Young Stellar Object Variability (YSOVAR)

Data Delivery #1

August 2015

L. M. Rebull and the YSOVAR team

1. Introduction

The YSOVAR (Young Stellar Object VARiability) Spitzer Space Telescope observing program obtained the first extensive mid-infrared (3.6 and 4.5 μm) time series photometry of the Orion Nebula Cluster plus smaller fields in 11 other star-forming cores (AFGL 490, NGC 1333, Mon R2, GGD 12-15, NGC 2264, L1688, Serpens Main, Serpens South, IRAS 20050+2720, IC 1396A, and Ceph C). We primarily used the Spitzer Infrared Array Camera (IRAC; Fazio et al. 2004) for photometric monitoring of these clusters. There are ~29,000 unique objects with light curves in either or both IRAC channels in the YSOVAR data set. YSOVAR and its sister project Coordinated Synoptic Investigation of NGC 2264 (CSI 2264; Cody et al. 2014) are exploring the variability properties of young stars in several young clusters at an unprecedented combination of cadence and photometric precision in the infrared.

Initial YSOVAR results were described in Morales-Calderón et al. (2011). Rebull et al. (2014; R14) describes the details of target selection, data reduction, and other conventions established for this project. Therefore, we do not repeat very much of that information here, and refer readers to R14. Individual papers are planned for each cluster, as described in R14. This delivery consists of data tables for the clusters that have been published (or submitted) as of the delivery date. The data for CSI2264 are delivered and maintained separately[1].

2. Delivery Philosophy

Each cluster's delivery consists of two large tables and a set of PNGs. One of the large tables, called the Object Table, has one line per object (with *many* columns) and includes single-epoch photometry as well as light curve metrics such as the mean – all entries in this table have a single value per object. See Figure 1 for a schematic, graphical representation of the Object Table; it is described in detail in Section 3. The other large table, called the Light Curve Table, has many lines per object and includes all the IRAC time series data (it is described in detail in Section 4). The PNGs are visualizations of the SED and light curve for each source.

