

ICON Data Product 3.3: O, N2 Profiles

This document describes the data product for ICON FUV O N2 Profiles; 48-day windows of data from the L2.4 v07 product are collected into altitude, longitude, latitude, and local time bins. Mean and standard deviations of each parameter are reported in this file. Note that COLUMN_O_N2 data does not have an altitude component, which is in NetCDF4 format.

This describes the data product for ICON Level 3 FUV Limb Daytime (DP 3.3), which is in NetCDF4 format.

The ratio of oxygen to nitrogen in the thermosphere is obtained from the two channels of ICON FUV instrument data in,

through an inversion process described in <https://doi.org/10.1007/s11214-018-0477-6>.

These files are named ICON_L3-3_O_N2_Profiles_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 FUV Day Limb files are produced from the L2.4 FUV Day Limb 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.

History

Version 001, First release version based on latest current L2.4 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	25
ICON_L33_Latitude	13
ICON_L33_Longitude	24
ICON_L33_Altitude	22

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_COLUMN_O_N2	Binned Column ON2 Ratio Mean value of column O/N2, taken over all good quality L2 datapoints in a 48-day time-span, as a function of longitude, latitude, time. Derived from ICON_L24_COLUMN_ON2	dimensionless	Epoch, ICON_L33_LocalTime, ICON_L33_Latitude, ICON_L33_Longitude
ICON_L33_O	Binned atomic O Mean value of atomic O, taken over all good quality L2 datapoints in a 48-day time-span, as a function of altitude, longitude, latitude, time. Derived from ICON_L24_O. Note this altitude profile is constrained by the L2 observations between ~140 - 300 km altitude, and values outside of this altitude range are an extrapolation based on the data and MSIS00.	cm-3	Epoch, ICON_L33_LocalTime, ICON_L33_Latitude, ICON_L33_Longitude, ICON_L33_Altitude
ICON_L33_N2	Binned molecular N2 Mean value of N2, taken over all good quality L2 datapoints in a 48-day time-span, as a function of altitude, longitude, latitude, time. Derived from ICON_L24_N2. Note this altitude profile is constrained by the L2 observations between ~140 - 300 km altitude, and values outside of this altitude range are an extrapolation based on the data and MSIS00.	cm-3	Epoch, ICON_L33_LocalTime, ICON_L33_Latitude, ICON_L33_Longitude, ICON_L33_Altitude
ICON_L33_O2	Binned molecular O2 Mean value of O2, taken over all good quality L2 datapoints in a 48-day time-span, as a function of altitude, longitude, latitude, time. Derived from ICON_L24_O2. Note this altitude profile is partially constrained by the L2 observations between ~140 - 300 km altitude, and values outside of this altitude range are an extrapolation based on MSIS00.	cm-3	Epoch, ICON_L33_LocalTime, ICON_L33_Latitude, ICON_L33_Longitude, ICON_L33_Altitude
ICON_L33_Temperature	Temperature Mean value of temperature, taken over all good quality L2 datapoints in a 48-day time-span, as a function of altitude, longitude, latitude, time. Derived from ICON_L24_TEMPERATURE. Note this altitude profile is constrained by the L2 observations between ~140 - 300 km altitude, and values outside of this altitude range are an extrapolation based on the data and MSIS00.	K	Epoch, ICON_L33_LocalTime, ICON_L33_Latitude, ICON_L33_Longitude, ICON_L33_Altitude
L33_Numdata	Number of data points Number of data points in each 48 day average, as a function of longitude, latitude, time	dimensionless	Epoch, ICON_L33_LocalTime, ICON_L33_Latitude, ICON_L33_Longitude

Variable Name	Description	Units	Dimensions
ICON_L33_Sigma_Column_O_N2	Sigma Column O/N2 1 standard deviation of the good column O/N2 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_O	Sigma O 1 standard deviation of the good O values used to compute the mean, as a function of altitude, longitude, latitude, time	cm-3	Epoch, ICON_L33_LocalTime, ICON_L33_Latitude, ICON_L33_Longitude, ICON_L33_Altitude
ICON_L33_Sigma_N2	Sigma N2 1 standard deviation of the good N2 values used to compute the mean, as a function of altitude, longitude, latitude, time	cm-3	Epoch, ICON_L33_LocalTime, ICON_L33_Latitude, ICON_L33_Longitude, ICON_L33_Altitude
ICON_L33_Sigma_O2	Sigma O2 1 standard deviation of the good O2 values used to compute the mean, as a function of altitude, longitude, latitude, time	cm-3	Epoch, ICON_L33_LocalTime, ICON_L33_Latitude, ICON_L33_Longitude, ICON_L33_Altitude
ICON_L33_Sigma_Temperature	Sigma Temperature 1 standard deviation of the temperature values used to compute the mean, as a function of altitude, longitude, latitude, time	K	Epoch, ICON_L33_LocalTime, ICON_L33_Latitude, ICON_L33_Longitude, ICON_L33_Altitude

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	Date YYYY-MM-DD format Dates used in each 48 day bin, in string format, in the format: 2017-05-27	string	Epoch, ICON_L33_Dates
ICON_L33_Altitude	Retrieved altitude grid Altitude grid used by the forward model, in WGS.	km	ICON_L33_Altitude
ICON_L33_LocalTime	Local Time Bin Local time binned in 0.5 hour intervals, local time +/- 0.25 hours.	hours	ICON_L33_LocalTime

Variable Name	Description	Units	Dimensions
ICON_L33_Latitude	Latitude Bin Latitude of the FUV Day Limb data, binned in 5 degree intervals, latitude +/- 2.5 degrees. Derived from ICON_FUV_Day-Limb_L24_Latitude	degrees	ICON_L33_Latitude
ICON_L33_Longitude	Longitude Bin Longitude of the FUV Day Limb data, binned in 15 degree intervals, longitude +/- 7.5 degrees. Derived from ICON_FUV_Day-Limb_L24_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 2025-11-04 16:37 using the file:

ICON_L3-3_0_N2_Profiles_v01r001.NC

Software version: ICON SDC > FUV v01r001