TIR is an infrared thermal imager onboard the Hayabusa2 spacecraft, which will perform thermal imaging of C-type asteroid 162173 Ryugu through in situ observations during the rendezvous phase from 2018 to 2019. The main purpose of TIR is to determine the thermal properties of the asteroid surface and to reveal the asteroid evolutionary history such as physical properties of the originally coalesced bodies, orbital changes due to the Yarkovsky effects, and the thermal evolution. In this study, data products of TIR in concern with global mapping using the Earth observation data and geometric correction using the Moon observation data during the Hayabusa2 Earth swingby are introduced. The observed data products are already available at the JAXA's website: http://darts.isas.jaxa.jp/planet/project/hayabusa2/

**Data Products**

- **Level-1. Temperature and radiance**: The brightness temperature and radiance images converted from raw digital number images. The analysis tool "HEAT" searches best-fit calibrated data at near temperature of the sensor in the observation from the pre-launch experiment DB because of reduction of sensor background (Endo et al., 2017).
- **Level-2. Intermediate data**: The observed pixel coordinates connect to the planetocentric coordinates, generated by the SPICE kernels. The file format is text tables (px, py, brightness temperature, distance, longitude, latitude, solar phase angle, solar incidence angle, solar emission angle).
- **Level-3a. Thermal inertia and Thermal emissivity map**: Global maps of the thermal inertia $\Gamma$ and the thermal emissivity $\varepsilon$ are derived from a one-dimensional non-steady-state heat transfer model for local areas. The heat model is fitted to observed temperature profiles by a least-squares method with parameters $\Gamma$ and $\varepsilon$.
- **Level-3b. Detail map**: More detail analysis thermal models for multiple facets of the asteroid shape model is fitted to observed data, including surface roughness, multiplying scattered and reabsorbed radiations, which have been developed at Chiba Institute of Technology and ISAS/JAXA (Takita et al., 2017).
- **Level-4. 4D Cube**: Absolute temperature data converted from brightness temperatures. Their radiometric and geometric corrections are completed. The data provides absolute surface temperatures by correction of the net thermal emissivities at local areas of the asteroid.
- **Level-5. Thermal Simulator**: The surface temperature simulator for the asteroid Ryugu. It is corrected for the temperature dependency of the surface physical properties by using the results of the laboratory experiments (Sakatani et al., 2012). In particular, surface particle size and porosity will be simulated.

**Geometric Correction**

After the Earth swingby of the Hayabusa2 spacecraft, TIR observed the Moon on Dec. 5 to Dec. 22, 2015. The geometric correction was performed by adjusting the detected pixels to the anticipated Moon position in J2000 coordinate system for 16 points by a least-squares fitting. The data was used for the alignment corrections, such as a rotation forward, and an inclination of the boresight forward, and the Flame Kernel of SPICE kernel (FK) was updated. The resulting positional accuracy is less than 100 km from 340000~350000 km observation for the Earth center position determined with the Earth limb position. This result indicates that the positioning accuracy of the asteroid observation will be achieved in ~6 m @ 20 km altitude. However, image corner is distorted about 1 or 2 pixels. Therefore, detail image distortion will be corrected in the asteroid observation phase by the observation of particular objects on the surface.

**Summary**

The observed data products of the TIR are ready at the JAXA's website (DARTS). The thermal inertia and thermal emissivity map of the asteroid Ryugu's surface will be provided (Level-3a) in the asteroid rendezvous phase. The higher degree products will be generated by model calculations with multiplying scattered absorption, radiation, which is derived by least-squares fittings for each polygon facet of the asteroid shape model (Level-3b). The positioning accuracy of the global maps is currently ~6 m at the 20 km home position (spatial resolution of the TIR is about 20 m / pixel @ 20 km). When the surface material samplings are performed, the TIR will take close-up images at low altitudes of about 5 m (5 mm resolution / pixel). These close-up images will be used for improving the positioning accuracy of TIR.