[1] http://irsa.ipac.caltech.edu/data/SPITZER/CSI2264/

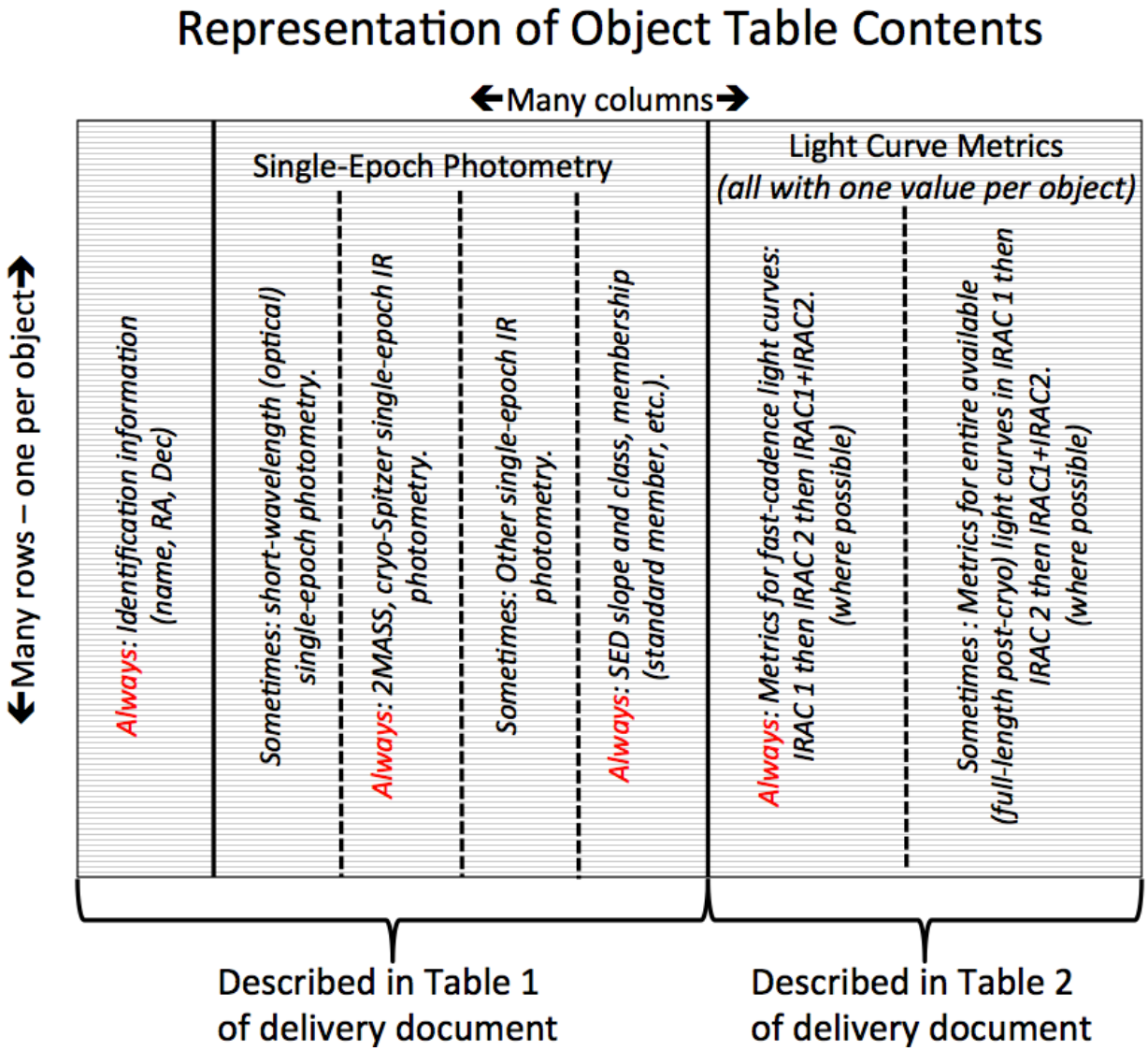

Figure 1: *Schematic, graphical representation of the Object Table. This table is described in Section 3, with the detailed contents of the single-epoch photometry columns in Table 1 of this document and the light curve metrics in Table 2 of this document. Additional columns (those tagged "sometimes") are described in the relevant cluster's section below.*

In the remainder of this document, we describe first (Sec. 3) the contents of the single-epoch photometry columns, e.g., the first ~40 columns of the Object Table, which is the minimum included for each cluster. We then describe the second ~40 columns of the Object Table (again the minimum included for each cluster), which is primarily light curve metrics -- means, medians, amplitudes, and other similar values. Sec. 4 describes the Light Curve Table for each cluster. Sec. 5 describes the PNG visualizations of the SED and light curve for each source.

While we have tried to be as consistent as possible between clusters, there are often specific differences customized to each cluster, reflecting differences in, for example, available single-epoch photometry data. Generally, the delivery should be identical to what

was used for the corresponding cluster paper, though may have more/different columns than what was published. There is a section for each of the clusters in this delivery that describes any specific modifications or issues for each cluster included in this delivery. Future deliveries will include more clusters.

3. Generic delivery contents: Object Table

The Object Table contains one line per object, and covers all of the objects for which we have light curves in the corresponding cluster's region. It consists of *both* photometry and light curve metrics, so it is very wide (with many columns). In all cases, "no data" is indicated by -9. The table contains ~40 columns of single-epoch photometry, and then ~40 *more* columns of light curve metrics (mean, median, amplitude, etc.). (See Figure 1 for a graphical representation.)

For **single-epoch photometry**, the Object Table contains, at minimum, near-IR photometry from 2MASS and mid-IR photometry from the cryogenic-era Spitzer observations. R14 contains a list of the cryo-era AORs (in its Table 4); only Serpens and IC1396 had deliberate time series observations in the cryo era, but all the clusters have serendipitous multi-epoch observations of sources in a "grid" pattern (see discussion in section 2.7 of R14). The Object Table may also include any single-epoch optical or NIR or MIR photometry obtained from the literature (as described in R14 and the corresponding cluster's paper). "No data" is indicated by -9. The table also includes an integer indication of whether or not the object is in the 'standard set of members', or in the 'standard set of variables' (see Section 3 of R14).

Table 1 below lists the minimum columns included for single-epoch photometry (and object identification) in the Object Table. Note that each delivery is customized to each cluster, and the table has grouped together the single-epoch photometry in order of approximate wavelength/survey. For example, NGC 1333 has additional optical (single-epoch) photometry available for some sources, and these columns appear after the position but before the NIR columns in its Object Table. (See the cluster sections for specific differences per cluster.) Therefore, note that it may not be the case that, say, the 2MASS J magnitude is always the 5th column, but the 2MASS J photometry will always have the same column name in each cluster's delivery.

Table 1: Minimum columns found in Object Table for position and photometry information

Column name	Description
SSTYSV_J	IAU-compliant, coordinate-based name (J2000) for this source with a YSOVAR light curve.
ra	Right ascension (J2000; 2MASS system)
dec	Declination (J2000; 2MASS system)
tmJlim	Limit flag on 2MASS J magnitude (>, <, or =)
tm_Jmag	J-band magnitude from the 2MASS point source catalog

