



Global monitoring of light pollution and night sky brightness from satellite measurements

Partly supported by Italian Space Agency (ASI) Contract 2001

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Applications

GLOBAL SCALE

● Light Pollution

- Informations on processes and polluting sources
- Maps of the upward light emission and its growth ⇒ geographical distribution of sources, energy saving, evolution
- Maps of the artificial night sky brightness ⇒ site testing and land monitoring (astronomy), index of environmental impact of artificial lighting (ecology and environmental sciences)
- Maps of the loss of limiting magnitude and stellar visibility ⇒ impact of artificial lighting (human sciences and governments)
- Other environmental impacts of light pollution (natural sci.)

● Remote Sensing

- Validation and calibration of OLS-DMSP radiance data

● Aerosols

- Vertical extinction ⇒ geographical distribution of aerosols
- Light scattering and stellar extinction ⇒ constraint/testing of models of 3D aerosol distribution, validation of other sources

Many subprojects

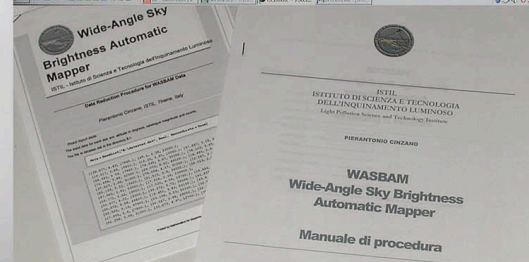
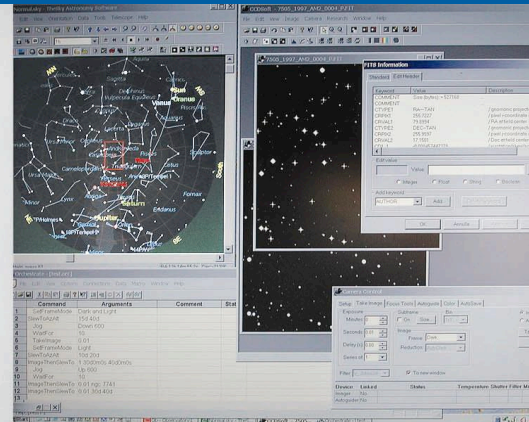
- **Second world atlas of the artificial night sky brightness and stellar visibility from satellite data (ISTIL)**
- **Mapping night sky brightness on the entire sky of astronomical sites (or any other site of the world) from satellite data (UNIPD)**
- **Upward emission from Earth sources**
- **Growth of light pollution and its effects**
- **Earth-based measurement campaigns (ISTIL, UNIPD and IDA)**

Funding and Collaborations

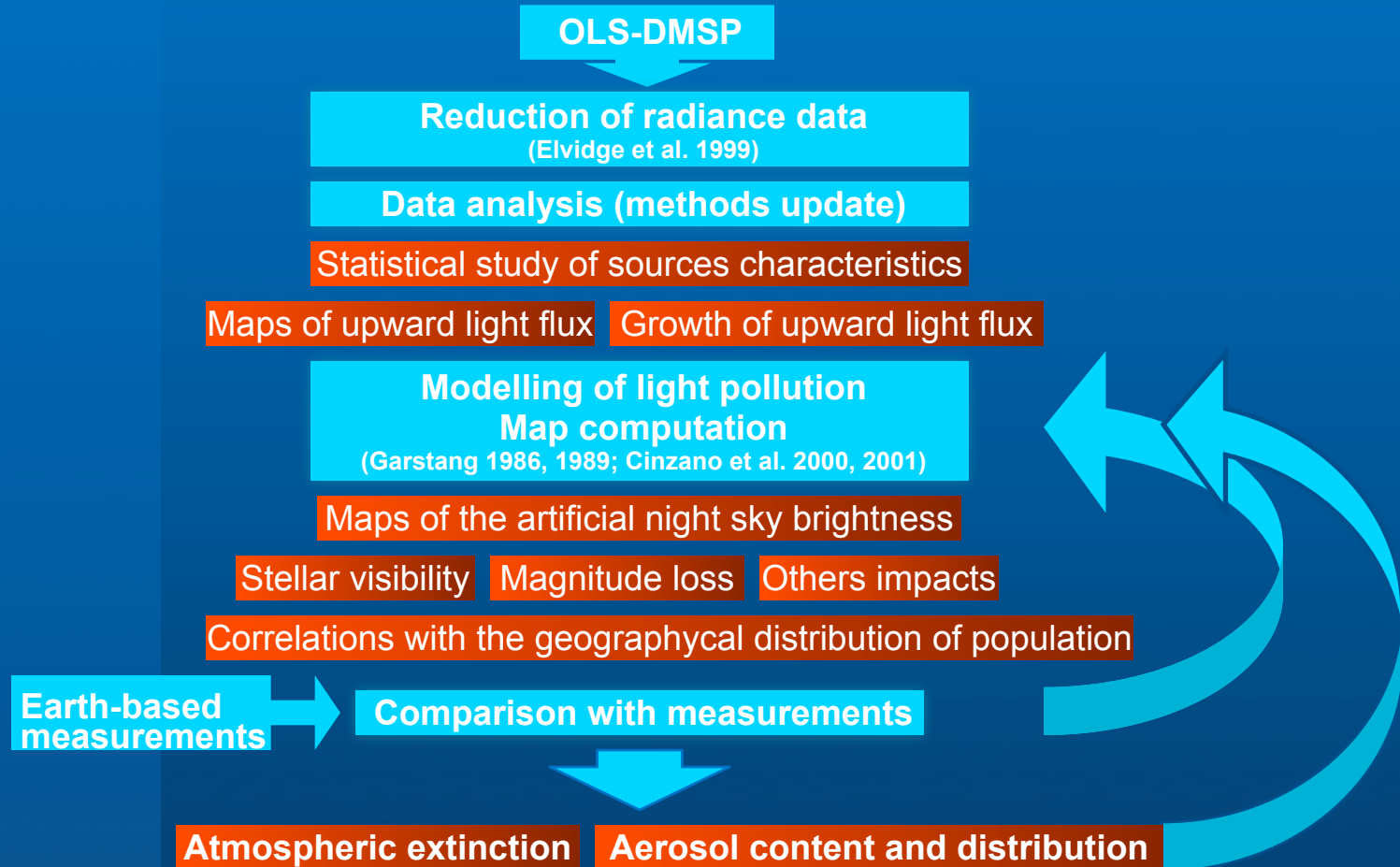
- **Italian Space Agency**
(Contract: Global monitoring of light pollution and night sky brightness from satellite measurements)
- **University of Padua, Dep. of Astronomy**
(Young Researcher's Project: Light pollution and the protection of astronomical sites)
- **International Dark-Sky Association, Tucson**
- **Astronomical Observatories (NOAA/CTIO, VAT, Lowell, IAC/OTPC, etc.)**
- **National and regional agencies for environmental protection**

