readme for TROPOMI UVN instrument spectral response function

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2016-03-01	1.0.0	Joost Smeets

Contents

1 Introduction

The TROPOMI Calibration Key Data (CKD) netCDF4 files contain ISRFs for the UV, UVIS, and NIR detector bands derived from TROPOMI calibration measurements performed in March 2015 at CSL in Liege, in particular by using Laser stimulus measurements for the UV bands and the Slit Function Stimulus (SFS) measurements for the UVIS and NIR bands over the Earth port.

The TROPOMI ISRF Calibration Key Data v1.0.0 are delivered in two variants, unbinned and binned. Please refer to the section below for details on the two variants.

The TROPOMI ISRF Calibration Key Data v1.0.0 have been generated using the following processors:

- L01b processor version: **trop_nightly_15107_20160220_1755**
- Calibration processing framework repository version: **9811**

For questions, support or remarks concerning this product please contact KNMI by sending an email to info@tropomi.eu

2 Changes with respect to issue v0.1.0

The ISRF v1.0.0 CKD includes a number of improvements with respect to the previous 0.1.0 release:

- Improved filtering of bad ISRF fits and shapes: several additional checks were introduced to prevent bad parameterizations from influencing the generated key data
- Improved alignment of ISRF CKD and stray light CKD: the ISRF CKD v1.0.0 has been derived such that the edge values of each ISRF are 0. This ensures that the ISRF CKD does not introduce stray light outside the range UV: [-0.5 nm, 0.5 nm], UVIS: [-1.2 nm, 1,2 nm], and NIR: [-0.6 nm, 0.6 nm]

- Improvement of the ISRF accuracy by improved ISRF parameterization functions: the so-called lack-of-fit of the ISRF parameterization functions was reduced from 1-2% in v0.1.0 to 0.5-1% for v1.0.0, leading to an improved accuracy.
- Correction of the ISRF with respect to the SFS line shape for the NIR detector: the spectral line shape of spectral lines produced by the SFS was expected to significantly affect the ISRF shape. After improving the validation analysis, and by comparing obtained ISRFs to ISRFs obtained by the PtCrNeAr spectral line source it was found that a correction of the ISRF for the SFS line shape was indeed necessary. The v1.0.0 CKD have been generated by fitting the convolution of ISRF and SFS line shape to the data.
- Additional smoothing of the ISRF over detector rows and columns. The v0.1.0 CKD were delivered without smoothing, leading to undesired high-frequent row-to-row variations in ISRF shape. The v1.0.0 CKD generation includes a smoothing step that improves continuity of the ISRF over in particular rows.
- Exclusion of ISRF CKD for SWIR: The ISRF CKD for SWIR are not in this delivery, and will be shipped in a separate package.

3 Package contents and installation

The package contains the following items:

- Unbinned Calibration Key Data: The unbinned ISRF Calibration Key Data consist of 6 individual netCDF v4 files, each corresponding to one of the 6 UVN bands. After unpacking, each of the files has a size of about 1.6 GBytes:

  S5P_OPER_AUX_L1ISRF_20160229T220112_unbinned_band1.nc: the 512 lower-wavelength columns of the UV detector (~270-300 nm)
  S5P_OPER_AUX_L1ISRF_20160229T220112_unbinned_band2.nc: the 512 higher-wavelength columns of the UV detector (~300-330 nm)
  S5P_OPER_AUX_L1ISRF_20160229T220112_unbinned_band3.nc: the 512 lower-wavelength columns of the UVIS detector (~300-400 nm)
  S5P_OPER_AUX_L1ISRF_20160229T220112_unbinned_band4.nc: the 512 higher-wavelength columns of the UVIS detector (~400-500 nm)
  S5P_OPER_AUX_L1ISRF_20160229T220112_unbinned_band5.nc: the 512 lower-wavelength columns of the NIR detector (~650-720 nm)
  S5P_OPER_AUX_L1ISRF_20160229T220112_unbinned_band6.nc: the 512 higher-wavelength columns of the NIR detector (~720-780 nm)
- Binned Calibration Key Data: The binned ISRF Calibration Key Data consist of a single netCDF v4 file
  S5P_OPER_AUX_ISRF___00000000T000000_99999999T999999_20160229T220112.nc
  that is 121 Mbytes after unpacking.