tm_Jerr	Error on J
tmHlim	Limit flag on 2MASS H magnitude (>, <, or =)
tm_Hmag	H-band magnitude from the 2MASS point source catalog
tm_Herr	Error on H
tmKlim	Limit flag on 2MASS Ks magnitude (>, <, or =)
tm_Kmag	Ks-band magnitude from the 2MASS point source catalog
tm_Kerr	Error on Ks
c3_6lim	Limit flag on Spitzer/IRAC channel 1 band (3.6 microns) magnitude from cryogenic-era Spitzer observations (>, <, or =)
c3_6mag	Spitzer/IRAC channel 1 band (3.6 microns) magnitude from cryogenic-era Spitzer observations
c3_6err	Error on [3.6] from cryogenic-era Spitzer observations
c4_5lim	Limit flag on Spitzer/IRAC channel 2 band (4.5 microns) magnitude from cryogenic-era Spitzer observations (>, <, or =)
c4_5mag	Spitzer/IRAC channel 2 band (4.5 microns) magnitude from cryogenic-era Spitzer observations
c4_5err	Error on [4.5] from cryogenic-era Spitzer observations
c5_8lim	Limit flag on Spitzer/IRAC channel 3 band (5.8 microns) magnitude from cryogenic-era Spitzer observations (>, <, or =)
c5_8mag	Spitzer/IRAC channel 3 band (5.8 microns) magnitude from cryogenic-era Spitzer observations
c5_8err	Error on [5.8] from cryogenic-era Spitzer observations
c8_0lim	Limit flag on Spitzer/IRAC channel 4 band (8.0 microns) magnitude from cryogenic-era Spitzer observations (>, <, or =)
c8_0mag	Spitzer/IRAC channel 4 band (8.0 microns) magnitude from cryogenic-era Spitzer observations
c8_0err	Error on [8.0] from cryogenic-era Spitzer observations
c24lim	Limit flag on Spitzer/MIPS channel 1 band (24 microns) magnitude from cryogenic-era Spitzer observations (>, <, or =)
c24mag	Spitzer/MIPS 24 micron band magnitude from cryogenic-era Spitzer observations
c24err	Error on [24] from cryogenic-era Spitzer observations
LogFx	log of F_x, where F_x is in units of ergs/cm^2/s
LogFxerr	Error on log of F_x, where F_x is in units of ergs/cm^2/s
LogLx	log L_x, where L_x is in units of ergs/s
slope2m24	SED slope, as observed, between 2 and 24 microns (see R14) – provided for all sources
class2-m4	SED class based on observed 2-24 micron slope (see R14) – only provided for YSOs
slope2m8	SED slope, as observed, between 2 and 8 microns (see R14) – provided for all sources
class2m8	SED class based on observed 2-8 micron slope (see R14) – only provided for YSOs
TMASS_name	Name from 2MASS point source catalog

stdmem	Indication if source is included in the set of standard members (see R14). 1=yes, 0=false.
bcX	Indication if source was added to set of standard members because of X-ray detection (see R14). 1=yes, 0=false.
anyyso	Indication if source is identified anywhere in the literature (here as well as older literature) as a YSO or candidate. Note that the degree to which the literature was combed for prior YSOs is described in the cluster's corresponding paper. 1=yes, 0=false.

For **light curve metrics**, the Object Table also contains, at minimum, metrics for the fast cadence YSOVAR campaign (see R14, section 2.4, for discussion of cadences). Table 2 below contains a brief description of each metric. These light curve metrics are grouped together, after all single-epoch photometry columns listed in Table 1 (and any customized single-epoch photometry columns for the cluster).

Note that, if there are additional YSOVAR monitoring data beyond the fast cadence, additional metrics on the entire YSOVAR campaign are provided after the fast cadence metrics. (See Figure 1 and the corresponding cluster section below; in this delivery, only L1688 has data beyond the fast cadence.)

Table 2: Minimum columns found in Object Table for fast cadence light curve metrics

Column name	Description
CYvar	Indication if source is identified as a cryo-to-YSOVAR (CY) variable (see R14). 1=yes, 0=false.
Var	Indication if source is identified from the fast cadence as a variable (see R14). 1=yes, 0=false.
np_36	Number of points in IRAC-1 (3.6 micron) light curve
Mean_36	Mean of the IRAC-1 (3.6 micron) light curve, in magnitudes.
Median_36	Median of the IRAC-1 (3.6 micron) light curve, in magnitudes.
Sdev_36	Standard deviation of the IRAC-1 (3.6 micron) light curve, in magnitudes.
Max_36	Maximum of the IRAC-1 (3.6 micron) light curve, in magnitudes.
Min_36	Minimum of the IRAC-1 (3.6 micron) light curve, in magnitudes.
Ampl_36	Amplitude of the IRAC-1 (3.6 micron) light curve, as defined in the papers (10^{th} to 90^{th} percentile of distribution), in magnitudes.
Drange_36	Range of the IRAC-1 (3.6 micron) light curve, in days.
Chis_36	Chisquare (χ^2) for the IRAC-1 (3.6 micron) light curve.
Ts_36	Timescale of the IRAC-1 (3.6 micron) light curve, in days, derived via the ACF (see R14 and Rebull et al. 2015).
Per_36	Period derived from the IRAC-1 (3.6 micron) light curve (see R14).
M_36	M metric, a measure of up/down symmetry of the IRAC-1 (3.6 micron) light curve, calculated as per Cody et al. (2014), for the original light curve.
Ms_36	M metric, a measure of up/down symmetry of the IRAC-1 (3.6 micron) light curve, calculated as per Cody et al. (2014), for the smoothed light curve.
Q_36	Q metric, a measure of repeated patterns in the IRAC-1 (3.6 micron) light

