VVVX Survey - ESO Phase 3 - Data Release 1

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Data Collection	VVVX
Release Number	1
Data Provider	Philip Lucas et al.
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Abstract

The VVVX Survey data delivered to ESO includes the VISTA tile images that were processed by the Cambridge Astronomical Survey Unit (CASU). These data files were successfully submitted via the Phase 3 tool to the ESO Archive before November 15, 2018. The data are from ESO programme 198.B-2004, with the VIRCAM instrument, using JHKs filters. The total sky coverage of 590 sq deg, typically covered in all 3 filters, save for exceptions where an image failed quality control. The J data benefit from double the exposure time (2 separate exposures appearing as 2 separate files) in order to increase the useful depth for construction of colour magnitude diagrams.

Overview of Observations

VVVX is an extension of the VVV time domain survey in area and in time. Primarily, VVVX is a time domain survey of the portions of the southern Galactic plane that were not covered by VVV. In addition, VVVX includes a small number of epochs in the original VVV survey area, taken in order to extend the time baseline for (i) significantly improved proper motion precision and (ii) monitoring of long term variable stars.

This Phase 3 release contains observations taken between July 2016 and August 2017, prior to an ESO-defined cut-off date of 1st October 2017. We refer to this product as DR1. All the data were processed with v1.5 of the CASU pipeline. This benefits from improved photometric calibration, relative to v1.3, and a fix to a bug in the illumination correction.

The VVVX DR1 data correspond to the multi-filter JHKs “master data” taken in reasonably good observing conditions, to be supplemented by time series Ks data in the next data release. The data were taken in 2 types of OB: (i) JHKs OBs in which all filters for a given 1.4°×1.1° VISTA tile were observed within ~1 hour (ii) J-only OBs, observed in order double the exposure time in that filter. Due to the restriction OB duration these additional J observations had to be separate from the JHKs observations, for a given tile. The intention in a future bandmerged release is to coadd the 2 J images of each tile and separately coadd the time series Ks images for each tile, in order to increase the useful depth of Ks vs J-Ks colour magnitude diagrams. Some OBs of both types were repeated due to marginal or changing observing conditions at the telescope. Additional observations from these OBs (in any or all filters) are included in this release if the data subsequently passed quality control by the survey team.

VVVX J observations within each OB have longer exposure times than the VVV observations. Individual stars are typically covered by 2 of the 6 VISTA pawprints in the tiling pattern (separated by a few minutes in time) leading to a total time on source in each OB of 120 s (J), 48s (H) and 16s (Ks). For comparison, the VVV multi-colour disc OB data (denoted "d[tile no.]") had 80s per filter and the VVV multi-colour bulge OB data (denoted "b[tile no.]") had 48 s (J), 16 s (H), 16 s (Ks). VVVX time series Ks data in future releases will have 16 s time on source for stars covered by 2 pawprints, the same as VVV.

The list for this Phase 3 release DR1 has 1660 tile images plus their associated weight maps and single-band source catalogues. In addition the release contains the 9960 pawprint images and their associated weight maps that were used to create the tile images. The total data volume is 1.82 TB in compressed format and ~3 TB uncompressed. Quality control of such a large dataset is never perfect, so visual inspection of the images is always recommended when studying individual sources.

The VVVX photometric dataset is divided into different disc and bulge tiles. The original VVV tile nomenclature goes from d001 to d152 in the disk, and from b201 to b396 in the bulge. In VVVX the bulge region is extended at higher and lower latitudes (see figure 1), including new tiles labeled b401 to b512. The new areas of the VVVX disc region are labeled e601 to e988. These new disc areas are located (i) at longitudes 10° to 20° (8 rows of tiles, partially overlapping with UKIDSS) and (ii) at longitudes 230° to 350°, comprising 8 rows of tiles at 230° to 295° and 2 rows of tiles above and 2 rows below the original VVV disc area at 295° to 350°.
The coordinates of the tile centers available in this release are listed in Table 1 below. A map of the available data is shown in figure 1. Each square indicates the location of a tile. There are small overlaps between adjacent tiles.

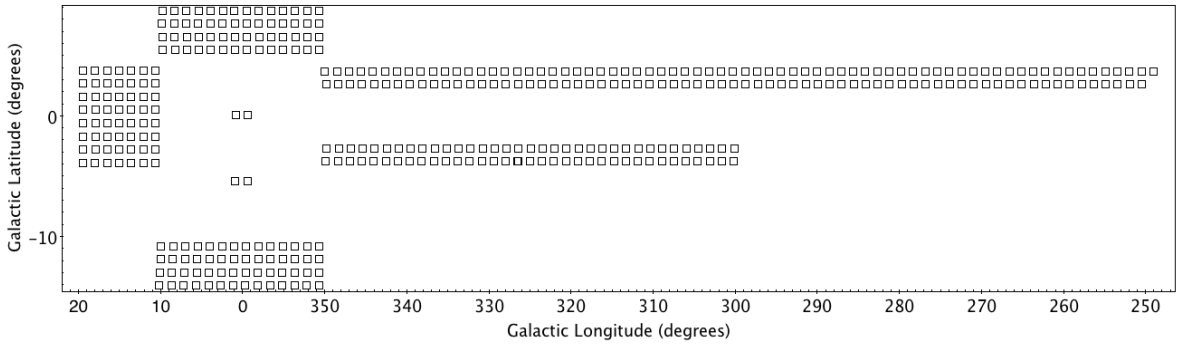

Figure 1. Map showing the VVVX DR1 sky coverage. The observed VVVX fields surround the previous VVV area that was located in the mid-plane and bulge at longitudes 295° to 10°.

Release Content

TABLE 1: Coordinates of VVVX DR1 tiles.