File checksums (MD5sum):

```
eb027dc10eb1252ccdb18f3c78b3ec32  S5P_OPER_AUX_L1ISRF_20160229T220112_binned.nc
63745dbc3a77dd6807e3acb54ae6b92a  S5P_OPER_AUX_L1ISRF_20160229T220112_unbinned_band1.nc
f3f715062b5cce0081752251787e8e4d  S5P_OPER_AUX_L1ISRF_20160229T220112_unbinned_band2.nc
290e507724c89054f5a2d53e3f041557  S5P_OPER_AUX_L1ISRF_20160229T220112_unbinned_band3.nc
406055ffa9ec358a5579be77def873bb  S5P_OPER_AUX_L1ISRF_20160229T220112_unbinned_band4.nc
818c9ef9e7eaa5fb59e53bc21488bcec  S5P_OPER_AUX_L1ISRF_20160229T220112_unbinned_band5.nc
29280b20b05d253b5ef48b43a4fe421a  S5P_OPER_AUX_L1ISRF_20160229T220112_unbinned_band6.nc
```

4 Processing of unbinned ISRF CKD into binned ISRF CKD

The Binned ISRF CKD has been derived from the unbinned ISRF CKD using an in-flight binning scheme that has meanwhile been fixed (2016-03-01): This binning scheme has the name ‘NOMOPS BF2bd2-6’, and has binning factor 2 in nadir for all bands except band 1 where the binning is 16 in nadir.

Each ISRF dataset group for bands 1 to 6 contains a 'measurement_to_detector_row_table' variable that links each binned row to a set of (possibly one) unbinned rows. In this variable the 'detector_start_row' indicates the index (0-based) of the first unbinned row contributing to the binned result; the 'detector_stop_row' indicates the unbinned row after the last row that should be included (so it is "up to but not including"). This is done as a convenience for programming, as python and many other programming languages can directly use indices with this definition to select the desired rows from the unbinned table. The table below gives the sampling interval of the ISRF, the ranges and the number of points for each of the TROPOMI bands.

Band	Sampling [nm]	Range [nm]	Number of points	Number of rows in NOMOPS BF2bd2-6
1	0.00390625	-0.5 - 0.5	257	77
2	0.00390625	-0.5 - 0.5	257	448
3	0.0093750954	-1.2 - 1.2	257	450
4	0.0093750954	-1.2 - 1.2	257	450
5	0.0046875477	-0.6 - 0.6	257	448
6	0.0046875477	-0.6 - 0.6	257	448

For each band the following processing steps have been performed to translate the unbinned ISRF CKD into the binned ISRF CKD:

1. For each binned row the unbinned rows are read from the input file. The indices of the unbinned pixels are taken from the measurement to detector row table.
2. For each column (wavelength dimension), the wavelengths of the contributing pixels are averaged.
3. For each column the ISRF is created.
    a. A destination grid is created (absolute wavelength grid, using the (fixed) relative offset with respect to the averaged wavelengths from step 2).
    b. Using spline interpolation, the contributing slit functions are calculated on the destination grid.
    c. The slit functions are added together.
    d. The resulting slit function is normalized by Romberg integration. The number of points on the destination grid is is selected to enable this. Romberg integration requires 2n+1 points, and 257 was chosen for bands 1-6.
4. The constructed slit function is stored in the intermediate file.
5. For each central wavelength in the destination grid the a slit function is constructed
6. For each of the 257 offsets a mean is taken over 16 points in the (absolute) wavelength dimension in the constructed slit function from step b. This reduces errors.
7. The smoothed slit functions are stored in the final output file.