LPLAB: Laboratory of Photometry and Radiometry of Light Pollution

www.lplab.it



Main steps

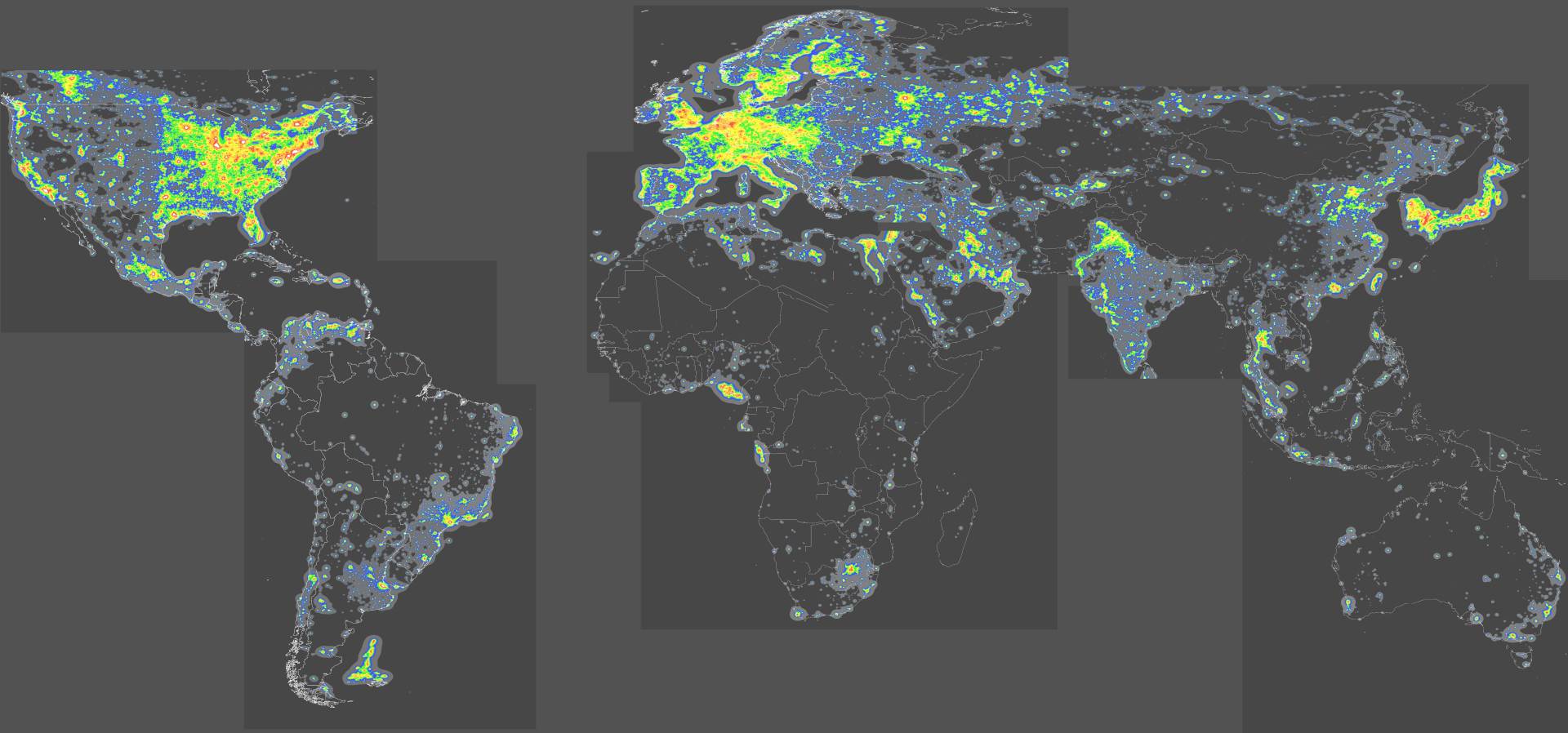


We want not only a new atlas but also to improve the method

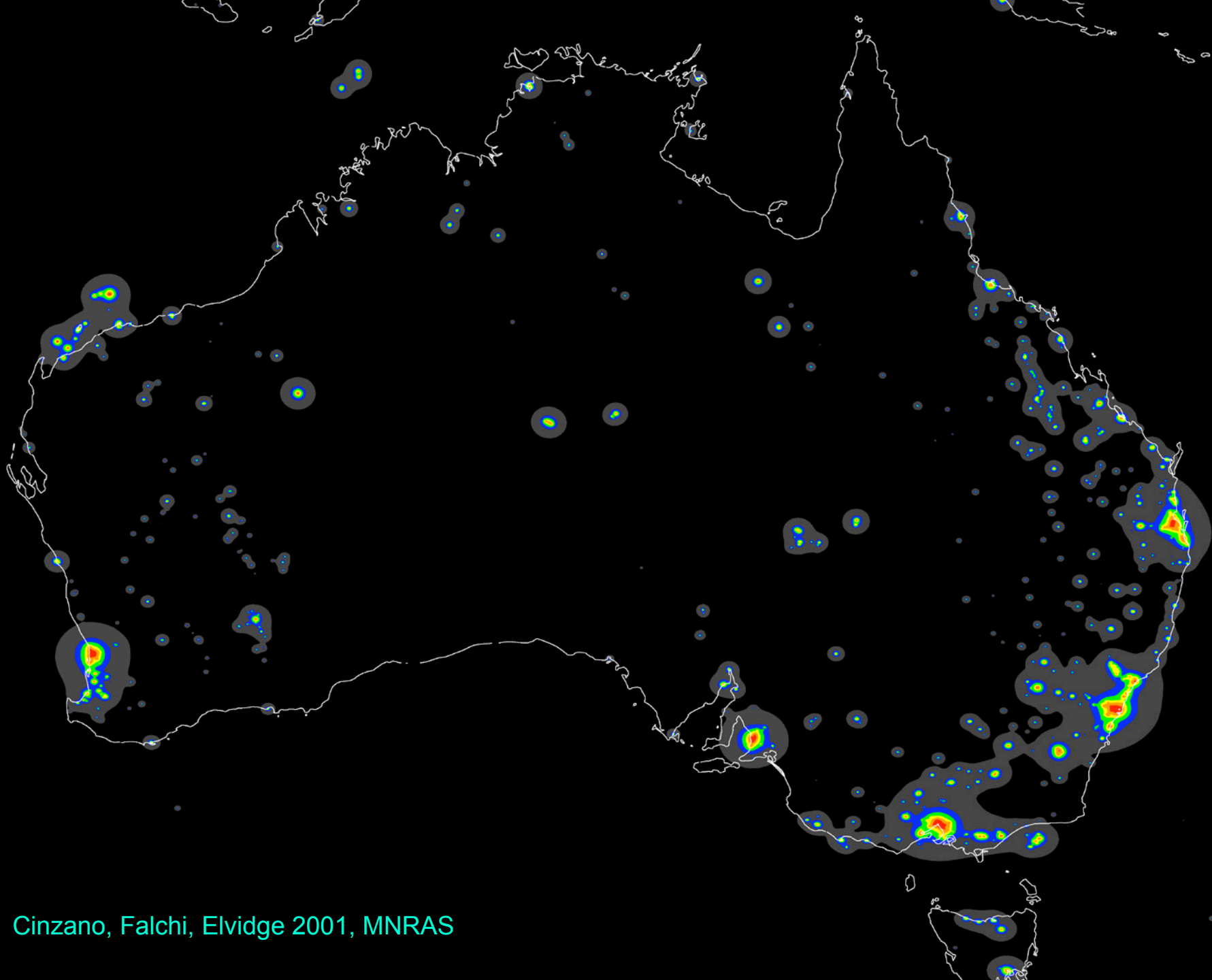
- More accurate informations on upward light emission
- To account for the shape of the upward emission when mapping night sky brightness and stellar visibility
- Better account for differences in aerosol content
- Faster code to account globally for elevation / screening
- Accurate measurements of both brightness and aerosol content for checking the results more accurately

We postponed improvements of Garstang models:

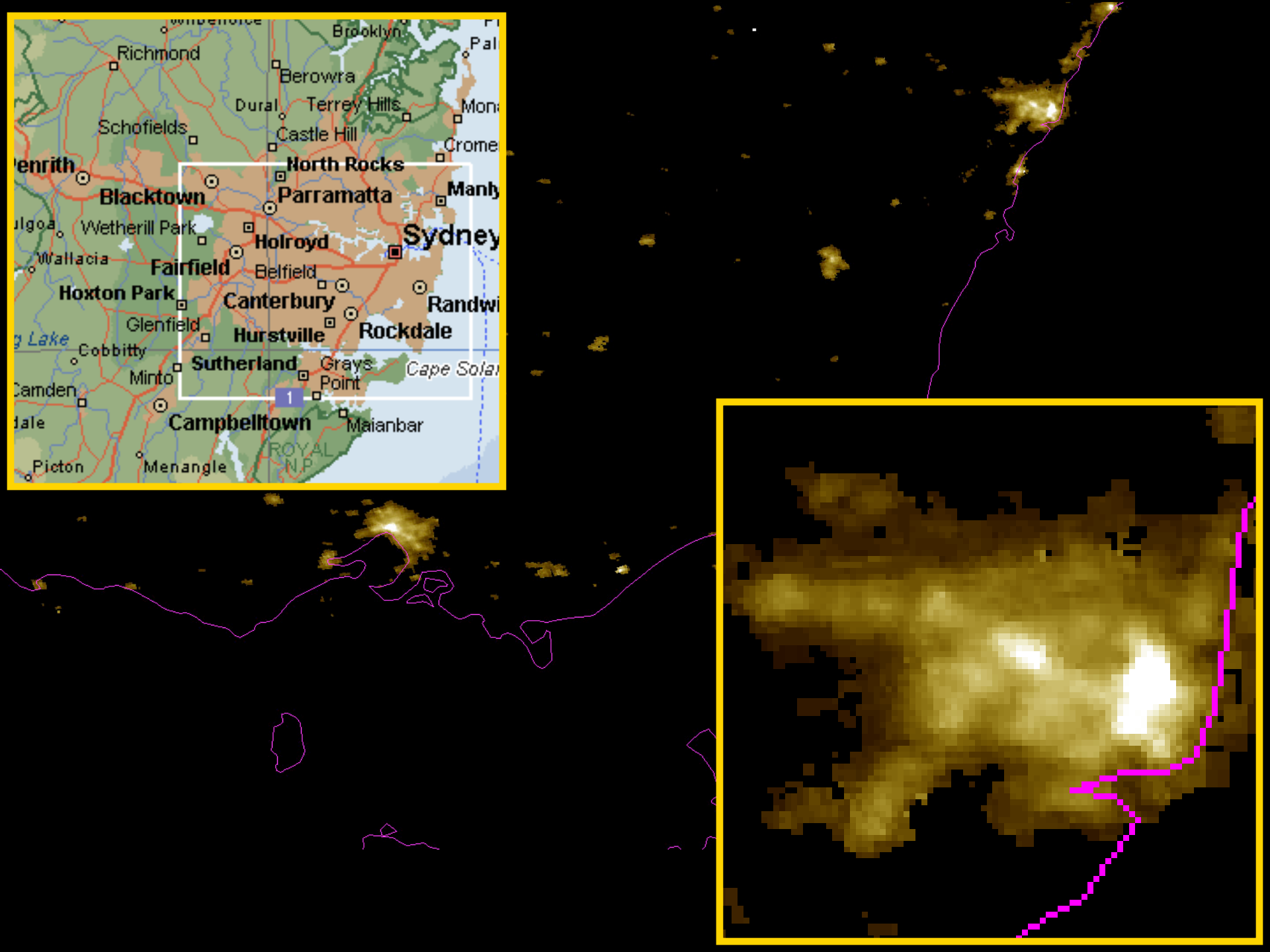
- a) Measurements are not sufficiently accurate to require and support more accurate modelling
- b) Accurate global maps of aerosol content still unavailable
- c) Model improvements increase the computational time whereas we need a faster code for global mapping