ID	RA	Dec	Longitude	Latitude
b0457	16:59:48.68	-33:33:05.0	350.64902	5.458677
b0458	17:04:02.66	-32:23:32.2	352.1157	5.4586406
b0459	17:08:09.36	-31:13:20.9	353.58228	5.4586306
b0460	17:12:09.19	-30:02:33.5	355.04883	5.458659
b0461	17:16:02.59	-28:51:11.9	356.5155	5.4586444

b0462	17:19:49.90	-27:39:18.6	357.98212	5.458622
b0463	17:23:31.46	-26:26:55.5	359.44867	5.458655
b0464	17:27:07.64	-25:14:04.2	0.91531175	5.458687
b0465	17:30:38.75	-24:00:46.7	2.3819306	5.458716
b0466	17:34:05.12	-22:47:04.7	3.8485613	5.4586606
b0467	17:37:27.02	-21:32:59.7	5.3151617	5.4585986
b0468	17:40:44.70	-20:18:32.7	6.781775	5.4586945
b0469	17:43:58.50	-19:03:45.6	8.248422	5.458626
b0470	17:47:08.59	-17:48:39.4	9.714992	5.45872
b0471	16:55:42.36	-32:52:35.2	350.65054	6.550842
b0472	16:59:57.61	-31:43:33.1	352.12024	6.5508265
b0473	17:04:05.64	-30:33:50.2	353.5901	6.550858
b0474	17:08:06.84	-29:23:29.8	355.05988	6.5508137
b0475	17:12:01.57	-28:12:33.8	356.52966	6.5508194
b0476	17:15:50.21	-27:01:04.3	357.99948	6.550833
b0477	17:19:33.09	-25:49:03.4	359.4693	6.550892
b0478	17:23:10.58	-24:36:33.4	0.9391094	6.5508113
b0479	17:26:42.93	-23:23:35.3	2.408941	6.550918
b0480	17:30:10.52	-22:10:11.7	3.878747	6.5508194
b0481	17:33:33.56	-20:56:23.6	5.348495	6.5508537
b0482	17:36:52.38	-19:42:12.5	6.818295	6.550839
b0483	17:40:07.23	-18:27:39.7	8.288141	6.55083
b0484	17:43:18.35	-17:12:46.8	9.75794	6.5508246
b0485	16:51:39.73	-32:11:36.2	350.65182	7.643068
b0486	16:55:56.19	-31:03:03.6	352.12537	7.6429644
b0487	17:00:05.42	-29:53:48.8	353.59894	7.642986
b0488	17:04:07.83	-28:43:54.8	355.07242	7.642973
b0489	17:08:03.78	-27:33:23.2	356.54605	7.643073
b0490	17:11:53.66	-26:22:17.1	358.01962	7.643022
b0491	17:15:37.76	-25:10:38.2	359.4932	7.643021
b0492	17:19:16.41	-23:58:28.8	0.96664315	7.642992
b0493	17:22:49.93	-22:45:49.8	2.4402323	7.6430435
b0494	17:26:18.62	-21:32:43.7	3.9137838	7.6430354
b0495	17:29:42.75	-20:19:11.8	5.387343	7.6430545
b0496	17:33:02.62	-19:05:15.8	6.860928	7.6429744
b0497	17:36:18.42	-17:50:57.0	8.334423	7.6430435
b0498	17:39:30.51	-16:36:16.7	9.808075	7.642893
b0499	16:47:40.86	-31:30:07.6	350.65366	8.735144
b0500	16:51:58.34	-30:22:03.5	352.13153	8.735183
b0501	16:56:08.64	-29:13:16.1	353.60934	8.735222
b0502	17:00:12.17	-28:03:47.6	355.08722	8.735203
b0503	17:04:09.24	-26:53:40.6	356.56503	8.735219
b0504	17:08:00.24	-25:42:57.2	358.04294	8.735148
b0505	17:11:45.43	-24:31:39.5	359.52078	8.735195
b0506	17:15:25.18	-23:19:49.5	0.99865097	8.735186
b0507	17:18:47.64	-22:11:37.6	2.3921387	8.7352295
b0508	17:22:17.64	-20:58:50.0	3.8700557	8.735206
b0509	17:25:43.01	-19:45:35.7	5.3478274	8.735186
b0510	17:29:04.04	-18:31:55.5	6.825684	8.735208
b0511	17:32:20.99	-17:17:51.1	8.303581	8.735217
b0512	17:35:34.10	-16:03:24.1	9.781457	8.735198
b0576	17:15:50.21	-27:01:04.3	357.99948	6.550833
b263	18:06:02.99	-32:08:32.6	359.43298	-5.412627
b264	18:09:19.56	-30:51:47.1	0.89700335	-5.412562
b333	17:43:59.50	-29:25:26.3	359.39838	0.048160497
b334	17:47:27.58	-28:10:43.5	0.857067	0.04818496

