

ESASky Statistics and Updates

Debbie Baines

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Overview



- Introduction
- ESASky Statistics
- Status update (since February 2019)
- ESASky Roadmap with future plans
- Demo
- Summary

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Image: Image

ESASky Concept



Goal: a scientific tool to facilitate data discovery and archival science

- Multi-wavelength
- Project agnostic
- Exploration



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ESASky Concept



Goal: a scientific tool to facilitate data discovery and archival science

- Multi-wavelength
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Interface "on top of" all ESA astronomy archives +

ESASky - sky.esa.int



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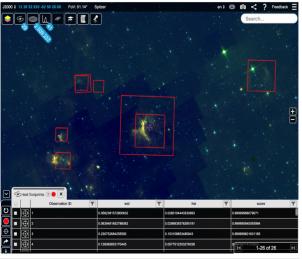
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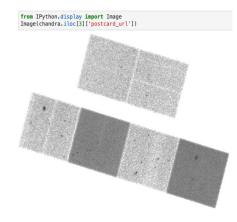


pyESASky: the Jupyter widget of ESASky: visualise astronomical data within a Jupyter notebook

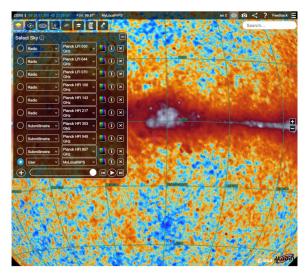
Upload data to ESASky: HiPS, tables, footprints



Download data from ESASky



Interact with functionalities: Search, HiPS (+ slider), FoV Grid, JWST planning tool





ESASky Statistics

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2018-06-12/02: The UG is interested in seeing the **number of users that access the archives via ESASky**.

Since May 2018 ESASky has been using Google Analytic events (replaced with Matomo in June 2020). Events help prioritize development based on user usage and includes:

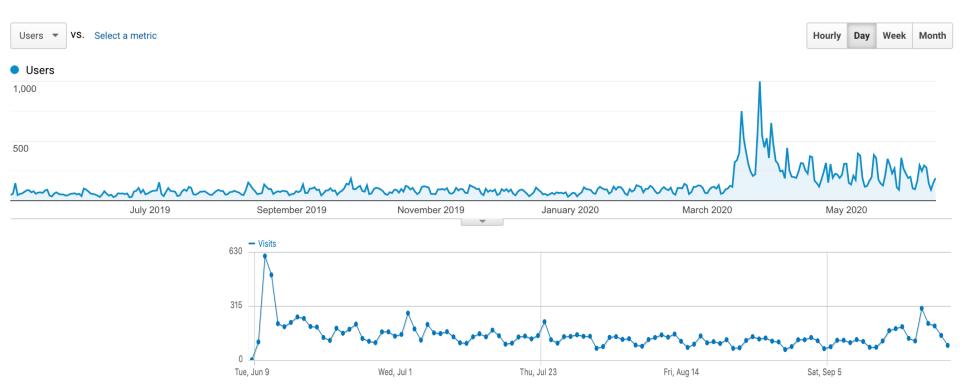
- accesses to the archives & download of data via ESASky
- how often HiPS are visualised
- how often postcards from the archives are visualised
- how often particular buttons are selected...

Note: number of events or accesses \neq number of users

ESASky Statistics: Number of users (May 2018 – mid Sept 2020)