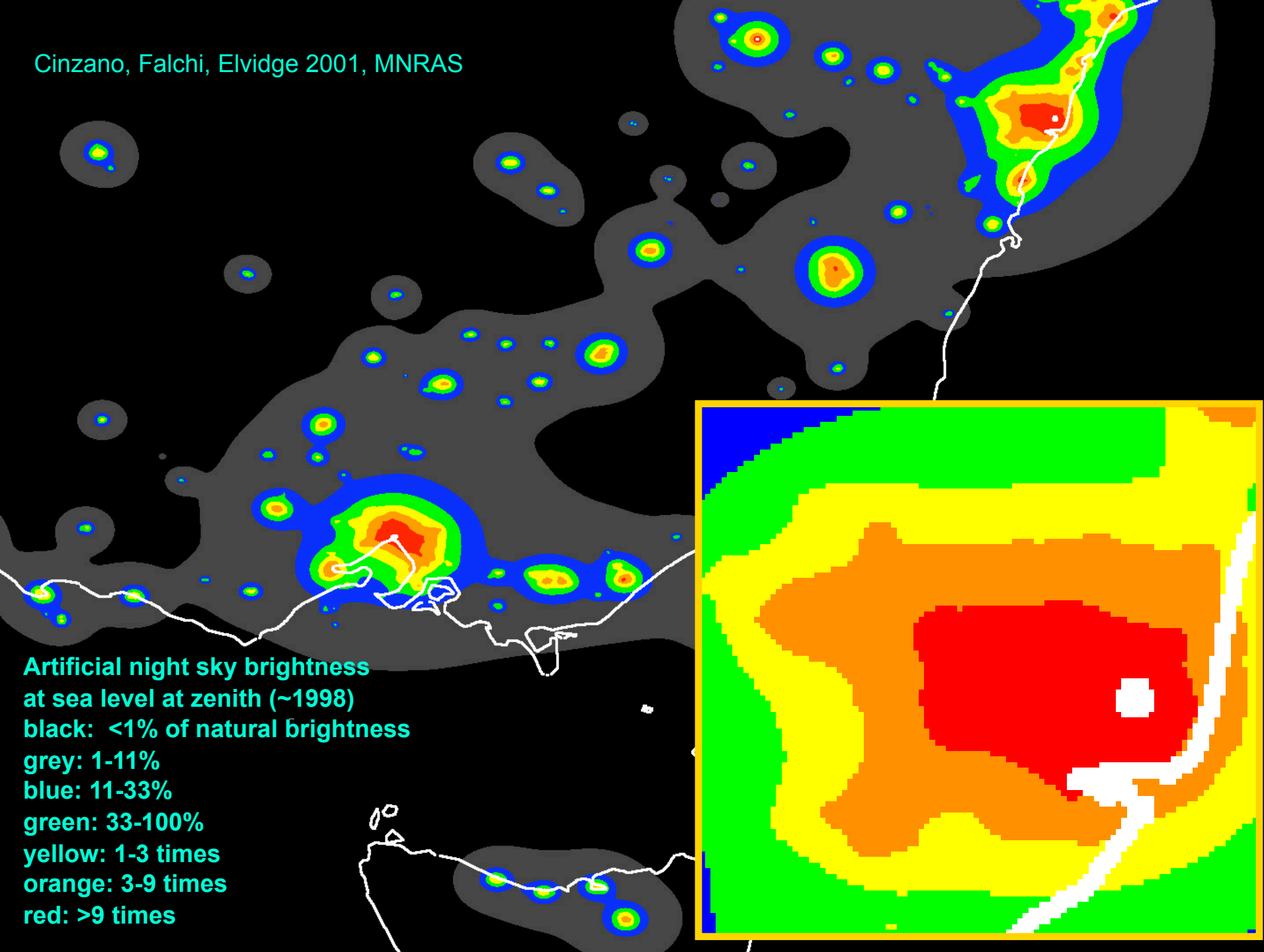


Cinzano, Falchi, Elvidge, 2001 © Royal Astronomical Society