b401	18:25:45.31	-43:45:22.5	350.6656	-14.091356
b402	18:29:00.95	-42:25:40.8	352.16626	-14.091318
b403	18:32:11.17	-41:05:53.0	353.66684	-14.091355
b404	18:35:16.46	-39:45:59.2	355.16748	-14.091269
b405	18:38:17.34	-38:26:01.2	356.6681	-14.091285
b406	18:41:14.24	-37:05:59.6	358.16873	-14.091369
b407	18:44:07.51	-35:45:54.8	359.66946	-14.091331
b408	18:46:57.52	-34:25:48.7	1.170014	-14.091309
b409	18:49:44.64	-33:05:41.2	2.670652	-14.091319
b410	18:52:29.16	-31:45:33.0	4.171359	-14.091297
b411	18:55:11.37	-30:25:25.6	5.671925	-14.091337
b412	18:57:51.52	-29:05:18.7	7.172576	-14.091273
b413	19:00:29.90	-27:45:13.5	8.673221	-14.091295
b414	19:03:06.71	-26:25:10.6	10.173812	-14.091282
b415	18:20:16.48	-43:18:07.8	350.66275	-12.999142
b416	18:23:37.70	-41:59:00.6	352.15677	-12.999154
b417	18:26:53.19	-40:39:45.2	353.65076	-12.999171
b418	18:30:03.48	-39:20:22.2	355.14484	-12.999122
b419	18:33:09.08	-38:00:53.6	356.6388	-12.999187
b420	18:36:10.40	-36:41:19.6	358.13284	-12.99918
b421	18:39:07.86	-35:21:41.4	359.6269	-12.999172
b422	18:42:01.81	-34:02:00.1	1.1208557	-12.999117
b423	18:44:52.64	-32:42:16.2	2.6148937	-12.999118
b424	18:47:40.64	-31:22:30.6	4.108925	-12.999098
b425	18:50:26.12	-30:02:44.0	5.602978	-12.999095
b426	18:53:09.35	-28:42:57.5	7.0969405	-12.999133
b427	18:55:50.58	-27:23:11.0	8.590999	-12.999094
b428	18:58:30.09	-26:03:25.6	10.085093	-12.999153
b429	18:14:52.69	-42:49:55.2	350.66	-11.907155
b430	18:18:19.06	-41:31:23.1	352.14777	-11.90696
b431	18:21:39.53	-40:12:40.3	353.6358	-11.906948
b432	18:24:54.56	-38:53:48.6	355.12387	-11.906971
b433	18:28:04.61	-37:34:49.4	356.61185	-11.9069605
b434	18:31:10.15	-36:15:43.5	358.09985	-11.906937
b435	18:34:11.66	-34:56:31.9	359.58795	-11.9071045
b436	18:37:09.36	-33:37:15.9	1.0758537	-11.907007
b437	18:40:03.72	-32:17:55.7	2.5638788	-11.906923
b438	18:42:55.09	-30:58:32.7	4.0519238	-11.907
b439	18:45:43.69	-29:39:07.6	5.539882	-11.906953
b440	18:48:29.87	-28:19:40.8	7.027944	-11.90696
b441	18:51:13.87	-27:00:13.3	8.515996	-11.906969
b442	18:53:55.95	-25:40:46.0	10.003997	-11.907039
b443	18:09:33.77	-42:20:45.6	350.65735	-10.814788
b444	18:13:05.16	-41:02:48.1	352.13992	-10.814814
b445	18:16:30.32	-39:44:38.4	353.62256	-10.814802
b446	18:19:49.78	-38:26:18.3	355.1051	-10.814767
b447	18:23:04.08	-37:07:48.9	356.58768	-10.814812
b448	18:26:13.63	-35:49:11.0	358.0703	-10.8147545
b449	18:29:18.89	-34:30:26.2	359.5529	-10.814777
b450	18:32:20.22	-33:11:35.4	1.0354502	-10.814782
b451	18:35:18.01	-31:52:39.3	2.5180674	-10.814837
b452	18:38:12.54	-30:33:38.9	4.000639	-10.814788
b453	18:41:04.17	-29:14:35.0	5.483249	-10.814788
b454	18:43:53.16	-27:55:28.6	6.965798	-10.814765
b455	18:46:39.82	-26:36:20.1	8.448436	-10.814806
b456	18:49:24.40	-25:17:10.4	9.931109	-10.814918

e0649	12:23:48.11	-66:30:54.8	300.17822	-3.791347
e0650	12:38:25.52	-66:37:49.5	301.63928	-3.7913342
e0651	12:53:08.08	-66:39:45.1	303.10034	-3.791335
e0652	13:07:49.99	-66:36:40.2	304.56143	-3.791306
e0653	13:22:25.39	-66:28:37.0	306.02246	-3.7913058
e0654	13:36:48.79	-66:15:40.4	307.48352	-3.7912872
e0655	13:50:55.12	-65:57:58.7	308.94458	-3.7913437
e0656	14:04:40.02	-65:35:41.8	310.40564	-3.7913501
e0657	14:17:59.84	-65:09:02.1	311.86673	-3.7913027
e0658	14:30:51.75	-64:38:13.8	313.32776	-3.7912748
e0659	14:43:13.79	-64:03:31.8	314.78885	-3.7913077
e0660	14:55:04.66	-63:25:11.2	316.2499	-3.7913032
e0661	15:06:23.81	-62:43:27.6	317.71097	-3.7913227
e0662	15:17:11.18	-61:58:36.2	319.17203	-3.791313
e0663	15:27:27.26	-61:10:51.6	320.6331	-3.791274
e0664	15:37:12.87	-60:20:28.3	322.09415	-3.7913094
e0665	15:46:29.09	-59:27:39.2	323.5552	-3.7913253
e0666	15:55:17.19	-58:32:36.6	325.0163	-3.791292
e0667	16:03:38.57	-57:35:32.6	326.4773	-3.791338
e0668	16:11:34.73	-56:36:36.9	327.93842	-3.7913287
e0669	16:19:07.09	-55:36:00.1	329.39938	-3.7913418
e0670	16:26:17.22	-54:33:50.0	330.86057	-3.7913134
e0671	16:33:06.46	-53:30:15.9	332.32156	-3.7913067
e0672	16:39:36.29	-52:25:24.6	333.7826	-3.791366
e0673	16:45:47.99	-51:19:22.5	335.24368	-3.7913518
e0674	16:51:42.83	-50:12:15.8	336.70477	-3.7913084
e0675	16:57:22.00	-49:04:10.5	338.1658	-3.7913275
e0676	17:02:46.61	-47:55:11.0	339.6269	-3.791296
e0677	17:07:57.71	-46:45:22.1	341.08795	-3.791279
e0678	17:12:56.26	-45:34:48.3	342.54895	-3.7913134
e0679	17:17:43.19	-44:23:32.6	344.01007	-3.7913394
e0680	17:22:19.29	-43:11:38.8	345.47113	-3.7912998
e0681	17:26:45.38	-41:59:10.1	346.9322	-3.7913055
e0682	17:31:02.17	-40:46:09.3	348.39322	-3.791315
e0683	17:35:10.33	-39:32:39.0	349.85425	-3.7913225
e0732	12:24:18.79	-65:25:20.4	300.11377	-2.6991138
e0733	12:38:19.52	-65:32:10.6	301.5735	-2.6991217
e0734	12:52:25.00	-65:34:14.5	303.03323	-2.6991394
e0735	13:06:30.12	-65:31:30.8	304.49295	-2.699144
e0736	13:20:29.81	-65:24:01.2	305.9527	-2.6991634
e0737	13:34:19.17	-65:11:49.9	307.41245	-2.6991553
e0738	13:47:53.71	-64:55:04.0	308.87213	-2.6991773
e0739	14:01:09.50	-64:33:52.1	310.33188	-2.6991062
e0740	14:14:03.19	-64:08:26.1	311.7916	-2.6991985
e0741	14:26:32.09	-63:38:57.2	313.25134	-2.6991324
e0742	14:38:34.22	-63:05:39.8	314.71106	-2.699182
e0743	14:50:08.26	-62:28:47.0	316.1708	-2.6991434
e0744	15:01:13.46	-61:48:33.6	317.63052	-2.699175
e0745	15:11:49.58	-61:05:13.2	319.09027	-2.6991482
e0746	15:21:56.83	-60:19:00.0	320.55	-2.699176
e0747	15:31:35.76	-59:30:06.7	322.00974	-2.6991289
e0748	15:40:47.19	-58:38:46.4	323.46948	-2.69912
e0749	15:49:32.16	-57:45:10.9	324.9292	-2.6991565
e0750	15:57:51.80	-56:49:31.1	326.38892	-2.6991572
e0751	16:05:47.39	-55:51:57.4	327.84863	-2.6991937
e0752	16:13:20.18	-54:52:38.9	329.30838	-2.69912

