

Wildfire detection using imagery from small satellites

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1. Introduction

During the months of August and September, wildfires are common in and near Indonesia when El Nino occurs because of a decrease in precipitation. The Indonesian wildfires that occurred during El Nino discharged a large amount of carbon dioxide in a very short period of time. Usually, when wildfires occur in Indonesia, they are extinguished by local firefighters, but extinguishing wildfires spanning large areas still remains a difficult task. The correct locations are not detected when wildfires occur in Indonesia.

The purpose of this study is to examine whether it is more feasible to use imagery offered by small artificial satellites for wildfire detection in Southeast Asia, including Indonesia, instead of using the present satellite imagery.

2. Present satellite wildfire observations

The detection of wildfires using NOAA/AVHRR has been performed since the 1990's via satellite observations. In recent years, wildfire detection has been performed mainly using MODIS on TERRA/AQUA platforms. The MOD14 algorithm using MODIS data is used worldwide, and there have been recent advances in fire detection algorithms, because AVHRR and MODIS can make observations once or twice per day. Furthermore, their time resolution is also high. The space resolution for wildfire detection averages about 1 km. MTSAT has a higher time resolution of approximately 30 min, but the spatial resolution is low and is of approximately 4 km. Because the resolution is low in the data collected from these satellites, field work is necessary to observe exact locations.

On the contrary, the infrared Band6 of the ETM+ sensor on LANDSAT7 has a resolution of 60 m, but has a low time resolution of one pass every 16 days. The thermal bands of ASTER sensors on TERRA platforms have a resolution of 90 m, and the returning cycle is of 16 days.

The imagery of the high space and low time resolution satellites is effective for future analysis, but in real time, the time would have already passed for extinguishing the fire.

3. Example of wildfire observations using a small satellite

Wildfire observations using small satellites have been made by the German satellite BIRD. It was launched in 2001 by the German Aerospace Center. It comprises three bands used for observing wildfires with a resolution of 350 m. The length of these bands is as follows: 0.84-0.90, 3.4-4.2, and 8.5-9.3 micrometers. Observations were completed in 2004, and it was shown that better detection of wildfires was possible experimentally; however, it was not used in extinguishing actual fires. For this satellite, the detection of wildfires was observed primarily using the band with a length of 4 micrometer and secondarily using the band with a length of 9 micrometer.

4. Discussion

Identification of the current position is possible in the daytime if multiple visible sensors are placed on the same satellite and synchronized with a thermal sensor. The visible sensor should have a spatial resolution that is higher than that of the thermal sensor, hence, supplementing the detection of wildfires.

It is very difficult to compare satellite imagery and general observations because there is almost no absolute data available. Furthermore, there is a possibility that small satellites do not provide a sufficiently precise position. Although the distribution of heat islands in a city might be observed using the same sensor, there are certain limits such as the images cannot be taken simultaneously for each observation and diurnal changes cannot be followed.

5. Integrating wildfire prediction with meteorological indices

The integration of wildfire prediction data with meteorological data, such as FFMC and FWI, has been developed in Canada, and an attempt to apply this to Southeast Asia is currently being made. Observation opportunities from the satellite will increase if such information is integrated with wildfire detection data obtained from satellite imagery by intensively managing the satellite observation.

Keywords: wildfire, detection, small satellite