

ICON ata Product 3.3: In Situ Ions

This document describes the data product for ICON In Situ Ions; 48-day windows of data from the L2.7 v08 product are collected into longitude, latitude, and local time bins. Mean and standard deviations of each parameter are reported in this file, which is in NetCDF4 format.

This describes the data product for ICON Level 3 In Situ Ions data (DP 3.3), which is in NetCDF4 format.

The Ion Velocity Meter (IVM) is comprised of two instruments, the Retarding Potential Analyzer (RPA) and the Drift Meter (DM).

The ion density, ion temperature, and O⁺ density fraction use the DM flag.

The ion velocities (Filed Aligned, Meridional, Zonal, East, North, and UP directions use the RPA Flag.

These files are named ICON_L3-3_In_Situ_Ions_vXXrZZZ.NC, where vXX shows the version number and ZZZ shows the revision number of this file. Each individual file nominally contains the data for the entire mission.

The L3 In Situ Ions files are produced from the L2.7 IVM-A files.

All variables within the file are described in their Var_notes attribute. The data are identified in one of 2 var_types: data – which contains the primary data product and support data – which contains parameters used in the retrieval such as geometry etc. that may also be useful in any analysis of this data.

The dimensions of the data also indicate its type. For example, anything with epoch as a dimension means there is 1 value corresponding to each instrument exposure.

No attempt has been made to remove the 24-hour mean from the drifts

History

Version 001, First release version based on latest current L2.7 files. S. L. England, B. Thurairajah

Dimensions

NetCDF files contain **variables** and the **dimensions** over which those variables are defined. First, the dimensions are defined, then all variables in the file are described.

The dimensions used by the variables in this file are given below, along with nominal sizes. Note that the size may vary from file to file. For example, the "Epoch" dimension, which describes the number of time samples contained in this file, will have a varying size.

Dimension Name	Nominal Size
Epoch	107
ICON_L33_Dates	48
ICON_L33_LocalTime	48
ICON_L33_Latitude	13
ICON_L33_Longitude	24

Variables

Variables in this file are listed below. First, "data" variables are described, followed by the "support_data" variables, and finally the "metadata" variables. The variables classified as "ignore_data" are not shown.

data

Variable Name	Description	Units	Dimensions
ICON_L33_ION_DENSITY	Binned ion density Mean value of ion density, taken over all good quality L2 datapoints in a 48-day time-span, as a function of longitude, latitude, time. Derived from ICON_L27_ION_DENSITY	N/cc	Epoch, ICON_L33_LocalTime, ICON_L33_Latitude, ICON_L33_Longitude
ICON_L33_ION_TEMPERATURE	Binned ion temperature Mean value of ion temperature, taken over all good quality L2 datapoints in a 48-day time-span, as a function of longitude, latitude, time. Derived from ICON_L27_ION_TEMPERATURE	K	Epoch, ICON_L33_LocalTime, ICON_L33_Latitude, ICON_L33_Longitude
ICON_L33_FRACTIONAL_ION_DENSITY_O	Binned Fraction of total plasma number density that is O+ Mean value of fraction of total plasma number density that is O+ taken over all good quality L2 datapoints in a 48-day time-span, as a function of longitude, latitude, time. Derived from FRACTIONAL_ION_DENSITY_O	dimensionless	Epoch, ICON_L33_LocalTime, ICON_L33_Latitude, ICON_L33_Longitude
ICON_L33_ION_VELOCITY_FIELD_ALIGNED	Binned Field-Aligned Ion Velocity Mean value of field-aligned ion velocity, taken over all good quality L2 datapoints in a 48-day time-span, as a function of longitude, latitude, time. Derived from ION_VELOCITY_FIELD_ALIGNED	m/s	Epoch, ICON_L33_LocalTime, ICON_L33_Latitude, ICON_L33_Longitude
ICON_L33_ION_VELOCITY_MERIDIONAL	Binned Meridional Ion Velocity Mean value of meridional ion velocity, taken over all good quality L2 datapoints in a 48-day time-span, as a function of longitude, latitude, time. Derived from ION_VELOCITY_MERIDIONAL. Meridional ion velocity is the ion velocity along local magnetic meridional direction, perpendicular to geomagnetic field and within local magnetic meridional plane. The local meridional vector maps to vertical at the magnetic equator, positive is up.	m/s	Epoch, ICON_L33_LocalTime, ICON_L33_Latitude, ICON_L33_Longitude
ICON_L33_ION_VELOCITY_ZONAL	Binned Zonal Ion Velocity Mean value of zonal ion velocity, taken over all good quality L2 datapoints in a 48-day time-span, as a function of longitude, latitude, time. Derived from ION_VELOCITY_ZONAL	m/s	Epoch, ICON_L33_LocalTime, ICON_L33_Latitude, ICON_L33_Longitude
ICON_L33_ION_VELOCITY_EAST	Binned IVM measured ion drifts along East, North, and Up directions Mean value of IVM measured ion drifts along East direction, taken over all good quality L2 datapoints in a 48-day time-span, as a function of longitude, latitude, time. Derived from ION_VELOCITY_EAST	m/s	Epoch, ICON_L33_LocalTime, ICON_L33_Latitude, ICON_L33_Longitude

