Global Thermal Inertia and Surface Roughness of Asteroid Ryugu by TIR on Hayabusa2

Y. Shimaki[1], H. Senshu[2], N. Sakatani[1], T. Okada[1], T. Fukuhara[3], S. Tanaka[1], T. Arai[4], H. Demura[5], K. Suko[5]

[1] *Japan Aerospace Exploration Agency (JAXA), Japan*
[2] *Chiba Institute of Technology, Japan*
[3] *Rikkyo University, Japan*
[4] *Ashikaga University, Japan*
[5] *University of Aizu, Japan*

The thermal infrared imager TIR [1] on Hayabusa2 imaged the thermal emission of the surface of the asteroid Ryugu to investigate its surface thermo-physical properties. A series of thermal images of Ryugu at every 6° for one rotation with about 5m per pixel resolution was taken at the Mid-Alt. observation on August 1, 2018. With the compiled ground calibration database for TIR called HEAT [2], the raw thermal images are converted to brightness temperature images. With SPICE kernels derived from a SPC shape model based on ONC-T images, the temperature images are projected on a shape model to acquire a diurnal temperature profile of a position on Ryugu. The diurnal temperature profiles of the surface of Ryugu show flat at noon and high at morning/evening relative to results of thermal calculations for flat surface, suggesting effects of the surface roughness. To have reference temperature profiles for the estimation of thermos-physical properties of Ryugu, we carried out a thermal calculation on a rough surface [3] with a constant asteroid configuration and various thermal inertia, roughness, and latitude. The calculated temperature profiles are fitted by 4-order function and multiple linear regression analyses were applied for its coefficients to obtain empirical equations for the thermal inertia and the roughness. From the empirical equations, fitting coefficients of 4-order function on observed temperature profiles, and slope corrections both in NS and EW directions, the global thermal inertia of Ryugu is obtained about 200±100 in MKS unit with moderate surface roughness, consistent with that obtained by the ground observations [4].

References:

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