Development of a multiband uncooled infrared cameras system for imaging volcanic sulfur dioxide (SO_2) gas

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National Research Institute for Earth Science and Disaster Resilience (NIED) launched the “Development of Remote Sensing Techniques for Surface Phenomena of Volcano” under the “Promotion Project for Next Generation Volcano Research Theme B subtheme 2 subtopic 2-2” in October 2016. The objective of this project is to develop a surface phenomenon imaging camera (SPIC), which combines the advantages of current airborne spectral imaging systems, visible-light cameras, and infrared cameras so that it can be used for both on-ground and oblique observations from helicopters. Under this project, we are planning to develop a new observation device called a surface phenomena imaging camera with uncooled infrared camera (SPIC-UC). In this study, we present first results of the development for SPIC-UC prototype. The SPIC-UC is planned to realize a highly cost-effective device used to measure the temperature and SO_2 gas concentration distributions by selecting an uncooled microbolometer focal plane array (FPA) to measure the long wave infrared regions (LWIR, 8000–14000 nm). To realize SPIC-UC, we prototyped a multiband uncooled infrared cameras system by adopting an uncooled VGA camera sensor (uncooled microbolometer) with built-in spectral filters. The prototyped cameras constitute a twin-lens camera system (capable of synchronous measurement) consisting of Camera 1 and Camera 2, with the following specifications: filters built in Camera 1 will have a transmission bandwidth for wavelengths of 9000 nm or more and those built in Camera 2 will have a transmission bandwidth for wavelengths between 8370 and 8920 nm, which much to the infrared light absorption region of SO_2 gas. The performance evaluations for the prototyped camera system revealed that it can achieve a NETD of approximately 0.6 K for blackbody temperatures of 0–81 ˚C in the ambient temperature range of -10 to 50 ˚C and that they can detect SO_2 gas concentration distributions of 1 to 2 ppmv or more at normal temperature in the background conditions of 50 ˚C or more. These results indicate that the proposed cameras can be a prototype SPIC-UC system.

Keywords: uncooled infrared camera, SO2 gas, volcano observations