5 Limitations

A number of remarks on limitations for use are given before explaining the organization and usage of the ISRF data:

1. ISRFs have been reported both for all detector pixels that are in the illumination area of the detector (all columns, and typically detector rows ~80 to ~940). Not all pixels inside the illumination area have been illuminated by the Slit Function Stimulus during the earth port calibration measurements. The unbinned ISRF CKD for a specific pixel has been calculated as a weighted average of all ISRFs within a rectangular detector range around the pixel with the following properties:
    a. UV key data (Laser): 101 rows, 21 columns
    b. UVIS key data (SFS): 241 rows, 21 columns
    c. NIR key data (SFS): 241 rows, 21 columns

    Weighting has been applied using a weighting function that decreases linearly from 1 at the center of the rectangular detector range, and 0 at the edges.

2. The reported ISRFs have a limited accuracy that is typically within 0.5-1% of peak value, mainly caused by lack-of-fit of the functions used to parameterize the actual ISRF shape. The data have been parameterized using an advanced double-sigmoid function for the UV and NIR detectors, and an exponential function that includes several negative polynomial terms up to order 6 for UVIS. Validation results using the other spectral line sources (HgCd and PtCrNeAr light sources) show agreement in line shape of typically 0 – 2.5% for UV, 0-2% of UVIS, and 0-2.5% for NIR.
3. Detector response in band 3 for columns below 100 (wavelengths below 310 nm) is low, which affects the ISRF quality.
4. All ISRF error values have been set as variances. The variances represent the combination of systematic errors such as lack of fit, and random errors such as noise
5. The errors that are available in the unbinned ISRF files are not used in the procedure described above.
6. The input file contains fill values for the last binned rows in bands 5 and 6 (binned row 447, corresponding to unbinned row 937). For this row the ISRF from binned row 446 has been used.

6 Usage

6.1 Unbinned data

Each of the unbinned ISRF netCDF4 products has the same structure (refer to the end of this section for a ncdump). The actual ISRF data is given per detector pixel as a compound data record with ‘value’ and ‘error’ fields, and describes the relative response of the pixel with respect to the wavelength under spatially homogeneous illumination conditions. The reported wavelength scale of the ISRF does not represent the absolute wavelength of the incident light, but rather the difference between the wavelength of the incident light and the pixel’s nominal wavelength.

The ISRF is described in the netCDF4 file as a netCDF4 variable inside a netCDF4 group “BANDX” with X the band number (1-6). Its contents consist of a three dimensional look-up table for piecewise linear interpolation with dimensions:

number_of_rows x number_of_columns x number_of_points_in_the_wavelength_grid

The array has 1025 row elements, where row 0 indicates the Read-out-register and rows 1-1024 the actual CCD rows. The 512 column elements refer to the 512 columns in a band. The relative wavelength of each wavelength point can be looked up using the isrf_wavelength_grid netCDF4 variable in the same netCDF4-group. Currently the wavelength grid is set from -0.6 to +0.6 nm in 0.005 nm step increments for UV and NIR, and from -1.2 to 1.2 nm in 0.01 nm step increments for UVIS . As mentioned, each element of the array is a compound data record with a ‘value’ field and a ‘error’ field that contain double precision values. Hence the total size of a netCDF file is about 1025 x 512 x 201 x 2 x 8 bytes, i.e. approximately 1.6 GBytes.

Data have been normalized such that SUM(ISRF*wavelength_grid_step) on the wavelength grid equals 1 (with wavelength expressed in nm).

Example for use (using python v2.7.3 on Linux):

```
>>> from netCDF4 import Dataset
>>> dataset=Dataset('S5P_OPER_AUX_L1ISRF_20160229T220112_unbinned_band1.nc')
>>> wavelength_grid=dataset.groups['BAND1'].variables['isrf_wavelength_grid'][:]
>>> print(wavelength_grid)
>>> isrf_example=dataset.groups['BAND1'].variables['isrf'][:]['value'][500,500,:]
>>> print(isrf_example)
```

6.2 Binned data

The binned ISRF CKD have been organized into a single netCDF4 product that contains 6 netCDF4 groups, one for each band, and named 'band_x' with x the band number.

```
>>> from netCDF4 import Dataset
>>> dataset=Dataset('S5P_OPER_AUX_L1ISRF_20160229T220112_binned.nc')
>>> wavelength_grid=dataset.groups['band_1'].variables['delta_wavelength'][:]
>>> print(wavelength_grid)
>>> isrf_example=dataset.groups['band_1'].variables['isrf'][20,20,:]
>>> print(isrf_example)
```