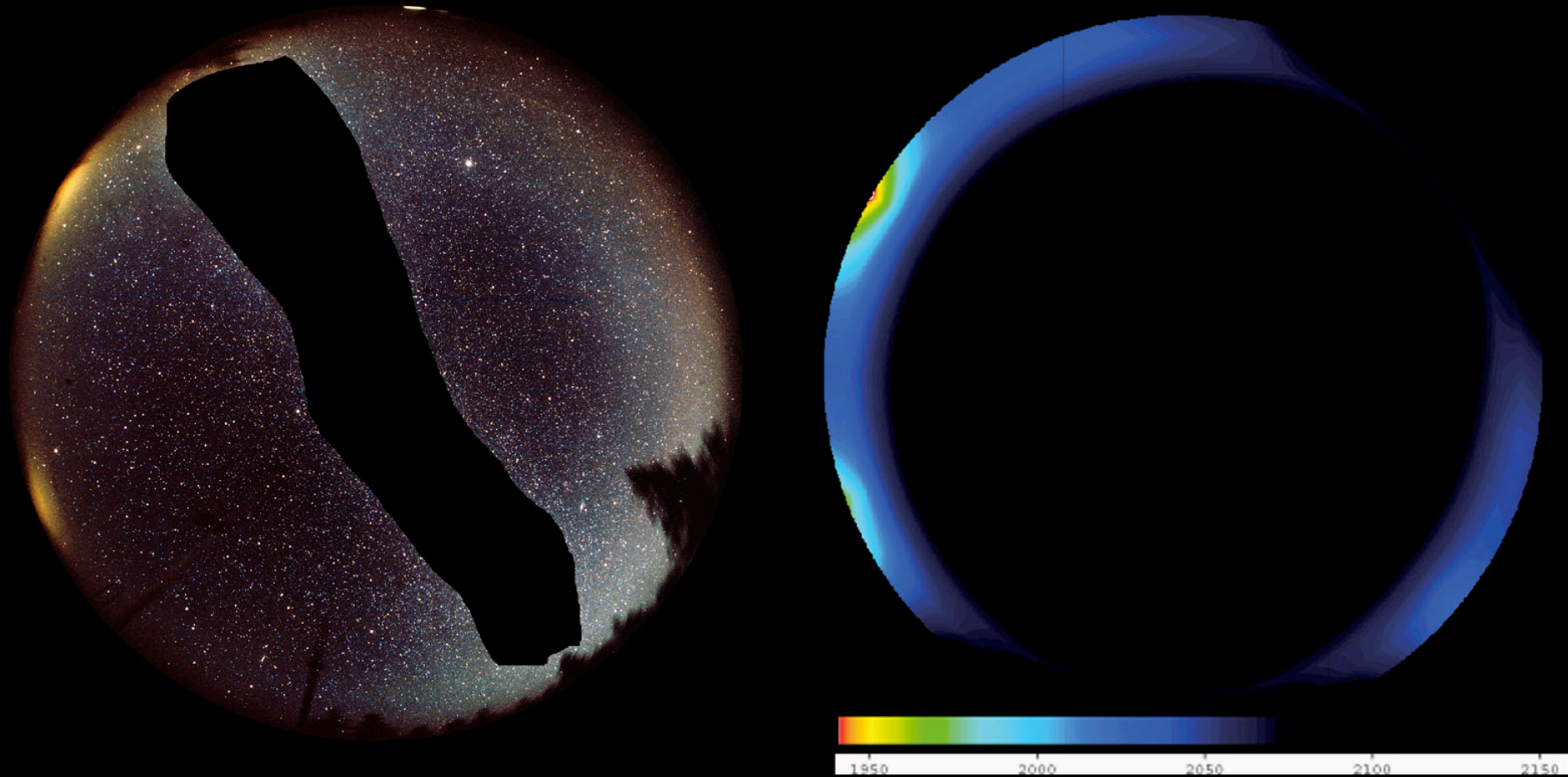


Cinzano, Falchi, Elvidge 2001, MNRAS



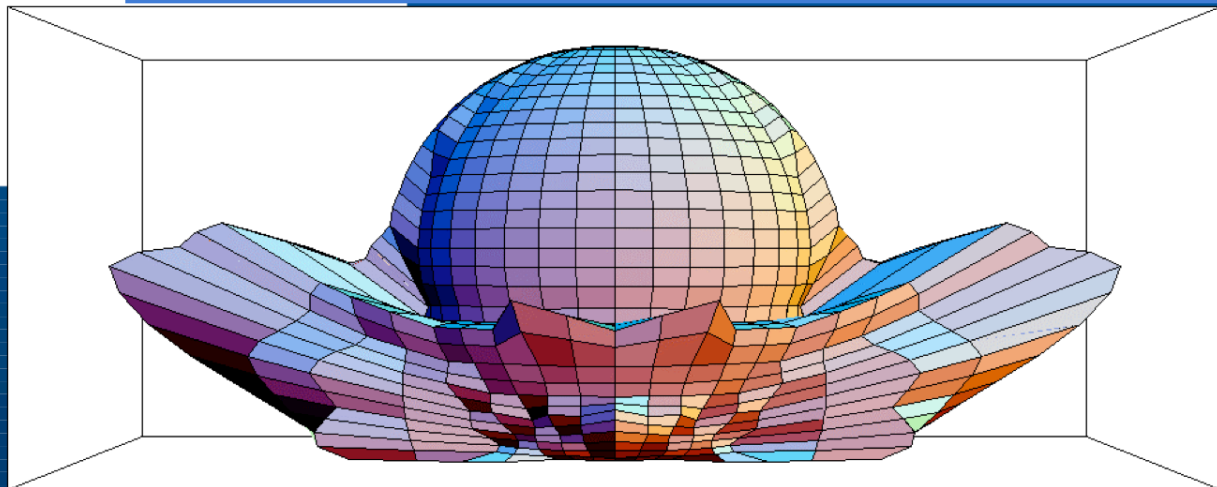