Variable Name	Description	Units	Dimensions
ICON_L33_ION_VELOCITY_NORTH	Binned IVM measured ion drifts along East, North, and Up directions Mean value of IVM measured ion drifts along North direction, taken over all good quality L2 datapoints in a 48-day time-span, as a function of longitude, latitude, time. Derived from ION_VELOCITY_NORTH	m/s	Epoch, ICON_L33_LocalTime, ICON_L33_Latitude, ICON_L33_Longitude
ICON_L33_ION_VELOCITY_UP	Binned IVM measured ion drifts along East, North, and Up directions Mean value of IVM measured ion drifts along up direction, taken over all good quality L2 datapoints in a 48-day time-span, as a function of longitude, latitude, time. Derived from ION_VELOCITY_UP	m/s	Epoch, ICON_L33_LocalTime, ICON_L33_Latitude, ICON_L33_Longitude
ICON_L33_data_points_RPA	Number of data points in the RPA measured data Number of data points in each 48 day average data, measured by the Retarding Potential Analyzer (RPA), as a function of longitude, latitude, time	dimensionless	Epoch, ICON_L33_LocalTime, ICON_L33_Latitude, ICON_L33_Longitude
ICON_L33_data_points_DM	Number of data points in the DM measured data Number of data points in each 48 day average data, measured by the Drift Meter (DM) as a function of longitude, latitude, time	dimensionless	Epoch, ICON_L33_LocalTime, ICON_L33_Latitude, ICON_L33_Longitude
ICON_L33_Sigma_ION_DENSITY	Sigma ion density 1 standard deviation of the good ion density values used to compute the mean, as a function of longitude, latitude, time	N/cc	Epoch, ICON_L33_LocalTime, ICON_L33_Latitude, ICON_L33_Longitude
ICON_L33_Sigma_ION_TEMPERATURE	Sigma ion temperature 1 standard deviation of the good fraction of ion temperature values used to compute the mean, as a function of longitude, latitude, time	K	Epoch, ICON_L33_LocalTime, ICON_L33_Latitude, ICON_L33_Longitude
ICON_L33_Sigma_FRACTIONAL_ION_DENSITY_O	Sigma Fraction of total plasma number density that is O+ 1 standard deviation of the good fraction of total plasma number density that is O+ values used to compute the mean, as a function of longitude, latitude, time	dimensionless	Epoch, ICON_L33_LocalTime, ICON_L33_Latitude, ICON_L33_Longitude
ICON_L33_Sigma_ION_VELOCITY_FIELD_ALIGNED	Sigma Field-Aligned Ion Velocity 1 standard deviation of the good ion field aligned ion velocity values used to compute the mean, as a function of longitude, latitude, time	m/s	Epoch, ICON_L33_LocalTime, ICON_L33_Latitude, ICON_L33_Longitude
ICON_L33_Sigma_ION_VELOCITY_MERIDIONAL	Sigma Meridional Ion Velocity 1 standard deviation of the good ion meridional ion velocity values used to compute the mean, as a function of longitude, latitude, time	m/s	Epoch, ICON_L33_LocalTime, ICON_L33_Latitude, ICON_L33_Longitude

