

# Light Pollution Observations in Indonesia

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## Abstract

Light pollution is a growing concern in the world. It affects many walk of lives, including human health, the degradation of nocturnal animal habitat, and the inability of the astronomers to observe dimmer objects. Maintaining a view of our dark skies has implications beyond the inspirational connection to the universe, it is also vital to the health and safety of humans and wildlife as well as our respective ecosystems, which often overlap.

Species may migrate during the nighttime hours to avoid daytime predators, maximize foraging time during the day, navigate using the moon or constellations, or to prevent bodies from overheating due to hours of wing flapping. These species now have to navigate new challenge in nighttime migration caused by the constant blaring light emitted from human settlements. Which in a longer term will caused negativity to the our ecosystem and biodiversity, mostly related to food chain and agricultural sector for human race.

We in Space Science Center of LAPAN (Indonesian National Institute of Aeronautics and Space) try to mitigate this through a coordinated observation of light pollution using Sky Quality Meter equipments which are located in several LAPAN's stations [Agam (West Sumatra), Pontianak (West Kalimantan), Sumedang (West Java), Garut (West Java), Pasuruan (East Java), Kupang (East Nusa Tenggara), and Biak (Papua)]. The observations has been conducted since 2018 in stationary and moving modes, and the results are then sent to a central database which is located in Space Science Center in Bandung (West Java). The results showed that there are some variations of light pollution across Indonesia. In this respect most of the stations have moderate pollution as can be seen from the values of Biak, Agam, Sumedang, and Pontianak (20.0, 19.5, 19.6, and 17.7 mpsas respectively). On the other hand, the stations which are located near or in cities have high light pollution (Bandung and Pasuruan with 17.1 and 18.0 mpsas, respectively). A particular station (Garut) has low light pollution (20.6 mpsas). In Kupang we build a National Observatory which is surrounded by a (planned) dark sky park so the observatory can operate as long as possible.

**Keywords:** light pollution, coordinated observations, Sky Quality Meter, moving and stationary observations, National Observatory, dark sky park

## Objectives

Light pollution is a growing concern all over the world. It affects all ways of life, human and animals alike. People are more and more affected by light pollution, and some are getting health problems like lack of sleep, obesity, and breast cancer. Other problems are that people can't see the beauty of night sky, the disruption of the circadian rhythm in human and animals, and the efficiency of energy in street lamps in cities.

Falchi et al. [1] analyzed light pollution all over the world. They made an atlas of light pollution in Europe, Asia, and North America.. They observed that more than 80% of the world and more than 99% of the U.S. and European populations live under light-polluted skies.. They concluded that this pose humanity with problems of unprecedented magnitude. Cinzano et. al [2] discussed the same problem and observed that this problem also affect many regions like Central Africa and Central Asia which was previously thought were free from this problem.

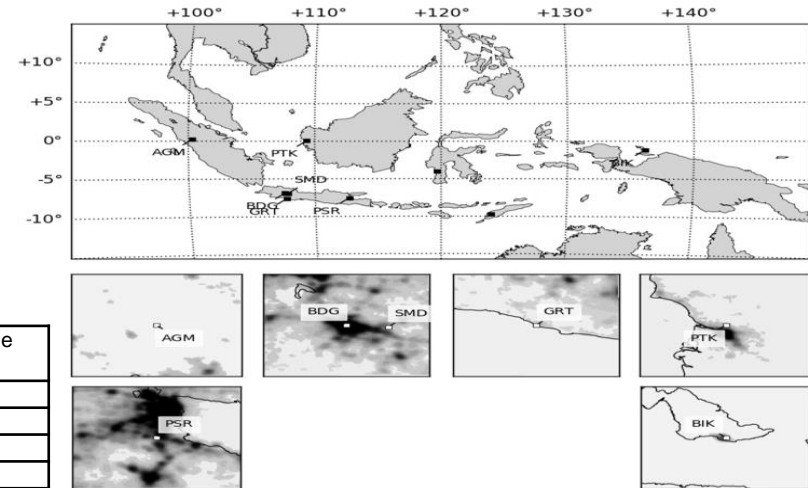
Light pollution observations had also been conducted in Indonesia, but those mainly were conducted sporadically mainly in an island (Java) and not in an extended period of time [3]; [4]; [5]. In this respect, we need observations of light pollution which conducted in extended period of time and in an extended area. As an archipelagic nation which covers vast area of sea and land, Indonesia need night sky brightness observations which conducted in regions outside Java so the comprehensive map of light pollution in Indonesia can be obtained.

