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Wild fire observation by satellites in Alaska

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According to articles sited in IPCC AR4, wildfire emits carbon into atmosphere for 1.7 to 4.1GtC/yr in entire earth (IPCC, Mack et al. 1996, Andreae et al. 2001), corresponding to one quarter to one half of anthropogenic greenhouse gas emission. On the other hand, many of wild fire in South East Asia is considered as ignited by human for slash and burn agriculture. Therefore, efficient wild fire suppression is quite important task to reduce the impact of wild fire on climate change. A system for accurate wild fire detection is indispensable for efficient wild fire suppression. Author developed an improved wild fire detection algorithm, detecting 82% more hotspots with 10% less false alarms comparing to MOD14 version 4.3.2.

Introduction

MOD14 algorithm (Giglio et al. 2003) improved the accuracy of wild fire detection algorithm remarkably and has been widely spread for distributed as packaged program. However, we still have many false alarm and omission errors especially in smoldering fire with low temperature. As well as weak infrared emission, a low temperature combustion produce much dense smoke compared to high temperature and a dense smoke plume limits the performance of fire detection of MOD14 algorithm. Author is developing more sensitive wild fire detection algorithm. At first, authors modified MOD14 algorithm to improve sensitivity using 2-dimensional stochastic test (Nakau et al. 2008), detecting about 15% more hotspots. Then, we propose an algorithm to detect wild fire using estimated radiation by wild fire.

Method

Proposed algorithm consists of core fire detection algorithm and ancillary algorithms, including selection of hotspot candidates, cloud mask and other masks. Combination of improved components enabled us to achieve the improved accuracy. For example, a dense smoke plume can be masked from fire detection as cloud for bright reflectance in visible channels in MOD14. On the other hand, the proposed algorithm utilizes the 1.38 m and other channels to detect clouds excluding smoke plumes. Other ancillary components are replaced.

Result

To compare the performance of each algorithm, we used Terra and Aqua MODIS daytime imagery covering Alaska from Jun. 20 to Sep10 in 2004. Among hotspots of this imagery, we extracted hotspots in a rectangle 60 to 70N and 160 to 141W, and we defined a correct hotspot as a hotspot with pixel center less than 3 km away from burned area of 2004 provided by AFS (Alaska Fire Service). As shown on table 1, the proposed algorithm detected more hotspots comparing to MOD14 v4.3.2 algorithm for 82% with fewer false alarms for 10%. This means the proposed algorithm detects hotspots with doubled signal to noise ratio comparing to MOD14 algorithm. For the proposed algorithm detects 82% more hotspots, a distribution of hotspots in a wild fire showed a different shape as shown on figure 1 and 2. This means that use of the proposed algorithm should have an impact on the strategy of wild fire extinguishment, for weak or small fire are omitted by MOD14 algorithm.

Keywords: forest, wildfire, fire, fireservice, disaster management, lightning strike