e0753	16:20:31.52	-53:51:45.1	330.7681	-2.6991642
e0754	16:27:22.66	-52:49:23.5	332.22778	-2.6991515
e0755	16:33:54.91	-51:45:41.4	333.6876	-2.6991663
e0756	16:40:09.42	-50:40:45.8	335.14728	-2.6991415
e0757	16:46:07.42	-49:34:42.6	336.60706	-2.699164
e0758	16:51:49.96	-48:27:37.5	338.06674	-2.699144
e0759	16:57:18.12	-47:19:35.7	339.52646	-2.6991713
e0760	17:02:32.89	-46:10:41.3	340.98624	-2.69917
e0761	17:07:35.15	-45:00:59.0	342.44595	-2.6991236
e0762	17:12:25.81	-43:50:32.7	343.9057	-2.6991432
e0763	17:17:05.65	-42:39:25.8	345.3654	-2.699143
e0764	17:21:35.45	-41:27:41.4	346.82513	-2.6991706
e0765	17:25:55.87	-40:15:22.4	348.28488	-2.6991107
e0766	17:30:07.62	-39:02:31.7	349.74466	-2.69914
e0781	08:19:00.95	-31:25:08.4	250.49835	2.6086564
e0782	08:22:55.13	-32:37:16.0	251.95912	2.608696
e0783	08:26:56.07	-33:48:52.6	253.42	2.6086845
e0784	08:31:04.19	-34:59:55.2	254.88078	2.6086786
e0785	08:35:19.98	-36:10:21.7	256.34158	2.6086915
e0786	08:39:43.93	-37:20:09.7	257.80246	2.6086771
e0787	08:44:16.54	-38:29:15.9	259.26324	2.6086643
e0788	08:48:58.39	-39:37:37.8	260.72412	2.6086433
e0789	08:53:50.03	-40:45:11.4	262.1849	2.6086724
e0790	08:58:52.08	-41:51:53.7	263.64575	2.608695
e0791	09:04:05.15	-42:57:40.9	265.10657	2.608652
e0792	09:09:29.94	-44:02:28.7	266.56744	2.6086655
e0793	09:15:07.09	-45:06:12.6	268.02826	2.6086423
e0794	09:20:57.32	-46:08:47.8	269.48904	2.608611
e0795	09:27:01.40	-47:10:09.0	270.94986	2.6086843
e0796	09:33:20.03	-48:10:11.1	272.4107	2.608684
e0797	09:39:53.96	-49:08:47.7	273.87152	2.608701
e0798	09:46:43.95	-50:05:52.9	275.3324	2.6086562
e0799	09:53:50.70	-51:01:19.1	276.79318	2.6086555
e0800	10:01:14.96	-51:54:59.7	278.25406	2.6086268
e0801	10:08:57.35	-52:46:46.1	279.7148	2.6086974
e0802	10:16:58.46	-53:36:31.0	281.17566	2.6086688
e0803	10:25:18.80	-54:24:05.3	282.63647	2.608664
e0804	10:33:58.76	-55:09:20.2	284.09732	2.6086428
e0805	10:42:58.55	-55:52:05.8	285.5581	2.6087093
e0806	10:52:18.22	-56:32:13.2	287.01892	2.6086917
e0807	11:01:57.64	-57:09:32.6	288.4798	2.6086247
e0808	11:11:56.37	-57:43:53.4	289.94058	2.6086736
e0809	11:22:13.78	-58:15:06.6	291.40143	2.6087012
e0810	11:32:48.83	-58:43:02.7	292.86224	2.6086729
e0811	11:43:40.28	-59:07:32.4	294.3231	2.6087115
e0812	11:54:46.45	-59:28:27.8	295.78387	2.6086671
e0813	12:06:05.49	-59:45:41.1	297.24475	2.6086705
e0814	12:17:35.08	-59:59:05.8	298.7055	2.60871
e0815	12:29:12.83	-60:08:37.3	300.16638	2.608663
e0816	12:40:55.98	-60:14:11.5	301.6272	2.608605
e0817	12:52:41.73	-60:15:45.6	303.08804	2.6086996
e0818	13:04:27.16	-60:13:20.0	304.54886	2.608659
e0819	13:16:09.40	-60:06:54.9	306.0097	2.608698
e0820	13:27:45.62	-59:56:33.5	307.47052	2.6086426
e0821	13:39:13.15	-59:42:19.4	308.9313	2.6086318
e0822	13:50:29.61	-59:24:17.9	310.39215	2.6086843

