

IRSPP version 1.2 – Release Note

01 February 2023

1. Introduction

The Infrared Sounder Pre-processor (IRSPP) is a software package designed to process hyperspectral sounder data from the IRS instrument on the MTG-S1 and MTG-S2 satellites. The package is designed primarily for applications in numerical weather prediction (NWP). The first version (v1.0) was released in March 2022.

IRSPP version 1.2 is an updated release, compatible with the pre-launch simulated test data released by EUMETSAT in November 2022, see <https://www.eumetsat.int/new-release-irs-test-data>. (This replaces an earlier set of test data from July 2022).

2. Changes in IRSPP v1.2

2.1 Overview

There are two main changes in IRSPP v1.2:

- To process the latest EUMETSAT test data. There has been a change to the format of the test data files, with top level string attributes now being held in variable length strings, which need to be read with the HDF5 API rather than the netCDF API.
- A new thinning option has been added, which is to select the warmest field of view in a box of a specified size. See section 2.2 for details.

A detailed list of changes is shown in Table 1.

Table 1: Changes in IRSPP v1.2

Changed file	Purpose of change
install_dependencies.sh	ecCodes latest release 2.27.1 (optional – earlier releases will still work)
src/bin/irs_main.f90	Use HDF5 reader if top-level attributes are variable length strings.
src/bin/irs_sss_filtering.f90	Use HDF5 reader if top-level attributes are variable length strings.
src/libirs/irs_data_mod.f90	New variables
src/libirs/Makefile	New subroutines <code>irs_read_irsattr_hdf5.o</code> , <code>irs_warmestfov.o</code>
src/libirs/irs_write_buf.f90	Bug fix in imager radiance mean/sd computation. Support warmest FOV thinning
src/libirs/irs_compute_rr.f90	Support warmest FOV thinning
src/libirs/irs_warmestfov.f90	Support warmest FOV thinning
src/libirs/irs_read_irsdata.f90	Check whether attributes are fixed length strings and exit if not
src/libirs/irs_read_irsattr_hdf5.f90	HDF5 reader for variable length string attributes

2.2 Thinning options

Thinning is controlled via the top-level namelist. The existing variable names, which may be used to generate a regular grid within the dwell of 160x160 fields of view, are:

- firstcolumn, columnstep
- firstrow, rowstep

For IRSP v1.2, a warmest field of view (FOV) option has been added, with additional namelist variables:

- `test_channel` – long-wave channel number used to define warmest radiance (default: 0, i.e. option turned off). It is suggested to set `test_channel=408` (approximately 10.8 μ m wavelength).
- `delta_column` – column increment defining a test box centred on the nominal FOVs (default: 0)
- `delta_row` – row increment defining a test box centred on the nominal FOVs (default: 0)

If row/column thinning is applied, the result is a grid of boxes, each with `columnstep` x `rowstep` samples. From each gridbox, only one FOV is selected: the warmest FOV from the central test box.

In this way, it is possible to avoid selection of two neighbouring FOVs, which may be undesirable since the instrument point spread function is significantly larger than the FOV spacing of 4km at the sub-satellite point (SSP).

Examples:

- `firstcolumn=3`, `columnstep=5`, `delta_column=1`, `firstrow=3`, `rowstep=5`, `delta_row=1`. Here the gridbox is 20x20km at SSP (5*5 samples); the warmest FOV is chosen from the central square 12x12km (3*3 samples)
- `firstcolumn=4`, `columnstep=8`, `delta_column=2`, `firstrow=4`, `rowstep=8`, `delta_row=2`. Here the gridbox is 32x32km at SSP (8*8 samples); the warmest FOV is chosen from the central square 20x20km (5*5 samples)..
- `firstcolumn = 4`, `columnstep = 8`, `delta_column = 2`, `firstrow = 2`, `rowstep = 3`, `delta_row = 1`. Here the gridbox is 32x12km at SSP (8*3 samples); the warmest FOV is chosen from the central rectangle 20x12km (5*3 samples). This is a grid in which NS and EW spacings are more closely matched at high latitudes.

We anticipate that users could implement different thinning schemes depending on geographical region, i.e. based on dwell number.

We welcome feedback from users as to whether this provides useful functionality.

3. Reference documents

The IRSP documents are listed in Table 2. The IRSP User Manual has been updated to reflect the changes made in IRSP v1.2.