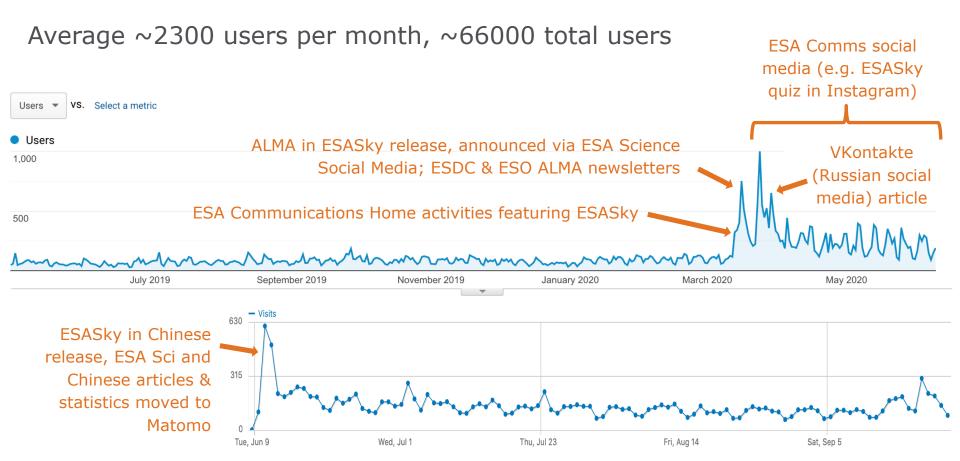


Average ~2300 users per month, ~66000 total users



ESASky Statistics: Number of users (May 2018 – mid Sept 2020)



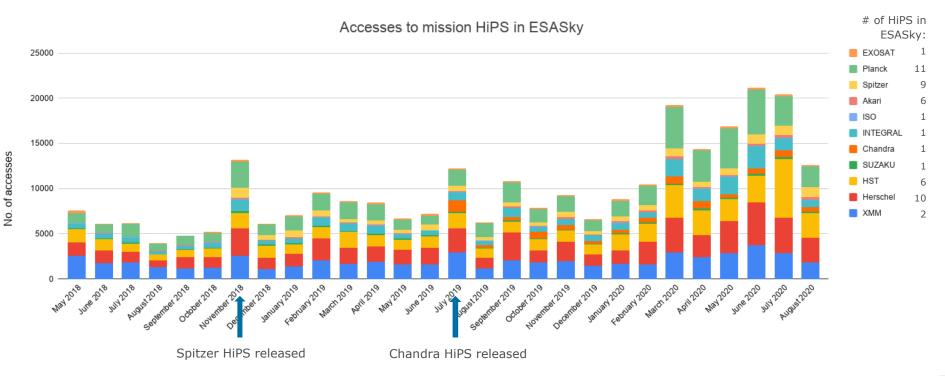


ESASky Statistics: ESA mission HiPS (May 2018 – Aug 2020)



Monthly accesses to ESA mission HiPS (Hierarchical Progressive Surveys).

XMM, Herschel, HST and Planck HiPS are the most viewed ESA HiPS.

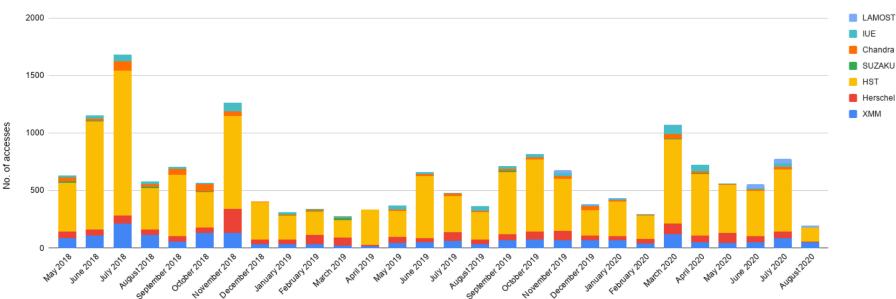


ESASky Statistics: opening archive postcards (May 2018 – Aug 2020)



Accesses to the archives by opening a postcard:

HST postcards are the most opened.



