Qsmr: definition of settings

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Version: 0.2

Date: 2016-09-09

Summary: This document contains a brief description of the settings considered by the Qsmr retrieval system. These settings are packed into a structure denoted as Q. This structure must contain an exact set of fields; all fields must be present and no additional ones are allowed. The defined fields are described below, in alphabetical order.

Qsmr operates also with two other structures. For the various pre-calculations a structure denoted as P is used. The fields of P are defined and are shortly described in the file p_std.m. The structure R works as repository for internal variables and data. That is, no fields of R is set by the user.

Most fields of Q are of simple types such scalar value, vector or string, but some fields are structures. This more complex type is only used for retrieval quantities, in order to allow simple communication with some functions copied from Qarts.

All fields listed affect the inversions, either in the pre-calculation phase or when doing the actual inversion. The settings are applied by various functions and if you are using individual functions of Qsmr you need to figure out what settings that have an effect or not. For example, the fields TB_SCALING_FAC and TB_CONTRAST_FAC are not applied directly when loading the data, but are applied on the L1B data by a special function.

ABSLOOKUP_OPTION

A string. This string gives the name of the sub-folder containing the absorption look-up table to use.

ABS_P_INTERP_ORDER

An integer. The polynomial order to apply for pressure interpolation of the absorption look-up table. See further the ARTS workspace variable with the same name.

ABS_SPECIES

An array of structures. Each array element provides settings for a gas species. The fields of the structure are as follows. TAG: Definition of the species following the ARTS format, e.g. O3-*-501e9-503e9. SOURCE: A string describing from where temperature a priori shall be taken. Handled options are 'WebApi' and 'Bdx'. RETRIEVE: A boolean, flagging if the species shall be retrieved or not. All fields below are ignored if RETRIEVE is false. L2: A boolean, flagging if the species is part of the L2 data of the frequency mode. GRID: Retrieval grid to use for the species. UNC_REL and UNC_ABS: Minimum relative and absolute uncertainty (1 std dev), respectively. The absolute and relative values are compared using the a priori profile and the largest of the two is selected (but not exceeding 1e3 in relative value). CORRLEN: Correlation length, in meter, to use when creating Sx. LOG_ON: Set to true to impose a positive constrain for the species.

Note that when creating L2 data the outermost points of GRID are removed.

ABS_T_INTERP_ORDER

An integer. The polynomial order to apply for temperature interpolation of the absorption look-up table. See further the ARTS workspace variable with the same name.

ARTS

A string. Name or path of the ARTS executable to use.

BACKEND_NR

An integer. Index of expected backend. Index coding described in L1B ATBD.

BASELINE

A structure. Definition of baseline off-set retrieval. The fields of the structure are as follows. RETRIEVE: A boolean, flagging if baseline off-set shall be retrieved or not. UNC: A priori uncertainty (1 std dev). MODEL: A string. If set to 'common' a single off-set is retrieved for each spectrum. If set to 'module' an off-set for each active AC module is retrieved, i.e. up to four off-set per spectrum are derived. If set to 'adaptive' then all modules contributing with more than 125 channels are grouped and a common off-set for these modules is retrieved, while separate off-sets are retrieved for remaining modules (<= 125 channels).

DZA_GRID_EDGES

A vector. Complements DZA_MAX_IN_CORE in the specification of the angular grid used for pencil beam calculations. The vector specifies the values to add outside the lower and upper boresight direction. These are relative angles (in degrees), where 0 shall not be included.

DZA_MAX_IN_CORE

A scalar value. Determines the maximum spacing (in degrees) of the angular grid used for pencil beam calculations. This value sets the spacing between the lower and upper boresight direction.

FOLDER_ABSLOOKUP

A string. Full path to folder containing the different versions of absorption look-up tables. That is, this folder is expected to contain folders. The exact folder specification is a result of this field and ABSLOOKUP_OPTION.

FOLDER_ANTENNA

A string. Full path to folder containing antenna pattern response files.

FOLDER_BACKEND

A string. Full path to folder containing backend channel response files.

FOLDER_BDX

A string. Full path to folder containing files of the Bordeaux a priori database. Files having .mat format are expected.

FOLDER_FGRID

A string. Full path to folder containing frequency grid files.

