

DINAR project website: <http://hono.aeronomie.be>

S5P COBRA Terms of Use

The TROPOMI HONO dataset is freely available.

In case the data is used in a presentation/report/publication, please acknowledge product developer Nicolas Theys (BIRA-IASB) and the ESA-funded DINAR project.

In case the TROPOMI HONO data is central to the study, offering co-authorship is encouraged.

TROPOMI HONO level-2 v23 data product description

Algorithm description: DINAR Algorithm Theoretical Basis Document available on the DINAR website (<http://hono.aeronomie.be>)

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File name: TROPOMIHONO_COBRA_v23_iter3_{yyyymmdd}_orb{orbit_number}.he5

Content: variables have dimensions of along-track x across-track, except pixel corners coordinates (dim: along-track x across-track x4), AMF, HONO VCD and HONO VCD error (dim: height x ssa x aod x along-track x across-track)

-AAI: Absorbing Aerosol Index* (-)

-AMF: total air mass factor (-) at 355nm for combinations of predefined plume height, single scattering albedo, aerosol optical depth

-CA: Cloud albedo* (-)

-CF: Cloud Fraction* (-)

-CP: Cloud Pressure* (Pa)

-Flag_land_ocean: Land ocean flag (0=ocean,1=land)

-latitude: Latitude pixel center (deg)

-latitude_bounds: Latitude pixel corners (deg)

-longitude: Longitude pixel center (deg)

-longitude_bounds: Longitude pixel corners (deg)

-Scene_Inhom: Scene Inhomogeneity parameter (-) (from BD3 L1 small_pixel_radiance)

-HONO_SCD: HONO slant column (molec.cm-2) [recommended product; result of the merging between COBRA and DOAS SCDs]

-HONO_SCD_cobra: COBRA HONO slant column (molec.cm-2)

-HONO_SCD_err_cobra: COBRA HONO slant column error (molec.cm-2)

-HONO_SCD_doas: DOAS HONO slant column (molec.cm-2)

-HONO_VCD: HONO vertical column (molec.cm-2) obtained by dividing HONO_SCD and AMF for predefined values of plume height, single scattering albedo, aerosol optical depth.

-HONO_VCD_err: HONO vertical column error (molec.cm-2) same dimension as HONO_VCD.

-HONO_detection_flag: HONO detection level of confidence [0=no confidence, 1=reasonable, 2=good, 3=very good]

-RMS_cobra: fitting residual of the COBRA retrieval (-)

-NO2_SCD: DOAS NO2 slant column (molec.cm-2)

-NO2_SCDE: DOAS NO2 slant column error (molec.cm-2)

-NO2_SCDcor: DOAS NO2 slant column after background correction (molec.cm-2) [recommended product in combination with HONO_SCD for estimating HONO to NO2 ratio]

-Surf_H: surface height (m)

-Surf_P: surface pressure (Pa)

-SAA: viewing zenith angle (deg)

-SAA: Solar Azimuth Angle (deg)

-SZA: solar zenith angle (deg)

-Time: observation time (s) seconds since 01-01-2010 0h UTC

-VAA: viewing azimuth angle (deg)

-VZA: viewing zenith angle (deg)

-aod: Aerosol optical depth grid (-) [1, 2, 5, 10]

-plume height: Plume height grid (km a.g.l.) [2, 5, 12 km]

-ssa: Single scattering albedo grid (-) [0.7, 0.8, 0.9]

**Variables copied from SSP L2 AAI and Cloud products (version 3.2).*

Recommendations on data usage:

Pixels selection:

It is recommended to use TROPOMI pixels with:

$SZA < 65$ & $HONO_SCD_err_cobra > 1.5e14$ & $(25 < \text{across-track position} < 426)$ & $HONO_detection_flag > 0$

For pixels with detection flag=1, it is useful to consolidate the pixels selection by consulting the absorbing aerosol index (smoke plumes have $AAI \gg 2$) and/or the retrieved NO₂ values.

After pixel selection, some false positives may still occur due to the large number of TROPOMI pixels. Additional selection that the user might consider are: $HONO_SCD > 2e15$ & $NO2_SCDcor > 3x NO2_SCDE$.

HONO to NO₂ ratio:

After pixels selection, recommended variables are HONO_SCD and NO₂_SCDcor. To avoid division by a small number, detectable amounts of NO₂ must be considered, e.g. pixels with $NO2_SCDcor > 3x NO2_SCDE$.

HONO VCD:

To limit the processing time, the HONO VCD is only provided for pixels with detectable amounts of HONO (i.e., $HONO_detection_flag > 0$). The HONO VCD is calculated for pre-defined values of:

- plume height (a.g.l): 2 km (tropical conditions, or young plume near the source), 5 km (extra-tropical conditions, or older plume), 12 km (lofted plume representing pyroconvection events).
- single scattering albedo: 0.7 (highly absorbing/black carbon, pixels in the immediate vicinity of the source), 0.8 (absorbing aerosols, young plume near the source), 0.9 (older plume).
- optical depth: 1, 2 (dispersed plume), 5, 10 (freshly emitted plume).

It is up to the user to select the most appropriate values (or linear combinations) depending on the conditions or external information on plume height and aerosols. As a baseline and in the absence of any information, it is recommended to use the HONO VCD for a plume height of 2km, SSA of 0.8 and AOD of 5.