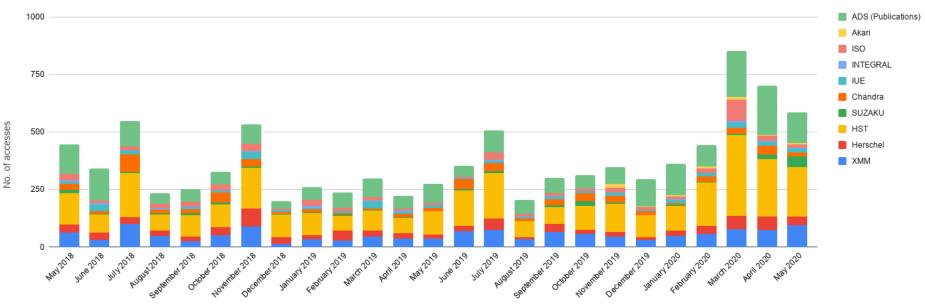
Accesses to the archives via ESASky by opening a postcard

ESASky Statistics: opening the archives (May 2018 – May 2020)



Accesses to the archives by clicking archive links (for ADS: clicking on a bibcode):

HST most accessed archive, followed by XMM. ADS links also popular.

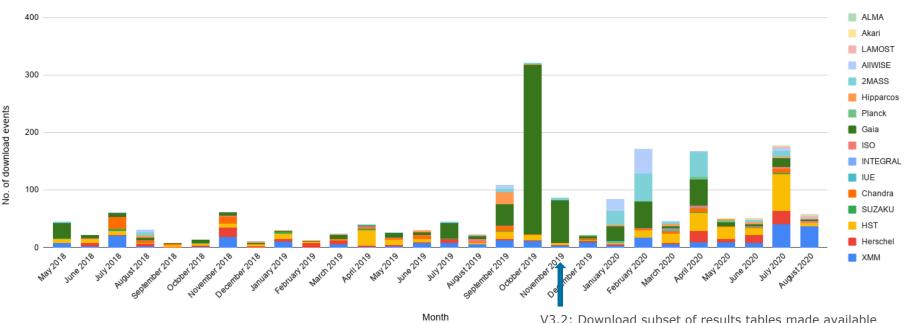


Accesses to the archives via ESASky by clicking on the archive links

ESASky Statistics: downloading data (May 2018 – Aug 2020)



Accesses to the archives by downloading data. In general, users are not downloading data via ESASky. Downloads on average increased in past year.



Accesses to the archives via ESASky by downloading data (images, spectra, catalogues)



Status Update

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Status update since February 2019



Release	Date	Main Contents
Version 3.1	07-Mar-19	ESASky in Spanish, pagination in the data panel, colour blind colours
Version 3.1.1	10-May-19	Support for pyESASky, horizontally scrollable tables, message banner
Version 3.1.2	28-Jun-19	Expanded ESASky Javascript API (for ext. apps such as pyESASky)
Version 3.1.3	16-Jul-19	Chandra colour HiPS (released in collaboration with CXC)
Version 3.2	15-Nov-19	Access to external data centres (ESO, CADC and MAST), AKARI IRC images and HiPS, LAMOST DR5, AKARI IRC PSC, XMM SUSS4.1, HiPS slider, coordinates grid, search by author and bibcode, publications feature upgrade, download subset of tables, +
Version 3.2.1	29-Nov-19	Improvements on external data centres access and MOC updates
Version 3.3	11-Dec-19	Updated XMM EPIC observations and HiPS, HTTPS
		cont

Details can be found in the release notes: <u>https://www.cosmos.esa.int/web/esdc/esasky-release-notes</u>

Status update since February 2019



Release	Date	Main Contents
Version 3.3.1	12-Dec-19	External data centre MOC bug fix
Version 3.3.2	29-Jan-20	JWST footprints in planning tool to latest SIAF (for cycle 1 call)
Version 3.4	12-Mar-20	ALMA observations and footprints, Updated HST obs, 4XMM-DR9, 4XMM-DR9s, XMMSL2, CSC2, HSC 3.1, treemap slider
Version 3.4.1	14-Mar-20	Internal patch release - configuration updates
Version 3.4.2	01-Apr-20	Updated XMM OM & HST observations and MOCs
Version 3.4.3	11-Jun-20	ESASky in Chinese, Updated Chandra observations and MOCs
Version 3.5	24-Sep-20	Spitzer Enhanced imaging products (SEIP), automatic updating of Chandra images, New interactive coverage maps with filtering on large amounts of data (up to 10M rows), Data panel user experience improved: moveable columns, handling of large tables, Switch between equatorial coordinate formats (hms - °).

