Radiance Simulator v1 Top-level Design

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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	06/08/2014	A. Smith	Final Draft
1.0	17/11/2014	A. Smith	Version updated for release

	Radiance Simulator v1 Top-level Design	Doc ID :NWPSAF- MO-DS-028 Version : 1.0 Date : 17/11/2014

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1. INTRODUCTION

This document defines the top level design for Version 1 of the Radiance Simulator, in accordance with the requirements of the NWP SAF.

1.1 Reference documents

[RD-1]   NWPSAF-MO-DS-027, Radiance Simulator Product Specification
[RD-2]   NWPSAF-MO-DS-033, Radiance Simulator User Guide

2. OVERVIEW

The main components of the radiance simulator are:

- **Input** of control, observation and model data from external files
- **Field conversions** – calculation of humidity, interpolation to observation locations etc
- **Initialisation and set-up** of the radiative transfer model (RTTOV);
- **Processing** - performing the simulation; looping over all observations, transferring model data to RT model profiles and calling the RT model.
- **Output** of the simulated radiances.

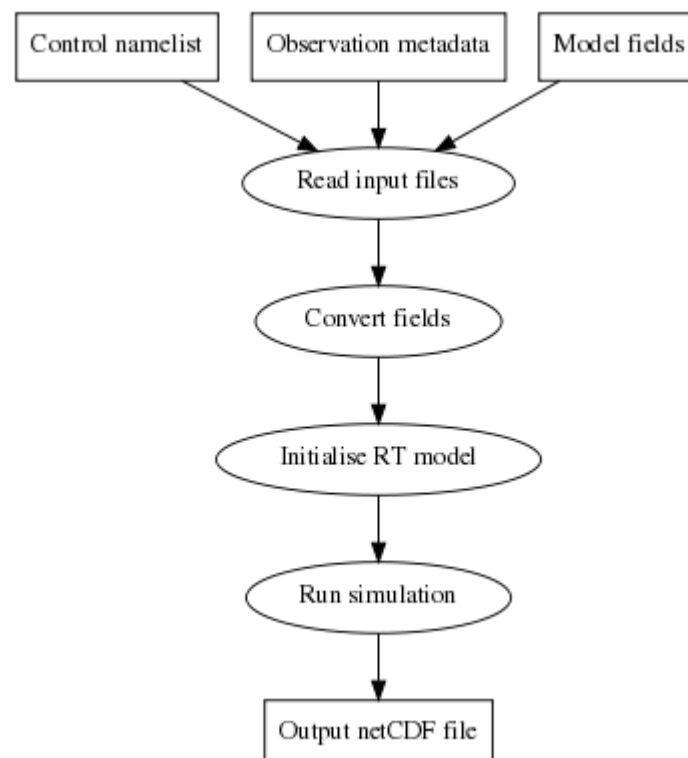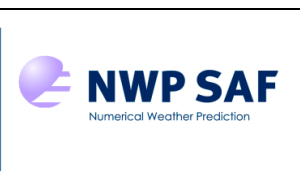The sequence of main functions is represented in Figure 1 below.

Figure 1: Main functions, input and output of the Radiance Simulator.

2.1 Input, Initialisation and Set-up.

The simulations are controlled via a Fortran namelist configuration file. The path to the file is supplied by the user on the command line. As a minimum, users will need to specify the following in the file:

- Path to the model profile data file.
- The location of the RTTOV coefficients file directories
- Satellite instrument identifiers

Optional configuration includes:

- Channels to use
- Path to an observation data file
- Run time options including cloudy IR, MW scattering simulations.
- Output definitions including output file location and variables to be written out.

Model fields can be provided in several formats:

- GRIB
- Met Office fieldsfiles/PP files
- NWPSAF diverse profile datasets (60, or 91 level sets are supported)

The optional observation data file allows simulations to be performed at observation locations (otherwise they are done at model profile locations). The file contains latitude, longitude, satellite zenith angle and surface type for each observation (one observation per row). More details can be found in the User Guide (RD-2).
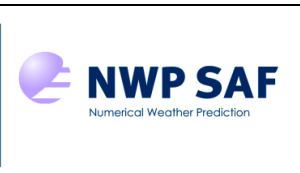
2.2 Processing / Simulation

The main processing steps are:

- Read in observation data
- Read in atmospheric profiles
- Interpolate fields to the observation locations (this assumes a regular lat/lon grid).
- Perform variable conversions as required (conversion supported are : θ to T, dewpoint to specific humidity; relative humidity to specific humidity)
- Rotate grid (if required)
- Set up RTTOV model
- Call RTTOV for each location
- Set QC flags (to indicate valid RT calculation, observation within model domain, etc)

2.3 Output

- Write output to a netCDF file

3. IMPLEMENTATION ASPECTS

3.1 Distribution and Installation

Source files will be distributed as a gzipped tar file. The file contains; Fortran source code, including interface files, an installation script with configuration files for different compilers, example namelist and observation data files, and a readme file containing instructions on how to install and run the code.

To install the code, users will need to specify the compiler and the location of external libraries (see below) in a configuration file before running the installation script.

Information on supported compilers is given in the User Guide (RD-2).

3.2 External libraries

Fortran versions of the following libraries are required. These are straightforward to download and install if they are not already available. See the User Guide (RD-2) for more details.

- RTTOV
- GRIB API
- netCDF
- HDF-5 *

* Note: it is not always necessary to specify the path to the HDF-5 library, this is platform dependent.