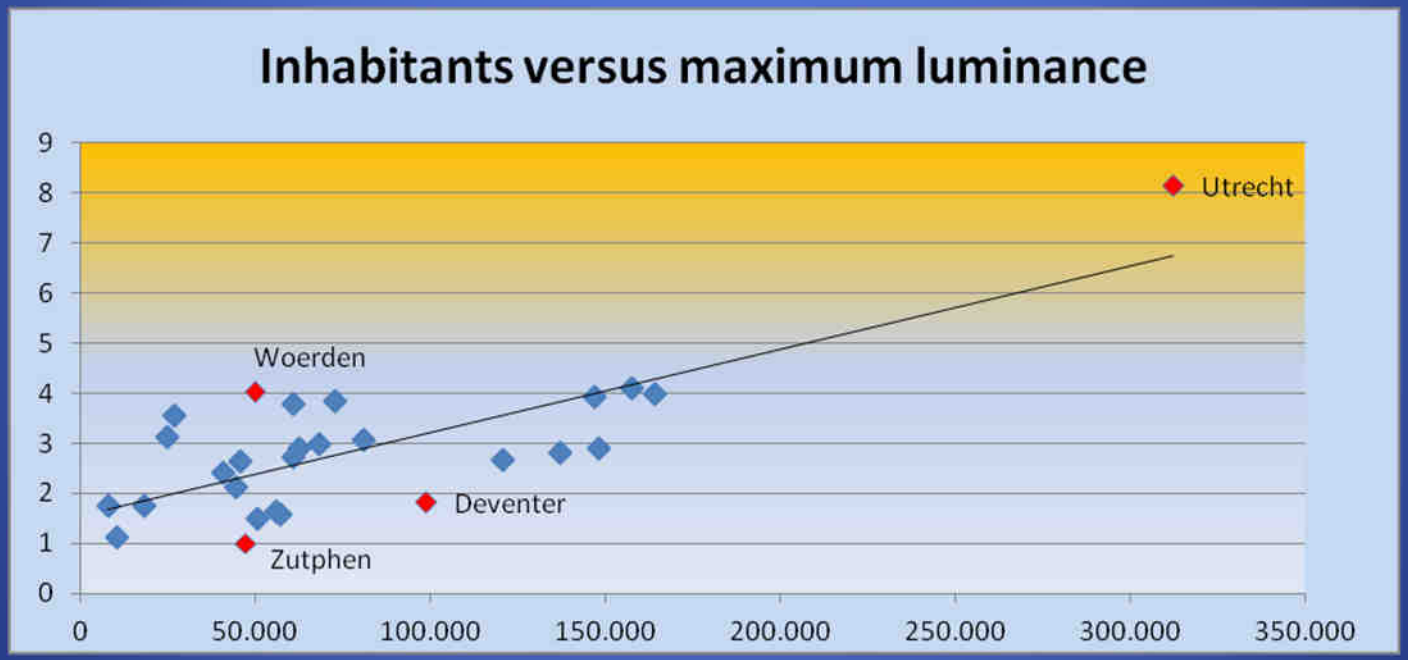


Steep gradient on the edge of a greenhouse area: from 29 till 72 mcd/m² in 2 kilometre