Details can be found in the release notes: <u>https://www.cosmos.esa.int/web/esdc/esasky-release-notes</u>



External Data Centres ESO, CADC & MAST added to v3.2, Nov 2019

- ESASky now connects to and displays the metadata and footprints of all ESO, CADC and MAST observations exposed through their TAP services (Table Access Protocol).
- More than 40 observatories: VLT; VISTA; Gemini; CFHT, TESS, JCMT, SWIFT, GALEX, K2, FUSE etc...)!
- Exposed in the same way that we are exposing ESA mission data in ESASky, minus the need to integrate the metadata (it's loaded automatically).

Vision: to link to all the major astronomical data centres worldwide!

Plan to add next: HEASARC; VizieR; IRSA; LSST (when ready); and the ability for the user to connect to any TAP of their choice.

• Any priorities from the AAUG on the data centres to access?

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Chinese translation:

- Chinese VO colleagues volunteered in May 2019 to translate ESASky into Chinese.
- 1st step agreed was to translate the GUI -> aim is to attract more astronomers from China.
- Released 11 June 2020 with ESA and CAS articles
- 2nd step might be to translate the education/outreach mode and features



ESASky Roadmap

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ESASky data contents roadmap



First Releases, v1.0 to v1.5 (May 2016 – Oct 2017)

•All-sky HiPS mosaics: •INTEGRAL (ESA) •SWIFT-BAT (JAXA)

- •XMM-Newton (ESA)
- •EXOSAT (ESA)
- •SUZAKU (JAXA)
- •SUZAKU (JAXA
- •HST (ESA)
- •ISO (ESA)
- •AKARI (ESA)
- •Herschel (ESA)
- •Planck (ESA)
- •+created by CDS: Fermi, GALEX, DSS2, SDSS9, 2MASS, AllWISE,...

•Science ready data (<u>images</u>):

- •INTEGRAL
- •XMM-Newton
- •HST
- •Herschel, ISO
- •Chandra (NASA), SUZAKU (JAXA)

•Catalogues:

Planck catalogues

•XMM: 3XMM-DR5; Slew, OM •INTEGRAL IBIS/ISGRI •TGAS -> Gaia DR1 •Hubble Source catalog (HSC) •Hipparcos-2, Tycho-2

•Chandra Source Cat (CSC)

Second releases, v2.0 to v2.3 (Oct 2017 – Nov 2018)

- •All-sky HiPS mosaics (v1.5+): •Planck (ESA: physical models)
- •Updated Herschel PACS & SPIRE
- •Updated Haslam •HI4PI NHI (21cm; CDS)

•Science ready data (v1.5+ images and <u>spectra</u>):

- XMM-Newton
- Chandra
- HST
- •IUE
- •ISO
- Herschel

•Catalogues (v1.5+):

- •Gaia DR2
- •HSC 2.1
- •3XMM-DR7; 3XMM-DR8
- •3XMM-DR7s
- •Herschel Point Source catalogues
- •2MASS
- AllWISE

Third releases, v3.0 to v3.6 (Nov 2018 – end 2020)

- •All-sky HiPS mosaics (v2.3+):
- •Updated XMM EPIC
- •Chandra RGB
- •Spitzer (cold SEIP IRAC)
- •Akari IRC

•Science ready data (v2.3+ images, spectra and <u>time series</u>):

- Updated INTEGRAL (automated)
 Updated XMM-Newton (automated)
 Updated Chandra (automated)
 Updated HST (automated)
 ALMA (ESO)
 AKARI IRC (JAXA)
 LAMOST (CAS)
 CDITZED (MACA)
- •SPITZER (NASA) •CHEOPS (ESA)
- •Catalogues (v2.3+):

