# Radiance Simulator v1.1 Release Note

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This documentation was developed within the context of the EUMETSAT Satellite Application Facility on Numerical Weather Prediction (NWP SAF), under the Cooperation Agreement dated 29 June 2011, between EUMETSAT and the Met Office, UK, by one or more partners within the NWP SAF. The partners in the NWP SAF are the Met Office, ECMWF, KNMI and Météo France.

| Change record | | | |
| --- | --- | --- | --- |
| Version | Date | Author / changed by | Remarks |
| 0.1 | 24/09/2014 | A. Smith | Beta release |
| 0.2 | 17/10/2014 | A. Smith | Updated for DRI |
| 1.0 | 17/11/2014 | A. Smith | Version updated for release |
| 1.1 | 29/09/2015 | A. Smith | Version 1.1 release |
| 1.2 | 30/10/2015 | A. Smith | Added zenith angle option. |
| | | | |

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## 1. DOCUMENTATION

The following documents are relevant to this release. Full instructions on how to install the package are included in the User Guide and also in the `readme.txt` file which can be found in the top level of the package distribution file.

```
NWPSAF-MO-DS-027-RadSim_ProductSpec.pdf
NWPSAF-MO-DS-028-RadSim_TopLevelDesign.pdf
NWPSAF-MO-DS-033-RadSim_UserGuide.pdf
NWPSAF-MO-TV-036-RadSim_TestPlan.pdf
NWPSAF-MO-UD-034-RadSim_ReleaseNote.pdf
```

## 2. CHANGES FOR THIS RELEASE

Version 1.1 is a minor upgrade to version 1.0. The following lists contain details of the changes made between versions 1.0 and 1.1.

Enhancements:

- RTTOV coefficient files in HDF5 format can now be used instead of the ASCII '.dat' files. This is essential for simulating very new instruments as coefficient files will be generated only in HDF5 format in future.
- Met Office Fieldsfiles containing 32-bit values (standard files contain 64-bit values) can now be used. This can help save disk space. There is no discernible difference in accuracy when using these files.
- Simulations involving very large numbers of profiles and channels are automatically split into batches to reduce the memory overhead, avoiding the situation on some systems whereby the virtual memory limit was exceeded for heavily loaded runs.
- netCDF error handling has been improved so that all errors originating from writing to netCDF files are reported explicitly. This is mainly of use in testing and should not affect users in most cases.
- Interpolation of other input fields added (surface height and trace gas concentrations but note that trace gases are not used in simulations).
- Option to change default zenith angle for model grid runs.

Bug Fixes:

- Fixed assignment of half-level pressures in RTTOV profiles for models where the number of half-levels is greater than the number of levels. This caused runtime failures and therefore does not affect the results of completed runs.
- Fixed output of half-level pressures (applies only when write_profiles option is switched on). This was disabled in the previous version.
- Fixed incorrect netCDF storage data type for some floating point fields. Fields produced with version 1.0 can still be used however.
- Fixed problem with uninitialised pointers causing runs from Met Office Fieldsfiles to fail on some systems. This does not affect results of completed runs.
- Fixed problem where the number of half-level pressure values was not initialised correctly before pressure level calculation for Met Office Fieldsfiles. This caused runtime failures on some systems but did not affect results of completed runs.

- Changed fieldsfile input to read and discard unwanted fields instead of using file positioning, in order to avoid a compiler bug with the pgfortran compiler whereby the file was positioned incorrectly on some READ statements.
- Fixed assignment of cloud fields in RTTOV profiles for IR scattering simulations when the input profiles have a negative z-axis.

Support and Admin:

- An additional check_install script, along with input files for a test simulation, has been provided so that users can verify that the installation is okay.
- IBM Power-7 (AIX, xlf compiler) testing was carried out for this release but can no longer be fully supported as there is no test platform available.
- Cray XC-40 (Cray Linux, ifort compiler) is now supported.
- The link step order has been changed in the install script to avoid missing library dependencies on some systems.
- Potential support for the NAG compiler nagfor has been dropped completely as it was not possible to install or access working versions of some external libraries.
- Testing in all cases has been carried out with HDF5 support enabled in the RTTOV installation.
- The heavy load test has been reduced slightly because it became apparent that writing out all possible output fields for an IASI simulation on a global model grid requires variable storage arrays larger than can be supported by netCDF and unfeasibly large output files. The test was therefore unworkable. Instead, of the optional output fields, only emissivity values are written out. With the memory reduction enhancement, this test is now successful on all tested systems.
- A new test suite has been developed, based on the Met Office Rose system, in order to improve the testing procedure and ensure that the code is reliable in as many configurations, on different platforms, as possible. This is not a part of the distribution.

## 3. LIMITATIONS AND KNOWN ISSUES

### 3.1 Limitations

There are a number of limitations that users should be aware of. Some of these will be addressed in a future release if there is sufficient demand. Most of the items here have already been discussed in other sections of the User Guide.

### 3.1.1 Input files

Met Office UM data files:
- Packed files are not supported and will not be supported in any future release. The UM ieee routine may be used to unpack the data.