FOLDER_MSIS90

A string. Full path to folder holding the MSIS90 climatology (version taken from arts-xml-data). Only needed of temperature data taken from MSIS90, which is the case for some pre-calculations.

FOLDER_WORK

A string. Full path to a folder where temporary files and/or folders can be placed. If this field is set to '/tmp', a temporary folder is created and all files are placed in this folder, and the folder is removed when the calculations are done. Otherwise, temporary files are placed directly in the specified folder, and these are left when the calculations are done. This option is useful for debugging, but note that just a single Qsmr process can use a folder for debugging. If several Qsmr processes are given the same debugging folder, files will be overwritten and the calculations will crash or be incorrect.

FREQMODE

An integer. The frequency mode. See L1B ATBD for definition of existing frequency modes.

FREQUENCY

A structure. Definition of frequency off-set retrieval. The fields of the structure are as follows. RETRIEVE: A boolean, flagging if frequency off-set shall be retrieved or not. UNC: A priori uncertainty (1 std dev).

FRONTEND_NR

An integer. Index of expected frontend. Index coding described in L1B ATBD.

F_RANGES

A matrix, having two columns. This matrix specifies the frequency ranges to include in the retrieval, where the first and second column give the lower and upper frequency limit, respectively. Each row specifies a new frequency range to include.

F_GRID_NFILL

An integer. If set to > 0, the sensor response matrix will include a cubic frequency interpolation of the spectra, with F_GRID_NFILL points added between existing grid points. See further the ARTS workspace method sensor_responseFillFgrid. If set to 0, no such interpolation is made.

F_LO_NOMINAL

A scalar value. Nominal value of the LO frequency.

GA_FACTOR_NOT_OK

A scalar value. The factor with which the Marquardt-Levenberg factor is increased when not a lower cost value is obtained. This starts a new sub-iteration. This value must be > 1.

GA_FACTOR_OK

A scalar value. The factor with which the Marquardt-Levenberg factor is decreased after a lower cost values has been reached. This value must be > 1.

GA_MAX

A scalar value. Maximum value for gamma factor for the Marquardt-Levenberg method. The inversion is halted and flagged as unsuccessful if this value is reached. This value must be > 0.

GA_START

A scalar value. Start value for gamma factor for the Marquardt-Levenberg method. See the L2 ATBD for a definition of the gamma factor. This value must be >= 0.

INVEMODE

A string. A short string naming the inversion set-up used.

LO_COMMON

A boolean. If true, the initial value of LO frequencies are set to be constant over the scan. This value is set following LO_ZREF. If false, the L1B value for each altitude is used.

LO_ZREF

A scalar value. Reference altitude for LO frequency. When performing frequency cropping, frequencies are taken from the spectra with the closest altitude. Further, if LO_COMMON is set to true, the LO frequency is taken from the L1B data of the spectrum closest to this altitude.

MIN_N_FREQS

A scalar value. The required number of frequencies (i.e. channels) of spectra to start an inversion. This number refers to the number of spectra after frequency cropping and quality filtering.

MIN_N_SPECTRA

A scalar value. The required number of spectra of a scan to start an inversion. This number refers to the number of spectra after altitude cropping and quality filtering.

NOISE_CORRMODEL

A string. Model of correlations inside Se. Only correlation between adjacent channels of each spectrum is modelled. The options are as follows. 'none': this generates a pure diagonal Se. 'empi': Uses empirically derived values making Se a five-diagonal matrix. 'expo': Exponentially decreasing correlation, approximating the empirically derived values.

POINTING

A structure. Definition of pointing off-set retrieval. The fields of the structure are as follows. RETRIEVE: A boolean, flagging if pointing off-set shall be retrieved or not. UNC: A priori uncertainty (1 std dev).

PPATH_LMAX

A scalar value. The maximum distance between points of the propagation path. See further the ARTS workspace variable with the same name.

PPATH_LRAYTRACE

A scalar value. The length to apply for ray tracing to consider the effect of refraction. See further the ARTS workspace variable with the same name.

P_GRID

A vector. The pressure grid to be used. See further the ARTS workspace variable with the same name. Note that this setting is also used when pre-calculating absorption lookup tables.

QFILT_LAG0MAX

A logical. Sets the maximum allowed value of ZeroLagVar. This quality filtering operates on AC sub-bands.