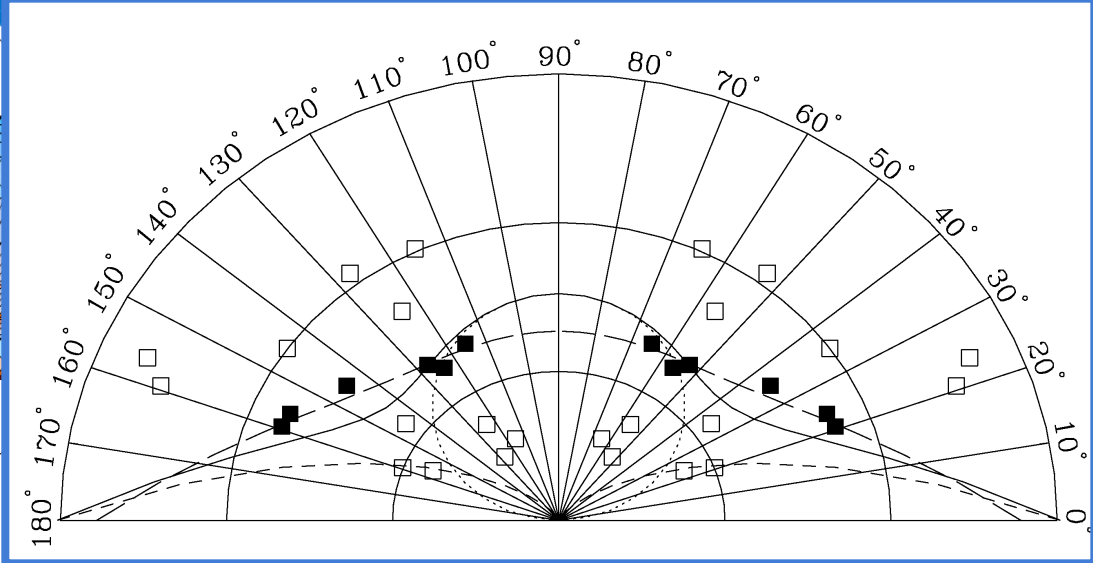
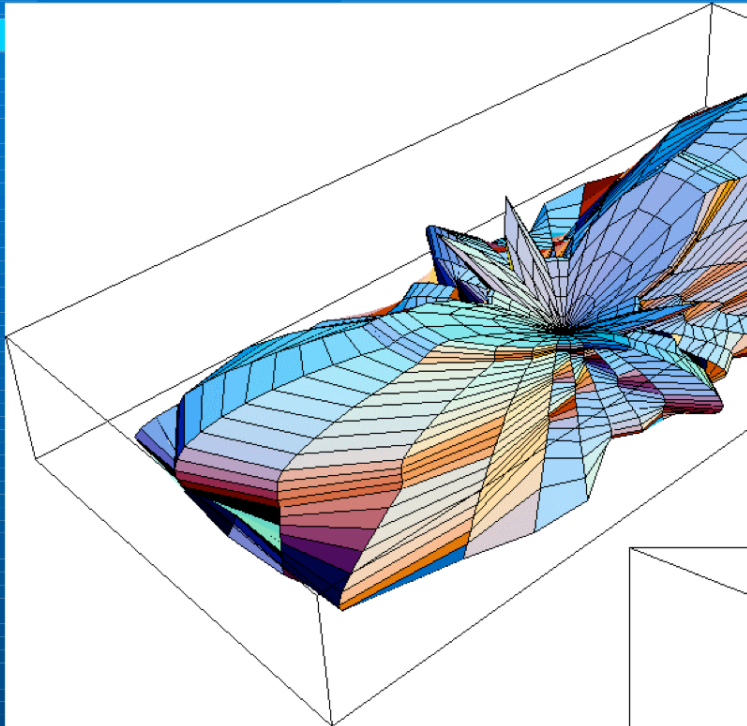


