

NWP SAF	Met Office 1D-Var Product Specification	Doc ID : NWPSAF-MO-DS-004 Version : 1.5 Date : 23.07.2013
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NWP SAF

**Met Office 1D-Var
Product Specification**

Version 1.5 rev 2

23rd July 2013

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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 25 November 1998, 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.

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Change record			
Version	Date	Author/changed by	Remarks
1.1	5/5/04	A. Collard	Code version 3.1
1.2 rev 1	9/1/07	E. Pavelin	Revised for code version 3.2: addition of RTTOV-8 interface
1.2 rev 2	23/1/07	E. Pavelin	Changed RTTOV 8.5 to 8.7
1.2 rev 3	14/3/07	E. Pavelin	Minor changes in response to comments from R. Francis
1.3	7/8/09	E. Pavelin	Revisions for code version 3.3: addition of RTTOV-9 interface
1.4	20/2/12	P. Weston	Revisions for code version 3.4: addition of RTTOV-10 interface and capability of microwave cloud liquid water retrieval
1.4 rev 2	4/5/12	P. Weston	Changes in response to comments from S. Keogh
1.5	13/6/13	P. Weston	Revisions for code version 3.5: addition of RTTOV-11 interface
1.5 rev 2	23/07/13	P. Weston	Changes in response to comments from S. Keogh

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1 INTRODUCTION

This document defines the specification for version 3.5 of the Met Office 1DVar (one dimensional variational analysis) scheme, in accordance with the requirements of the NWPSAF. The Product Specification describes the deliverable from the point of view of the user.

2 PURPOSE

The Met Office NWPSAF 1DVar scheme is a stand-alone retrieval package for nadir-viewing passive sounding satellite instruments. The code was originally developed for the IASI instrument (hence the naming convention for the subroutines and the name of the executable, IASI_1DVar) but it may be used with many different sounding instruments with minimal changes.

The philosophy behind the development of this code is to produce a flexible, stand-alone 1DVar retrieval system that may be used for a wide variety of situations. It is anticipated that users may want to remove routines that are superfluous to their requirements (or alternatively simply take selected routines) before using this code.

3 FUNCTIONALITY

The aim of this deliverable is to produce retrieved atmospheric states based on the following inputs:

- Observed satellite radiances from the ATOVS, AIRS, IASI or SSMIS instruments and the associated error covariance
- Background (a priori) atmospheric state (one per observation or one for all observations) and associated error covariance

Also required is a user supplied radiative transfer model. RTTOV (versions 7, 8.7, 9.3, 10.2 and 11.1), Gastropod and RTIASI are supported by default.

The atmospheric parameters that may be retrieved are limited by whether a suitable background (and error covariance) are available and whether the parameter is supported by the radiative transfer model.

Figures 1 and 2 overleaf illustrate the functionality of the package.

