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Assessing the contribution from different parts of Canary islands to the hemispheric spectral sky radiance levels over European Northern Observatories

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Abstract. In this paper, we suggest to use a sky radiance model which accounts for heterogeneous distribution of light fixtures, their photometry, the ground reflectance and topography, to infer the point to point contribution of Canary Islands to the artificial sky radiance at Observatorio del Teide (Tenerife) and Observatorio Roque de los Muchachos (La Palma). In-situ hyperspectral sky radiance measurements, acquired on site in 2010, have been used to calibrate the model and to evaluate its inherent error. We aim to identify and characterize zones at which any lighting level increase or decrease may have a larger impact on light pollution at both European Northern Observatory sites, and then help to control and/or reduce their light pollution levels. This innovative methodology, can then be seen as a high level decision tool to help local authorities to restrict or reduce light pollution with the objective of protecting research class astronomical sites.

Keywords. sky radiance, modelling, measurements, Canary Islands

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An overview of artificial sky brightness modeling and measuring experiment in both European Northern Observatories is presented. The numerical radiative transfer model ILLUMINA (Aubé *et al.* 2005; Aubé 2007) has been used to calculate artificial sky radiance. During this experiment, a large amount of sky spectral radiance measurements have been acquired on both observatories to calibrate modeled radiances. As a standard output, the model delivers the sky radiance value, the relative contribution map, and the relative sensivity map for each set of input parameters (5 key wavelengths, 4 aerosol optical depths, many viewing angles, 2 observatories, before/after midnight). Sky radiance relative contribution map gives the contribution of each square km to the modeled sky radiance in percentage. Basically it says from where the sky radiance is coming at the given site, viewing angle and atmospheric conditions. The relative sensitivity map is the contribution map divided by the installed lumen in each square km and then renormalized. The map indicates how each pixel will impact the sky radiance when one removes or adds a standard light fixture. So basically the highest levels on that map indicates the first place to make changes to the light fixture inventory in order to have the highest reduction. Various maps can be seen in our prototype portal at galileo.graphycs.cegepsherbrooke.qc.ca/atlas

References

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