•4XMM-DR9, 4XMM-DR9s, •XMM Slew 2.0, XMM OM 4.1 •CSC 2.0 •HSC 3.1, Gaia eDR3, HCV •LAMOST DR5, Akari IRC PSC

•External Data Centres (images, spectra, catalogues, <u>cubes</u>, <u>measurements, time series</u>, <u>visibilities</u>): •ESO

•MAST STScI •CADC

Future Releases (2021+)

•All-sky HiPS mosaics:

ESA missions in operations (automated)
New ESA mission HiPS e.g. JWST, Euclid
Upload user HiPS
GW probability maps
+more

Science ready data (v3.6+ images, spectra, time series, <u>cubes</u>): ESA missions in operations e.g. JWST, Euclid, PLATO ... ESA missions in legacy e.g. EXOSAT, COROT, Hitomi ... Upload user data +more

•Catalogues:

Latest catalogue versions
All Hipparcos catalogues
Be-X-ray binaries
Upload user catalogues

•External Data Centres (v3.6+): •HEASARC •IRSA •VizieR •LSST/Rubin •User defined centres (TAPs) •+more

ESASky data contents roadmap



Future Releases (2021+)

•All-sky HiPS mosaics:

- •Updated and automated HiPS for ESA missions in operations
- •New ESA mission HiPS e.g. JWST, Euclid etc.
- •Upload user HiPS
- •GW probability maps
- •+more

•Science ready data (v3.6+ images, spectra, time series, <u>cubes</u>):

- •ESA missions in operations e.g. JWST, Euclid, PLATO ...
- •ESA missions in legacy e.g. EXOSAT, CoRoT, Hitomi ...
- •Upload user data
- •+more

•Catalogues:

•Latest versions of catalogues

- already in ESASky
- •All Hipparcos catalogues
- •Be-X-ray binaries
- •Upload user catalogues

•External Data Centres (v3.6+):

- •HEASARC
- •IRSA
- VizieR
- •LSST/Rubin
- •User defined centres (TAPs)
- •+more

ESASky technology roadmap



First Releases (May 2016 – Oct 2017)

- •Scientific validation of footprints and ESA all-sky HiPS by ESA
- •Refactoring of prototype into robust and stable application
- •Interoperability with VO tools
- Documentation
- •Helpdesk Support
- •Hardware scaling requirements
- •Screenshot and bookmarks
- Astroquery.esasky
- •Observations planning tool for JWST

Second releases (Oct 2017 – Nov 2018)

•Solar System Objects (SSOs) search functionality •Generation of detailed footprints (**spectra**)

Publications Tool

•New and improved User Interface with support to mobiles

- •Improved usability and user experience
- •Improved representation of available data
- •Faster access to users outside Europe
- •Visualisation of proper motion arrows for astrometric catalogues
- •Change catalogue and footprint colours / shapes •Outreach: dice feature
- and example source lists.

Third releases (Nov 2018 – end 2020)

•Explorer mode/Science mode with different functionalities •Access to external data

centres (ESO, CADC, MAST) •pyESASky Jupyter widget

•ESASky Javascript API with customisable buttons (eJWST)

- •Improved SSOs functionality, with refined cross-matches and new objects
- •Improved look-and-feel: header; resize and move columns; horizontally scrollable data panel; improved column filtering
- •HiPS and treemap slider
- Coordinates Grid
- •Faster visualization of mission coverages (MOCs)
- •Filtering on MOCs
- $\bullet Search$ by author & bibcode
- Message Banner
- HTTPS
- •ESASky in Spanish and Chinese
- Colour blind colours
- •Links to World Wide Telescope •Improved usability for touch devices

•eJWST using ESASky API

Future releases (2021+)