	curve, calculated as per Cody et al. (2014), for the original light curve.
Ql_36	Q metric, a measure of repeated patterns in the IRAC-1 (3.6 micron) light curve, calculated as per Cody et al. (2014), for the long-term-trend-subtracted light curve.
np_45	Number of points in IRAC-2 (4.5 micron) light curve.
Mean_45	Mean of the IRAC-2 (4.5 micron) light curve, in magnitudes.
Median_45	Median of the IRAC-2 (4.5 micron) light curve, in magnitudes.
Sdev_45	Standard deviation of the IRAC-2 (4.5 micron) light curve, in magnitudes.
Max_45	Maximum of the IRAC-2 (4.5 micron) light curve, in magnitudes.
Min_45	Minimum of the IRAC-2 (4.5 micron) light curve, in magnitudes.
Ampl_45	Amplitude of the IRAC-2 (4.5 micron) light curve, as defined in the papers (10^{th} to 90^{th} percentile of distribution), in magnitudes.
Drange_45	Range of the IRAC-2 (4.5 micron) light curve, in days.
Chis_45	Chisquare (χ^2) for the IRAC-2 (4.5 micron) light curve.
Ts_45	Timescale of the IRAC-2 (4.5 micron) light curve, in days, derived via the ACF (see R14 and Rebull et al. 2015).
Per_45	Period derived from the IRAC-2 (4.5 micron) light curve (see R14).
M_45	M metric, a measure of up/down symmetry of the IRAC-2 (4.5 micron) light curve, calculated as per Cody et al. (2014), for the original light curve.
Ms_45	M metric, a measure of up/down symmetry of the IRAC-2 (4.5 micron) light curve, calculated as per Cody et al. (2014), for the smoothed light curve.
Q_45	Q metric, a measure of repeated patterns in the IRAC-2 (4.5 micron) light curve, calculated as per Cody et al. (2014), for the original light curve.
Ql_45	Q metric, a measure of repeated patterns in the IRAC-2 (4.5 micron) light curve, calculated as per Cody et al. (2014), for the long-term-trend-subtracted light curve.
Np3645	Number of pairs of IRAC-1 ([3.6]) and IRAC-2 ([4.5]) points.
Mean3645	Mean of the [3.6]-[4.5] light curve, in magnitudes.
Sdev3645	Standard deviation of the [3.6]-[4.5] light curve, in magnitudes.
Per3645	Period derived from of the [3.6]-[4.5] light curve, in days.
Stet3645	Stetson index calculated from the paired [3.6] and [4.5] points.
Corr363645	Correlation coefficient calculated for the distribution of the paired [3.6] and [4.5] points, in the [3.6] vs. [3.6]-[4.5] color-magnitude diagram.
cpro363645	Probability that the distribution of the paired [3.6] and [4.5] points, in the [3.6] vs. [3.6]-[4.5] color-magnitude diagram, could be explained by a random distribution of uncorrelated points, given the errors in two-dimensions (see Rebull et al. 2015).
Corr453645	Correlation coefficient calculated for the distribution of the paired [3.6] and [4.5] points, in the [4.5] vs. [3.6]-[4.5] color-magnitude diagram.
cpro453645	Probability that the distribution of the paired [3.6] and [4.5] points, in the [4.5] vs. [3.6]-[4.5] color-magnitude diagram, could be explained by a random distribution of uncorrelated points, given the errors in two-dimensions (see Rebull et al. 2015).

sloped363645	Angle of the slope of the best fit line in the [3.6] vs. [3.6]-[4.5] color-magnitude diagram, in units of degrees.

4. Generic delivery contents: Light Curve Table

The Light Curve Table consists of Spitzer light curves in IRAC-1 (3.6 microns) and IRAC -2 (4.5 microns). There are many rows for each object, because each object has many epochs of data.

Important caveats:

- Light curves are only delivered if at least 5 good YSOVAR epochs were obtained (see R14).
- Light curves are delivered for variables and non-variables, and generally for all objects in the field, members and non-members (however, see the cluster delivery notes for where this is not the case).
- "No data" is indicated by -9.
- Some objects may have a few cryo-era epochs, in addition to the YSOVAR epochs (see R14). Cryo exhaustion occurred on 15 May 2009, or Julian date 2454966.5, or (heliocentric) modified Julian date 54966, so points in the delivered tables with HMJD less than this are from the cryo era. (See R14 for important notes on this.)
- All clusters will have fast cadence observations. Some clusters will have additional slow cadence (or even intensive cryo-era) monitoring observations. (R14 discusses the cadences and data.) In this delivery, only L1688 has slow-cadence data.
- To the best of our knowledge and ability, only good data are retained here. Data flagged by the pipeline as having insufficient frames, or affected by cosmic rays (etc.) are dropped. Additional epochs are dropped based on an object-by-object, frame-by-frame basis, via individual inspection. Not all light curves have been inspected – we did not look at light curves not identified by our approach as variable). While we tried to be conservative, some texture in some light curves may be subject to instrumental effects. If in doubt, check the images (which can be downloaded from the SHA).
- Light curves between the two channels are not matched in time in this catalog. R14 shows figures of the regions of sky covered in each cluster. In the region where data at both IRAC channels were obtained, each channel's observations were usually obtained within 15 minutes of the other channel, and these observations were paired in our work to calculate the Stetson Index. To preserve the maximum amount of information, the original date of observation is retained in this delivery, e.g., the 2-channel observations are not pairwise matched.
- The two last columns (std_mem and std_var) are copies of columns in the Object Table. These two flags, which indicate which sources are in the standard set of members and which are in the standard set of variables (see R14), are provided to enable users to pull data more easily – for example, to select light curves for just variables, or just members.

Table 4: Minimum columns found in Light Curve Table

Column name	Description
SSTYSV_J	IAU-compliant, coordinate-based name (J2000) for this source with a light curve
RA	Right ascension (J2000; 2MASS system)
Dec	Declination (J2000; 2MASS system)
HMJD	Heliocentric modified Julian date
MAG_I1	Magnitude in the IRAC 3.6-micron band
ERR_I1	Uncertainty on the 3.6-micron band magnitude. The value is estimated from photon noise and sky background, plus a systematic, as described in R14.
MAG_I2	Magnitude in the IRAC 4.5-micron band
ERR_I2	Uncertainty on the 4.5-micron band magnitude. The value is estimated from photon noise and sky background, plus a systematic, as described in R14.
STD_MEM	Indication if source is included in the set of standard members (see R14). 1=yes, 0=false. (Repeat from Object Table to enable fast searches.)
STD_VAR	Indication if source is identified from the fast cadence as a variable (see R14). 1=yes, 0=false. (Repeat from Object Table to enable fast searches.)

5. Generic delivery contents: SED and Light Curve PNGs

We also have delivered PNG representations of the SED of each object and its light curve. Note that in most cases, PNG files are provided regardless of an object's membership or variability status. An annotated example is shown in Figure 2.

We plot the SED for each object, with all the broadband photometry available in our database (and in the Object Table). In the SEDs, on the y-axis, log λF_λ is plotted with λF_λ in cgs units (erg/s/cm^2). On the x-axis, log λ is plotted with λ in microns. Diamonds are 2MASS, circles are IRAC (with the green ones being the means from the YSOVAR campaign), and squares are MIPS. (Additional data, not uniformly available, include stars for WISE and plus signs or triangles for optical.) Vertical black lines are error bars (or amplitude of YSOVAR campaign in the case of the green IRAC point, where amplitude is defined as the 10th to 90th percentile of the distribution). Upper or lower limits are arrows.

If the object is in the standard set of YSOs (see R14), then it says 'YSO' in the lower left corner of the SED plot.

For the Spitzer light curves, we plot the Spitzer/IRAC magnitudes for both the 3.6 micron band (filled dots) and the 4.5 micron band (open circles). To display both light curves on the same plot, we have shifted the median of the 3.6 micron data to match that of the 4.5 micron band data. This shift is indicated on the y-axis of the plots by "[3.6] (solid) & ([4.5]+x) (open)" (where 'x' is meant to indicate the relative offset of the means). When there are no 4.5 micron (3.6 micron) data available, then 3.6 micron (4.5 micron) points are plotted alone and unshifted. Error bars are not included.

If the object is identified as variable in the fast cadence (part of the standard set of variables; see R14), then it says 'VAR' in the lower left corner of the light curve plot.