GRIB files:
- Only those originating from ECMWF are supported. This is due to variations in the way fields can be stored, particularly with regard to pressure levels. Support for other sources may be added in future releases.

netCDF files:

- No support planned but may be added if there is a new requirement.

### 3.1.2 Processing options

The following processing options are not supported but some may be added in a future release:

- Interpolation of irregular grids, i.e., those that don't have a fixed lat,lon spacing between grid points. Simulations will take place on the original grid.
- The effects of reflected solar radiation in the IR.
- Use of variable trace gas ($CO_2$, $N_2O$, $CO$, $CH_4$) profiles.
- Use of aerosol profiles.

### 3.1.3 General

- No special consideration is given to the interpolation of surface fields near coastlines, hence one might occasionally get unrepresentative values of, for example, surface skin temperature at such points.

## 3.2 Known Issues

The following is a list of known problems that will be addressed in a future release. Please report any additional problems via the NWP SAF helpdesk feedback form at http://nwpsaf.eu/feedback.html.

The following are not handled correctly:

- Interpolation of staggered grids. This applies only to the components of the surface wind field which are currently assumed to be coincident with the regular grid. Surface wind is only used for MW emissivity calculations over sea-surfaces. This usually has only a minor effect on results and is not an important factor in general for radiance simulation.
- Rotation of vector fields. This applies only to the surface wind field. Affected simulations are those from a limited area model with rotated pole and for polarised microwave channels that have a significant surface contribution. Other combinations are unaffected.


## 4. PACKAGE CONTENTS

The Radiance Simulator code is distributed in the gzipped tar file

```
radsim.tar.gz
```

Contents of the unpacked distribution file are listed below (listing is the direct output from the ls –R command). Instructions on building the code can be found in the readme.txt file and in the User Guide.

```
build
etc
install.files
```

```
radsim_check_install
radsim_install
readme.txt
src
user.cfg

./build:
cfg
include

./build/cfg:
common.cfg
cray-ifort.cfg
gfortran.cfg
ifort.cfg
nagfor.cfg
pgfortran.cfg
xlf.cfg

./build/include:
radsim_calc_ecmwf_plevels.interface
radsim_calc_meto_plevels.interface
radsim_calc_pz.interface
radsim_check_ff_packing.interface
radsim_check_fields.interface
radsim_convert_fields.interface
radsim_error_report.interface
radsim_esat.interface
radsim_grid_calc.interface
radsim_grid_init.interface
radsim_grid_rotate.interface
radsim_init_obs_out.interface
radsim_interp.interface
radsim_interp_horiz.interface
radsim_model_to_rttov.interface
radsim_print_cfg.interface
radsim_print_ob.interface
radsim_qsat.interface
radsim_read_cfg.interface
radsim_read_ecprof60.interface
radsim_read_ecprof91.interface
radsim_read_ff_headers.interface
radsim_read_fieldsfile.interface
radsim_read_grib.interface
radsim_read_obsdata.interface
radsim_read_pp.interface
radsim_set_fields.interface
radsim_set_stash.interface
radsim_setup_rttov.interface
radsim_store_stash.interface
radsim_write_netcdf_init.interface
radsim_write_netcdf_obs_1d.interface
```

```
radsim_write_netcdf_obs_nd.interface

./etc:
nwp_saf_t_test.atm
nwp_saf_t_test.sfc
obsdata_example.txt
radsim-metop_2_amsua-check_install.nc
radsim_cfg_example.nl
radsim_check_install.nl
rtcoef_metop_2_amsua.dat

./src:
code
scripts

./src/code:
main
utils

./src/code/main:
radsim.f90
radsim_calc_ecmwf_plevels.f90
radsim_calc_meto_plevels.f90
radsim_check_ff_packing.f90
radsim_check_fields.f90
radsim_convert_fields.f90
radsim_dealloc.f90
radsim_error_report.f90
radsim_esat.f90
radsim_grid_calc.f90
radsim_grid_init.f90
radsim_grid_rotate.f90
radsim_init_obs_out.f90
radsim_interp.f90
radsim_interp_horiz.f90
radsim_mod_cfg.f90
radsim_mod_constants.f90
radsim_mod_io.f90
radsim_mod_process.f90
radsim_mod_types.f90
radsim_model_to_rttov.f90
radsim_print_cfg.f90
radsim_print_ob.f90
radsim_qsat.f90
radsim_read_cfg.f90
radsim_read_ecprof60.f90
radsim_read_ecprof91.f90
radsim_read_ff_headers.f90
radsim_read_fieldsfile.f90
radsim_read_grib.f90
radsim_read_obsdata.f90
radsim_read_pp.f90
```

```
radsim_set_fields.f90
radsim_set_stash.f90
radsim_setup_rttov.F90
radsim_store_stash.f90
radsim_write_field_nc.f90
radsim_write_netcdf_init.f90
radsim_write_netcdf_obs_1d.f90
radsim_write_netcdf_obs_nd.f90
radsim_write_nf90.f90

./src/code/utils:
radsim_calc_pz.f90
radsim_calc_wp.f90
radsim_mod_utils.f90

./src/scripts:
radsim_validate.py
```