RAL IMS retrieval of SO2 and sulphates

Description of the product

The RAL (Rutherford Appleton Laboratory) Infrared/Microwave Sounder (IMS) retrieval core scheme (Siddans, 2019) uses an optimal estimation spectral fitting procedure to retrieve atmospheric and surface parameters jointly from co-located measurements by IASI (Infrared Atmospheric Sounding Interferometer), AMSU (Advanced Microwave Sounding Unit) and MHS(Microwave Humidity Sounder) on MetOp-B spacecraft, using RTTOV 12 (Radiative Transfer for TOVS)(Saunders et al., 2017) as the forward radiative transfer model. The use of RTTOV 12 enables the quantitative retrieval of volcanic-specific aerosols (sulphate aerosol) and trace gases (SO2). The present dataset includes IMS SO2 and sulphate aerosols retrievals from its near-real time implementation. The IMS scheme retrieves the SO2 in the sensitive region around 1100-1200 cm^{-1}, in ppbv assuming a uniform vertical mixing ratio. It retrieves sulphate-specific AOD (Aerosol Optical Depth) at 1170 cm^{-1} (i.e. the peak of the mid-infrared extinction cross section (Sellitto and Legras, 2016)), assuming a Gaussian extinction coefficient profile shape peaking at 20 km altitude, with 2 km full-width half-maximum. The bulk of the spectroscopic information on SO2 and sulphate aerosols, in the IMS scheme, thus comes from the IASI Fourier transform spectrometer (Clerbaux et al., 2009).
We refer to the two retrieved products as IMS SO2 and IMS SA OD.

References

Clerbaux, C., Boynard, A., Clarisse, L., George, M., Hadji-Lazaro, J., Herbin, H., Hurtmans, D., Pommier, M., Razavi, A., Turquety, S., Wespes, C., and Coheur, P.-F.: Monitoring of atmospheric composition using the thermal infrared IASI/MetOp sounder, Atmospheric Chemistry and Physics, 9, 6041–6054, https://doi.org/10.5194/acp-9-6041-2009, 2009.

Saunders, R., Hocking, J., Rundle, D., Rayer, P., Hayemann, S., Matricardi, A., Lupu, C., Brunel, P., and Vidot, J.: RTTOV-12 SCIENCE AND VALIDATION REPORT; Version : 1.0, Doc ID : NWPSAF-MO-TV-41, https://nwp-saf.eumetsat.int/site/download/documentation/rtm/docs_rttov12/rttov12_svr.pdf, 2017.

Sellitto, P. and Legras, B.: Sensitivity of thermal infrared nadir instruments to the chemical and microphysical properties of UTLS secondary sulfate aerosols, Atmospheric Measurement Techniques, 9, 115–132, https://doi.org/10.5194/amt-9-115-2016, 2016.

Siddans, R.: Water Vapour Climate Change Initiative (WV-CCI) - Phase One, Deliverable 2.2; Version 1.0, https://climate.esa.int/documents/1337/Water_Vapour_CCI_D2.2_ATBD_Part2-IMS_L2_product_v1.0.pdf, 2019.

Description of the data

The archive IMS-2022.tgz contains level 3 daily gridded files for the two retrieved products IMS SO2 and IMS SA OD in the period 13 January to 30 April 2022. A few days are missing between 9 March and 13 March. The first 8 letters of the name of each file contain the date. There are 4 files per day as the two products are in separate files and there is a file collecting day-time orbits and another one for night-time orbits every day.

For the 28 April 2022, the four files are

```
20220428_ims_metopb_tir_qnrt_aot0_day_global_g0.5_qc0.nc          SA OD day-time orbits
```

```
20220428_ims_metopb_tir_qnrt_aot0_night_global_g0.5_qc0.nc       SA OD night-time orbits
20220428_ims_metopb_tir_qnrt_so2_day_global_g0.5_qc0.nc          SO2 day-time orbits
20220428_ims_metopb_tir_qnrt_so2_night_global_g0.5_qc0.nc        SO2 night-time orbits
```

The names for other dates can be derived by changing the first 8 letters.

The format is netdcf4 that is readable with many programming languages and graphics packages. The data are on a [-90,90] x [-180,180] lat x lon grid with resolution 0.25°, that is a 720 x 1440 array of centered values.
For both SO2 and SA OD, the values are in the ‘data’ variable. The variable ‘qa_value’ is a quality control value used to screen values for plotting; 0 means do not plot; -1 means mask is not defined so the mask is not used (data will be plotted).
SO2 units are ppbv (assuming a uniform mixing ratio vertical profile). SA OD is an optical depth with no unit.

Reading software

A python package to read and process the data is available at https://github.com/bernard-legras/ASTuS/tree/master/IMS
and in the IMS-reader.tgz archive