Data Release 17

This data release contains the data files and maps generated from them for all IBEX-Lo triple coincidence hydrogen ENAs. The data release includes annual data and maps covering an entire solar cycle.

Data Directory Structure and Naming Conventions

The data in this release are separated into one-year segments. The annual all sky maps represent the following IBEX orbits and dates:

Year	Skymap Name	Start-end Orbits or Arcs	Dates
1	Map2009	11-58 (excluding 32 - 48)	12/25/2008 – 12/25/2009
2	Map2010	59-106 (excluding 62, 81 - 101)	12/25/2009 – 12/26/2010
3	Map2011	107-150a (excluding 110 - 114, 128 - 144)	12/26/2010 – 12/24/2011
4	Map2012	150b-190b (excluding 150b - 155, 170 - 182)	12/24/2011 – 12/26/2012
5	Map2013	191a-230b (excluding 207, 210 - 222)	12/26/2012 – 12/26/2013
6	Map2014	231a-270b (excluding 250 - 261)	12/26/2013 – 12/24/2014
7	Map2015	271a-310b (excluding 289 - 300, 303, 304)	12/24/2014 – 12/23/2015
8	Map2016	311a-351a (excluding 316 - 317, 323, 329 - 339)	12/24/2015 – 12/26/2016
9	Map2017	351b-391a (excluding 368 - 380, 390)	12/26/2016 – 12/25/2017
10	Map2018	391b-431b (excluding 405, 408 - 418)	12/25/2017 – 12/26/2018
11	Map2019	432a-471b (excluding 441, 446, 448 - 460)	12/27/2018 – 12/26/2019

Some orbits are excluded due to Super Good Times criteria (see the paper, “One solar cycle of heliosphere observations with the Interstellar Boundary Explorer” (Galli et al), for more details).

Map directories are named using keywords that indicate the type of data they contain:

antiram - data were collected when the spacecraft was moving away from the incoming ENAs.
cg - Compton-Getting corrections have been applied to transform the ENA intensities from the spacecraft reference frame to the solar inertial reference frame.
noSP - no survival probability corrections have been applied to the data.
ram - data were collected when the spacecraft was ramming into the incoming ENAs.
tabular - survival probability corrections have been applied to the ENA intensities to account for the loss of ENAs due to radiation pressure, photoionization and ionization via charge exchange with solar wind protons as they stream through the heliosphere. This correction scales the ENA intensities from the IBEX heliocentric distance at 1 AU out to ~100 AU.
yyyy - identifies a particular set of orbits spanning year yyyy.

Filename Description

Data and map files are named using additional keywords that indicate the type of data they contain:

cnts - total counts data
desc - description of processing details
ener - energies data
fexp - total time exposure data
ffsn - flux data exceeding S/N threshold
flux - flux data
fraw - raw orbit data
fsnr - signal/noise (S/N) data
fvar - flux variances
hstransport-chan-0n-surv - survival probability for nth IBEX-Lo energy bin
lo-n - data from the nth IBEX-Lo energy bin
lohb - IBEX-Lo histogram events
numb - samples per pixel
trp - triple coincidence

File Headers

The first number in the first line of each data file gives the number of lines taken up by the header followed by the number of rows times the number of columns in the data (i.e. 30x60 indicates 30 rows of declination by 60 columns of right ascension values). Row 1 corresponds to the South Ecliptic Pole, while row 30 corresponds to the North Ecliptic Pole. The columns start at ecliptic longitude 0 and step through to ecliptic longitude 360; the values of the first and last columns in each map are identical. The layout of the columns corresponds to Solar Ecliptic East Longitude, right to left as seen outward by IBEX. The keyword “h_title” gives the description of the data and the units used.

Calculation Notes for Users to Combine Multiple Maps

Combining different maps can be done by accounting for the statistical uncertainties and time exposure weighting. This approach works well if the ENA intensities do not vary with time. Below is an example of combining three different maps in this manner.

ENA Exposure times for the three ENA maps: tau1, tau2, tau3;
ENA fluxes for the three ENA maps: flux1, flux2, flux3;
ENA flux variances for the three ENA maps: var1, var2, var3;
We now calculate the weights from the exposure times as,
wt1=tau1/(tau1+tau2+tau3)
wt2=tau2/(tau1+tau2+tau3)

wt3=tau3/(tau1+tau2+tau3)
Combined fluxes and propagated variances are then determined using:
combined_flux=flux1*wt1 + flux2*wt2 + flux3*wt3
combined_var=var1*(wt1)^2 + var2*(wt2)^2 + var3*(wt3)^2

If there is real variation with time, the above approach will bias the average to those years where there is more measurement time. This seems to be the case if the evolution over all 11 years, in particular at medium energies, is examined. For the 11-year average maps in the paper, unweighted means were calculated and only individual pixels with insufficient coverage or with an anomalously high variability or with an anomalously low exposure weight were excluded.