An example: preliminary results for Mount Graham



from Cinzano 2003, Light pollution by luminaires in roadway lighting

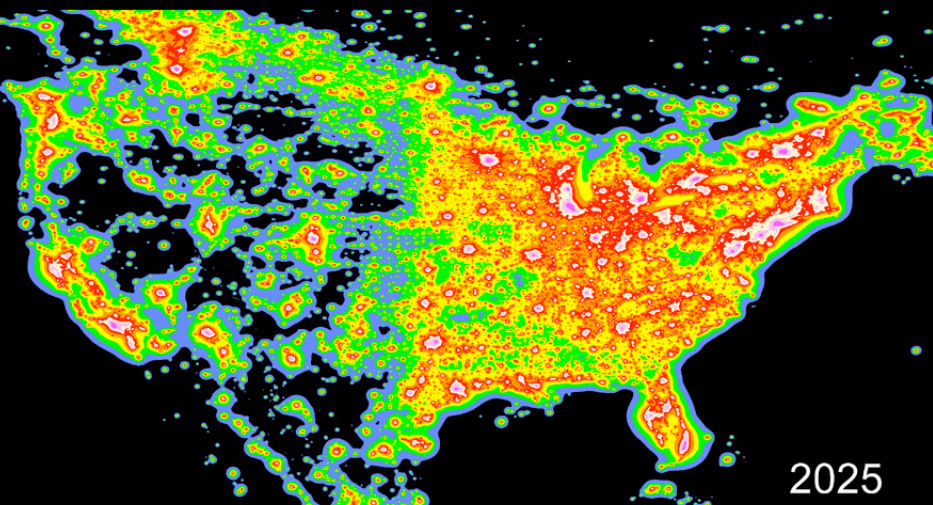
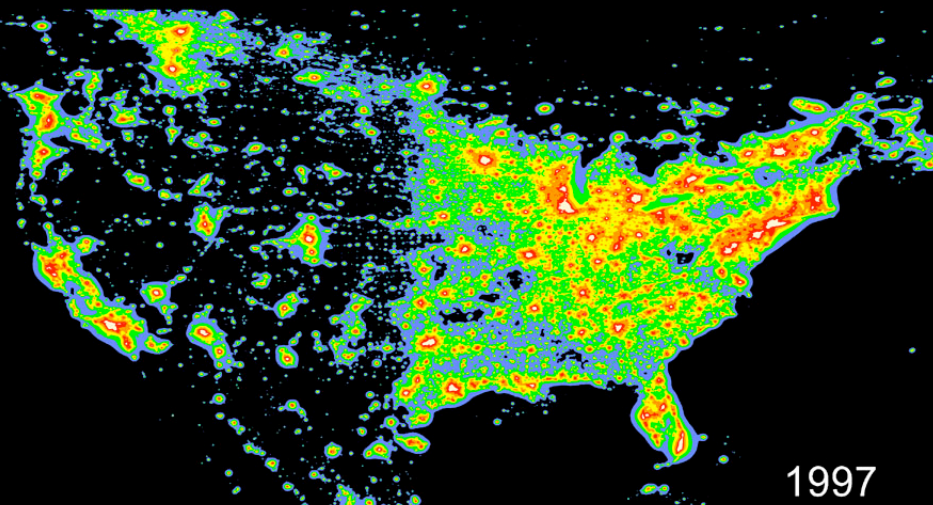
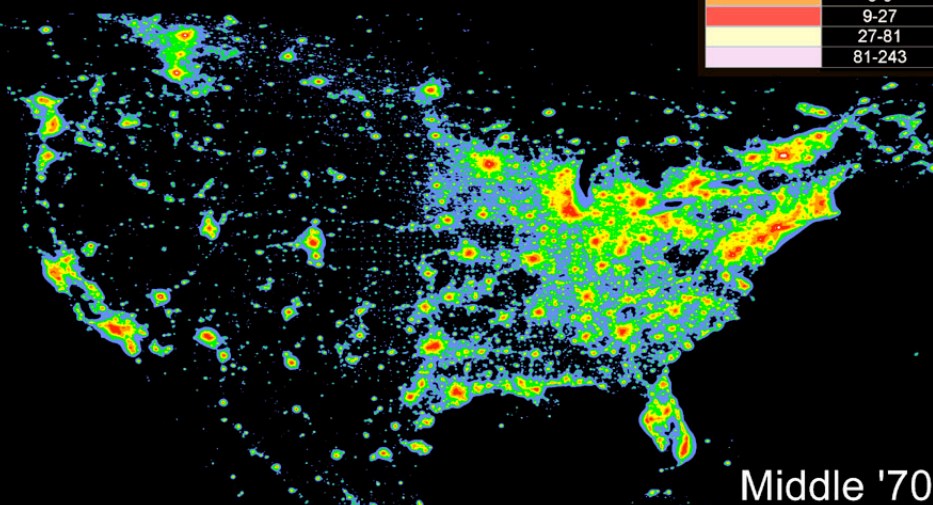
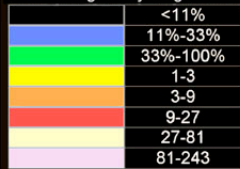
Upward light distribution



