MOPITT V7 Level 1 Data Quality Summary

The following information applies to MOPITT Level 1 (L1) data, Version 7 (V7; L1V3.50)
July, 2016

CO Channel Radiances

Achieving the highest quality MOPITT carbon monoxide (CO) retrievals requires a thorough understanding of the errors that characterize MOPITT's Level 1 calibrated radiances.

Long-term Instrumental Degradation. Long-term gradual changes in the temperatures and pressures of the MOPITT gas correlation cells can potentially bias the MOPITT radiances (relative to the operational radiative transfer model) and therefore produce retrieval biases. Beginning with the Version 5 release, the operational radiative transfer model explicitly represents this effect, and therefore no retrieval bias should result. More information on this effect is included in the Version 5 validation paper (Deeter, M. N., et al., 'Validation of MOPITT Version 5 thermal-infrared, near-infrared, and multispectral carbon monoxide profile retrievals for 2000–2011,' *Journal of Geophysical Research: Atmospheres*, doi:10.1002/jgrd.50272, 2013).

Radiance Bias Correction. Static radiance bias correction factors are employed in the MOPITT Level 2 processor to account for unresolved biases between the MOPITT Level 1 radiances and the operational radiative transfer model. Methods used to determine appropriate radiance bias correction factors for V7 retrieval products are described in the V7 User's Guide.

NIR Calibration. Calibration of MOPITT's NIR channels (e.g., Channel 6) relies on a two-point calibration scheme involving both cold-calibration ("cold-cal") events and hot-calibration ("hot-cal") events. Cold-cals occur many times per day, while hot-cals are performed only about once per year. Ideally, NIR channels are calibrated with gain and offset values determined by interpolating the information from hot-cals occurring both before and after the time of observation. While this method is feasible in retrospective processing mode (i.e., processing previous years of data), it is not possible in forward processing mode (i.e., when processing recently acquired observations). Thus, in forward processing mode, only information from the most recent hot-cal is used to calibrate MOPITT's NIR radiances. Recent comparisons of NIR-only retrieval products generated in retrospective and forward processing modes have revealed significant differences (10% to 20%) in total column results, with the retrospectively processed data in better agreement with daytime/land TIR-only total column values and time dependence. Therefore, because of the lower quality of MOPITT products processed in forward processing mode, V7 Level 1, 2, and 3 products generated in this manner will be labeled as "beta" products. These products will be reprocessed and replaced by standard archival files following the next hot-cal. Typically, this will occur no more than a year from the time of a particular observation (depending on the date of the most recent hot-cal). The beta products should not be exploited for examining long-term records of CO although these products should still be useful for some applications.

Level 1 File Contents. The content of the Level 1 product files containing the MOPITT calibrated radiances is unchanged for V7, with the exception of a new diagnostic, 'Daily Gain Dev.' This diagnostic provides the standard deviation of the gain values used to calibrate the radiances for a

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particular channel and pixel on one day. This diagnostic may be useful as a metric for the Channel 5 calibration issue described in Section 5 of the V7 User's Guide. The 'Daily Gain Dev' diagnostic is also included in V7 Level 2 data files.

Methane Channel Radiances

Methane (CH_4) channel radiances are not available in the V6 Level 1 product.

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