e0823	14:01:32.80	-59:02:36.1	311.85297	2.6086884
e0824	14:12:20.86	-58:37:21.7	313.31378	2.608634
e0825	14:22:52.25	-58:08:42.6	314.77463	2.6086695
e0826	14:33:05.74	-57:36:48.5	316.23547	2.6086366
e0827	14:43:00.39	-57:01:48.5	317.6963	2.6086657
e0828	14:52:35.61	-56:23:52.8	319.1571	2.6086185
e0829	15:01:51.03	-55:43:10.7	320.6179	2.6086447
e0830	15:10:46.58	-54:59:51.9	322.07877	2.6087055
e0831	15:19:22.31	-54:14:06.8	323.53955	2.6086504
e0832	15:27:38.52	-53:26:03.9	325.0004	2.608626
e0833	15:35:35.57	-52:35:52.3	326.46118	2.6086586
e0834	15:43:14.05	-51:43:40.4	327.9221	2.608677
e0835	15:50:34.51	-50:49:36.8	329.3829	2.6086538
e0836	15:57:37.63	-49:53:48.8	330.84375	2.6086516
e0837	16:04:24.10	-48:56:23.6	332.30453	2.6087072
e0838	16:10:54.83	-47:57:28.3	333.7656	2.6084225
e0839	16:17:10.16	-46:57:08.7	335.2262	2.6086712
e0840	16:23:11.21	-45:55:31.2	336.687	2.6086423
e0841	16:28:58.61	-44:52:40.7	338.1479	2.608654
e0842	16:34:33.04	-43:48:42.8	339.60867	2.6087017
e0843	16:39:55.26	-42:43:42.2	341.06946	2.6086712
e0844	16:45:05.93	-41:37:42.7	342.53033	2.608712
e0845	16:50:05.71	-40:30:49.2	343.99118	2.6086566
e0846	16:54:55.20	-39:23:04.9	345.45197	2.6086729
e0847	16:59:35.03	-38:14:33.6	346.91278	2.6086283
e0848	17:04:05.74	-37:05:18.1	348.3736	2.608673
e0849	17:08:27.90	-35:55:21.9	349.83438	2.6086478
e0863	08:19:27.62	-29:37:05.8	249.06128	3.7008595
e0864	08:23:17.29	-30:49:15.8	250.52391	3.7008739
e0865	08:27:13.31	-32:00:54.8	251.98651	3.7008529
e0866	08:31:16.10	-33:12:00.5	253.44907	3.7008593
e0867	08:35:26.11	-34:22:31.3	254.91179	3.7008343
e0868	08:39:43.75	-35:32:23.4	256.3743	3.7008789
e0869	08:44:09.52	-36:41:35.6	257.83694	3.7008154
e0870	08:48:43.94	-37:50:03.8	259.29956	3.7009032
e0871	08:53:27.48	-38:57:46.0	260.7622	3.7008123
e0872	08:58:20.73	-40:04:37.7	262.22473	3.700854
e0873	09:03:24.26	-41:10:36.2	263.68735	3.7008605
e0874	09:08:38.67	-42:15:37.4	265.15	3.7008777
e0875	09:14:04.56	-43:19:37.2	266.61264	3.7008495
e0876	09:19:42.58	-44:22:30.8	268.0752	3.7008636
e0877	09:25:33.40	-45:24:14.0	269.53787	3.70083
e0878	09:31:37.67	-46:24:40.9	271.00046	3.700854
e0879	09:37:56.08	-47:23:46.6	272.46307	3.700839
e0880	09:44:29.29	-48:21:25.1	273.9257	3.7007701
e0881	09:51:18.01	-49:17:29.8	275.38834	3.7007856
e0882	09:58:22.82	-50:11:53.8	276.8509	3.7008128
e0883	10:05:44.37	-51:04:30.3	278.31345	3.700852
e0884	10:13:23.23	-51:55:12.1	279.7761	3.7008412
e0885	10:21:19.87	-52:43:50.7	281.2387	3.7008796
e0886	10:29:34.67	-53:30:18.7	282.7014	3.700738
e0887	10:38:07.91	-54:14:25.7	284.16388	3.7008438
e0888	10:46:59.75	-54:56:04.5	285.62653	3.7008252
e0889	10:56:10.15	-55:35:05.4	287.08917	3.7008204
e0890	11:05:38.82	-56:11:18.9	288.55173	3.7008555
e0891	11:15:25.37	-56:44:36.3	290.01434	3.7008817