QFILT_MOON

A logical. Determines if data shall be filtered based on the MOON quality flag. This quality filtering operates on tangent altitudes.

QFILT_NOISE

A logical. Determines if data shall be filtered based on the NOISE quality flag. This quality filtering operates on tangent altitudes.

QFILT_REF1

A logical. Determines if data shall be filtered based on the REF1 quality flag. This quality filtering operates on tangent altitudes.

QFILT_REF2

A logical. Determines if data shall be filtered based on the REF2 quality flag. This quality filtering operates on tangent altitudes.

QFILT_SCANNING

A logical. Determines if data shall be filtered based on the SCANNING quality flag. This quality filtering operates on tangent altitudes.

QFILT_SPECTRA

A logical. Determines if data shall be filtered based on the SPECTRA quality flag. This quality filtering operates on tangent altitudes.

QFILT_TBRANGE

A logical. Determines if data shall be filtered based on the TB range quality flag. This quality filtering operates on tangent altitudes.

QFILT_TINT

A logical. Determines if data shall be filtered based on the TINT quality flag. This quality filtering operates on tangent altitudes.

QFILT_TREC

A logical. Determines if data shall be filtered based on the TREC quality flag. This quality filtering operates on tangent altitudes.

QFILT_TSPILL

A logical. Determines if data shall be filtered based on the TSPILL quality flag. This quality filtering operates on tangent altitudes.

SIDEBAND_LEAKAGE

A scalar. Relative contribution of the sideband. So far the sideband leakage is assumed to be flat over each frequency band.

STOP_DX

OEM stop criterion. The iteration is halted when the change in x is < stop_dx. Eq. 5.29 in the book by Rodgers is followed, but a normalisation with the length of x is applied. This means that STOP_DX should in general be in the order of 0.01 (and not change with the length of the state vector).

REFRACTION_DO

A boolean. Determines if refraction is considered or not by the forward model. Set to true to include refraction.

T

A structure. Definition of atmospheric temperature profile. The fields of the structure are as follows. SOURCE: A string describing from where temperature a priori shall be taken. Handled options are 'WebApi' and 'MSIS90'. RETRIEVE: A boolean, flagging if temperature shall be retrieved or not. All fields below are ignored if RETRIEVE is false. L2: A boolean, flagging if temperature is part of L2 data of the frequency mode. GRID: Retrieval grid to use for temperature. UNC: A vector of length 5, with a priori uncertainty (1 std dev) at 100, 10, 1, 0.1 and 0.01 hPa (roughly 16, 32, 48, 64 and 80 km). CORRLEN: Correlation length, in meter, to use when creating Sx.

TB_CONTRAST_FAC

A scalar value. This factor modifies the contrast of each spectrum part. If this factor is denoted as c, the scaling is: Tb_new = c * (Tb -Tb_min) + Tb_min, where Tb_min as an estimate of the noise-free minimum value of each spectrum part. This scaling is applied after TB_SCALING_FAC. This contrast scaling is applied on each AC module separately. That is, the complete spectrum is divided into four individual parts when performing this scaling. To leave the data unchanged, set this field to [] or 1.

TB_SCALING_FAC

A scalar value. The L1B brightness temperature data are scaled with this factor. If this factor is denoted as c, the scaling is Tb_new = c * Tb. For example setting this field to 1.005 will convert an original Tb-value of 200 K to 201 K. To leave the data unchanged, set this field to [] or 1.

ZTAN_LIMIT_BOT

A vector of length 4. The lower limit for tangent altitudes to include in the inversion. That is, this setting determines the lower limit when cropping the scan range. The four values give the tangent altitude limit at 0, +-30, +-60 and +-90 degrees in latitude. That is, the tangent altitude mask is assumed to be symmetric around the equator.

ZTAN_LIMIT_TOP

A scalar value. The upper limit for tangent altitudes to include in the inversion. That is, this setting determines the upper limit when cropping the scan range.

ZTAN_MIN_RANGE

A vector of length two. This field specifies the minimum altitude coverage of a scan to start an inversion. The order between lower and upper limit is free. The scan must have at least one tangent altude below and above the given limits. This check is done after applying ZTAN_LIMIT_BOT/TOP.