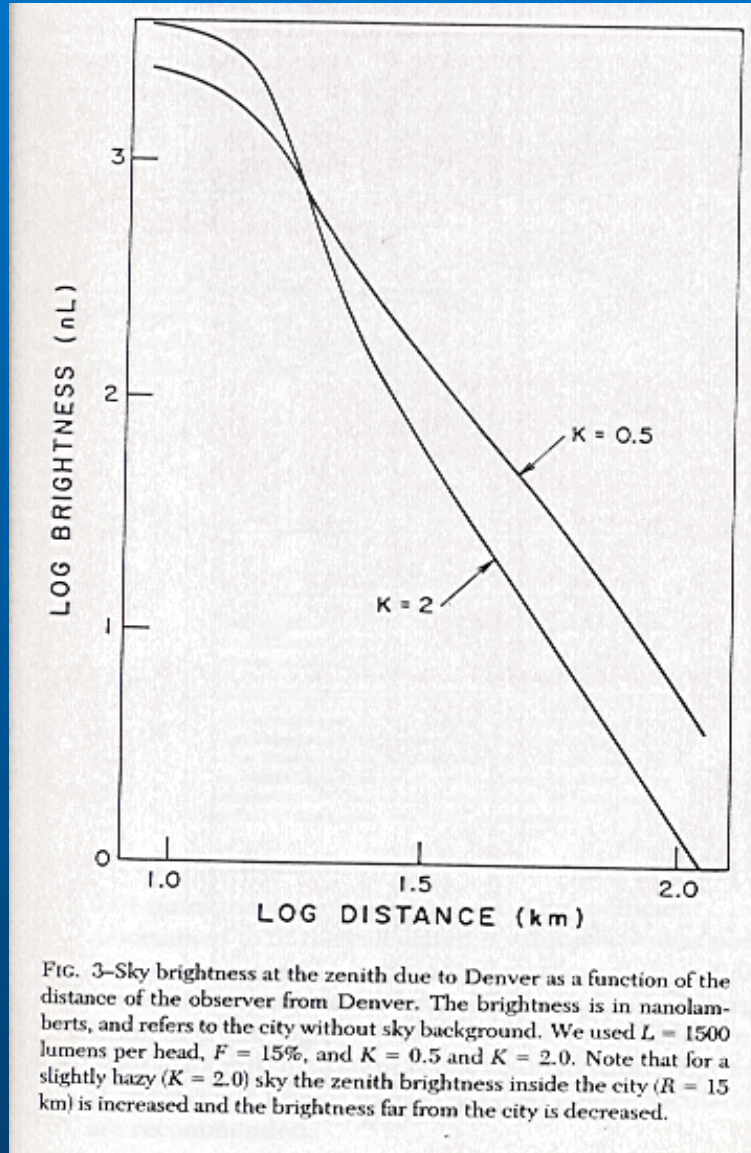
Artificial Night Sky Brightness due to Light Pollution in North America

A preliminary picture of the growth from 1950 to 2025

Artificial night sky brightness at zenith, at sea level, for standard clean atmosphere as fraction of the average natural night sky brightness



Aerosol content must be measured together with night sky brightness



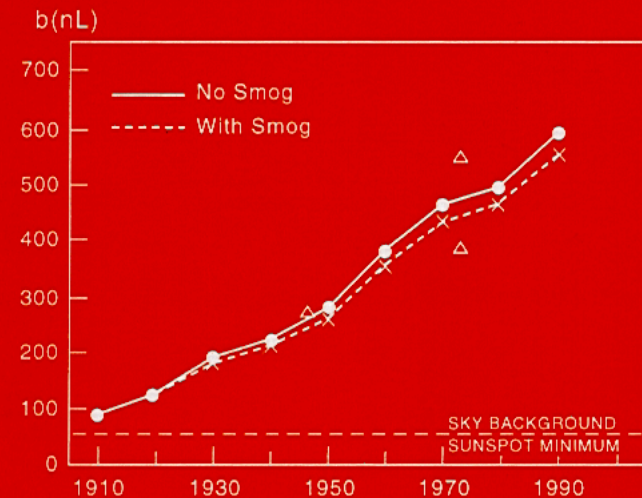
Garstang
(1996)

MEMORIE

DELLA SOCIETÀ ASTRONOMICA ITALIANA

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Vol. 71 - N. 1 - 2000



MEASURING AND MODELLING LIGHT POLLUTION

Edited by P. Cinzano

Garstang (2000)

Problems 1: funding

- **ASI support expires next week. Money already “expired” months ago so that I was forced to provide 8 Keuro by myself. Due to the new way in Italian politics on research funding, ASI will not renew contracts**
- **The Young Researcher Project at the University of Padova expires next January and cannot be applied again**
- **No other funding source have been recognized. After January the expenses for the research work likely will have to be supported by Dr. Cinzano, as before...**

Problems 2: any kind of delay...

- Delay in delivery of DMSP data, expected in 1999
- Delay due to problems in DMSP data calibration, set-up of instruments (including filters evaluation), LPLAB calibration systems, etc.
- Delay in monitoring campaigns due to Fabio's CCD default, contract managements, etc.
- Many time-expensive contributes required by the strong activity against light pollution in Italy
- Other time-expensive activities like book publishing, public outreach, education, etc.

The Proceedings of the
Venice Conference
published by ISTIL
are available on-line

www.lightpollution.it/istil/venice/

for other publications see also
<http://dipastro.pd.astro.it/cinzano/>