7 File structure

7.1 Unbinned data

The structure of the unbinned ISRF netCDF4 products is as follows (using ncdump –h and band 1 as example):

```
netcdf S5P_OPER_AUX_L1ISRF_20160229T220112_unbinned_band1 {
types:
  compound datapoint {
    double value ;
    double error ;
  }; // datapoint

group: BAND1 {
  dimensions:
        row = 1025 ;
        column = 512 ;
        delta_wavelength = 201 ;
  variables:
        datapoint isrf(row, column, delta_wavelength) ;
                datapoint       isrf:_FillValue       =       {9.96920996838687e+36,
9.96920996838687e+36} ;
                isrf:units = "nm-1" ;
        double isrf_wavelength_grid(delta_wavelength) ;
                isrf_wavelength_grid:units = "nm" ;

  // group attributes:
                :svn_revision = "9806" ;
  } // group BAND1
}
```

7.2 Binned data

The structure of the binned ISRF netCDF product is as follows (using ncdump –h):

```
netcdf S5P_OPER_AUX_L1ISRF_20160229T220112_binned {
types:
  compound msmt_to_det_row_table_type {
    short detector_start_row ;
    short detector_end_row ;
  }; // msmt_to_det_row_table_type
dimensions:
        time = 1 ;
        scanline = 1 ;
variables:
        double time(time) ;
        int scanline(scanline) ;

// global attributes:
                :institution = "KNMI" ;
```

```
                :validity_start = "00000000T000000" ;
                :validity_stop = "99999999T999999" ;
                :creation_date = "20160229T220113" ;
                :dataset_name = "S5P_AUX_ISRF__" ;
                :version = "9811" ;

group: band_1 {
  dimensions:
        ground_pixel = 77 ;
        central_wavelength = 24 ;
        delta_wavelength = 257 ;
  variables:
        int ground_pixel(ground_pixel) ;
                ground_pixel:comment = "Binned ground_pixel index, length taken
from binning table" ;
                ground_pixel:units = "1" ;
        float central_wavelength(central_wavelength) ;
                central_wavelength:comment = "Central wavelength" ;
                central_wavelength:standard_name = "radiation_wavelength" ;
                central_wavelength:units = "nm" ;
        float delta_wavelength(delta_wavelength) ;
                delta_wavelength:comment = "number of points on the ISRF." ;
                delta_wavelength:long_name = "wavelength offset for instrument
spectral response function, lambda(stimulus) - lambda(pixel)" ;
                delta_wavelength:units = "nm" ;
        float isrf(ground_pixel, central_wavelength, delta_wavelength) ;
                isrf:long_name = "instrument spectral response function" ;
                isrf:units = "1/nm" ;
        msmt_to_det_row_table_type          measurement_to_detector_row_table(time,
scanline, ground_pixel) ;

  // group attributes:
                :wavelength_range = 265.848165249316, 299.77426083621 ;
                :svn_revision = "9811" ;
                :source                                                         =
"/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf
_uvn/isrf.band1.ckd.nc,
/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf_
uvn/isrf.band2.ckd.nc,
/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf_
uvn/isrf.band3.ckd.nc,
/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf_
uvn/isrf.band4.ckd.nc,
/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf_
uvn/isrf.band5.ckd.nc,
/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf_
uvn/isrf.band6.ckd.nc" ;
                :binning_scheme = "NOMOPS BF2bd2-6" ;
  } // group band_1

group: band_2 {
  dimensions:
        ground_pixel = 448 ;
        central_wavelength = 24 ;
        delta_wavelength = 257 ;
  variables:
        int ground_pixel(ground_pixel) ;
                ground_pixel:comment = "Binned ground_pixel index, length taken
from binning table" ;
                ground_pixel:units = "1" ;
        float central_wavelength(central_wavelength) ;
                central_wavelength:comment = "Central wavelength" ;
                central_wavelength:standard_name = "radiation_wavelength" ;
                central_wavelength:units = "nm" ;
        float delta_wavelength(delta_wavelength) ;
```

```
                delta_wavelength:comment = "number of points on the ISRF." ;
                delta_wavelength:long_name = "wavelength offset for instrument
spectral response function, lambda(stimulus) - lambda(pixel)" ;
                delta_wavelength:units = "nm" ;
        float isrf(ground_pixel, central_wavelength, delta_wavelength) ;