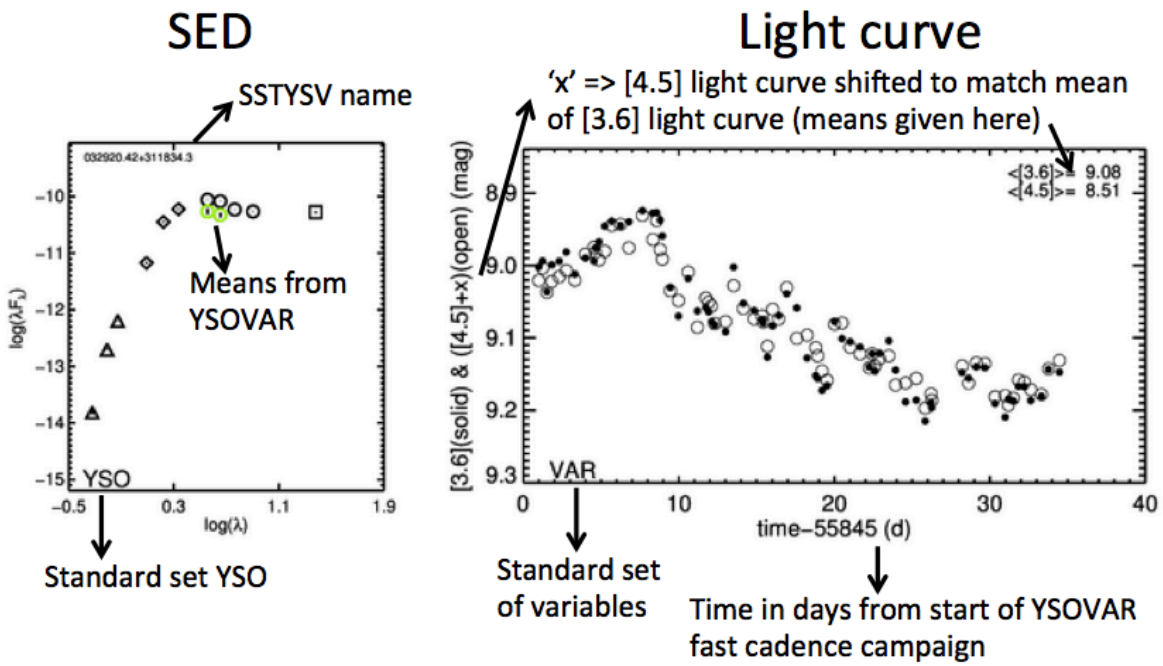

Figure 2*: Annotated example of delivered PNG. SED on left and light curve on right. This object is from NGC 1333 (based on the coordinates and the subdirectory in which it resides), has a well-populated SED (u-band through MIPS-24), is part of the standard set of YSOs, and the (green points) means from the YSOVAR campaign suggest significant changes between the cryo-Spitzer observations and the YSOVAR epochs. It has light curves in both IRAC bands, and the [4.5] light curve has been shifted such that the mean [3.6] and mean [4.5] match (the actual means, in magnitudes, are given in the upper right), and viewers can see the structure in both light curves clearly. It is identified as a variable.*

6. Specific delivery contents: L1688

L1688 is discussed in detail in Günther et al. (2014). This work discussed light curves from all objects detected with a light curve (as opposed to just cluster members). Generally, for an object to be included in the set of light curves, we required at least 5 points be in the light curve. For clusters with only fast cadence monitoring, that means that there be at least 5 points in the fast cadence. However, in this cluster, 53 sources have fewer than 5 fast cadence points, but more than 5 post-cryo points (all slow cadence). These 53 sources were included in the published analysis (Günther et al. 2014), and so have been included here in both the Object and Light Curve Tables, but they do not have any light curve metrics in the Object Table. (They are not included in the PNG visualizations.)

Object Table Modifications

Table 5 contains the additional columns in the Object Table for L1688, which fall into two categories. (1) There are single-epoch photometric observations available from UKIDSS (UKIRT Infrared Deep Sky Survey) and c2d (Cores to Disks Spitzer Legacy project) to complement the standard data. (2) There are slow-cadence YSOVAR data available in addition to the fast cadence data, so some light curve metrics are included that encompass the entire available post-cryo light curve, not just the fast (or just the slow) cadence.

Light Curve Table Modifications

For the Light Curve Table, there are slow-cadence YSOVAR observations in addition to fast-cadence observations for this cluster. All data are included in the Light Curve Table. A few outliers in the fast cadence light curves were identified for a few sources after this cluster's data were published. Thus, some of the light curve metrics for a few sources do not match the published values.

PNG Visualization Modifications

The UKIDSS data appear as triangles in the SEDs. Only the fast cadence data are shown in the light curves.

Table 5: Additional columns found in Object Table for L1688

Column name	Description
ukidss_zmag	Magnitude in z band from UKIDSS (Vega-based)
ukidss_zerr	Error in magnitude in z band from UKIDSS (copied as reported in UKIDSS archive; may be 0 to precision reported here)
ukidss_ymag	Magnitude in y band from UKIDSS (Vega-based)
ukidss_yerr	Error in magnitude in y band from UKIDSS (copied as reported in UKIDSS archive; may be 0 to precision reported here)
ukidss_Jmag	Magnitude in J band from UKIDSS (Vega-based)
ukidss_Jerr	Error in magnitude in J band from UKIDSS(copied as reported in UKIDSS archive; may be 0 to precision reported here)
ukidss_Hmag	Magnitude in H band from UKIDSS (Vega-based)
ukidss_Herr	Error in magnitude in H band from UKIDSS (copied as reported in UKIDSS archive; may be 0 to precision reported here)
ukidss_Kmag	Magnitude in K band from UKIDSS (Vega-based)
ukidss_Kerr	Error in magnitude in K band from (copied as reported in UKIDSS archive; may be 0 to precision reported here)
c70lim	Limit flag on Spitzer/MIPS channel 2 band (70 microns) magnitude from cryogenic-era Spitzer observations (from c2d processing).
c70mag	Spitzer/MIPS 70 micron band magnitude from cryogenic-era Spitzer observations (from c2d processing).
c70err	Uncertainty on [70] from cryogenic-era Spitzer observations (from c2d