This article is a summary of works related to the night sky brightness observations in Indonesia after its installation in 2018. The purpose of this article is to present the current understanding of light pollution in Indonesia using observations in several locations in Indonesia.

## Data, Observations, and Results

Table below is the location of observations: Agam (West Sumatra), Pontianak (West Kalimantan), Bandung (West Java), Sumedang (West Java), Garut (West Java), Pasuruan (East Java), and Biak (Papua).

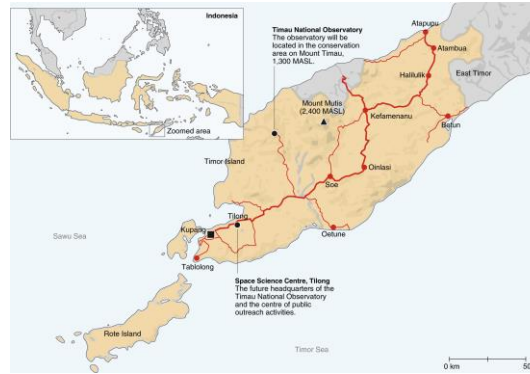
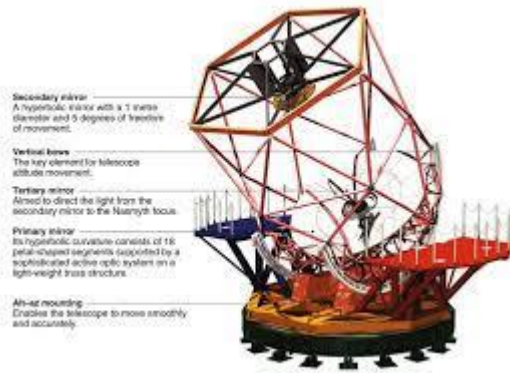
Stations	Longitude	Latitude	Condition
Agam (AGM)	100 19' 10.00" E	0 13' 48.00" S	Rural
Pontianak (PTK)	109 20' 23.00" E	0 02' 48.00" N	Peri urban
Bandung (BDG)	107 40' 40.21" E	6 55' 32.03" S	Urban
Sumedang (SMD)	107 50' 13.97" E	6 54' 47.08" S	Rural
Garut (GRT)	107 41' 31.97" E	7 39' 00.22" S	Rural
Pasuruan (PSR)	112 40' 00.00" E	7 34' 00.00" S	Peri urban
Biak (BIK)	136 01' 00.00" E	1 17' 00.00" S	Urban



No	Station	S Q M (mag/arc sec <sup>2</sup> )	Bortle Scale	Satellite (mag/arc sec <sup>2</sup> )	Bortle Scale
1.	Agam	19.5	5	21.99	3
2.	Bandung	17.1	8	19.93	6
	Sumedang	19.6	5	21.00	4
	Garut	20.6	2	21.95	2
	Pontianak	17.7	8	19.93	6
	Pasuruan	18	6	20.44	5
	Biak	20	5	20.98	4



## Timau National Observatory and Dark Sky Park Proposal



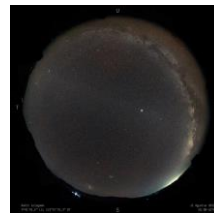
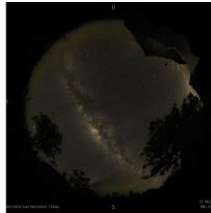
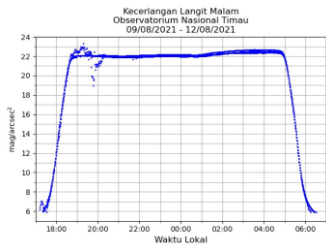
Indonesia is finishing a National Observatory which located in Kupang, East Nusa Tenggara.

The main telescope is a segmented mirror telescope with diameter 3,8 m.

The location was chosen due to the good sky quality and dry climate which high expectation of clear sky during the night.

The sky has 21-22 mpsas with value of 1 in Bortle scale.

It is proposed that an area with radius of 25 km surrounding this observatory will be designated as a dark sky park to protect the sky above the observatory from unwanted pollution.





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