

MOPITT V9 Level 3 Data Quality Summary

The following information applies to MOPITT Level 3 (L3) data, Version 9 (V9; L3V5.9.x and L3V95.9.x), first released June, 2021.

Further details on MOPITT data quality and recommended analysis methods may be found in the updated V9 User's Guide, which is available on the MOPITT Publications page (<https://www2.acom.ucar.edu/mopitt/publications>). Featured improvements in the V9 retrieval product, which are described in the User's Guide, involve revisions to (1) the forward radiative transfer model, (2) the cloud detection algorithm, and (3) the strategy used for NIR calibration.

Gridded CO Retrieval Products

MOPITT Level 3 data files are produced in HDF-EOS5 format for both individual days and individual months, providing daily-mean and monthly-mean CO distributions at a resolution of 1 degree (latitude and longitude) respectively. Compared to Level 2 products, these gridded products typically are less affected by random retrieval errors (e.g., due to instrument noise or geophysical noise) and are packaged into much smaller HDF5 data files. Within each type of Level 3 file, data-averaged products are separately available for daytime and nighttime MOPITT observations. Retrieval sensitivity is generally greater for daytime overpasses than for nighttime overpasses, particularly over land. Generally, there exists a corresponding L3 product for each data field in the Level 2 Product. In addition, the number of Level 2 retrievals (or 'Number of Pixels') used as the basis of each Level 3 gridded value is also provided. Moreover, for each retrieved parameter, additional fields provide (1) the mean uncertainty of the Level 2 values and (2) the variability of the Level 2 values as represented by the standard deviation.

Three different types of Level 3 products are available based on different subsets of the MOPITT calibrated radiances. Each type of Level 3 product is based on the corresponding Level 2 product. The format and variables contained in the three types of Level 3 files are identical.

The V9 Level 3 products include:

- Daily and monthly TIR-only products. *Example filenames:* MOP03T-20010101-L3V5.9.1.he5 (daily) and MOP03TM-200101-L3V95.9.1.he5 (monthly).
- Daily and monthly NIR-only products. *Example filenames:* MOP03N-20010101-L3V5.9.2.he5 (daily) and MOP03NM-200101-L3V95.9.2.he5 (monthly).
- Daily and monthly TIR/NIR products. *Example filenames:* MOP03J-20010101-L3V5.9.3.he5 (daily) and MOP03JM-200101-L3V95.9.3.he5 (monthly).

Data Filtering

MOPITT Level 3 products are available as gridded daily-mean and monthly-mean files. Data averaging is performed on a one-degree latitude/longitude grid. The filtering method used for V9 Level 3 processing relies on both pixel filtering and signal-to-noise ratio (SNR) thresholds

for Channel 5 and 6 Average radiances (i.e., 5A and 6A). SNR values for each observation are obtained using radiance and radiance uncertainty values contained in the diagnostic 'Level1RadiancesandErrors' in the Level 2 data files. Observations from Pixel 3, one of the four elements of MOPITT's linear detector array, are excluded from TIR-only and TIR/NIR L3 products due to highly variable Channel 7 SNR values. Observations with relatively low SNR tend to yield retrievals weighted heavily by the a priori and generally result in low DFS. Excluding low-SNR observations from the Level 3 cell-averaged values raises overall mean DFS values. The specific filtering rules used for both the daily-mean and monthly-mean V9 Level 3 products are:

- V9 Level 3 TIR-only products exclude all observations from Pixel 3 in addition to observations where the 5A SNR < 1000
- V9 Level 3 NIR-only products exclude all observations where the 6A SNR < 400
- V9 Level 3 daytime TIR/NIR products exclude all observations from Pixel 3 in addition to observations where both (1) the 5A SNR < 1000 and (2) the 6A SNR < 400
- V9 Level 3 nighttime TIR/NIR products exclude all observations from Pixel 3 in addition to observations where the 5A SNR < 1000.

Methane Retrieval Products

Gridded methane (CH₄) retrievals are not available in this data version, or any previous version.