e0892	11:25:29.05	-57:14:48.6	291.477	3.7008529
e0893	11:35:48.88	-57:41:46.7	292.93958	3.7008688
e0894	11:46:23.61	-58:05:22.6	294.40216	3.7008698
e0895	11:57:11.71	-58:25:28.9	295.8648	3.7008042
e0896	12:08:11.36	-58:41:58.3	297.32742	3.7008078
e0897	12:19:20.50	-58:54:45.1	298.79004	3.7008615
e0898	12:30:36.84	-59:03:45.1	300.25262	3.700847
e0899	12:41:57.92	-59:08:54.6	301.7152	3.7008677
e0900	12:53:21.20	-59:10:12.0	303.17786	3.7008328
e0901	13:04:44.04	-59:07:36.6	304.64047	3.7007987
e0902	13:16:03.82	-59:01:09.2	306.1031	3.7008154
e0903	13:27:17.99	-58:50:52.5	307.56567	3.7008085
e0904	13:38:24.17	-58:36:49.9	309.02826	3.7008777
e0905	13:49:20.16	-58:19:07.2	310.49088	3.700804
e0906	14:00:03.95	-57:57:49.8	311.9535	3.7007995
e0907	14:10:33.83	-57:33:04.7	313.4161	3.7008781
e0908	14:20:48.37	-57:05:00.5	314.87872	3.700827
e0909	14:30:46.36	-56:33:44.9	316.3413	3.7008746
e0910	14:40:26.97	-55:59:27.3	317.80392	3.7008314
e0911	14:49:49.55	-55:22:16.3	319.26654	3.7008424
e0912	14:58:53.71	-54:42:21.4	320.72916	3.7008376
e0913	15:07:39.29	-53:59:51.7	322.19174	3.7008286
e0914	15:16:06.31	-53:14:56.0	323.65436	3.7008753
e0915	15:24:14.97	-52:27:43.6	325.11697	3.7008417
e0916	15:32:05.57	-51:38:22.6	326.5796	3.7008524
e0917	15:39:38.56	-50:47:01.5	328.0422	3.700802
e0918	15:46:54.43	-49:53:47.8	329.5048	3.7007942
e0919	15:53:53.75	-48:58:48.9	330.9674	3.700843
e0920	16:00:37.17	-48:02:12.1	332.43	3.7008383
e0921	16:07:05.35	-47:04:03.6	333.89267	3.7008462
e0922	16:13:18.91	-46:04:29.9	335.35526	3.700896
e0923	16:19:18.58	-45:03:36.8	336.81784	3.7008843
e0924	16:25:05.05	-44:01:29.7	338.28046	3.7007766
e0925	16:30:38.91	-42:58:13.3	339.74304	3.7007987
e0926	16:36:00.85	-41:53:52.3	341.20566	3.7008684
e0927	16:41:11.53	-40:48:31.5	342.66827	3.700842
e0928	16:46:11.54	-39:42:14.4	344.13092	3.700872
e0929	16:51:01.48	-38:35:05.4	345.5935	3.7008178
e0930	16:55:41.88	-37:27:07.3	347.05615	3.7008946
e0931	17:00:13.34	-36:18:24.2	348.5187	3.7008026
e0932	17:04:36.32	-35:08:58.3	349.98132	3.700829
e0933	18:23:44.43	-21:34:16.2	10.647361	-3.8913352
e0934	18:26:37.97	-20:16:45.3	12.108529	-3.8912861
e0935	18:29:29.23	-18:59:08.0	13.569752	-3.8913076
e0936	18:32:18.40	-17:41:25.0	15.030991	-3.8912663
e0937	18:35:05.72	-16:23:37.3	16.492235	-3.89128
e0938	18:37:51.38	-15:05:45.7	17.953436	-3.8912985
e0939	18:40:35.59	-13:47:51.0	19.414597	-3.8913734
e0940	18:19:35.62	-21:03:40.0	10.646756	-2.799142
e0941	18:22:30.74	-19:46:23.8	12.106616	-2.7991755
e0942	18:25:23.44	-18:29:00.2	13.566434	-2.7991602
e0943	18:28:13.96	-17:11:30.0	15.026244	-2.7991426
e0944	18:31:02.52	-15:53:53.8	16.486101	-2.7991135
e0945	18:31:02.52	-15:53:53.8	16.486101	-2.7991135
e0946	18:33:49.35	-14:36:12.6	17.94599	-2.799186
e0947	18:15:28.52	-20:32:41.5	10.646106	-1.7069724