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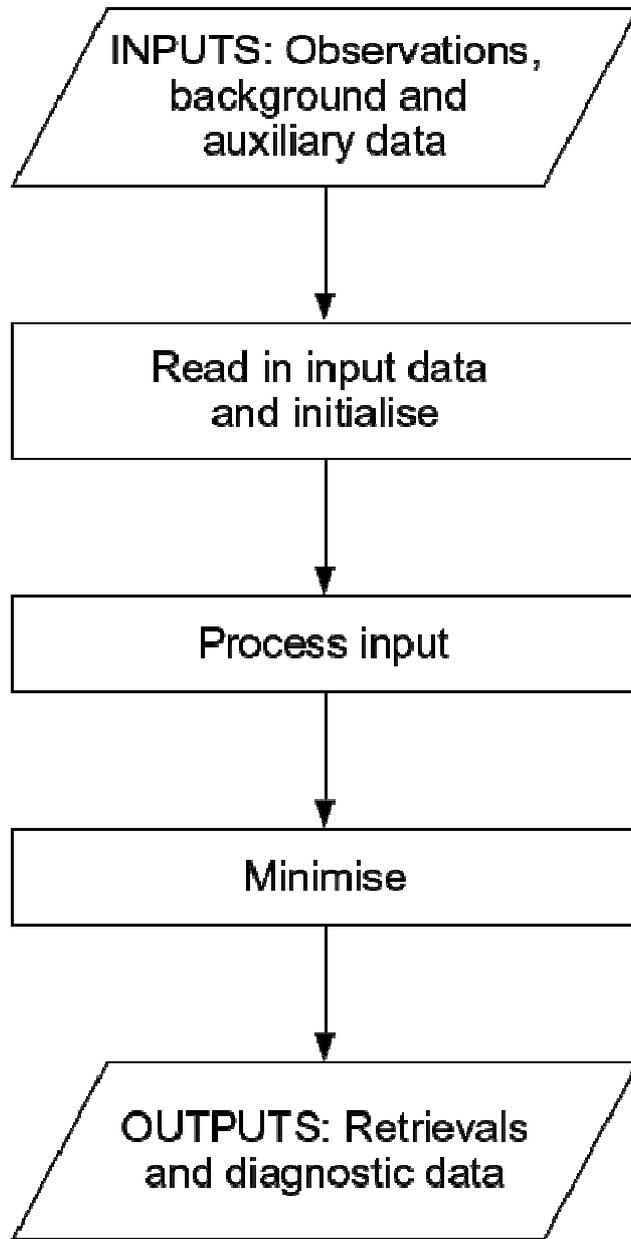


Figure 1: Overview

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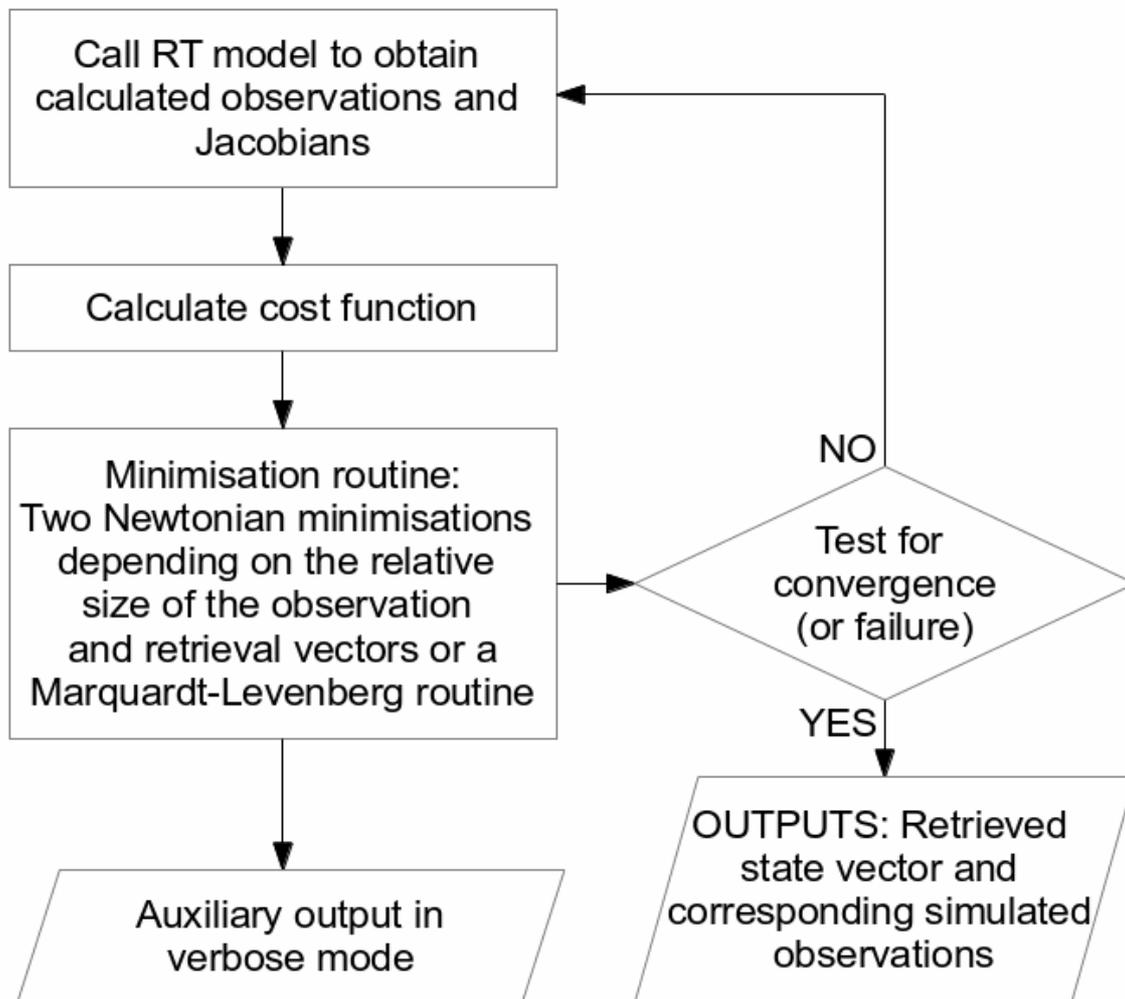