                isrf:long_name = "instrument spectral response function" ;
                isrf:units = "1/nm" ;
        msmt_to_det_row_table_type          measurement_to_detector_row_table(time,
scanline, ground_pixel) ;

  // group attributes:
                :wavelength_range = 299.119034776608, 333.042908969697 ;
                :svn_revision = "9811" ;
                :source                                                          =
"/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf
_uvn/isrf.band1.ckd.nc,
/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf_
uvn/isrf.band2.ckd.nc,
/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf_
uvn/isrf.band3.ckd.nc,
/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf_
uvn/isrf.band4.ckd.nc,
/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf_
uvn/isrf.band5.ckd.nc,
/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf_
uvn/isrf.band6.ckd.nc" ;
                :binning_scheme = "NOMOPS BF2bd2-6" ;
  } // group band_2

group: band_3 {
  dimensions:
        ground_pixel = 450 ;
        central_wavelength = 68 ;
        delta_wavelength = 257 ;
  variables:
        int ground_pixel(ground_pixel) ;
                ground_pixel:comment = "Binned ground_pixel index, length taken
from binning table" ;
                ground_pixel:units = "1" ;
        float central_wavelength(central_wavelength) ;
                central_wavelength:comment = "Central wavelength" ;
                central_wavelength:standard_name = "radiation_wavelength" ;
                central_wavelength:units = "nm" ;
        float delta_wavelength(delta_wavelength) ;
                delta_wavelength:comment = "number of points on the ISRF." ;
                delta_wavelength:long_name = "wavelength offset for instrument
spectral response function, lambda(stimulus) - lambda(pixel)" ;
                delta_wavelength:units = "nm" ;
        float isrf(ground_pixel, central_wavelength, delta_wavelength) ;
                isrf:long_name = "instrument spectral response function" ;
                isrf:units = "1/nm" ;
        msmt_to_det_row_table_type          measurement_to_detector_row_table(time,
scanline, ground_pixel) ;

  // group attributes:
                :wavelength_range = 299.643828540358, 400.09542458197 ;
                :svn_revision = "9811" ;
```

```
                :source                                                 =
"/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf
_uvn/isrf.band1.ckd.nc,
/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf_
uvn/isrf.band2.ckd.nc,
/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf_
uvn/isrf.band3.ckd.nc,
/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf_
uvn/isrf.band4.ckd.nc,
/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf_
uvn/isrf.band5.ckd.nc,
/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf_
uvn/isrf.band6.ckd.nc" ;
                :binning_scheme = "NOMOPS BF2bd2-6" ;
  } // group band_3

group: band_4 {
  dimensions:
        ground_pixel = 450 ;
        central_wavelength = 71 ;
        delta_wavelength = 257 ;
  variables:
        int ground_pixel(ground_pixel) ;
                ground_pixel:comment = "Binned ground_pixel index, length taken
from binning table" ;
                ground_pixel:units = "1" ;
        float central_wavelength(central_wavelength) ;
                central_wavelength:comment = "Central wavelength" ;
                central_wavelength:standard_name = "radiation_wavelength" ;
                central_wavelength:units = "nm" ;
        float delta_wavelength(delta_wavelength) ;
                delta_wavelength:comment = "number of points on the ISRF." ;
                delta_wavelength:long_name = "wavelength offset for instrument
spectral response function, lambda(stimulus) - lambda(pixel)" ;
                delta_wavelength:units = "nm" ;
        float isrf(ground_pixel, central_wavelength, delta_wavelength) ;
                isrf:long_name = "instrument spectral response function" ;
                isrf:units = "1/nm" ;
        msmt_to_det_row_table_type          measurement_to_detector_row_table(time,
scanline, ground_pixel) ;

  // group attributes:
                :wavelength_range = 397.799414890634, 501.611681279163 ;
                :svn_revision = "9811" ;
                :source                                                 =
"/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf
_uvn/isrf.band1.ckd.nc,