	processing).
c2d_name	Name of counterpart in c2d catalogs
Varf	Indication if source is identified from the **full** light curve as a variable, using same Stetson and Chi squared metrics and cutoffs as . 1=yes, 0=false.
np_36f	Number of points in **full-length** IRAC-1 (3.6 micron) light curve
Mean_36f	Mean of the **full-length** IRAC-1 (3.6 micron) light curve, in magnitudes.
Median_36f	Median of the **full-length** IRAC-1 (3.6 micron) light curve, in magnitudes.
Sdev_36f	Standard deviation of the **full-length** IRAC-1 (3.6 micron) light curve, in magnitudes.
Max_36f	Maximum of the **full-length** IRAC-1 (3.6 micron) light curve, in magnitudes.
Min_36f	Minimum of the **full-length** IRAC-1 (3.6 micron) light curve, in magnitudes.
Ampl_36f	Amplitude of the **full-length** IRAC-1 (3.6 micron) light curve, as defined in the papers (10^{th} to 90^{th} percentile of distribution), in magnitudes.
Drange_36f	Range of the **full-length** IRAC-1 (3.6 micron) light curve, in days.
Chis_36f	Chisquare (χ^2) for the **full-length** IRAC-1 (3.6 micron) light curve.
np_45f	Number of points in **full-length** IRAC-2 (4.5 micron) light curve.
Mean_45f	Mean of the **full-length** IRAC-2 (4.5 micron) light curve, in magnitudes.
Median_45f	Median of the **full-length** IRAC-2 (4.5 micron) light curve, in magnitudes.
Sdev_45f	Standard deviation of the **full-length** IRAC-2 (4.5 micron) light curve, in magnitudes.
Max_45f	Maximum of the **full-length** IRAC-2 (4.5 micron) light curve, in magnitudes.
Min_45f	Minimum of the **full-length** IRAC-2 (4.5 micron) light curve, in magnitudes.
Ampl_45f	Amplitude of the **full-length** IRAC-2 (4.5 micron) light curve, as defined in the papers (10^{th} to 90^{th} percentile of distribution), in magnitudes.
Drange_45f	Range of the **full-length** IRAC-2 (4.5 micron) light curve, in days.
Chis_45f	Chisquare (χ^2) for the **full-length** IRAC-2 (4.5 micron) light curve.
Mean3645f	Mean of the **full-length** [3.6]-[4.5] light curve, in magnitudes.
Sdev3645f	Standard deviation of the **full-length** [3.6]-[4.5] light curve, in magnitudes.
Stet3645f	Stetson index calculated from the **full-length** paired [3.6] and [4.5] points.

7. Specific delivery contents: GGD 12-15

GGD 12-15 is discussed in detail in Wolk et al. (2015). This work discussed light curves from all objects detected with a light curve (as opposed to just cluster members). There were little ancillary data available in the literature for this region, and there are just fast-cadence YSOVAR observations, so only the minimum columns appear in the delivery, and there are no additional columns found in the Object or Light Curve tables, or additional symbols in the delivered PNGs.

8. Specific delivery contents: IRAS 20050+2720

IRAS 20050+2720 is discussed in detail in Poppenhaeger et al. (2015). This work discussed light curves from **just the standard set of cluster members** (as opposed to all objects with a light curve).

Object Table Modifications

The field rotation over the YSOVAR campaign is substantial, and the spatial 'fans' of single-band coverage reach beyond the Spitzer cryo-era maps, so WISE (Wide-field Infrared Survey Explorer) data are included where there is little or no Spitzer data. All of the optical ancillary data were obtained from Günther et al. (2012), which includes new data reported there and data from IPHAS (Isaac Newton Telescope Photometric H-Alpha Survey). Data in this delivery are only included for the standard set of cluster members.

Light Curve Table Modifications

Light curves from only the standard set of cluster members is included. There are just fast-cadence YSOVAR observations available.

PNG Visualization Modifications

WISE data appear as stars in the SED. Images for only the standard set of cluster members is included.