Variable Name	Description	Units	Dimensions
ICON_L33_Sigma_ION_VELOCITY_ZONAL	Sigma Zonal Ion Velocity 1 standard deviation of the good ion zonal ion velocity values used to compute the median, as a function of longitude, latitude, time	m/s	Epoch, ICON_L33_LocalTime, ICON_L33_Latitude, ICON_L33_Longitude
ICON_L33_Sigma_ION_VELOCITY_EAST	Sigma of ion drifts along East direction 1 standard deviation of the good ion drifts along East direction values used to compute the mean, as a function of longitude, latitude, time	m/s	Epoch, ICON_L33_LocalTime, ICON_L33_Latitude, ICON_L33_Longitude
ICON_L33_Sigma_ION_VELOCITY_NORTH	Sigma of ion drifts along North direction 1 standard deviation of the good ion drifts along North direction values used to compute the mean, as a function of longitude, latitude, time	m/s	Epoch, ICON_L33_LocalTime, ICON_L33_Latitude, ICON_L33_Longitude
ICON_L33_Sigma_ION_VELOCITY_UP	Sigma of ion drifts along Up direction 1 standard deviation of the good ion drifts along Up direction values used to compute the mean, as a function of longitude, latitude, time	m/s	Epoch, ICON_L33_LocalTime, ICON_L33_Latitude, ICON_L33_Longitude

support_data

Variable Name	Description	Units	Dimensions
Epoch	Milliseconds since 1970-01-01 00:00:00 UTC Time corresponding to the middle of each 48 day average, in milliseconds since Jan 1 1970.	milliseconds	Epoch
ICON_L33_Included_Dates_RPA	Date YYYY-MM-DD format Dates used in each 48 day bin, in string format, in the format: 2017-05-27; data measured by the Retarding Potential Analyzer; from RPA flag used in all data products	string	Epoch, ICON_L33_Dates
ICON_L33_Included_Dates_DM	Date YYYY-MM-DD format Dates used in each 48 day bin, in string format, in the format: 2017-05-27; data measured by the Drift Meter; from DM flag used only in drifts (not in ion temperature, ion density, ion density O	string	Epoch, ICON_L33_Dates
ICON_L33_LocalTime	Local Time Bin Local time binned in 0.5 hour intervals, local time +/- 0.25 hours.	hours	ICON_L33_LocalTime
ICON_L33_Latitude	Latitude Bin Latitude of the IVM data, binned in 5 degree intervals, latitude +/- 2.5 degrees. Derived from ICON_IVM-A_L27_Latitude	degrees	ICON_L33_Latitude

Variable Name	Description	Units	Dimensions
ICON_L33_Longitude	Longitude Bin Longitude of the IVM data, binned in 15 degree intervals, longitude +/- 7.5 degrees. Derived from ICON_IVM-A_L27_Longitude	degrees	ICON_L33_Longitude

Acknowledgement

This is a data product from the NASA Ionospheric Connection Explorer mission, an Explorer launched at 21:59:45 EDT on October 10, 2019, from Cape Canaveral AFB in the USA. Guidelines for the use of this product are described in the ICON Rules of the Road (<http://icon.ssl.berkeley.edu/Data>).

