JAPANESE HYPER-MULTI SPECTRAL MISSION

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1. INTRODUCTION

Hyper-multi spectral mission is a next Japanese project of spectral imager that will be on board ALOS-3 in 2015. The hyper-spectral radiometer obtains images of 185 bands with the ground sampling distance of 30 meters. The multi-spectral radiometer scans the wide swath of 90 km with the ground sampling distance of 5 meters. The project is a heritage from the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) [1] although the thermal bands are not included. A narrow-bandwidth multiband imager of ASTER in infrared region is succeeded as a hyperspectral sensor, as shown in Table 1. Coupling these instruments and high-resolution pan images obtained by ALOS-3 leads to next-generation spatial data.

2. HYPERSPECTRAL RADIOMETER

Hyperspectral radiometer covers the spectral range from visible to short-wavelength infrared region (0.4 – 2.5 μm). To satisfy high signal-to-noise ratio, the diameter of the telescope is designed to 30 centimeters for the ground sampling distance of 30 meters. The ground footprint is projected to the slits with the gap of 30 μm. The light enters in the slits is introduced to two spectrometers, one for visible and near infrared radiometer (VNIR) and the other for short-wavelength radiometer (SWIR). Both spectrometers adopt reflective grating system. Table 1 shows the specification of hyperspectral radiometer. Since the smile and keystone phenomena distort the spectrogram, which is difficult to correct by data processing, fine spectrogram is obtained at the interval of 2.5 nm for VNIR and 6.75 nm for SWIR that are decimated on board by shifting data in the spectrum direction to correct the smile distortion. Therefore, the smile distortion is minimized and the response function is improved. The designed signal-to-noise ratio is 450 and 300 for VNIR and SWIR respectively.

3. MULTISPECTRAL RADIOMETER

Multispectral radiometer covers the visible and near infrared region with the ground sampling distance of 5 meters, which satisfies the user requirement for high spatial resolution. The blue band is added for the users those

investigate seawater regions. Radiometric accuracy is almost the same as that of the ASTER and better MTF performance is expected using the new scanning technique. Table 1 shows the specification of multispectral radiometer. The wide swath of 90 km is achieved using the three-mirror off-axis telescope, which increases the observation frequency of the specified target areas. The optical components are arranged to minimize stray light caused by reflection at the elements.

By coupling the multi- and hyper-spectral radiometers, data users enjoy both the high spatial and high spectral resolutions, which is useful for precise land cover management and other regional researches in next decade following the ASTER.

Table 1 Specification of Hyper and Multi Spectral Sensor and Comparison with ASTER

Parameter		ASTER	Hyper-Multi Spectral Mission	
			Multispectral Radiometer	Hyperspectral Radiometer
Ground Sampling Distance	VNIR	15m	5m	30m
	SWIR	30m	-	30m
	TIR	90m	-	-
Swath Width		60km	90km	30km
Wavelength Range	VNIR	0.52 - 0.60 μm 0.63 - 0.69 μm 0.76 - 0.86 μm	0.45 - 0.52 μm 0.52 - 0.60 μm 0.63 - 0.69 μm 0.76 - 0.90 μm	0.4 - 0.97 μm Wavelength Sampling Interval; Average 10nm 57 bands
	SWIR	1.6 – 1.7μm 2.145 – 2.185 μm 2.185 – 2.225 μm 2.235 – 2.285 μm 2.295 – 2.365 μm 2.36 – 2.43 μm	-	0.9 - 2.5 μm Wavelength Sampling Interval; Average 12.5nm 128 bands
	TIR	8.125 – 8.475 μm 8.475 – 8.825 μm 8.925 – 9.275 μm 10.25 – 10.95 μm 10.95 – 11.65 μm	-	-
SN ratio	VNIR	> 200	> 200	> 450 @ 0.62 μm
	SWIR	> 200/>100/>75	-	> 300 @ 2.1 μm
	TIR (NEdT)	0.3K	-	-

[1] Y. Yamaguchi, A. B. Kahle, H. Tsu, T. Kawakami, and M. Pniel, "Overview of Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER)," IEEE Transactions on Geoscience and Remote Sensing, Vol. 36, No.4, 1998, pp.1062-1071.