Gradient on the edge of town: From 8,5 till 2,5 mcd/m² in 2 kilometre

Variations in space

Sky luminance - population relation of towns

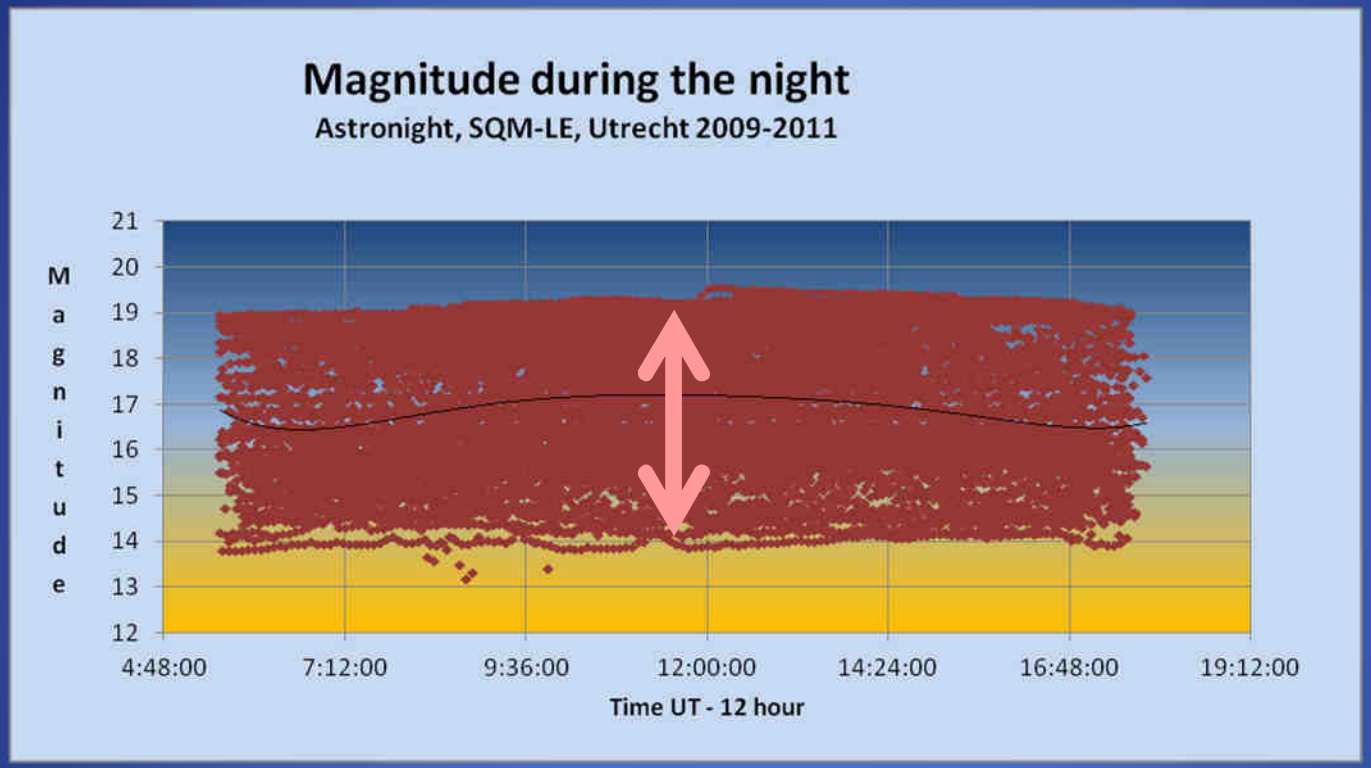


Is this real?

Variations in time

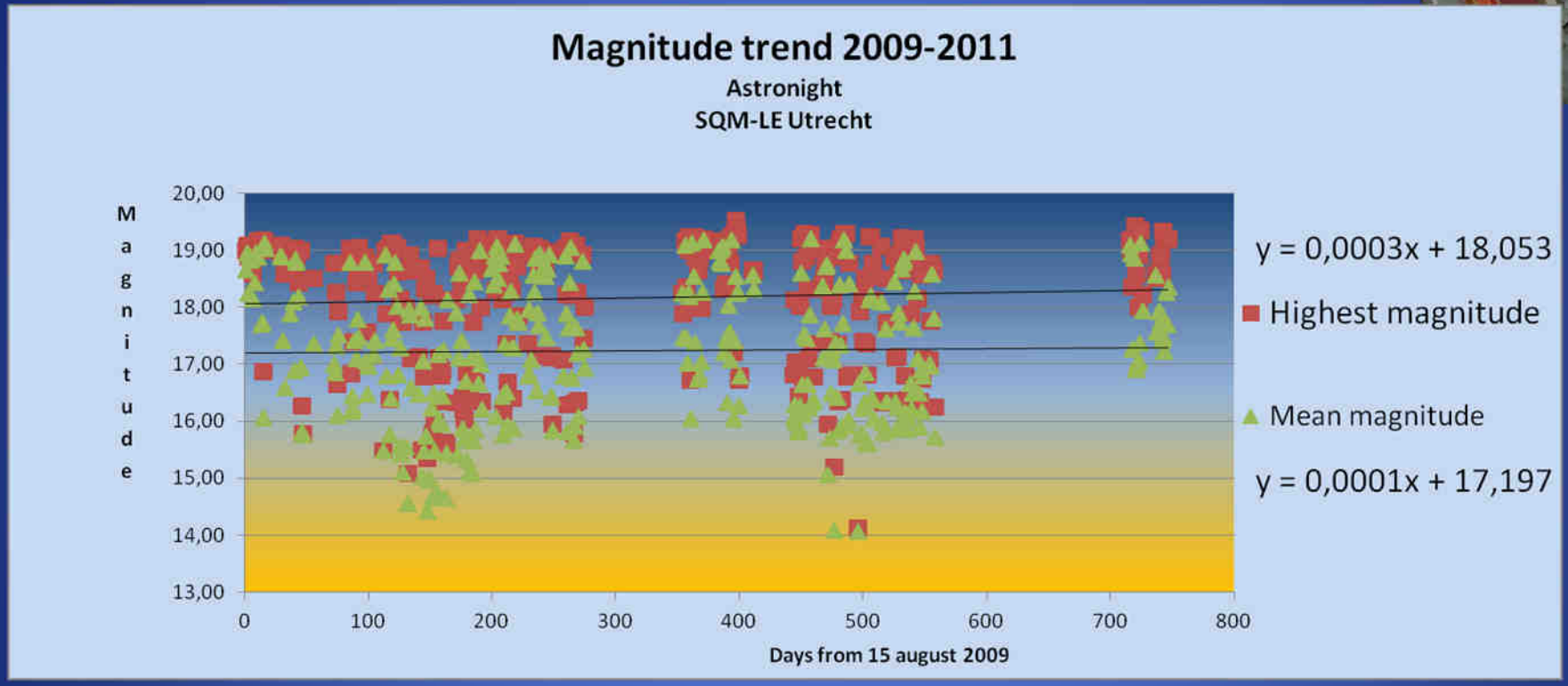
- Two years of measurements with SQM-LE and Austrian Lichtmeter Mark 2.3

Variations in time



- 5,5 magnitude variation
- Increase darkness till 1 or 2 o'clock: less light?
- Decrease darkness after 2 o'clock : inversion layer gets thicker?

Variations in time



- Maximum red dots: Increase of 0,22 magnitude in two years
- Mean green dots: increase of 0,08 magnitude in two years
- Explanation? Getting darker? Higher trees? Sensor ?

Information

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