/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf_
uvn/isrf.band2.ckd.nc,
/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf_
uvn/isrf.band3.ckd.nc,
/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf_
uvn/isrf.band4.ckd.nc,
/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf_
uvn/isrf.band5.ckd.nc,
/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf_
uvn/isrf.band6.ckd.nc" ;
                :binning_scheme = "NOMOPS BF2bd2-6" ;
  } // group band_4

group: band_5 {
  dimensions:
        ground_pixel = 448 ;
        central_wavelength = 47 ;
        delta_wavelength = 257 ;
```

```
  variables:
        int ground_pixel(ground_pixel) ;
                ground_pixel:comment = "Binned ground_pixel index, length taken
from binning table" ;
                ground_pixel:units = "1" ;
        float central_wavelength(central_wavelength) ;
                central_wavelength:comment = "Central wavelength" ;
                central_wavelength:standard_name = "radiation_wavelength" ;
                central_wavelength:units = "nm" ;
        float delta_wavelength(delta_wavelength) ;
                delta_wavelength:comment = "number of points on the ISRF." ;
                delta_wavelength:long_name = "wavelength offset for instrument
spectral response function, lambda(stimulus) - lambda(pixel)" ;
                delta_wavelength:units = "nm" ;
        float isrf(ground_pixel, central_wavelength, delta_wavelength) ;
                isrf:long_name = "instrument spectral response function" ;
                isrf:units = "1/nm" ;
        msmt_to_det_row_table_type          measurement_to_detector_row_table(time,
scanline, ground_pixel) ;

  // group attributes:
                :wavelength_range = 656.433382775662, 724.506948808722 ;
                :svn_revision = "9811" ;
                :source                                                          =
"/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf
_uvn/isrf.band1.ckd.nc,
/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf_
uvn/isrf.band2.ckd.nc,
/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf_
uvn/isrf.band3.ckd.nc,
/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf_
uvn/isrf.band4.ckd.nc,
/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf_
uvn/isrf.band5.ckd.nc,
/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf_
uvn/isrf.band6.ckd.nc" ;
                :binning_scheme = "NOMOPS BF2bd2-6" ;
  } // group band_5

group: band_6 {
  dimensions:
        ground_pixel = 448 ;
        central_wavelength = 45 ;
        delta_wavelength = 257 ;
  variables:
        int ground_pixel(ground_pixel) ;
                ground_pixel:comment = "Binned ground_pixel index, length taken
from binning table" ;
                ground_pixel:units = "1" ;
        float central_wavelength(central_wavelength) ;
                central_wavelength:comment = "Central wavelength" ;
                central_wavelength:standard_name = "radiation_wavelength" ;
                central_wavelength:units = "nm" ;
        float delta_wavelength(delta_wavelength) ;
                delta_wavelength:comment = "number of points on the ISRF." ;
                delta_wavelength:long_name = "wavelength offset for instrument
spectral response function, lambda(stimulus) - lambda(pixel)" ;
                delta_wavelength:units = "nm" ;
        float isrf(ground_pixel, central_wavelength, delta_wavelength) ;
                isrf:long_name = "instrument spectral response function" ;
                isrf:units = "1/nm" ;
        msmt_to_det_row_table_type          measurement_to_detector_row_table(time,
scanline, ground_pixel) ;

  // group attributes:
```

```
                :wavelength_range = 721.726500124499, 787.208257776167 ;
                :svn_revision = "9811" ;
                :source                                                         =
"/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf
_uvn/isrf.band1.ckd.nc,
/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf_
uvn/isrf.band2.ckd.nc,
/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf_
uvn/isrf.band3.ckd.nc,
/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf_
uvn/isrf.band4.ckd.nc,
/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf_
uvn/isrf.band5.ckd.nc,
/data/storage02/trop_lx/shared/nightly_success_run12/trop/ckd/occ/ckd_release/isrf_
uvn/isrf.band6.ckd.nc" ;
                :binning_scheme = "NOMOPS BF2bd2-6" ;
  } // group band_6
}
```