Far-infrared observations of compact solar-system objects measured with ISOPHOT in mini-map mode

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1 Introduction

The mini-map observing mode was one of the most efficient ways of obtaining point source photometry with the ISOPHOT C100 and C200 detectors. It was also the mode used for FCS calibration observations. C100 mini-maps are typically 3x3 raster maps performed in satellite coordinate system centered on the source. In the recommended and most frequently used configuration $\Delta M = \Delta N = 46''$ (one detector pixel) in combination with an odd number of raster steps in both directions. For the C200 detector the usual configuration was $\Delta M = \Delta N = 92''$ together with an even number of raster steps. For a discussion of the special features and advantages of this observing mode see our report "Far-infrared observations of normal stars measured with ISOPHOT in mini-map mode" (Moór et al. (2003); hereafter Report I).

In Report I we described the recalibration of the mini-map mode and we compiled a catalogue including recalibrated fluxes of 555 measurements of 229 normal stars. In the present report we (1) collect 168 far-infrared mini-map observations of 11 compact solar-system objects; (2) reprocess them following the scheme developed in Report I; and (3) compile a catalogue from the sample. The results will be available as a Highly Processed Data Product (HPDP) in the ISO Data Archive.

2 Data-base of compact solar-system objects observed in mini-map mode

In order to create a database of compact solar-system objects we searched the ISO Archive for observations of asteroids and planets according to the following criteria:

- AOT P22 and P99 rasters with raster step numbers of $2 \leq \mathrm{M} \leq 7$ and $2 \leq \mathrm{N} \leq 7$;
- raster step sizes in the range to $45'' \pm 2''$ for C100, and $45'' \pm 2''$ or $91'' \pm 2$ in the case of the C200 detector;

This query resulted in 155 TDT numbers including 168 mini-maps. Most of these observations belong to the ISOPHOT calibration programme.

3 Data processing

In general we followed the data reduction scheme as documented in details in Report I. Deviations from this scheme are listed below:

- Four measurements of Uranus were saturated at revolution day 133. In these cases the saturated data points were not used in the flux extraction rather we determined the total flux from the footprint fraction at ± 1 raster step. These measurements were denoted in the catalogue by a new remark (R14 see Sect. 4.).

- In our scheme the background flux is determined as the remaining offset whe f_{ij} footprint fraction is extrapolated to zero (see fig. 9 in Report I.). In the cases of very bright sources this method turned to be less successful resulting even negative background fluxes. The most likely explanation for this effect is some linearity problem remained after the signal linearization. In order to provide a better background estimate in these cases we constrained the fit by excluding the raster step towards the source. When the background brightness was lower than three times its uncertainty its entry in the catalogue was set to 0.0.

3.1 Error budget

Since for majority of the objects in the catalogue have predicted fluxes (in the case of asteroids see Müller & Lagerros (2002), while in the case of planets see Griffin&Orton) there is a possibility to validate the formal uncertainties of the processing. Fig. 1 shows the ratio of the measured to predicted flux. We plotted all data from all wavelengths (60, 65, 80, 90, 100, 105, 120, 150, 170, 180, 200 μm). The standard deviation of the whole

