

How much starry is the night?

A measure of light pollution by high-school students

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During the winter 2009, in the framework of the IYA2009, students of several High Schools of Latium (Italy) have monitored the night sky to check the faintest star visible by naked eye from their home location. A dedicated web interface has been realized, providing project description, star maps, students registration, insertion of geographical positions and of observations. A GoogleMap tool allowed real time monitoring of the best results for each observing location. A preliminary map of the stars visibility has been derived and compared with the map realized by Cinzano using DMSP satellite data. A fair overall agreement was found, but marked differences between observers located in nearby places are present, suggesting that local conditions of artificial illumination are rather inhomogeneous.

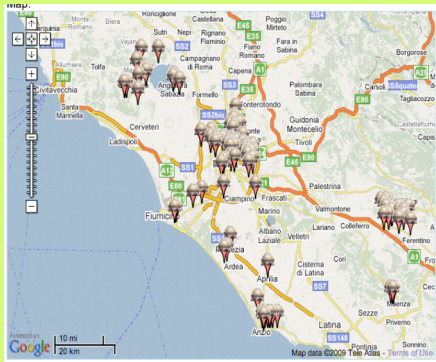


Figure 1
positions of the observers

Purposes of the project:

- Stimulate the students to the direct observation of the night sky
- Insert the students in a REAL work of observations and data collection in a scientific framework;
- Stimulate a cooperative effort between students of different schools to derive a map of star visibility in their Region;
- Get the students aware of the problem of light pollution.

Strategy

- Realization of a dedicated web site and database;
- Selection of the schools with a referent teacher;
- Registration of the students;
- Presentation at Roma Planetarium of the operative instructions

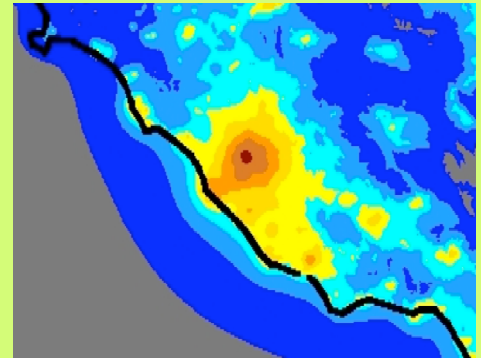


Figure 2
Expected limiting magnitudes according to Cinzano 2001, based on the data of the DMSP satellite

The web site and database

- Realization of a web site where the students registered with their geographical position (Nesci & Cirimele 2009);
- Put their observations in a common database;
- Have a dedicated Forum to interact and help each other.

The observations

Nearly 100 students made useful observations during the winter 2009, using stars in the Constellations of Cassiopeia, Taurus, Orion and Gemini. A histogram of the number of observations per student is shown in Figure 3.

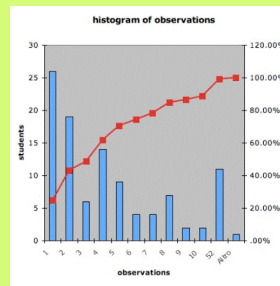


Figure 3
Histogram of the number of observations by the students

Data analysis

For each observer the faintest detected star was selected. Then the region was divided into homogenous areas (see Table 1, column 1) including at least three observers, and the median value computed (column 2): the rms deviation of the results within the area is reported (column 3) as indication of the spread of the star visibility. The expected range for the area according to Cinzano 2001 (see Fig. 2) is reported in column 4. The number of observers in each area is listed in column 5.

Main problems

- The main difficulties met during the project were :
- Scarce attention by the students in reading the operating instructions;
 - Little informatics alphabetization of students and teachers;
 - Scarce ability by the students in finding their geographical coordinates;
 - No attention in checking the consistency of their results;
 - Insufficient capability of the teachers to help their students;
 - A general expectation to have a pre-defined scheme to fill-in, without thinking with their own head.

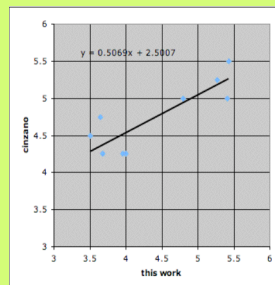


Figure 4
Comparison of the results of this work with the predictions of the model by Cinzano 2001

Table 1. Visibility results

Zone	Mag_Lim.	Disp.	Expected	Obs.
Bracciano	5.27	0.84	5.00-5.25	13
Roma North	3.68	0.74	4.25-4.50	7
Roma East	3.68	1.01	4.25-4.50	12
Roma Center	3.77	1.64	3.75-4.25	13
Roma West	3.96	1.25	4.25-4.50	7
Roma South	4.00	0.58	4.25-4.50	4
Pomezia-Aprilia	5.38	0.24	4.75-5.00	9
Anzio-Nettuno	3.51	0.35	4.50-4.75	7
Anagni	3.65	0.85	4.75-5.00	18
Roccagorga	5.43	0.50	5.25-5.50	3

Results

- Our main results may be summarized as follows:
- There is a global overall agreement with the expectation, with a better star visibility from outside the cities;
 - There is little difference between large and small cities, because what matters is the local light pollution;
 - Strong dispersion of the data between observers in nearby locations;
 - The correlation between the prediction based on satellite data with actual observations from the ground is fair, but the slope is markedly different from 1;
 - The participating students and teachers were satisfied of what they learned during the project and asked if it could be repeated the following year.

References

- Cinzano P. 2001, <http://www.lightpollution.it/istil/index.html>
 Nesci R. & Cirimele G. 2009, <http://astrowww.phys.uniroma1.it/monitorr>



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