Table 6: Additional columns found in Object Table for IRAS 20050+2720

Column name	Description
Umag	Magnitude in the U band from Günther et al. (2012)
Umerr	Error in magnitude in the U band from Günther et al. (2012)
Bmag	Magnitude in the B band from Günther et al. (2012)
Bmerr	Error in magnitude in the B band from Günther et al. (2012)
Vmag	Magnitude in the V band from Günther et al. (2012)
Vmerr	Error in magnitude in the V band from Günther et al. (2012)
Rmag	Magnitude in the R band from Günther et al. (2012)
Rmerr	Error in magnitude in the R band from Günther et al. (2012)
Imag	Magnitude in the I band from Günther et al. (2012)
Imerr	Error in magnitude in the I band from Günther et al. (2012)
Iphas_rmag	Magnitude in the IPHAS r band
Iphas_rmerr	Error in magnitude in the IPHAS r band
Iphas_imag	Magnitude in the IPHAS i band
Iphas_imerr	Error in magnitude in the IPHAS i band

Iphas_hamag	Magnitude in the IPHAS Halpha band
Iphas_hamerr	Error in magnitude in the IPHAS Halpha band
w3_4lim	Limit flag on WISE channel 1 band (3.4 microns) magnitude from cryogenic-era WISE observations (>, <, or =)
w3_4mag	WISE channel 1 band (3.4 microns) magnitude from AllWISE catalog
w3_4err	Error on [3.4] from AllWISE catalog
w4_6lim	Limit flag on WISE channel 2 band (4.6 microns) magnitude from AllWISE catalog (>, <, or =)
w4_6mag	WISE channel 2 band (4.6 microns) magnitude from AllWISE catalog
w4_6err	Error on [4.6] from AllWISE catalog
w12lim	Limit flag on WISE channel 3 band (12 microns) magnitude from AllWISE catalog (>, <, or =)
w12mag	WISE channel 3 band (12 microns) magnitude from AllWISE catalog
w12err	Error on [12] from AllWISE catalog
w22lim	Limit flag on WISE channel 4 band (22 microns) magnitude from AllWISE catalog (>, <, or =)
w22mag	WISE channel 4 band (22 microns) magnitude from AllWISE catalog
w22err	Error on [22] from AllWISE catalog

9. Specific delivery contents: NGC 1333

NGC 1333 is discussed in detail in Rebull et al. (2015). This work discussed light curves from all objects detected with a light curve (as opposed to just cluster members). There are just fast-cadence YSOVAR observations.

Object Table Modifications

Rebull (2015) describes the assembly of a catalog of all objects in the direction of NGC 1333. This catalog is included as part of the delivery here for data discovery purposes, and is integrated into NGC 1333's Object Table. NGC 1333's Object Table has everything in this direction, regardless of whether or not any given object has a light curve. These additional data are reported in Rebull (2015), and thus are limited to 52° < RA < 52.5° and 31° < Dec < 31.6°. The light curve metrics, obviously, appear only for objects with light curves, and did not appear in Rebull (2015). The first column in the Object Table is usually SSTYSV_J, but because there are so many objects in this catalog that do not have SSTYSV numbers, the heading of that column is R15-NGC1333_J_or_SSTYSV_J. In other words, if an object has a light curve in YSOVAR, its SSTYSV name and R15-NGC1333 name are identical, but if it does not have a light curve in YSOVAR, its IAU-compatible name is the R15-NGC1333 name. Optical data discussed in Rebull et al. (2015) are included here.

Light Curve Table Modifications

There are only fast cadence data for NGC 1333, so only the standard columns are included. (The objects without light curves are not included, so it is consistent with the Light Curve Table from other clusters.)

PNG Visualization Modifications

The delivered PNGs are only for objects with light curves. (The objects without light curves are not included, so this is consistent with the PNGs from other clusters.) Optical data discussed in Rebull et al. (2015) are included in the SEDs. Rarely, WISE data (from AllWISE) appear as stars.

Table 7: Additional columns found in Object Table for NGC 1333

Column name	Description
CF_umag	CFHT u-band magnitude (Vega-based mags) from Rebull et al. (2015)
CF_umer	Error on CFHT u-band magnitude (Vega-based mags)
CF_gmag	CFHT g-band magnitude (Vega-based mags) from Rebull et al. (2015)
CF_gmer	Error on CFHT g-band magnitude (Vega-based mags)
CF_rmag	CFHT r-band magnitude (Vega-based mags) from Rebull et al. (2015)
CF_rmer	Error on CFHT r-band magnitude (Vega-based mags)
CF_imag	CFHT i-band magnitude (Vega-based mags) from Rebull et al. (2015)
CF_imer	Error on CFHT i-band magnitude (Vega-based mags)
Su_imag	Subaru i-band magnitude (Vega-based mags) from Rebull et al. (2015)
Su_imer	Error on Subaru i-band magnitude (Vega-based mags)

6. References

Cody, A. M., et al., 2014, AJ, 147, 82
Fazio, G., et al., 2004, ApJS, 154, 10
Günther, H., et al., 2012, AJ, 144, 101
Günther, H., et al., 2014, AJ, 148, 122
Morales-Calderón, M., et al., 2011, ApJ, 733, 50
Poppenhaeger, K., et al., 2015, AJ, 150, 118
Rebull, L., et al., 2014, AJ, 148, 92
Rebull, L., 2015, AJ, 150, 17
Rebull, L. et al., 2015, AJ, in press
Wolk, S., et al., 2015, AJ, in press