Responsibility for the mission science falls to the Principal Investigator, Dr. Thomas Immel at UC Berkeley: Immel, T.J., England, S.L., Mende, S.B. et al. Space Sci Rev (2018) 214: 13. <https://doi.org/10.1007/s11214-017-0449-2> Immel, T.J., England, S.L., Harding, B.J. et al. Space Sci Rev (2023) 219: 41. <https://doi.org/10.1007/s11214-023-00975-x>

Responsibility for the validation of the L1 data products falls to the instrument lead investigators/scientists. EUV: Dr. Martin Sirk and Dr. Eric Korpela : <https://doi.org/10.1007/s11214-023-00963-1>, and <https://doi.org/10.1007/s11214-017-0384-2> FUV: Dr. Harald Frey : <https://doi.org/10.1007/s11214-023-00969-9>, and <https://doi.org/10.1007/s11214-017-0386-0> MIGHTI: Dr. Christoph Englert : <https://doi.org/10.1007/s11214-023-00971-1>, <https://doi.org/10.1007/s11214-017-0358-4>, and <https://doi.org/10.1007/s11214-017-0374-4> IVM: Dr. Roderick Heelis : <https://doi.org/10.1007/s11214-017-0383-3>

Responsibility for the validation of the L2 data products falls to those scientists responsible for those products.

- * Daytime O/N2 ratio : Dr. Robert Meier : <https://doi.org/10.1007/s11214-018-0477-6>
- * Daytime (EUV) O+ profiles: Dr. Andrew Stephan : <https://doi.org/10.1007/s11214-022-00933-z>, and <https://doi.org/10.1007/s11214-017-0385-1>
- * Nighttime (FUV) O+ profiles: Dr. Farzad Kamalabadi : <https://doi.org/10.1007/s11214-018-0502-9>
- * Neutral Wind profiles: Brian Harding : <https://doi.org/10.1007/s11214-017-0359-3>, and <https://doi.org/10.1029/2020JA028947>
- * Neutral Temperature profiles: Dr. Michael Stevens : <https://doi.org/10.1007/s11214-022-00935-x>, and <https://doi.org/10.1007/s11214-017-0434-9>
- * Ion Velocity Measurements : Dr. Roderick Heelis : <https://doi.org/10.1007/s11214-017-0383-3>

Additional theoretical work in support of these products was supported by Dr. Robert Meier

Daytime O/N2 product <https://doi.org/10.1029/2020JA029059>
Daytime (EUV) O+ profiles : <https://doi.org/10.1029/2023JA031533>

Additional validation work was performed by Dr. Jonathan Makela, Dr. Gilles Wautelet, and Dr. Yen-Jung (Joanne) Wu:

Neutral wind profiles : <https://doi.org/10.1029/2020JA028726>
Nighttime (FUV) O+ profiles : <https://doi.org/10.1007/s11214-023-00970-2>
Daytime (EUV) O+ profiles : <https://doi.org/10.1007/s11214-022-00930-2>
Ion Velocity Measurements : <https://doi.org/10.1007/s11214-023-00993-9>

Responsibility for Level 4 products falls to those scientists responsible for those products.

- * Hough Modes : Dr. Chihoko Cullens : <https://doi.org/10.1186/s40645-020-00330-6> and <https://doi.org/10.1007/s11214-017-0401-5>
- * TIEGCM : Dr. Astrid Maute : <https://doi.org/10.1007/s11214-017-0330-3>
- * SAMI3 : Dr. Joseph Huba : <https://doi.org/10.1007/s11214-017-0415-z>

Pre-production versions of all above papers are available on the ICON website.
<http://icon.ssl.berkeley.edu/Publications>

Overall validation of the products is overseen by the ICON Project Scientist, Dr. Scott England.

NASA oversight for all products is provided by the Mission Scientist, Dr. Jeffrey Klenzing (2018-2022) and Dr. Ruth Lieberman (2022-present).

Users of these data should contact and acknowledge the Principal Investigator Dr. Immel and the party directly responsible for the data product (noted above) and acknowledge NASA funding for the collection of the data used in the research with the following statement : "ICON is supported by NASA's Explorers Program through contracts NNG12FA45C and NNG12FA42I".

These data are openly available as described in the ICON Data Management Plan on the ICON website (<http://icon.ssl.berkeley.edu/Data>).

This document was automatically generated on 2025-07-02 13:58 using the file:

ICON_L3-3_In_Situ_Ions_v01r001.NC

Software version: ICON SDC > In Situ Ions v01r001