

Ver. 005-06-0150 Release Notes

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1. Descriptions

- The version 0150 is a third test retrieval version to verify L1B and L2 data processing.
- We request that the version 0150 data should be used very cautiously for scientific purposes, under the condition that you know characteristics of the data well.
- The period of coverage of this version is from October 12, 2009 to April 20, 2010.
 - From November 30 to December 15, 2009, the ISS Solar Paddle stopped just in front of the SMILES IFOV due to the maintenance of the Port Solar Power Module elements of the ISS.
 - From February 25 to March 5, 2010, the number of L1B data is only around 10% of ordinary condition, due to the trouble of communication system of ISS/JEM (not according to SMILES itself).
- There are two types of products. The one consists of minimum information (*L2Product_G_RA*, 0.8 MB/file), which is identical with the product of previous version. In addition, the other has detailed information, such as the status flag from L1B and averaging kernels (*L2Product*, 8MB/file). Refer to the Product Guide for details.
- The pointing direction for determining tangent altitudes (in geometric) is calculated by using SMILES scan mirror angle and ISS position. However, since the pointing accuracy would heavily affect to the error of tangent altitude determination, an average altitude within a single scan is retrieved using the Star Sensor of SMILES in L2 processing. In case that sunlight or moonbeam enters in the FOV of SMILES Star Sensor, positioning information cannot be obtained, so in such cases it will be estimated from the information of 50 scans around that.
- The tangent altitude for L2 data is retrieved as an altitude offset.
- For the retrieval of band C, *a priori* value of the tangent altitude and temperature is provided from band A or B. (There are operational modes with band A+C and band B+C.)
- This version of L2 product includes some profiles which are inadequate for scientific use. In using these products, it is strongly recommended to pick up usable profiles according to the following conditions:
 - The L2 product might include the data of scan in case of antenna FOV interference with ISS solar paddles, and the number of such scan is about 10%

of all scans in the product. We encourage to exclude these scans, which are under condition that $fovInterference > 0$, from any data analysis. However, there is no forecast data for FOV interference in about 17% of “antenna FOV interference” scan, so it is difficult to exclude these scan data.

- The converged profiles can be picked up with the condition of $NumIterPerform > 3$. The criterion is the most credible quality information, and around 70% of all products would meet this condition.
- The nearly converged profiles can be picked up with the condition of $Convergence < 10$. About 80% of all products would meet this condition. However, a few scans of abnormal data per day might be included in each product.
- L2 products include altitude range not usable for validation and/or science. If the $L2Precision$ is more than 50% compared to the $AprioriError$, it is probable that L2 algorithm is just answering *a priori*. In this case, the value of $L2Precision$ has been turned into negative. ($L2Precision$ and $AprioriError$ are defined as HDF EOS5 names in the SMILES L2 products.)
- Preliminary “status flag” has been newly added in this version.

2. Improvements

- Illegal value in longitude in case the longitude of tangent point is around 180 degree, has been corrected.
- Altitude offset of Star Trackers (STT) has been reduced to +/- 1km, according to implementation of compensation formula of time from STT.
- Rate of convergence in the retrieval process has been improved, by smoothing vibrations in the ISS altitude data which do not seem to represent actual vibrations.
- Description of line shape has been refined with introducing the coefficient (ν/ν_0) .
- Line parameters of O₃, HNO₃, HO₂ and ozone isotopes have been changed from the JPL catalog to HITRAN2008.
- Profiles of temperature and HCl around 50km have been improved, with compensation of an effect from the Doppler shift.
- Consistency between retrieval results from band A in Setting 2 (band A/C) and Setting 3 (band B/A) have been improved, by taking compensation between the response function of AU1 and AU2 (2 units in AOS).
- Hydrostatic assumption has been introduced as a constraint in the calculation of pressure and temperature.
- Retrieval results of HOCl have been improved, by ignoring ozone isotopes whose

absorption lines overlap that of HOCl in band A.

- Information contents of ozone isotopes, HNO₃, ClO and CH₃CN have been increased, by adjusting the error value in *a priori* profile.
- Rate of convergence in the retrieval process has been increased, by ignoring temperature retrieval in band C.
- Rate of convergence in the retrieval process has been increased, by raising upper limit of iteration trials in the retrieval process from 5 to 8.

3. Remaining Issues after ver. 0024/0032

- In the forward model we notice a bug for the antenna pattern. In the current version of antenna pattern, consideration for 0.5-second antenna moving is not sufficient. It should be considered that the antenna is moving during the 0.5 second AOS integration. [Continuing from ver. 0032]
- HOCl, HNO₃ (in band A) and BrO data (in band A) still look not usable. [Continuing from ver. 0024]
- We recommend zonal mean processing on using CH₃CN, BrO (in band C), HNO₃ (in band C) and HO₂ data.
- Checking of O₃ isotope products has not been sufficiently done yet. [Continuing from ver. 0024]

4. Newly Found Issue in ver. 0150

- (1) According to the new “status flag”, detection of FOV interference with the ISS solar paddle is not perfect.
- (2) Matrix elements of *AveragingKernel* are misplaced, with mixing up rows and columns.
- (3) Values of *InformationValue* and *VerticalResolution*, which are calculated from *AveragingKernel*, are not appropriate.

* The issues (2) and (3) will be fixed in the bug fix release, soon after this ver. 0150. The products of bug fix release will be uploaded gradually.

** These values can be calculated by users as follows:

AveragingKernel: transposed matrix of stored *AveragingKernel*

$$AK_{corrected}(i, j) = AK_{stored}(j, i).$$

InformationValue: integrated value of row vector of corrected *AveragingKernel*

$$InformationValue(i) = \sum_j AK_{corrected}(i, j).$$

VerticalResolution: full width at half maximum of row vector of corrected *AveragingKernel*.