Table 2: IRSP documentation

Doc reference	Title	Version / year	Status
NWPSAF-MO-UD-053	IRSP User Manual	1.2 / 2022	Updated
NWPSAF-MO-DS-037	IRSP Product Specification	1.0 / 2018	Published
NWPSAF-MO-DS-037	IRSP Top Level Design	1.4 / 2022	Published

Note that the User Manual is the main document that users should refer to, as it includes details of how to install the software, how to run the software and the scientific principles.

The documents can be accessed from the NWP SAF web site at

<https://nwp-saf.eumetsat.int/site/software/irspp/>

4. Package files

The IRSPP package files are listed in Table 3.

Table 3: IRSPP v1.1 package files

File name	Size (bytes)	Purpose
Release_note_IRSPP_v1.2.pdf		This document
IRSPP_v1.2_source.tgz	36663	Source code
IRSPP_v1.2_exec.tgz	24223166	Executables and dynamic libraries (built on Red Hat 7.9) - OPTIONAL
IRSPP_v1.2_test_cases.tgz	528226782	Updated to use latest EUMETSAT PC score product for LAC4 and an SSS file. The previous test cases, exercising other parts of IRSPP, are still available and may be run if required.

Access to the IRSPP v1.2 code and executables is via the “software downloads” tab on the NWP SAF web site. User registration is required.

Users have the choice of building the package from source or using the supplied Red Hat 7.9 executables, if their system is compatible. See the User Manual for further information about compatibility.

The test cases are accessible from https://nwp-saf.eumetsat.int/downloads/irspp_testcases/

5. License

To use this software, users need to have agreed to the terms of the NWP SAF License Agreement. The License Agreement is displayed when a user is logged into the NWP SAF web site and chooses to change software preferences. It can also be viewed here:

<https://nwp-saf.eumetsat.int/site/software/licence-agreement/>.

6. System requirements

IRSPP has been tested on systems compatible with 64-bit CentOS7 and CentOS8. It would be expected to work on other Linux distributions, provided support for the dependency libraries exists. The dependency libraries include:

- ecCodes, distributed by ECMWF
- netCDF (Fortran and C interfaces)
- hdf5 (with Fortran enabled)
- LAPACK

For building IRSPP from source, a Fortran90 compiler is required. The recommended F90 compilers are gfortran and ifort.

The supplied test case scripts are based on Bash shell.

Standard Unix utilities (including gmake, ar, tar) are used.

There are no particular requirements on disk space (IRSPP takes up only about 300MB when built). But you will need space for the input and output IRS data files. The PC product occupies approximately 33MB per 10 second dwell. The instrument records 280 dwells per hour (see <https://www.eumetsat.int/mtg-infrared-sounder>), so throughput would be expected to be 220GB per day.

The test cases include a README file that gives typical run times on a system with 8 GB of memory and 4 processor cores. This could be considered a minimum configuration. IRSPP v1 does not include parallelisation within the Fortran code, but it is possible to improve throughput by processing several dwells simultaneously, provided the system has sufficient memory and cores.

7. Installing IRSPP

For instructions on installing IRSPP, please see sections 2 and 3 of the IRSPP User Manual. If you are building IRSPP from source, two scripts are supplied to assist the process:

- *install_dependencies.sh* – downloads the necessary dependency libraries and builds them
- *configure_irspp.sh* – prepares the necessary makefiles, ready for the user to run “make”

For details on using these scripts, see the User Manual.

8. Running the test cases

The test cases are documented in section 9 of the User Manual and are distributed as a single gzipped tar file.

The original test cases are based largely on a granule of simulated IRS data that was released by EUMETSAT in December 2019: see <https://www.eumetsat.int/mtg-test-data>.

The test case released with IRSPP v1.1 is based on full-disc simulated IRS data that was released by EUMETSAT in July 2022: see <https://www.eumetsat.int/new-mtg-s-irs-l1b-full-disc-test-dataset>.

The test case released with IRSPP v1.2 is based on full-disc simulated IRS data that was released by EUMETSAT in November 2022: see <https://www.eumetsat.int/new-release-irs-test-data>.

The availability of new test cases will be communicated to users via the IRSPP web page and NWP SAF news announcements.

9. Version control

Contents of the IRSPP_version.txt file released as part of IRSPP v1.2:

Last Changed Rev: 2055

Last Changed Date: 2023-01-16 11:19:14 +0000 (Mon, 16 Jan 2023)

This refers to the Subversion repository held at the Met Office.

10. User feedback

If you encounter a problem, or have suggestions for improvements, please use the NWP SAF Helpdesk, at <https://nwp-saf.eumetsat.int/site/help-desk/>.