Figure 2: Minimization and output

4 INPUTS/OUTPUTS

When running the IASI_1DVar executable the following inputs (all compatible with the instrument of choice) are required:

- Radiative transfer coefficients file
- Background error covariance matrix
- Observation error covariance matrix
- Channel choice file
- Retrieval namelist
- Control namelist
- Observations file
- Background profile
- Emissivity atlas (optional)

and the following outputs are generated:

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- Analysis error covariance matrix
- Minimisation logs
- Retrieved brightness temperatures for each channel in the channel choice file
- Retrieved profiles of temperature, humidity and ozone (and optionally cloud liquid water) on the number of levels defined by the background profile

5 SYSTEM REQUIREMENTS

5.1 Language

The code is written in Fortran 90. The code is capable of compilation on a range of Fortran 90 and 95 compilers. A list of compilers which the code has been tested with can be found in the Portability document.

Shell scripts are based on the Korn shell.

5.2 Supported platforms

The Met Office 1DVar code has been installed and is currently supported on a couple of UNIX-based platforms, IBM and PC (Linux). The code is sufficiently standard that it should work on other platforms with only minor code or configuration changes

5.3 Performance

The performance of the 1DVar scheme is limited by the radiative transfer model. Therefore, the number of iterations required for minimisation determines the CPU time. This number of iterations may be optimised for a given application through the careful choice of minimisation method (three are provided) and convergence criteria, all of which are adjustable by the user.

6 LIMITATIONS

This code is designed as a general research tool but it is unlikely that every eventuality can be covered without additional work by the user. The most obvious limitation is that there is no pre-processing before the minimisation stage to produce a good first guess (with the exception of minimum residual code used in the cloudy retrieval section) as this is not generally necessary in an NWP context.

Note that when using RTTOV-9, the 1D-Var code is currently not designed to support interpolation from user-defined profile levels. Therefore, retrievals may only be performed on the level set defined by the RTTOV coefficients in use.

7 LIST OF REQUIREMENTS

This section details specific requirements to be addressed in the Met Office 1DVar version 3.5 Test Plan.

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- 7.1 The Release Note accompanying the package shall list the contents of the package and how to unpack the software.
- 7.2 Met Office 1DVar v3.5 should be successfully built, following instructions in the readme file and manual. Where the user requires, it shall be possible to link external libraries to the Met Office 1DVar, including a radiative transfer model and netCDF.
- 7.3 The software should compile and run on a range of UNIX platforms including Linux PC and AIX.
- 7.4 The test runs for each instrument shall be run using the test script and IASI_1DVar executable with the compilers and radiative transfer model coefficients files specified in the readme file and produce identical results to those found in the Sample_Output folder. This is the requirement that the code can perform 1D-Var retrievals for the ATOVS, AIRS, IASI and SSMIS instruments.
- 7.5 Met Office 1DVar v3.5 shall enable support for the use of RTTOV-11. This requirement came from a user request.