e0948	18:18:25.10	-19:15:40.0	12.105032	-1.7069623
e0949	18:21:19.20	-17:58:29.6	13.564081	-1.7069795
e0950	18:24:11.02	-16:41:11.7	15.02307	-1.7070076
e0951	18:27:00.77	-15:23:46.9	16.482042	-1.7069962
e0952	18:29:48.67	-14:06:16.1	17.94099	-1.7070044
e0953	18:32:34.92	-12:48:39.6	19.400028	-1.7069745
e0954	18:11:23.15	-20:01:19.8	10.645919	-0.61480343
e0955	18:14:21.14	-18:44:32.4	12.104556	-0.6147852
e0956	18:17:16.54	-17:27:35.2	13.563228	-0.61476064
e0957	18:20:09.59	-16:10:29.5	15.021861	-0.6148369
e0958	18:20:09.59	-16:10:29.5	15.021861	-0.6148369
e0959	18:23:00.46	-14:53:15.5	16.480526	-0.61476743
e0960	18:28:36.62	-12:18:27.2	19.397865	-0.6148618
e0961	18:07:19.43	-19:29:36.5	10.64591	0.47739702
e0962	18:10:18.78	-18:13:03.1	12.104769	0.4773302
e0963	18:13:15.44	-16:56:18.5	13.563709	0.47734684
e0964	18:16:09.64	-15:39:24.3	15.022571	0.47733742
e0965	18:19:01.58	-14:22:21.0	16.481415	0.47740722
e0966	18:21:51.52	-13:05:09.6	17.9403	0.4773471
e0967	18:24:39.61	-11:47:50.6	19.399204	0.47737348
e0968	18:03:17.35	-18:57:32.4	10.646121	1.5695196
e0969	18:06:17.96	-17:41:12.2	12.105782	1.5695466
e0970	18:09:15.79	-16:24:40.5	13.565311	1.5695654
e0971	18:12:11.11	-15:07:57.4	15.025002	1.5695287
e0972	18:15:04.07	-13:51:04.5	16.484554	1.5695708
e0973	18:17:54.94	-12:34:02.0	17.944254	1.5695556
e0974	18:20:43.88	-11:16:51.3	19.403877	1.569547
e0975	17:59:16.86	-18:25:07.2	10.646784	2.6617384
e0976	18:02:18.69	-17:09:00.4	12.107693	2.6616998
e0977	18:05:17.65	-15:52:40.5	13.568565	2.6617463
e0978	18:08:14.00	-14:36:08.5	15.029466	2.6617458
e0979	18:11:07.96	-13:19:25.4	16.490387	2.6616657
e0980	18:13:59.68	-12:02:31.8	17.951286	2.661744
e0981	18:16:49.41	-10:45:28.9	19.412174	2.6617525
e0982	17:55:17.88	-17:52:23.4	10.647396	3.7539406
e0983	17:58:20.86	-16:36:29.4	12.110128	3.7538984
e0984	18:01:20.90	-15:20:21.1	13.572854	3.753921
e0985	18:04:18.24	-14:03:59.8	15.035537	3.7539043
e0986	18:07:13.08	-12:47:26.0	16.498259	3.753956
e0987	18:10:05.66	-11:30:41.0	17.96099	3.7538998
e0988	18:12:56.14	-10:13:45.7	19.423649	3.7538679

The files for DR1 include images and their respective photometry catalogues that have passed the Quality Control (QC). We make a distinction between single filter source lists, which are part of this release, and merged multi-band photometric catalogues, which are a distinct data product.

Release Notes

Data Reduction and Calibration

This DR1 is based on the CASU version v1.5 pipeline, which produces publication quality results provided that appropriate checks are made. The main changes to the pipeline since

version 1.3 (used for the VVV data) are as follows.

(i) The nightly photometric calibration (based on the 2MASS Point Source Catalogue) benefits from new improved colour transformations from 2MASS to VIRCAM, including a better treatment of the effect of interstellar extinction on the transformations. (For full details see Gonzalez Fernandez et al., 2018, MNRAS, 474, 5459).

(ii) A bug in the illumination correction has been fixed.

Full details of the data pipeline procedure and the version changes can be found at: http://apm49.ast.cam.ac.uk/surveys-projects/vista/data-processing/

The photometric and astrometric calibrations are both derived from the 2MASS Point Source Catalogue. The photometric calibration includes an additional colour term designed to correct for the effect of interstellar extinction on the 2MASS to VISTA/VIRCAM photometric transformations. The typical photometric calibration precision in the J, H and Ks passbands is now 2% (see Gonzalez Fernandez et al., 2018). Any fields with slightly poorer than average photometric calibration in J, H or Ks are solely due to poor and changing weather conditions, which will be apparent from the zero points and the seeing given in the FITS catalogue headers.

Most users will wish to use aperture 1, aperture 2 or aperture 3 magnitudes, which correspond to aperture diameters of 1.0, √2 and 2.0 arcsec respectively. The trade off is between a smaller and more accurate aperture correction for larger apertures vs. increased effects of overlapping apertures on the photometry in crowded fields. The CASU aperture photometry does attempt to deblend the fluxes of adjacent sources with overlapping apertures but the results are not as good as profile fitting photometry (which is much more computationally intensive). Consequently, some users may wish to do their own profile fitting photometry on small portions of the images in this release, in the more crowded fields. See e.g. Mauro et al.(2013). Profile fitting photometry products are planned for a future VVVX release.

The team has worked on the quality control using the v1.5 data, as detailed below.

The VVVX saturation limit ranges between Ks=10-11.5 mag depending on seeing and sky background, with some variation amongst 16 VIRCAM detectors also. For brighter magnitudes the 2MASS photometry should be preferred. The photometric limit is typically Ks=17.5mag.

The photometric catalogues contain calibrated aperture photometry, and the limiting magnitudes correspond to the aperture photometry.

Data Quality

The same words of caution as before apply as in VVV releases: even though we checked the images for defects, we are still identifying images that need to be reprocessed or reacquired.

The Quality Control for the Phase 3 data checked for variations in sky background in the tile images (by visual inspection of all the JHKs master tiles) and performed cuts on seeing, zero

points, ellipticity and astrometric quality (based on the r.m.s. residual to the fit) at tile level. We also cut tiles with gross changes in seeing or zero point between the 6 pawprints that make up each tile. We note that low level variations in the sky background do not affect the photometry but might inhibit visual searches for clusters or nebulae.

Known Issues

There are a number of well known image defects intrinsic to VISTA, e.g. holes in some of the arrays and bright streaks caused by reflections of stars located just off the edge of an array. These defects are documented in the peer-reviewed paper describing the telescope and camera (Sutherland et al.2015, A&A, 575, A25) and they are illustrated with pictures in the CASU web page located at: casu.ast.cam.ac.uk/surveys-projects/vista/technical/known-issues.

Data Format

File Types

There are 5 types of file, all in FITS format. Tile images (file names ending in "_st_tl.fits.fz"), associated weight maps (file names ending in "_st_tl_conf.fits.fz") and tile catalogues (file names ending in "_st_tl_cat.fits"). Also, there are pawprint images (filenames ending in "_st.fits.fz") and their associated weight maps (file names ending in "_st_conf.fits.fz"). The pawprint images are in multi-extension FITS format with 1 extension for each of the 16 VISTA/VIRCAM arrays plus an initial header with whole-pawprint data.

