

Modelling the night sky brightness and light pollution sources of Montsec protected area

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Abstract

The main goal of this study is to evaluate the light pollution that Parc Astronòmic Montsec (PAM) is receiving from any relevant light pollution source nearby. Montsec region, located in the northeast of Spain, is protected and labeled as Reference Point according to the legal framework of Catalonia and also certified as Starlight Reserve due to its pristine conditions.

The present study is based on the light pollution numerical model ILLUMINA (Aubé 2005). Ground based measurements (Ribas 2016), including both photometric and spectroscopic data, has been used to fit and evaluate the input parameters of the model. The output of ILLUMINA helps us better understand what kind of light sources produces light pollution and in which manner. We also used it, after converting it to astronomical magnitudes, to know how they affect astronomical observations: the resulting data is used to build all-sky maps comparable with the ones obtained with ground based measurements. The effect of light pollution are studied using both Johnson-Cousins photometric system filters B, V and R in any line of sight, and integrated all sky indexes such as Artificial Light to natural light Ratio (ALR).

In the first modelling attempt (Linares 2018) the city of Lleida, 140k inhabitants located 50km south-west from the observatory, was considered as the unique source of light pollution. After simulations were validated qualitatively by measurements a spectral comparison between the light pollution produced by Lleida before and after updating its lighting system in 2014 were performed.

Here we present: 1) an extended version of the simulated all sky maps that includes any source of light within 50km from the observatory, including known polluting cities as Balaguer (17k inhabitants) and Tremp (6k inhabitants) located at 15km and 20km respectively, and the distant city of Barcelona (>2M inhabitants) located at 150km from the observatory; 2) a light pollution contribution study by municipalities within the area similar to the one presented by Bará (2018); 3) full comparison between the light pollution produced by Lleida before and after updating its lighting system and the simulation of other hypothetical cases.

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