

Decrement of Night-Sky Brightness after the Tohoku Earthquake

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Night-sky brightness caused by artificial lights with human activities has become a serious obstacle to the ground-based astronomical observations. Undesired brightness called "Light Pollution" is known as one of the environmental hazard, and observational data of night-sky brightness have been reported by the Ministry of Environment of Japan. In the other hand, statistical observation of night-sky brightness and artificial light are desired to clarify the relationship between them.

We installed a digital camera to measure night-sky brightness in Yamanashi Prefectural Science Center located at Kofu city, and had directly compared the night-sky brightness with artificial lights from October 2009. The night-sky brightness highly correlates with artificial lights measured for two years. This result means that bright sky over cities are strongly affected by the artificial lights. Under the assumption that the correlation between night-sky brightness and artificial lights depend on size of city and population, we installed new camera in Sumida Lifelong Learning Center of Tokyo from November 2010. This camera can observe more polluted night-sky of Tokyo, and we expected to clarify the time variation of brightness over Tokyo.

We adopt commercially available digital cameras to measure the sky brightness. We use green channel of RGB bands for measurement because visibility of human eyes has peak of green. In addition, for accurate measurement, we chose RAW format of digital camera, which is not compressed and combined the Bayer pattern. We calibrate sensor response against input light intensity to achieve gamma linearity using calibrated gray scale chart. Because digital camera sensitivity is individually changing, we calibrate sensor gain by measuring standard star on the images. We adopt Johnson V magnitude as a standard star brightness because spectral characteristics of green band on consumer digital camera has similar response of Johnson V band filter. Both camera takes the images every 10 or 15 minutes from 18:00 JST to 6:00 JST for every night.

After the Tohoku earthquake at March 11, 2011, city lights in Kofu city decrease about 40% compared to the lights measured before. As the city light is reduced, the night-sky brightness in Kofu city and Tokyo decrease about 40% after the earthquake. The brightness in Tokyo on April 4, 2011 shows value of 17.1 mag/arcsec² while the brightness from November 2010 to February 2011 shows value of 16.5 mag/arcsec². Because no intended power outage was brought in operation during observation period and it was found that billboard and outdoor lightings turned off from the night view of Kofu city, only energy saving made the night sky darker. In most cases, light sources which illuminate night sky are waste of electric power. For assessment of light pollution and evaluate the efficient power usage, it is desired to measure night-sky brightness over the long term.

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