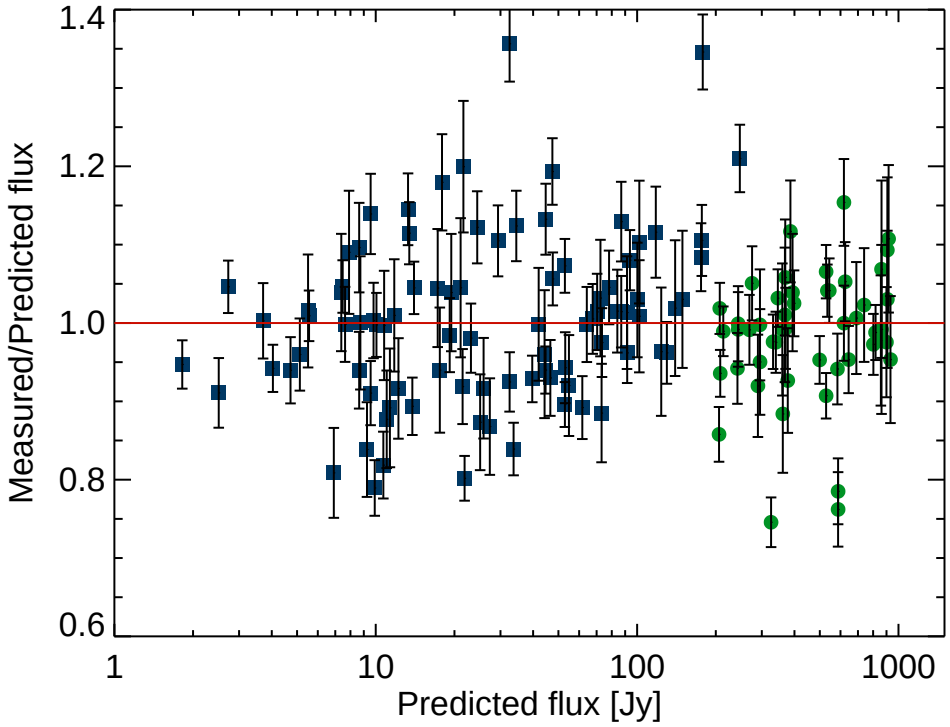

Figure 1: Measured/predicted flux ratio vs. predicted flux. Blue squares: Asteroids. Green dots: planets

sample around 1.0 is $\sim$ 11 % in the cases of asteroids and $\sim$ 8 % in the cases of planet observations.

The individual uncertainties are lower than these values, probably due to the uncertainties of the predicted fluxes (see Müller & Lagerros (2002)) which was not taken into account in our error propagation.

4 Description of the catalogue

Column	Field	Unit	Description
(1)	ISO name		Target name as given by the original ISO proposer
(2)	ISO type		Object type based on the IDA classification
(3)	TDTNUM_ON		The 8-digit TDTNUM of the on-source observation
(4)	On_Meas.		Index of the on-source measurement within TDTNUM_ON
(5)	RA(2000)		RAh, RAm, RAs of the ISOPHOT position
(6)	Dec(2000)		DECd, DECm, DECs of the ISOPHOT position
(7)	Detector		ISOPHOT detector (C1 or C2 for C100 and C200)
(8)	Wavelength	[micron]	Nominal wavelength of the ISOPHOT filter
(9)	Aperture	[arcsec]	Square aperture for C100 (43.5 arcsec) and C200 (89.4 arcsec) detectors
(10)	Epoch		Epoch of the observation
(11)	TDTNUM_OFF		The 8-digit TDTNUM of the off-source observation
(12)	Off_Meas.		Index of the off-source measurement within TDTNUM_OFF
(13)	Flux density	[Jy]	Flux density of the source. In case of a point source the measured flux is corrected for the size of the point spread function. In case of an extended source it corresponds to the integrated brightness. No colour correction applied.
(14)	Flux uncertainty	[Jy]	Flux uncertainty. No colour correction applied.
(15)	Background	[MJy/sr]	Background surface brightness. No colour correction applied.
(16)	Detection	[sigma]	The significance level of the source being detected above the background.
(17)	Object size		Indicates if the object is point-like (P) or extended (E)
(18)	Quality		Quality of the observation R1 – Standard processing according to the scheme described in the report. R2 – Minimap performed in astronomical (rather than satellite) coordinate R3 – ISOPHOT position differs from SIMBAD position by more than 10” R4 – Suspected ISO pointing problem R5 – Only one FCS is available R6 – No useful FCS is available, default FCS is used R7 – Archive quality mark R8 – Not enough data points to perform drift correction R9 – Fitting smooth baseline to the data points failed, drift correction (partly/completely) omitted R10 – Observation was carried out at the very end of orbit. Reduced photometric reliability at orbital phase greater than 0.8 R11 – A large increase in the proton flux from the Sun was observed R12 – Non-stabilised target signal R13 – Measured flux was out of the empirically calibrated range R14 – Measurement towards the source saturated; flux determined from the footprint fraction at ± 1 raster step

Table 1: Description of the catalogue

References

Moór, A., Ábrahám, P., Kiss, Cs., Csizmadia, Sz., 2003, Far-infrared observations of normal stars measured with ISOPHOT in mini-map mode (http://pma.iso.vilspa.esa.es:8080/hpdp/techn ical_reports/technote5.pdf)
Müller, T.G., Lagerros, J.S.V., 2002, A&A, 381, 324