- •ESASky API in eJWST archive and other ESA archives
- •New viewer with all-sky maps FITS visualization, overlay fits images and tune contrast of images.
- •Time series
- •Integration of ESASky into Glue
- •Update astroquery.esasky
- •Advanced visualization of cubes, spectra, time series, etc.
- •Upload any user provided data
- •Improved data download
- Link to ESA datalabs
- •Jupyter notebook side panel •ADQL
- •ESASky links from ADS & JWST/HST APT
- •More missions in planning tool
- •Visualization of planned observations and object visibilities
- •Integration of a BeXRB database and special visualizations (time series)
- •Multi-target summary table
- •State-fullness
- •ML algorithms
- •+more

ESASky technology roadmap



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- •State-fullness
- •ML algorithms (classifier, help bot, ...)
 - •+more

ESASky technology roadmap



Future releases (2021+)

- ESASky API in eJWST archive and other ESA archives *
- •New viewer with all-sky maps FITS visualization, overlay fits images and tune contrast of images. *
- •Time series *
- •Integration of ESASky into Glue
- Update astroquery.esasky +
- Advanced visualization of cubes, spectra, time series, etc. *+
- •Upload any user provided data
- •Improved data download
- •Link to ESA datalabs +
- •ADQL +

- * Flagged as important from AAUG and some missions
- + Flagged as important from user survey (for ESDC archival development in general)

- •Jupyter notebook side panel
- •ESASky links from ADS & JWST/HST APT
- •More missions in planning tool
- •Visualization of planned observations and object visibilities
- •Integration of a BeXRB database and special visualizations (time series)
- •Multi-target summary table
- •State-fullness
- •ML algorithms (classifier, help bot, ...)
 - •+more





Demo

ESASky: <u>https://youtu.be/fCmdXwPTmlg</u> pyESASky: <u>https://youtu.be/8WT_QFcsqMI</u>

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Statistics:

- Mission HiPS heavily viewed in ESASky
- ESASky does seem to be directing users to the archives, some more than others
- How can we improve the data download via ESASky? Does it matter?

Plans for end 2020 and 2021:

- Data: CHEOPS; Gaia eDR3, all operational data automatically updated (daily); more external data centres; more catalogues; upload user data.
- Technology: ESASky API in eJWST archive (+other ESA archives); New viewer with all-sky maps FITS visualization, overlay and tune contrast of fits images; Time series; Advanced visualization of data.

Any new priorities from the AAUG? Priorities on which external data centres to include next?

Back-up slides



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ESASky Statistics: main buttons (May 2018 – Aug 2020)

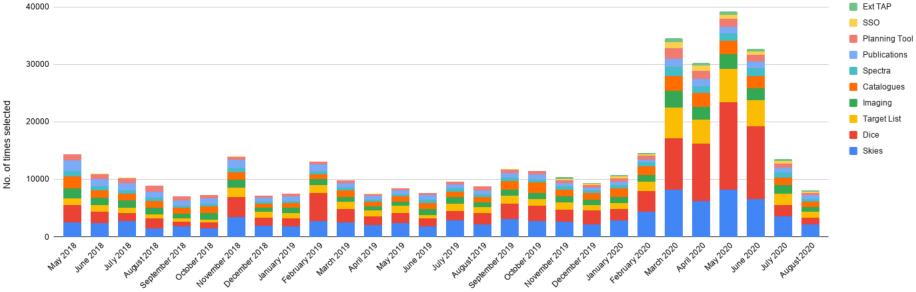


Additional: Number of events for the main buttons, i.e. number of 'clicks'

'Skies' and 'Dice' most selected buttons.

'Planning tool' decreased then increasing since Nov '19 (expected with JWST delay?)

Number of times the main ESASky buttons are selected



ESASky Statistics: header buttons (May 2018 – Aug 2020)



Additional: Number of events for the header bar buttons

'Science mode' button very popular since release in Nov'18. 'Screenshot' and 'Menu' also popular. Grid popular since release Nov'19

Number of times the ESASky header bar buttons are selected