Calibrated magnitudes can be derived from the various aperture fluxes in the catalogues using the equation:
CalMag = MAGZPT – 2.5log10(AperfluxN/DIT) – 0.05(Airmass-1) - APCORN

where the capitalised variables are quantities available in the FITS catalogue headers and the "N" in AperfluxN and APCORN (the aperture flux and aperture correction terms) should be replaced with the chosen photometric aperture number (see list of columns below).
Airmass = 0.5(AIRM START + AIRM END).

Catalogue Columns

1	Seq No.	running number for ease of reference, in strict order of image detections
2	Isophotal flux	standard definition of summed flux within detection isophote, apart from detection filter is used to define pixel connectivity and hence which pixels to include. This helps to reduce edge effects for all isophotally derived parameters.
3	X coord	intensity-weighted isophotal centre-of-gravity in X
4	Error in X	estimate of centroid error
5	Y coord	intensity-weighted isophotal centre-of-gravity in Y
6	Error in Y	estimate of centroid error
7	Gaussian sigma	these are derived from the three general intensity-weighted second

		moments
8	Ellipticity	the equivalence between them and a generalised elliptical Gaussian
9	Position angle	Orientation (east of north) of the elliptical Gaussian, in degrees
10	Areal profile 1	number of pixels above a series of threshold levels relative to local sky.
11	Areal profile 2	levels are set at T, 2T, 4T, 8T . . . 128T where T is the threshold. These
12	Areal profile 3	can be thought of as a sort of poor man's radial profile. Note that for now deblended, i.e. overlapping images, only the first areal profile is
13	Areal profile 4	computed and the rest are set to -1, flagging the difficulty of computing accurate profiles
14	Areal profile 5	
15	Areal profile 6	
16	Areal profile 7	for blended images this parameter is used to flag the start of the sequence of the deblended components by setting the first in the
17	Areal profile 8	sequence to 0
18	Peak height	in counts relative to local value of sky - also zeroth order aperture flux
19	Error in pkht	
20	Aperture flux 1	The aperture fluxes are sky-corrected integrals (summations) with a soft-edge (ie. pro-rata flux division for boundary pixels). However, for overlapping images they are more subtle than this since they are in practice simultaneously fitted top-hat functions, to minimise the effects of crowding. Images external to the blend are also flagged and not included in the large radius summations. Aperture 1 has a 1.0 arcsec diameter. Each successive aperture increases in size by a factor of sqrt(2) for apertures 1 to 7.
21	Error in flux	
22	Aperture flux 2	Flux in a 1.414 arcsec diameter aperture.
23	Error in flux	
24	Aperture flux 3	Flux in a 2 arcsec diameter aperture.
25	Error in flux	
26	Aperture flux 4	Flux in a 2.282 arcsec diameter aperture.
27	Error in flux	
28	Aperture flux 5	Flux in a 4 arcsec diameter aperture.
29	Error in flux	
30	Aperture flux 6	Flux in a 4.564 arcsec diameter aperture.
31	Error in flux	
32	Aperture flux 7	Flux in an 8 arcsec diameter aperture.
33	Error in flux	
34	Aperture flux 8	Flux in a 10 arcsec diameter aperture.
35	Error in flux	
36	Aperture flux 9	Flux in a 12 arcsec diameter aperture.
37	Error in flux	
38	Aperture flux 10	Flux in a 14 arcsec diameter aperture.
39	Error in flux	
40	Aperture flux 11	Flux in a 16 arcsec diameter aperture.
41	Error in flux	

42	Aperture flux 12	Flux in a 20 arcsec diameter aperture.
43	Error in flux	
44	Aperture flux 13	Flux in a 24 arcsec diameter aperture.
45	Error in flux	
46	Petrosian radius	rp as defined in Yasuda et al. 2001 AJ 112, 1104
47	Kron radius	rk as defined in Bertin and Arnouts 1996 A&A Supp 117, 393
48	Hall radius	rh image scale radius eg. Hall & Mackay 1984 MNRAS 210, 979
49	Petrosian flux	flux within circular aperture to k x rp with k=2
50	Error in flux	
51	Kron flux	
52	Error in flux	
53	Hall flux	
54	Error in flux	
55	Error bit flag	bit pattern listing various processing error flags initially set to the no. of bad pixels within aperture 3 (the 2 arcsec diameter aperture) - note this can be fractional due to soft-edged apertures
56	Sky level	local interpolated sky level from background tracker
57	Sky rms	local estimate of variation in sky level around image
58	Av conf	average confidence level within default rcore aperture useful for spotting spurious outliers in various parameter selection spaces
59	RA	Sexagesimal RA and Dec explicitly put in columns for overlay programs that cannot, in general, understand astrometric solution coefficients. Note real*4 storage precision accurate only to 50 mas.
60	Dec	Astrometry can be derived more precisely from the WCS in the header and XY in columns 5 and 6.
61	Classification	Flag indicating most probable morphological classification: eg. -1 stellar, +1 non-stellar, 0 noise, -2 borderline stellar (Saturated images can be flagged by comparing the peak height + local sky with the SATURATE keyword in the header.)
62	Statistic	
63	MJDoff	Offset (in minutes) of the median epoch of observation of each object from the integer Modified Julian Date of the catalogue given by header keyword MJD_DAY. The epoch is MJD_DAY + MJDoff.
64	Blank64	
65	Blank65	
66	Blank66	
67	Blank67	
68	Blank68	
69	Blank69	
70	Blank70	
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Further Details

More detailed information can be found at: - the CASU webpages
http://casu.ast.cam.ac.uk/surveys-projects/vista/

- by contacting the VVV/VVVX Science Team Members listed at the survey webpage

http://vvvsurvey.org

- the VVV Science Team papers:

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